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FINAL STATUS SURVEY REPORT FOR NON TIME CRITICAL REMOVAL ACTION FOR SITE 1 NSWC INDIAN HEAD MD

9/26/2016

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FINAL STATUS SURVEY REPORT
IR SITE 1 NON TIME CRITICAL REMOVAL ACTION

NAVAL SUPPORT FACILITY INDIAN HEAD

INDIAN HEAD, MD

For the:

U.S. ARMY JOINT MUNITIONS COMMAND

ROCK ISLAND, IL

Project No. USN 2015-011

Contract No. W52P1J-08-D-0034/DO: 0092

September 26, 2016

Rev. 1

Prepared by:

Aleut World Solutions, LLC
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Approvals Page

FINAL STATUS SURVEY REPORT

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Abbreviations and Acronyms

ALARA	As Low As Reasonably Achievable
ANL	Argonne National Laboratory
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOC	Areas of Concern
AWS	Aleut World Solutions, LLC
Bgs	Below grade surface
BLDG	Building
CDE	Committed Dose Equivalent
CFR	Code of Federal Regulations
Cm	Centimeter
cpm	Counts per minute
DCGLs	Derived Concentration Guideline Limits
DDE	Deep Dose Equivalent
DOD	Department of Defense
DOT	Department of Transportation
dpm/100 cm^2	disintegrations per 100 square centimeters
DQO	Data Quality Objectives
ε_i	Instrument Efficiency
ε_s	Surface Efficiency Factor
EE/CA	Engineering Evaluation and Cost Analysis
EPA	U.S. Environmental Protection Agency
ft	Feet
ft^2	square feet
FSS	Final Status Survey
HASL-300	Environmental Laboratory Procedures Manual, 28th Edition 1997
HASP	Health and Safety Plan
IOP	Instrument Operating Procedure
ISO	International Organization for Standardization
LDE	Lens Dose Equivalent
LLRW	Low Level Radioactive Waste
M	Meter
m^2	square meter
MARSSIM	Multi Agency Radiation Survey & Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR MDE	Minimal Detectable Count Rate Maryland Department of the Environment
MSDS	Material Safety Data Sheets
msl	mean sea level
mrem/y	milliRem per year
N/A	Not Applicable
NaI	sodium iodide

NIST	National Institute of Standards and Technology
NSF	Naval Support Facility
NRC	Nuclear Regulatory Commission
NTCRA	Non Time Critical Removal Action
OSHA	Occupational Safety and Health Administration
pCi/g	pico Curies per gram
PM	Project Manager
PPE	personal protective equipment
QA	Quality Assurance
QC	Quality Control
RESRAD	Residual Radiation Modeling Software
RASO	Naval Sea Systems Command Detachment, Radiological Affairs Support Office
RI	Remedial Investigation
RSO	Radiation Safety Officer
RWP	Radiation Work Permit
SDE	Shallow Dose Equivalent
σ	standard deviation
SOPs	Standard Operating Procedures
TEDE	Total Effective Dose Equivalent
Th-228	thorium-228
Th-230	thorium-230
Th-232	thorium-232
TLD	thermo-luminescent dosimeter
μR/h	micro roentgens per hour
WRS	Wilcoxon Rank Sum Test
yr	Year

RECORD OF REVISIONS

Revision Number	Description	Date
0	Draft Survey Report, NSF Indian Head Site 1	3/14/2016
1	Draft Survey Report, NSF Indian Head Site 1	5/19/2016
1	Final Survey Report, NSF Indian Head Site 1	9/26/2016

1.0 Executive Summary

Aleut World Solutions (AWS) was contracted by the U.S. Army Joint Munitions Command (JMC) to perform a soil removal action and Final Status Survey in accordance with MARSSIM guidelines at the IR Site 1 located at the Naval Support Facility Indian Head (NSF-IH) in Indian Head, MD. Navy trainings with radioactive materials (Thorium-232) were conducted in the past in this area. The work was performed from 5 October 2015 to 30 October 2015 (removal) and from 30 November 2015 to 17 December 2015 (backfill/site restoration).

A map showing the location of the Naval Support Facility Indian Head is provided in Figure 1 below. Figure 2 presents an overview map of the site.

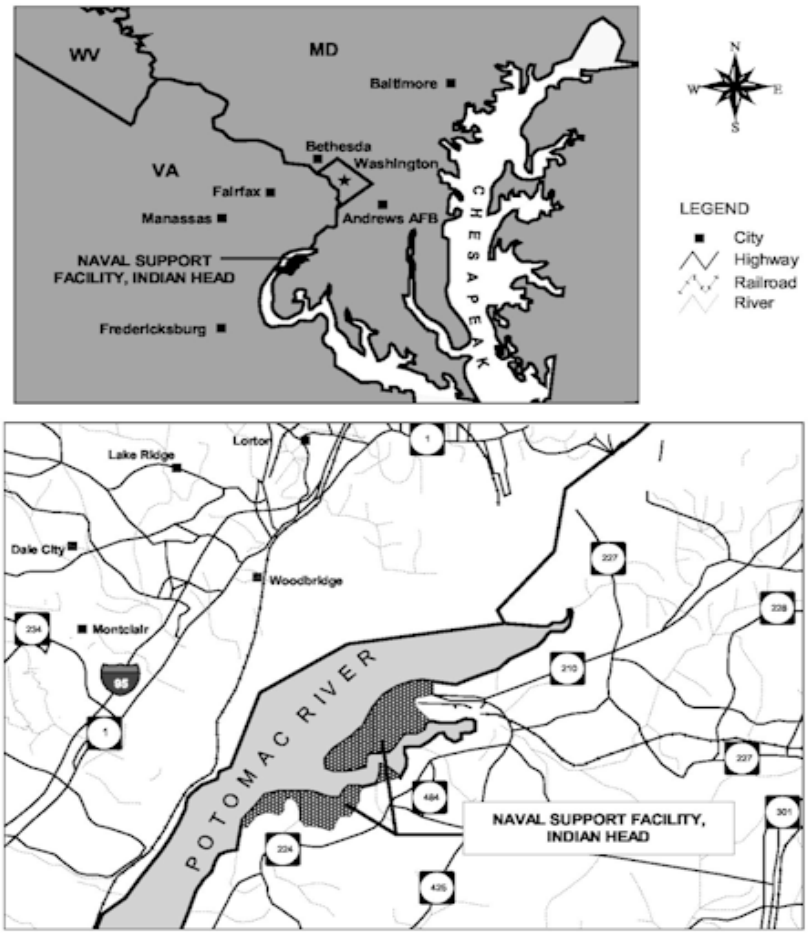


Figure 1. Naval Support Facility Indian Head Location Map

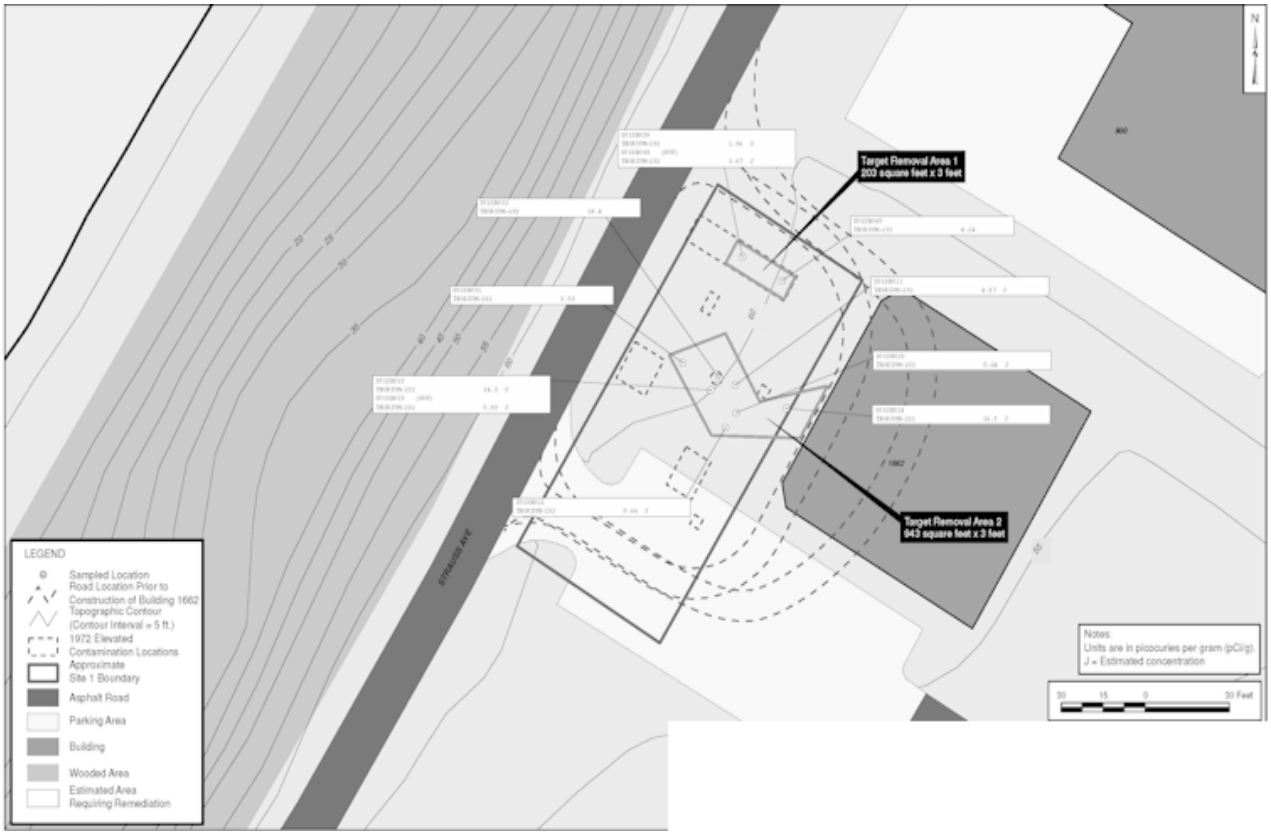


Figure 2. Site Overview Map

Soils were removed in the excavation area to a depth of 4’ below grade surface (bgs). Even though the first 2’ of the excavation had been previously backfilled with non-impacted soils from a prior removal action conducted in 2013 (Appendix Z), gamma scan surveys of each excavator and wheel loader bucket were performed to screen the soils during removal activities as a precautionary measure. Any soils above the investigation level described in Section 6.4.6.3 were segregated and placed into a “hot” soil stockpile.

Once the 2’ bgs level was reached, the soils were removed in 6” lifts down to 4’ bgs (four 6” lifts). Once the excavation bottom was reached (4’ bgs), a final status survey of the excavation bottom and sidewalls was performed. This included a 100% gamma scan walkover survey of the excavation bottom and sidewalls. In addition, systematic soils samples were also collected and sent to the offsite laboratory for isotopic thorium (alpha spectroscopy) analysis.

Based upon the gamma scan survey and soil sample analysis results, it was determined that the area of concern had been successfully remediated to the cleanup goals stated in Section 6.3 (3.0 pCi/g of Thorium-232 in soil) of this report.

A summary of the soil sample results are provided in Table 1 below.

Table 1. Soil Sample Summary Table

Survey Unit/Area Sampled	Number of Samples Collected	Average Th-232 Concentration in pCi/g	Maximum Th-232 Concentration in pCi/g
Excavation Bottom	24	0.78	2.33
Excavation Sidewalls	20	0.79	1.31
Soil Laydown Area	16	0.65	0.89

The offsite laboratory used to support this project was:

Test America Laboratories Inc.
13715 Rider Trail North
Earth City, MO 63045
DOD ELAP Cert # ADE-1430

A total of approximately 172 cubic yards (~ 156 tons) of impacted soils were removed from the excavation area.

On 30 November 2015, following written approval from RASO, the crew mobilized to the site to backfill and restore the excavated area. The excavation area was backfilled with clean fill and compacted in 6” lifts. A six inch layer of topsoil was placed over the area and seeded.

During the two site visits, the following tasks were completed:

- Radiation safety briefing(s) to staff assigned to the project who have not previously received a radiation safety briefing.
- Incoming equipment and material surveys.
- Excavated impacted areas down to 4’ below grade surface in 6” lifts.
- Surveying and surface soil sampling of over burden soils as Class 1 areas (6” lifts) in accordance with MARSSIM guidelines.
- Surveying and surface soil sampling of the impacted areas as a Class 1 area following excavation down to 4’ below grade surface in accordance with MARSSIM guidelines.
- Loaded thirteen 20 cubic yard IP-1 Type containers with contaminated soils for disposal following screening for UXO by UXO personnel.
- Provided radiological monitoring during the collection of samples.
- Performed personnel surveys while the work was being performed, when necessary.
- Performed radiological release surveys on outgoing equipment and material.
- Performed a final status survey of the excavation area bottom and sidewalls following impacted soil removal in the area in accordance with MARSSIM guidelines.
- Backfilled and restored the excavated area following screening for unexploded ordnance (UXO) by subcontracted UXO personnel. Restoration included backfilling, compaction, and reseeding affected area.

2.0 Project Background Information

2.1 FACILITY LOCATION

NSF-IH is located in northwestern Charles County, Maryland, as shown on Figure 3.

NSF-IH is approximately 25 miles southwest of Washington, D.C. NSF-IH is a military facility consisting of the Main Area on the Cornwallis Neck Peninsula and the Annex on Stump Neck. As shown on Figure 1, the Main Area is bounded by the Potomac River on the northwest, west, and south, the Mattawoman Creek to the south and east, and the Town of Indian Head to the northeast. Stump Neck Annex is located across the Mattawoman Creek and is not contiguous with the Main Area.

The location of Site 1 is shown on Figure 4.

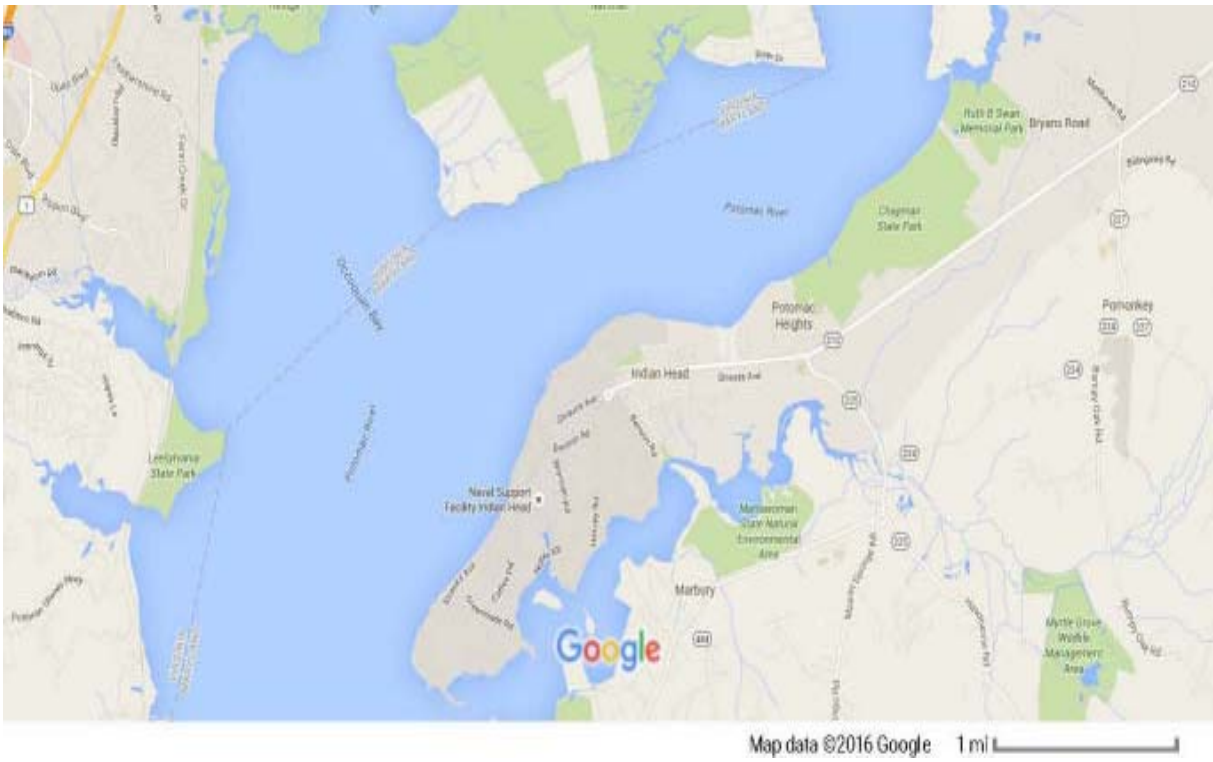


Figure 3. NSF Indian Head Map

Figure 4. Site 1 Location

2.2 FACILITY HISTORY/BACKGROUND

The Indian Head peninsula is located in the Atlantic Coastal Plain Physiographic Province, approximately 8 to 10 miles east of the Fall Line that marks the western extent of the Coastal Plain physiographic province. Indian Head has gently rolling to undulating topography with elevations ranging from sea level to more than 100 feet (ft) above mean sea level (msl). The higher elevations are on the eastern portion of the facility, and the land surface generally slopes to the southwest and southeast. The portion of NSF-IH along the Potomac River is characterized by 20- to- 100 feet bluffs. The portion along Mattawoman Creek is more gently sloping.

The historical primary mission of NSF-IH consists of the following:

- Provision energetics for all warfare centers through engineering, fleet and operation support, manufacturing technology, limited production, and industrial base support.
- Research, development, testing, and evaluation of energetic materials, ordnance devices and components, and other related ordnance engineering standards including chemicals, propellants and their propulsion systems, explosives, pyrotechnics, warheads, and simulators.
- Technical support to all warfare centers, military departments, and the ordnance industry for special weapons, explosive safety, and ordnance environmental issues.

In 1951, the Navy was assigned the joint-service explosive ordnance disposal (EOD) responsibilities for basic training and research and development. In 1953, the research and development tasks were established as a separate organization, and re-designated the Naval EOD Technical Center. The training function was renamed the Naval School, EOD (NAVSCOLEOD). From 1955 forward, all joint service EOD training was provided at NSF-IH. In 1958, the NAVSCOLEOD moved from its Jackson Road location to Strauss Avenue. The NAVSCOLEOD command moved to Eglin AFB (AFB) in 1993, and the NAVSCOLEOD at NSF-IH was designated as a detachment until the detachment was relocated to Eglin in 1999.

The Commanding Officer and the NAVSCOLEOD Headquarters returned to NSF-IH in 1994 while a construction project was being completed at Eglin AFB. In January 1999, the NAVSCOLEOD was consolidated at Eglin AFB. A detachment of EOD personnel remains at NSF-IH.

2.3 SITE INFORMATION

2.3.1 SITE DESCRIPTION

Site 1 is an area of approximately 60 by 135 feet located between Building 1662 and Strauss Avenue (Figure 5). The area is currently covered by a parking lot and maintained lawn. Building 1662 is used for electrical and satellite communications.

Future land use is expected to be any military, industrial, or commercial use needed to support the NSF-IH mission. It is unlikely that the site area would be developed for residential use while under government control. (TTNUS, 2010).

2.3.2 SITE BACKGROUND/HISTORY

The Naval Sea Systems Command Detachment (NAVSEADET) Radiological Affairs Support Office (RASO) provided the historical information that served as the basis for site background information.

The construction of Building 1662 was completed in 1983. Building 900, located northeast of Building 1662, was in place prior to 1962.

Thorium is a soft, silvery white metal that dissolves slowly in water. Thorium-232 is a naturally occurring isotope found in thorite ore, and has a half-life of 14 billion years and decays by alpha emission with accompanying gamma radiation. Thorium-232 is at the top of a long decay series that contains key radionuclides such as radium-228, its direct decay product, and radon-220. Two other isotopes of thorium are thorium-230 and thorium-228, both of which also belong to other decay series. They decay by alpha emission with accompanying gamma radiation, and have half-lives of 75,400 years and 1.9 years, respectively.

Thorium was first placed on the ground at Site 1 in 1962 in connection with radiation training exercises conducted by the NAVSCOLEOD. Thorium ore from approximately five drums of 30 to 50-gallon capacity was spread over the site. No U.S. Atomic Energy Commission (USAEC) license was issued at the time the ore was purchased.

Thorite ore was first placed on Site 1 in 1962. Early in 1967, some of the thorite ore was removed from the site, placed into barrels, and transferred to an unknown destination. The remaining soil on the site was then disked and harrowed several times to uniformly incorporate any residual thorite ore into the soil. It was reported that the soil was affected to a depth of 8 to 12 inches.

In 1971, a sample of the thorite ore was assayed for thorium content by the Engineering Division, U.S. Army Engineer Power Group, Fort Belvoir, Virginia. The results were reported as, “Thorium content 2.5 w/o thorium with a specific activity of 100 disintegrations per second (dps) per gram.” A radiological survey conducted at Site 1 on March 28, 1972, determined that the affected areas included seven locations covering a total of approximately 600 square feet. The depths of the affected soil ranged from 12 to 18 inches below ground surface (bgs).

In July 1972, the radioactive soil was excavated, placed into fifty 55-gallon drums, and staged at the facility’s radiation training area. The drums were shipped in October for disposal at the Nuclear Engineering Company, Inc., in Morehead, Kentucky. Two subsequent radiological surveys, each followed by the removal of radioactive material, occurred in November 1972. The excavated area was backfilled with 18 to 24 inches of clean soil to reestablish original grade.

A final radiological survey of the area was performed by RASO personnel in February 1976. In a March 1976 memorandum, RASO indicated that based on the survey, “the subject area has been returned to background and may be released for unrestricted use.” However, in 1983, two buried drums containing thorium material, dirt, and gravel were discovered near the site during construction of Building 1662. The drums were shipped off-site for disposal as low-level radioactive waste (LLRW).

Prior to constructing an addition to Building 900, a radiological survey was performed in October 2001 along the southeastern side of the building where the Site 1 was initially thought to be located. Ten subsurface soil (0.5 to 2 ft bgs) samples were collected. The

associated survey report concluded that "based on the laboratory results, no further actions regarding thorium are required at this time. Soil remediation will not be required as part of Building 900 Joint Interoperability Project."

In November 2004, RASO indicated that it considered all known drums of thorium ore to have been accounted for and properly disposed. However, RASO indicated in the same communication that "radiation measurements made in 1972 are not definitive as to the thorium concentrations remaining after the cleanup. Characterization surveys are still necessary."

Following a search of historical files, RASO provided a description of the location of Site 1:

Clean soil covers the 60-ft by 90-ft area to a depth of 12 to 18 inches as a result of the 1972 removal of contaminated soil and its replacement with clean soil. No drums currently exist at the site. If contamination exists at the site, it will be found below the 12 to 18 inches of clean soil and within the next 12 inches of depth (i.e., the bottom of the interval in question is 24 to 30 inches bgs). (TTNUS, 2010).

2.3.3 PREVIOUS INVESTIGATIONS AND ACTIVITIES

The investigation at Site 1 began in 2005 to determine whether historical practices and operations resulted in the release of thorium at concentrations of potential environmental concern. During the investigation, soil samples were collected from the RASO-approved Reference Area and from the onsite study area. Samples were collected from variable depth intervals (18 to 24, 24 to 30, or 30 to36 inches bgs) from a 3-inch diameter borehole and sent to a laboratory for thorium-232 analysis using alpha spectroscopy. The appropriate depth interval for laboratory sample selection was based on the highest gross gamma radiation reading in the field from a gamma probe scintillator lowered down each borehole.

The presence or absence of residual contamination at Site 1 was determined by evaluating analytical results between the site and the Reference Area (uncontaminated background conditions). Background conditions, or a derived concentration guideline level (DCGL), were/was established by adding 1 picoCurie per gram (pCi/g) to each of the Reference Area data (determined by RASO to be an appropriate incremental concentration by which the site could not exceed the Reference Area). The site and background data sets were compared using the Wilcoxon Rank Sum (WRS) test. The results of the 2005 effort, along with additional research on historical activities, indicated an expanded study area was required.

Subsequently, a larger study area was established and additional soil samples were collected in 2007 and analyzed for thorium-232 [a subset of samples also were analyzed for naturally occurring radioactive material (NORM) by gamma spectroscopy]. After evaluating both the 2005 and the expanded 2007 data sets, it was determined that nine sample locations (S01SB011, S01SB014, S01SB020, S01SB021, S01SB023, S01SB031, S01SB032, S01SB039, and S01SB040) exhibited elevated activity considering the DCGL and field measurements. Figure 5 shows these areas.

Based on exceedences of the DCGL and elevated field readings, there were nine sampling locations within two areas that were candidates for excavation and removal to depths ranging from 24 to 36 inches bgs.

- Area 1 was defined by sample locations S01SB039 and S01SB40 in the northern portion of the site. The estimated area of contamination is 300 square feet, and the depth of contamination is 30 inches (2.5 feet).
- Area 2 was defined by the remaining sample locations in the central portion of the site. The estimated area of contamination is 775 square feet, and the average depth of contamination is 30 inches (2.5 feet). (TTNUS, 2010).

In order to reduce the number of survey units, individual soil stockpile areas, and soil samples, Target Removal Area 1 and Target Removal Area 2 were combined into one contiguous area.

The total removal area was estimated to be 35' wide by 56.5' long, and 26' wide by 26' long. The area is ~2,653 ft^2 in size. The estimated amount of soil to be removed was 393 cubic yards.

Figure 5 presents a map of the consolidated soil removal area. The area is outlined in red.

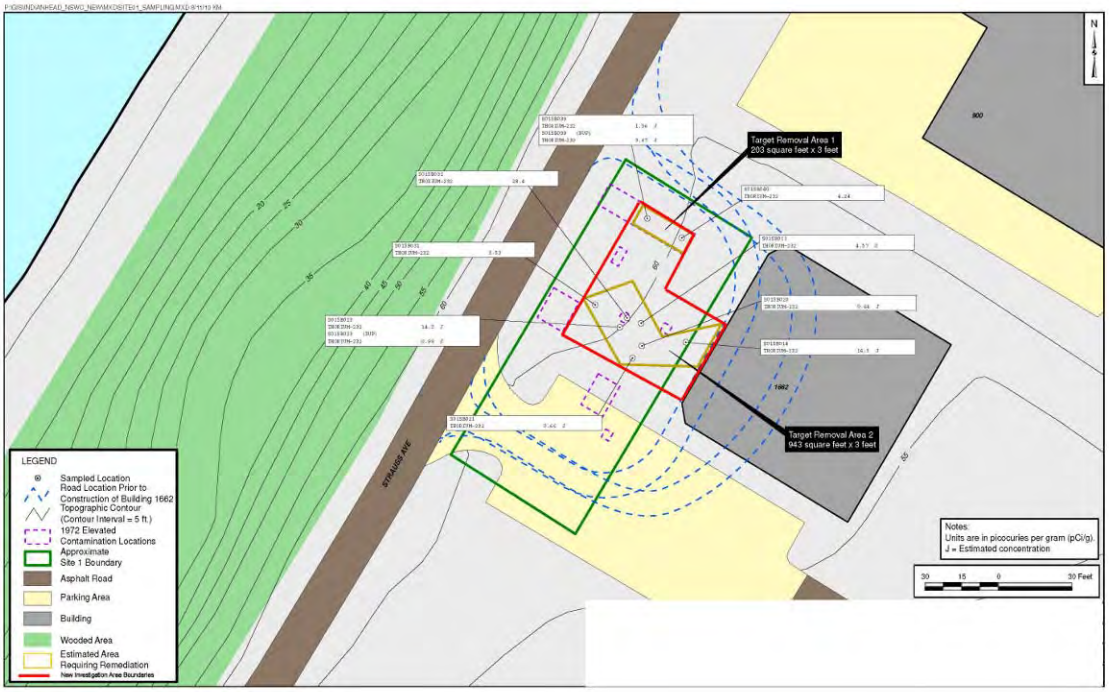


Figure 5. Site 1 Soil Removal Areas

2.3.4 RECENT REMEDIATION ACTIVITIES

AWS performed a removal action at Site 1 from 11 February 2013 to 8 March 2013 and from 19 August 2013 to 6 September 2013.

The original plan was to remove soils in the excavation area to a depth of 4' below grade surface (bgs). However, due to the unexpected amount of radiologically impacted soils discovered in the first 2 feet of the excavation and also the discovery of potential unexploded ordnance in the area, a stop work order was issued by the Navy.

At approximately 0835 hours on 1 March 2013 while walking down the excavation area prior to soil removal, potential unexploded ordinance was discovered in the area. A phone call was placed to NSF-IH security and the area was evacuated.

A Navy UXO team was dispatched to the site from the Naval Surface Warfare Center Dahlgren. The UXO team entered the area and found what appeared to be a submunition, two land mines, and a grenade. All of the items were determined to be inert training/practice items.

As a precautionary measure, the items were removed from the excavation area and taken to a remote location in the "Restricted Area" at NSF-IH to be destroyed. Prior to removal to that area the items were surveyed for radiological contamination. No detectable activity above background was found on any of the items.

At this time a stop work order was issued by the Navy and no further excavation was performed in the area. The area was secured and the work crew was demobilized from the site. On 19 August 2013 the crew was re-mobilized to the site under a modified work scope. The Navy directed AWS to perform a limited characterization survey in the excavation area footprint, package and transport removed contaminated soils off site for disposal, and backfill and restore the excavation area. No further excavation was to be done in the area.

In addition, the removed radiologically impacted and non-impacted soils were screened for UXO during loading into roll off bins for disposal, and into the excavation area for backfill.

During the two site visits, work completed included:

- Radiation safety briefing(s) to assigned staff not previously trained in radiation safety.
- Incoming equipment and material surveys.
- Excavation of former burial areas down to 2' below grade surface in 6" lifts.
- Surveying and surface soil sampling of over burden soils as Class 1 areas (6" lifts) in accordance with MARSSIM guidelines.
- Surveying and surface soil sampling of former burial areas as a Class 1 area following excavation down to 2' below grade surface in accordance with MARSSIM guidelines.
- Loaded seven 25 cubic yard intermodal roll off bins with radiologically contaminated soils for disposal following screening by UXO personnel.
- Provided radiological monitoring during collection of samples.
- Performed personnel surveys during performance of work as necessary.
- Performed radiological release surveys on outgoing equipment and material.
- Performed limited characterization survey in the excavation area to determine the potential volume of radiologically impacted soils that would require future removal.
- Backfilled and restored the excavation area following screening by UXO personnel. Restoration included backfilling, compaction, and reseeding of the area.

A detailed summary of the work performed can be found in the Final Report (AWS, 2013) in Appendix Z.

2.3.5 PREVIOUS CHARACTERIZATION ACTIVITIES

Aleut World Solutions (AWS) was contracted by the U.S. Army Joint Munitions Command (JMC) to perform a characterization survey and sampling effort in accordance

with MARSSIM guidelines at the IR Site 1 located at the Naval Support Facility Indian Head (NSF-IH) in Indian Head, MD. Experiments with radioactive materials (Thorium-232) were conducted in the past in this area. The characterization surveys and sampling were performed during the period of 26 January through 30 January 2015 (see Appendix AA). Figure 6 presents an overview map of the site and the borehole locations.

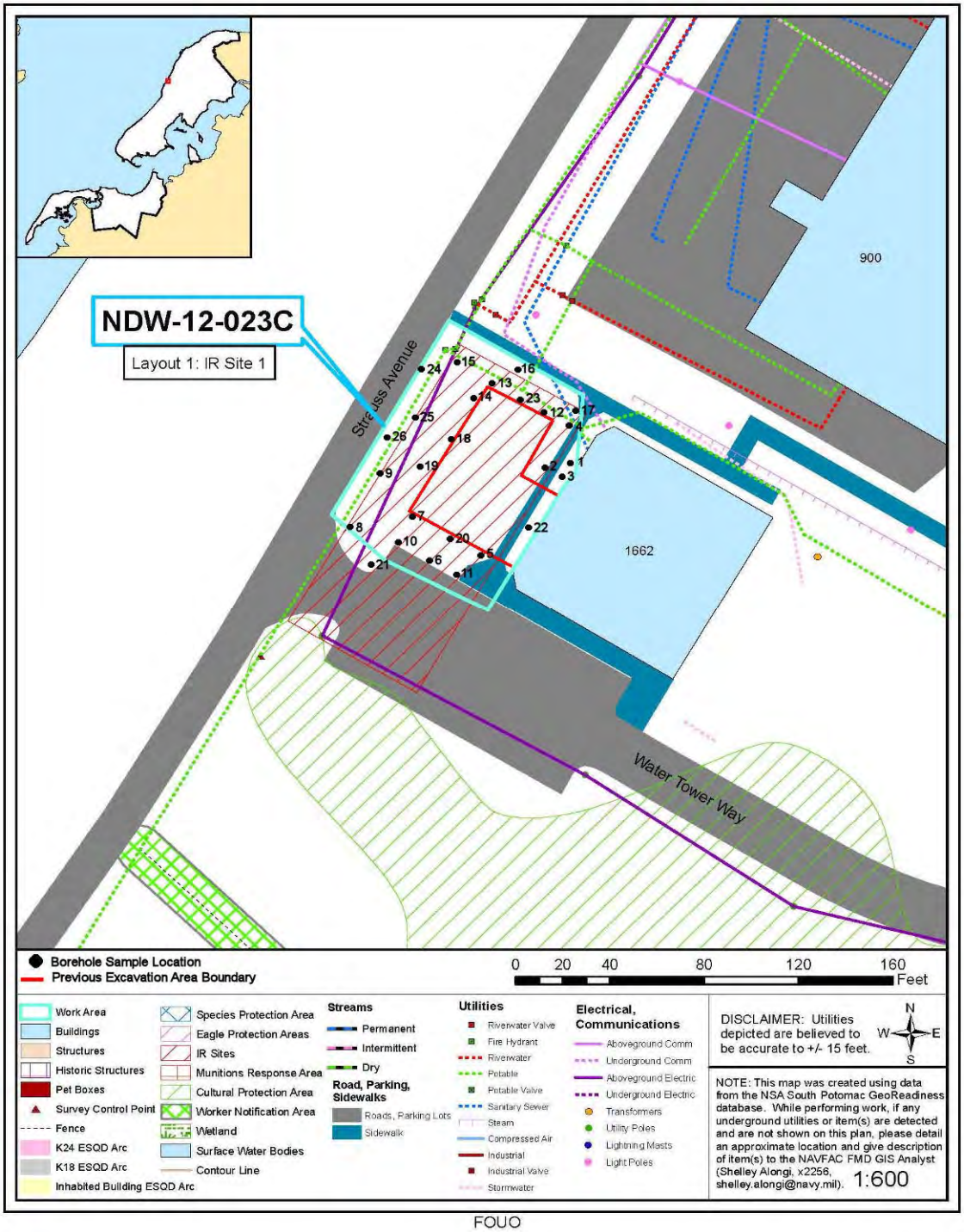
2.3.5.1 Summary of Work Performed

The work that was performed included:

Characterization surveys and sampling of the IR Site 1 area including soil boreholes, gamma logging of the boreholes, gamma scan surveys, and soil sampling for offsite isotopic thorium analysis.

The results of the characterization survey and sampling effort concluded that the remaining radiologically impacted soils were limited to the current removal area, and that the removal area would not have to be expanded outside of the current footprint. It also estimated approximately 200 cubic yards (CY) of radiologically impacted soils remained in the removal area.

A detailed summary of the work performed can be found in the Final Report (AWS, 2015a) located in Appendix AA.



FOUO

Figure 6. Borehole Location Map

2.4 LICENSE NUMBER, STATUS, AND AUTHORIZED ACTIVITIES

All work detailed in this report was performed under the AWS Nuclear Regulatory Commission (NRC) Broad Scope Radioactive Materials License 50-29273-01.

A Memorandum of Understanding (MOU) was completed between the Navy, JMC, and AWS prior to the start of the remediation and survey activities defining the license responsibilities between the three organizations.

The signed Memorandum of Understanding is presented in this report in Appendix A.

3.0 Radiological Control Requirements

3.1 RADIATION WORK PERMIT

A Radiation Work Permit (RWP) was prepared that specified the field activities to be performed and all radiological safety requirements for the work. All personnel assigned to site work were required to read and sign the RWP, acknowledging that they understood the requirements of the RWP, prior to beginning work.

The RWP was also used as an information document for industrial safety. Site hazards other than radiological were included in the RWP so proper protective actions could be taken for all potential hazards. The RWP clearly specified the need for a briefing on the radiological conditions present in the work environment.

The RWP listed tasks and specific levels of protection for each worker covered by the RWP. The RWP also detailed the dosimetry requirements, the protective clothing requirements, and the expected radiation and contamination levels to be encountered during the remediation and field survey activities.

The RWP is presented in this report in Appendix B.

3.2 PERSONNEL MONITORING AND DOSIMETRY

3.2.1 EXTERNAL WHOLE BODY EXPOSURE MONITORING

Even though the planned work consisted of excavation, equipment, and area surveys and potential minor decontamination efforts, the likelihood that personnel would receive any external or internal exposure was considered minimal. However, AWS administrative policies require the use of external dosimetry on any field project that has the potential for exposure to radioactive material.

The Project Manager (or designee) was responsible for ensuring that all AWS personnel assigned to perform the work (employees, vendors, contractors, and visitors) were appropriately monitored for exposure to ionizing radiation. Each individual working at the site wore the dosimetry devices specified in the RWP. Personnel were issued a thermo-luminescent dosimeter (TLD). The issuance of the monitoring devices was documented on a Badge Issue Log and furnished to the vendor that processes the TLD's. The TLDs were worn by personnel on the front of the body between the neck and the waist. Due to the low exposure rates in the areas, perimeter environmental TLD's were not required.

3.2.2 INTERNAL EXPOSURE MONITORING

Urine (bioassay) samples were collected from the workers and sent to an offsite laboratory for analysis at the beginning (baseline) and completion of excavation activities to evaluate the presence or absence of radioactive material inside of the body.

3.3 OFFICIAL EXPOSURE DETERMINATION AND PROJECT DOSE ESTIMATE

The official and permanent record of accumulated external dose received by individuals was obtained from the processing of the personnel monitoring devices. The vendor TLD processing report showed that no personnel received any detectable whole body exposure greater than 10 millirem, which is the detection threshold of the TLDs.

In addition, the results of the bioassay samples collected indicated that no internal exposure was received during the soil removal activity.

Copies of the laboratory data for the bioassay samples can be found in Appendix C. A copy of the vendor TLD report can be furnished upon request.

4.0 Site Preparation, Equipment and Personnel

4.1 ACCESSIBILITY

Access to the active work areas was radiologically controlled using temporary fencing, barricades, and/or boundary rope/tape. The appropriate postings were displayed. This limited access to only those personnel performing work in the areas.

4.2 OFFICE SPACE AND RESTROOM FACILITIES

A temporary office trailer and restroom facilities were utilized during the task.

4.3 EROSION AND SEDIMENT CONTROL PLAN

Maryland Department of the Environment (MDE) regulations required an approved Erosion and Sediment Control Plan (E & SC) since the amount of soil to be excavated was greater than 100 cubic yards. All the requirements of this plan were implemented prior to excavation activities starting in the work area. The E & SC Plan was prepared by Colbert, Matz, Rosenfelt, Inc.

A copy of the approved E & SC Plan is provided in Appendix D of this report.

4.4 SOIL LAYDOWN AREA PRE/POST JOB SURVEYS

The area underwent a 50% gamma scan survey prior to the start of work to identify areas of elevated activity. No areas of elevated activity above background were found during the gamma scan survey. Gamma scan results were between 5,000 to 6,000 gross counts per minute (cpm) gamma. Post job surveys of this area were also performed following completion of the project yielding identical results.

4.5 ELECTRICAL POWER

Portable generators were used for electrical power in work areas where needed.

4.6 TEMPORARY FENCING

Temporary fencing was used to restrict access to work areas where needed.

4.7 AREA POSTING AND ACCESS CONTROL

In order to minimize unauthorized access to, and/or removal from the site of radioactive material(s), application of appropriate security protective measures were exercised (i.e., temporary fencing with locked gates, boundary ropes with warning signs). Identification of locations where radioactive materials were present was accomplished with the use of conspicuous postings compliant with Title 10 Code of Federal Regulations (CFR) Part 20. Pre-authorized areas were used to store radioactive materials at NSF-IH. These areas were selected with authorization and concurrence of RASO and appropriate NSF-IH personnel.

Radioactive material handling activities was performed in a manner to ensure:

- Access to areas was restricted where radioactive materials were known to be present.
- Surveys of radioactive materials storage areas were completed periodically as warranted.

4.8 IMPORT BACKFILL SOIL

Farm Service Inc. located in Accokeek, MD was selected as the source of import backfill soils. Grab samples were collected from the stockpiles of the provider. The samples were sent to Test America, Inc. for analysis. The analysis included:

- Total Volatile Organic Compounds
- Total Semi-volatile Organic Compounds
- Total Mercury
- Total RCRA Metals
- Total Herbicides
- Total Pesticides
- Total Gasoline Range Organics
- Total Diesel Range Organics
- Radionuclide's (Gamma Spectroscopy, to include Ra-226)

The results of the sample analysis were compared to the Maryland Department of the Environment (MDE) cleanup standards for soil and groundwater. All sample results were found acceptable and appropriate for clean fill.

The laboratory data for the sample results are presented in this report in Appendix E.

The total amount of import select backfill soil used for the restoration of Site1 was approximately 150 tons and the total amount of import screened topsoil used was approximately 60 tons.

4.9 TRAINING

Prior to the start of operations, all site personnel, including subcontractors, attended a briefing stating all radiological conditions and controls implemented at the site.

4.10 UNDERGROUND UTILITY LOCATION

A licensed subcontractor (Line Locator's Inc.) visited the site prior to the start of excavation activities to locate and mark underground utilities in the excavation area. No interferences in the excavation area were found. All underground utilities were located outside of the excavation area.

4.11 IR WORK APPROVAL PERMITS

An Installation Restoration (IR) work approval permit, and excavation permit were issued by NSF-IHprior to the start of onsite work activities.

Copies of these work approval permits are presented in this report in Appendix F.

4.12 INCOMING CONTAINER SURVEYS/INSPECTION

Upon arrival at the site, each 20 cubic yard Type IP-1 container underwent incoming radiological surveys. The internal surfaces of the containers were surveyed. The surveys consisted of fixed and loose surface contamination surveys for gross alpha-beta/gamma activity. The results of the surveys were compared to the applicable DOT limits set forth in 49 CFR Parts 173.441 and 173.443. None of the results of the surveys were above the applicable DOT limits.

The container incoming surveys are presented in Appendix G of this report. After loading, the bins external surfaces were also surveyed (see Section 12.1). The containers were also inspected prior to use, the inspection included, but was not limited to the following:

4.12.1 CONTAINER OUTER SURFACE CONDITION

Inspect the outer surface of the container (lid included) for conditions that could compromise the integrity of the container (for example, holes, cracks, bulges, deformations, dents, and evidence of severe corrosion). If present, inspect the lid lifting rings and attachment points for damage and signs of fatigue.

4.12.2 CONTAINER INNER SURFACE CONDITION

Inspect the inner surface of the container (lid included). Inspect for holes, cracks, bulges, deformations/dents, and evidence of severe corrosion, which could compromise the integrity of the container.

Note: For both outer and inner surface conditions, minor corrosion and paint flaking was acceptable.

4.12.3 CONTAINER CLOSURE

- Inspect the lid gasket for deformations, cracks, bulges, and other conditions which could compromise the sealing of the container.
- Inspect the gasket-seating surface of the container for cleanliness and debris. Remove any foreign debris and clean the seating surface (as necessary) to ensure proper sealing of the lid.
- If present, inspect lid closure bolts and devices for damage and/or signs of fatigue.

4.13 PERSONNEL

Task personnel consisted of the following:

Project Manager – Primary point of contact responsible for overall operations and safety of the project team. The Project Manager also acted as the onsite Radiation Safety Officer (RSO) for the project.

Health Physics Technicians – Performed surveys, sampling operations and supervised any decontamination efforts that were required.

Equipment Operator – Operated heavy equipment used to support excavation and remediation activities.

Decontamination Technicians – Performed decontamination efforts as required and provided general labor support.

Truck Drivers – Operated trucks for the movement of waste containers between the excavation area and the rail loading facility.

U.S. Army JMC Certified Senior Waste Broker – (employed by AWS) - Prepared and completed all waste manifests and applicable DOT shipping documentation for the waste shipments.

Bering Sea Environmental UXO II Tech – Responsible for the screening of soils for the presence of UXO.

Bering Sea Environmental Senior UXO Supervisor – Responsible for the supervision of the screening of soils for the presence of UXO.

Visionary Solutions, LLC and I.C.E. Service Group, Inc. – Responsible for scheduling logistics of the waste that was packaged and transported to the interim transloading site for transport to the ultimate disposal facility (US Ecology). Provided truck support for bin movement and support functions at the rail loading facility.

All personnel were trained and experienced at the tasks they performed.

5.0 Soil Removal and Excavation Activities

Figure 13 presents a map of the final excavation area boundaries.

5.1 GAMMA SCAN SURVEYS

Prior to each 6" lift below 2' bgs in the excavation area, a 100% walkover gamma scan survey was performed in the area with 2" by 2" NaI detectors. The following is a summary of the ranges found during the gamma scan surveys (background levels were ~ 5,500 cpm):

- 1st 6" Lift (2'-2.5' bgs): 5,000-62,000 cpm
- 2nd 6" Lift (2.5'-3.0' bgs): 5,000-28,000 cpm
- 3rd 6" Lift (3.0'-3.5' bgs): 5,000-140,000 cpm
- 4th 6" Lift (3.5'-4.0' bgs): 5,000-11,000 cpm

Copies of the surveys are presented in this report in Appendix H.

The instrument information used during these surveys is as follows:

Instrument Model #: Ludlum Model 2350-1 Data Logger

Instrument Serial Number: 120588

Detector Model #: Ludlum Model 44-10

Detector Serial Number: 318218

Calibration Due Date: 6/19/2016

5.2 SOIL SAMPLES

Following each gamma scan survey of each 6" lift in the excavation area, systematic soil samples were collected in the area. The samples were sent to the offsite laboratory for isotopic thorium (alpha spectroscopy) analysis. Figures 7, 8, 9, and 10 present maps of the soil sample locations.

The laboratory data for the soil samples are in this report in Appendix I.

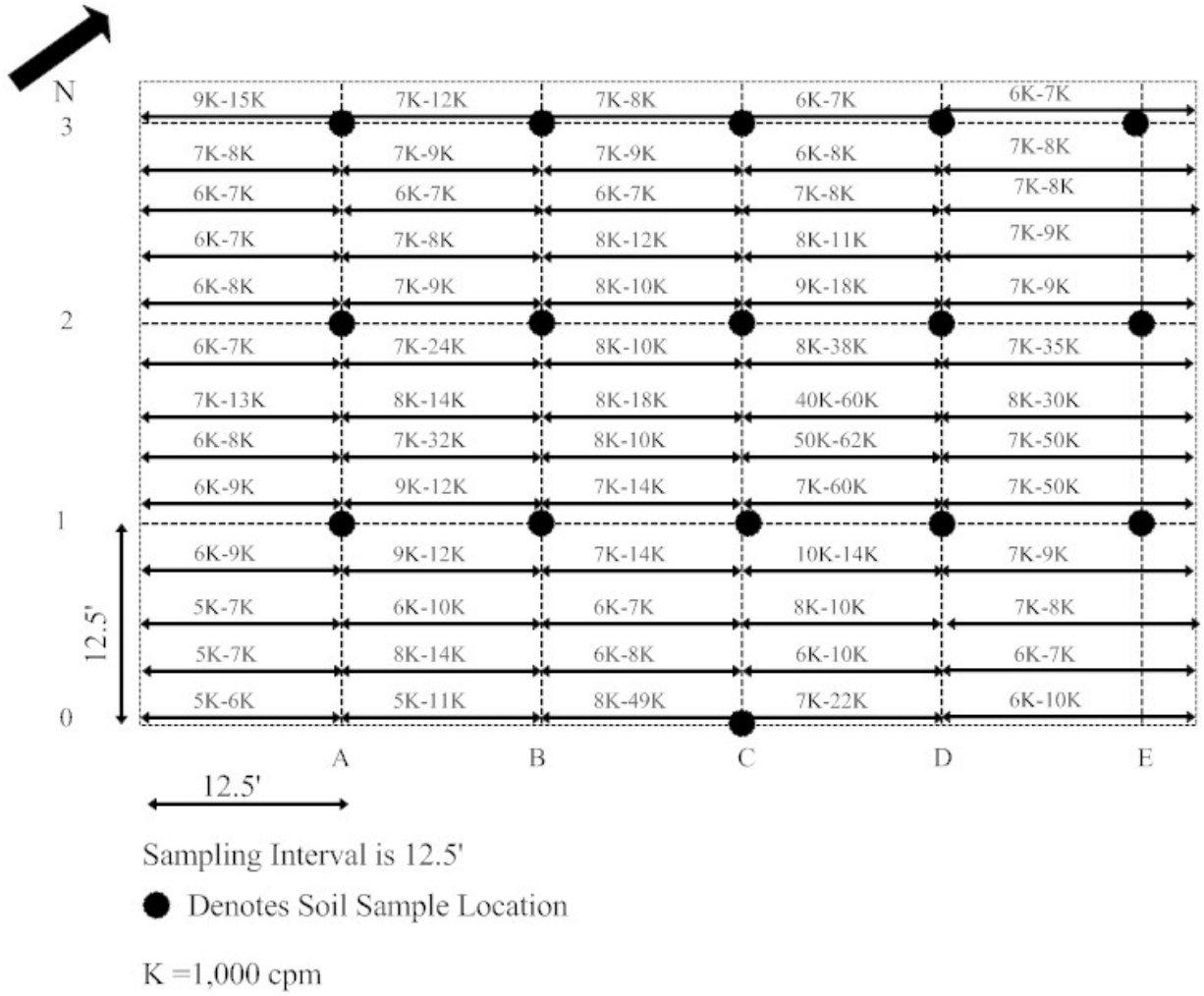


Figure 7. 1st 6" Lift Soil Sample Location Map

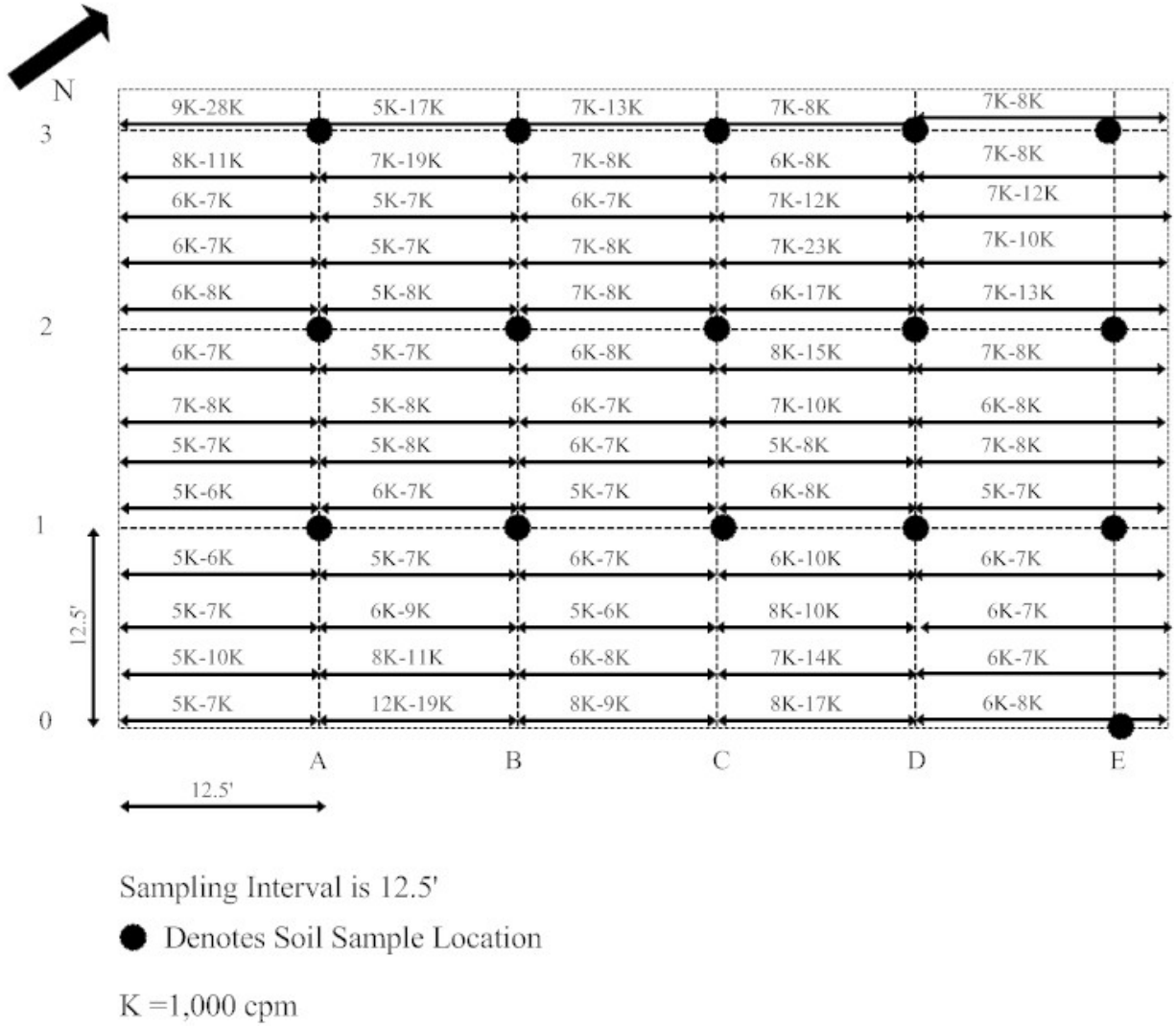


Figure 8. 2nd 6" Lift Soil Sample Map

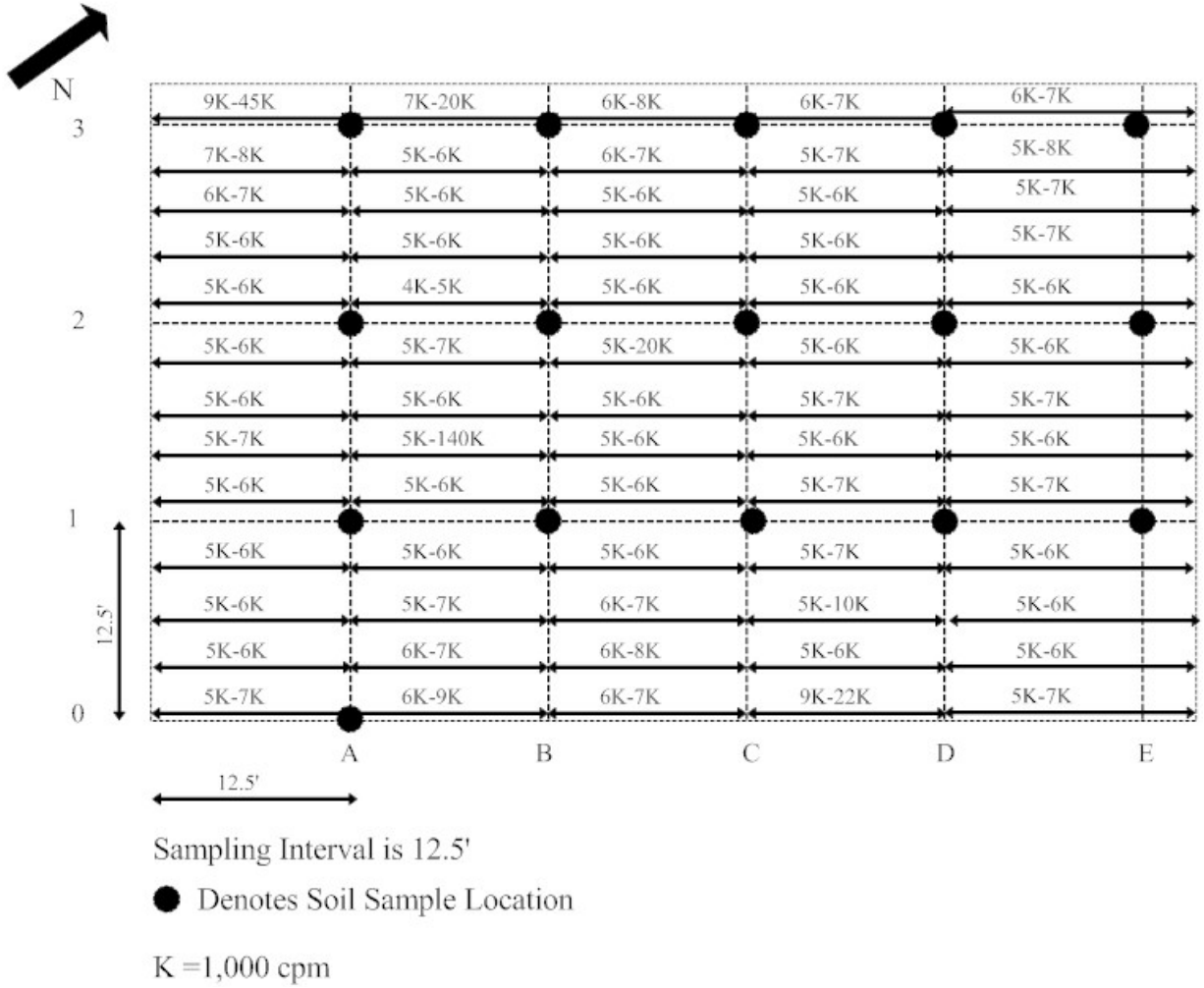


Figure 9. 3rd 6" Lift Soil Sample Map

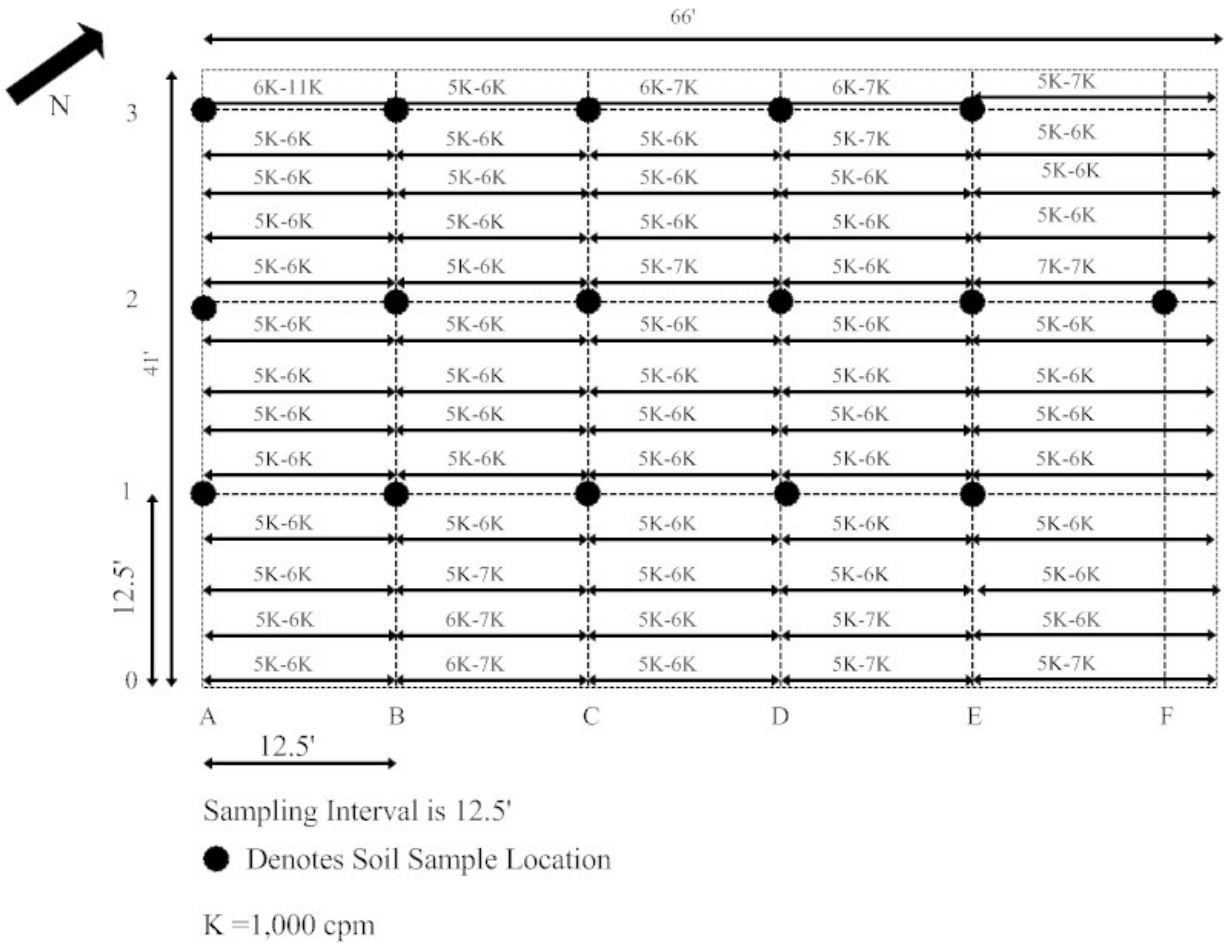


Figure 10. 4th 6" Soil Sample Map

Summaries of the soil sample results are provided in Tables 2, 3, 4, and 5 below.

Tables 2 through 5 present summaries of the isotopic thorium analysis results for the three isotopes of thorium. They also present the 2σ (standard deviation) counting uncertainty error for each of the samples. The average sample concentration and standard deviation of the sample group is also presented at the bottom of the table. Only one sample (7.07 pCi/g), was above the DCGL of 3.0 pCi/g for Th-232. This sample was from a depth below grade surface (bgs) of 30-36 inches.

Table 2. 1st 6" Lift Soil Sample Result Summary Table

						Isotopic Thorium/Alpha Spectroscopy						
Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in inches	Sample Matrix	Location/Description	Th-228 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-230 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-232 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Comments/Notes
IHS1L5- A1	10/16/2015	1037	24-30"	Soil	Fifth 6" Lift Sample	0.958	0.201	0.734	0.171	0.739	0.171	
IHS1L5- A2	10/16/2015	1032	24-30"	Soil	Fifth 6" Lift Sample	0.549	0.139	0.638	0.152	0.682	0.157	
IHS1L5- A3	10/16/2015	1027	24-30"	Soil	Fifth 6" Lift Sample	0.518	0.146	0.658	0.163	0.652	0.162	
IHS1L5- B1	10/16/2015	1042	24-30"	Soil	Fifth 6" Lift Sample	0.735	0.165	0.451	0.126	0.694	0.157	
IHS1L5- B2	10/16/2015	1222	24-30"	Soil	Fifth 6" Lift Sample	1.13	0.21	0.707	0.161	1.12	0.209	
IHS1L5- B3	10/16/2015	1122	24-30"	Soil	Fifth 6" Lift Sample	0.557	0.146	0.631	0.154	0.397	0.12	
IHS1L5- C0	10/16/2015	1052	24-30"	Soil	Fifth 6" Lift Sample	1.29	0.229	0.663	0.154	1.53	0.252	
IHS1L5- C1	10/16/2015	1047	24-30"	Soil	Fifth 6" Lift Sample	1.31	0.232	0.526	0.136	1.07	0.203	
IHS1L5- C2	10/16/2015	1247	24-30"	Soil	Fifth 6" Lift Sample	2.69	0.37	0.665	0.157	2.49	0.35	
IHS1L5- C3	10/16/2015	1230	24-30"	Soil	Fifth 6" Lift Sample	0.6	0.145	0.519	0.132	0.487	0.127	
IHS1L5- D1	10/16/2015	1100	24-30"	Soil	Fifth 6" Lift Sample	0.515	0.134	0.527	0.134	0.567	0.139	
IHS1L5- D2	10/16/2015	1243	24-30"	Soil	Fifth 6" Lift Sample	0.763	0.171	0.574	0.144	0.682	0.158	
IHS1L5- D3	10/16/2015	1235	24-30"	Soil	Fifth 6" Lift Sample	0.44	0.124	0.542	0.137	0.531	0.134	
IHS1L5- E1	10/16/2015	1110	24-30"	Soil	Fifth 6" Lift Sample	0.427	0.127	0.485	0.132	0.353	0.111	
IHS1L5- E2	10/16/2015	1117	24-30"	Soil	Fifth 6" Lift Sample	0.407	0.125	0.345	0.11	0.305	0.103	
IHS1L5- E3	10/16/2015	1240	24-30"	Soil	Fifth 6" Lift Sample	0.54	0.15	0.567	0.151	0.537	0.146	
					Maximum:	2.690		0.734		2.490		
					Average:	0.839		0.577		0.802		
					Standard Deviation:	0.577		0.103		0.550		

Denotes Sample Result Between 2.0 and 3.0 pCi/g.

DCGL is 3.0 pCi/g for Th-232.

Table 3. 2nd 6" Lift Soil Sample Result Summary Table

Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in inches	Sample Matrix	Location/Description	Th-228 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-230 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-232 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Comments/Notes
IHS1L6- A1	10/20/2015	O822	30-36"	Soil	Sixth 6" Lift Sample	0.708	0.162	0.516	0.134	0.611	0.146	
IHS1L6- A2	10/20/2015	O827	30-36"	Soil	Sixth 6" Lift Sample	0.433	0.125	0.454	0.125	0.588	0.144	
IHS1L6- A3	10/20/2015	O832	30-36"	Soil	Sixth 6" Lift Sample	8.9	0.919	0.745	0.167	7.07	0.76	
IHS1L6- B1	10/20/2015	O836	30-36"	Soil	Sixth 6" Lift Sample	0.637	0.152	0.463	0.127	0.601	0.146	
IHS1L6- B2	10/20/2015	O840	30-36"	Soil	Sixth 6" Lift Sample	1.13	0.208	0.687	0.155	0.917	0.182	
IHS1L6- B3	10/20/2015	O844	30-36"	Soil	Sixth 6" Lift Sample	0.76	0.168	0.659	0.154	0.72	0.162	
IHS1L6- C1	10/20/2015	O849	30-36"	Soil	Sixth 6" Lift Sample	0.875	0.187	0.484	0.132	0.755	0.168	
IHS1L6- C2	10/20/2015	O851	30-36"	Soil	Sixth 6" Lift Sample	0.86	0.179	0.504	0.131	0.781	0.167	
IHS1L6- C3	10/20/2015	O855	30-36"	Soil	Sixth 6" Lift Sample	0.647	0.152	0.585	0.142	0.602	0.144	
IHS1L6- D1	10/20/2015	O858	30-36"	Soil	Sixth 6" Lift Sample	0.775	0.175	0.762	0.171	0.633	0.153	
IHS1L6- D2	10/20/2015	O901	30-36"	Soil	Sixth 6" Lift Sample	1.95	0.311	0.623	0.157	1.82	0.294	
IHS1L6- D3	10/20/2015	O904	30-36"	Soil	Sixth 6" Lift Sample	0.611	0.153	0.587	0.147	0.524	0.137	
IHS1L6- E0	10/20/2015	O907	30-36"	Soil	Sixth 6" Lift Sample	0.568	0.147	0.649	0.155	0.486	0.131	
IHS1L6- E1	10/20/2015	O910	30-36"	Soil	Sixth 6" Lift Sample	0.878	0.19	0.5	0.137	0.849	0.182	
IHS1L6- E2	10/20/2015	O913	30-36"	Soil	Sixth 6" Lift Sample	0.623	0.152	0.571	0.141	0.767	0.166	
IHS1L6- E3	10/20/2015	O916	30-36"	Soil	Sixth 6" Lift Sample	0.625	0.155	0.569	0.144	0.719	0.163	
					Maximum:	8.900		0.762		7.070		
					Average:	1.311		0.585		1.153		
					Standard Deviation:	2.053		0.096		1.607		

Denotes Sample Result Greater Than 3.0 pCi/g.

DCGL is 3.0 pCi/g for Th-232.

Table 4. 3rd 6" Lift Soil Sample Result Summary Table

						Isotopic Thorium/Alpha Spectroscopy						
Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in inches	Sample Matrix	Location/Description	Th-228 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-230 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-232 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Comments/Notes
IHS1L7- A0	10/21/2015	O753	36-42"	Soil	Seventh 6" Lift Sample	0.552	0.145	0.536	0.14	0.596	0.147	
IHS1L7- A1	10/21/2015	O757	36-42"	Soil	Seventh 6" Lift Sample	0.676	0.157	0.404	0.118	0.486	0.129	
IHS1L7- A2	10/21/2015	O801	36-42"	Soil	Seventh 6" Lift Sample	0.538	0.143	0.564	0.143	0.536	0.139	
IHS1L7- A3	10/21/2015	O806	36-42"	Soil	Seventh 6" Lift Sample	1.13	0.213	0.538	0.138	1.09	0.206	
IHS1L7- B1	10/21/2015	O809	36-42"	Soil	Seventh 6" Lift Sample	0.622	0.143	0.506	0.13	0.63	0.143	
IHS1L7- B2	10/21/2015	O814	36-42"	Soil	Seventh 6" Lift Sample	0.693	0.16	0.574	0.144	0.548	0.139	
IHS1L7- B3	10/21/2015	O818	36-42"	Soil	Seventh 6" Lift Sample	0.62	0.149	0.879	0.179	0.687	0.155	
IHS1L7- C1	10/21/2015	O819	36-42"	Soil	Seventh 6" Lift Sample	0.708	0.159	0.669	0.156	0.59	0.143	
IHS1L7- C2	10/21/2015	O822	36-42"	Soil	Seventh 6" Lift Sample	0.665	0.158	0.687	0.159	0.629	0.151	
IHS1L7- C3	10/21/2015	O826	36-42"	Soil	Seventh 6" Lift Sample	0.593	0.14	0.577	0.137	0.598	0.139	
IHS1L7- D1	10/21/2015	O843	36-42"	Soil	Seventh 6" Lift Sample	0.409	0.12	0.522	0.133	0.394	0.112	
IHS1L7- D2	10/21/2015	O851	36-42"	Soil	Seventh 6" Lift Sample	0.63	0.151	0.549	0.137	0.403	0.115	
IHS1L7- D3	10/21/2015	O900	36-42"	Soil	Seventh 6" Lift Sample	0.525	0.133	0.552	0.135	0.614	0.143	
IHS1L7- E1	10/21/2015	O846	36-42"	Soil	Seventh 6" Lift Sample	0.647	0.155	0.798	0.173	0.569	0.142	
IHS1L7- E2	10/21/2015	O854	36-42"	Soil	Seventh 6" Lift Sample	0.433	0.118	0.432	0.115	0.477	0.121	
IHS1L7- E3	10/21/2015	O858	36-42"	Soil	Seventh 6" Lift Sample	0.781	0.172	0.669	0.156	0.96	0.191	
					Maximum:	1.130		0.879		1.090		
					Average:	0.639		0.591		0.613		
					Standard Deviation:	0.163		0.124		0.181		

DCGL is 3.0 pCi/g for Th-232.

Table 5. 4th 6" Lift Soil Sample Result Summary Table

Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in inches	Sample Matrix	Location/Description	Th-228 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-230 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-232 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Comments/Notes
IHS1L8- A1	10/22/2015	1024	42-48"	Soil	Eigth 6" Lift Sample	0.601	0.15	0.568	0.144	0.653	0.156	
IHS1L8- A2	10/22/2015	1027	42-48"	Soil	Eigth 6" Lift Sample	0.958	0.194	0.74	0.166	0.696	0.16	
IHS1L8- A3	10/22/2015	1029	42-48"	Soil	Eigth 6" Lift Sample	0.881	0.185	0.859	0.181	0.845	0.179	
IHS1L8- B1	10/22/2015	1032	42-48"	Soil	Eigth 6" Lift Sample	1.25	0.226	0.605	0.148	1.1	0.208	
IHS1L8- B2	10/22/2015	1033	42-48"	Soil	Eigth 6" Lift Sample	0.688	0.152	0.691	0.152	0.567	0.134	
IHS1L8- B3	10/22/2015	1035	42-48"	Soil	Eigth 6" Lift Sample	0.544	0.14	0.537	0.137	0.633	0.149	
IHS1L8- C1	10/22/2015	1038	42-48"	Soil	Eigth 6" Lift Sample	0.484	0.128	0.525	0.134	0.377	0.11	
IHS1L8- C2	10/22/2015	1041	42-48"	Soil	Eigth 6" Lift Sample	0.799	0.175	0.766	0.17	0.825	0.176	
IHS1L8- C3	10/22/2015	1043	42-48"	Soil	Eigth 6" Lift Sample	0.716	0.161	0.659	0.151	0.781	0.166	
IHS1L8- D1	10/22/2015	1047	42-48"	Soil	Eigth 6" Lift Sample	1.3	0.239	0.849	0.186	0.87	0.187	
IHS1L8- D2	10/22/2015	1050	42-48"	Soil	Eigth 6" Lift Sample	0.544	0.139	0.518	0.138	0.461	0.126	
IHS1L8- D3	10/22/2015	1052	42-48"	Soil	Eigth 6" Lift Sample	0.823	0.179	0.629	0.153	0.801	0.174	
IHS1L8- E1	10/22/2015	1054	42-48"	Soil	Eigth 6" Lift Sample	0.806	0.176	0.706	0.163	0.692	0.161	
IHS1L8- E2	10/22/2015	1056	42-48"	Soil	Eigth 6" Lift Sample	0.534	0.135	0.584	0.144	0.507	0.13	
IHS1L8- E3	10/22/2015	1059	42-48"	Soil	Eigth 6" Lift Sample	0.615	0.149	0.858	0.178	0.701	0.158	
IHS1L8- F2	10/22/2015	1103	42-48"	Soil	Eigth 6" Lift Sample	0.771	0.172	0.662	0.155	0.461	0.126	
					Maximum:	1.300		0.859		1.100		
					Average:	0.770		0.672		0.686		
					Standard Deviation:	0.240		0.117		0.186		

DCGL is 3.0 pCi/g for Th-232.

5.3 RADIOLOGICALLY IMPACTED SOIL REMOVAL SITE 1

The soil was excavated in one 2' and four 6" lifts with an excavator and placed directly into a wheel loader bucket. The first 2' of soil was considered clean fill based on the previous removal action 2013. However, every bucket load of soil was gamma scan surveyed. Following gamma scan surveys of the excavator and wheel loader buckets, the soils were then placed directly into a designated soil stockpile located in the soil laydown area. Each excavator and front end loader bucket was gamma scan surveyed to identify point sources of radioactive material and to determine if soils were radiologically impacted. No point sources were discovered in any of the bucket loads.

Approximately 172 cubic yards of radiologically impacted soils were removed from the excavation area. The excavated soils were stored and covered in the soil laydown area in accordance with the requirements of the E & SC Plan.

5.4 CONCRETE SLABS

Uncovered portions of concrete slabs were screened manually for alpha and beta/gamma emitters. The surveys consisted of 100% alpha-beta and gamma scans and alpha-beta direct measurements. The alpha/beta scans were conducted in accordance with Section 7.6.2 of this report. The alpha/beta direct measurements were conducted in accordance with Section 7.6.3 of this report. The gamma scans were conducted in accordance with Section 7.6.5 of this report. All of the survey results were less than the DCGL's presented in Table 8 of this report.

Survey data for the concrete slabs is provided in Appendix J of this report.

5.5 DUST SUPPRESSION

Water was used to lightly wet the soils if dust levels increased during excavation activities.

5.6 AIR SAMPLING

Concentrations of radioactive material in air was determined, as needed, by sampling the air. Air samples were collected downwind during excavation activities in the immediate vicinity of the area being excavated. Air sampling was conducted in accordance with the guidance provided in NRC Regulatory Guide 8.25, "Air Sampling in the Workplace", July 1992 (NRC 1992a). The samples were collected under known physical conditions (e.g. filter, sample time, flow rate). The flow meters of air samplers were calibrated at least annually.

Air samples were collected from general and localized areas when there was potential for generation of airborne radioactive material (during excavation activities) These samples were used to verify that the confinement of radioactive material was effective, and to provide any warning of elevated concentrations for planning or response actions. In each case, the sampling point was located in the airflow pathway near the known or suspected release point(s). More than one air sample location was used, as necessary, to provide a reasonable estimate of the general concentration of airborne radioactive material.

The air sample filters were analyzed onsite for gross alpha-beta activity with a Ludlum Model-2929 Dual Channel Scaler phoswich detector or equivalent.

The following equation was used to calculate the initial and decayed count airborne activity:

$$A_F = \frac{(GrossCounts / CountTime) - BackgroundCountRate}{F * 2.22E+6 * V * \varepsilon_i * 2.83E+4}$$

Where:

A_F	Air Sample Activity in µCi/ml
F	Filter Efficiency Factor
V	Total Volume of Air Collected on Air Sample Filter in cubic feet
2.22E+6	Conversion Factor for dpm to µCi
ε_i	2 π Instrument Efficiency
2.83E+4	Conversion Factor for cubic feet to milliliter

The AWS Project Manager applied professional judgment and experience to identify air sampling appropriate for the specific situation. Such judgment was based on historical air sampling and characterization results, quantity of contamination of the material being handled, potential for release of contaminants based on physical form and activity, type of confinement or containment, and other factors specific to the activity.

An administrative action level was established for breathing zone air samples of 10% of the derived air concentration (DAC); air sample results greater than this administrative action level was reported to the AWS Project Manager. Individual exposure greater than this action level required the individual to be restricted from work involving potential exposure to airborne radioactive material unless approved by the AWS RSO. This condition was not encountered during remediation activities.

The 10% DAC value for Th-232 is 1.0 E-13 µCi/ml which can be found in 10 CFR Part 20, Appendix B, Table 1, Column 3.

All of the air sample results were less than the 10% DAC value for Th-232 for all work conducted during remediation activities. The air sample results are presented in Appendix K of this report.

Table 6 presents a summary of the air sample results.

Table 6. Air Sample Result Summary Table

Sample ID	Date	Sample Location	Initial Count α Results In µCi/ml	Initial Count βγ Results In µCi/ml	Decayed Count α Results In µCi/ml	Decayed Count βγ Results In µCi/ml	# of Hours Decayed
AS-01	10/13/15	Downwind During Excavation	3.9 E-11	1.6 E-10	9.4 E-14	3.8 E-14	20
AS-02	10/13/15	Downwind During Excavation	1.6 E-10	5.9 E-10	6.7 E-14	4.8 E-14	20
AS-03	10/14/15	Downwind During Excavation	1.0 E-10	3.8 E-10	8.9 E-14	6.4 E-14	20
AS-04	10/14/15	Downwind During Excavation	6.5 E-11	2.3 E-10	8.9 E-14	6.4 E-14	20
AS-05	10/15/15	Downwind During Excavation	4.2 E-11	1.7 E-10	8.9 E-14	9.5 E-14	20
AS-06	10/15/15	Downwind During Excavation	2.7 E-11	1.0 E-10	6.7 E-14	9.5 E-14	20
AS-07	10/16/15	Downwind During Excavation	8.9 E-11	3.4 E-11	8.9 E-14	6.4 E-14	20
AS-08	10/19/15	Downwind During Excavation	5.8 E-11	2.2 E-10	8.0 E-14	9.5 E-14	20
AS-09	10/19/15	Downwind During Excavation	1.8 E-11	6.6 E-11	6.7 E-14	5.7 E-14	20
AS-10	10/20/15	Downwind During Excavation	8.4 E-11	3.0 E-10	6.7 E-14	6.4 E-14	20
AS-11	10/21/15	Downwind During Excavation	1.7 E-10	6.1 E-10	3.3 E-14	7.2 E-14	20
AS-12	10/21/15	Downwind During Excavation	1.1 E-10	3.9 E-10	8.4 E14	7.2 E-14	20
AS-13	10/22/15	Downwind During Excavation	2.1 E-10	7.3 E-10	6.7 E-14	2.4 E-14	20
AS-14	10/22/15	Downwind During Excavation	1.2 E-10	4.3 E-10	8.4 E-14	7.2 E-14	20
AS-15	10/23/15	Downwind During Excavation	7.5 E-11	2.6 E-10	2.2 E-14	9.5 E-14	20
AS-16	10/23/15	Downwind During Excavation	6.6 E-11	2.4 E-10	3.3 E-14	4.8 E-14	20
AS-17	10/26/15	Downwind During Excavation	5.2 E-11	2.1 E-10	6.7 E-14	9.5 E-14	20
AS-18	10/26/15	Downwind During Excavation	2.2 E-11	8.7 E-11	6.7 E-14	2.4 E-14	20

6.0 Planning Phase of Radiological Surveys

6.1 RADIONUCLIDE OF CONCERN

Based upon historical information from previous investigations and soil sample analysis conducted at Site 1 the radionuclide of concern is the naturally occurring Thorium-232 (Th-232) isotope. The radionuclide of concern is the radionuclide at a particular site that could potentially contribute to the dose received by the public, or in this case, military personnel.

Table 7 lists the radionuclide of concern with the half-life and principle types of radiation (alpha, beta, or gamma).

Table 7. Radionuclide of Concern

Radionuclide	Half-life	Radiations
Thorium-232	1.405 E+10 years	Alpha (α)/gamma (γ)

6.2 SURFACE ACTIVITY DERIVED CONCENTRATION GUIDELINE LIMITS (DCGLS) FOR RADIONUCLIDE OF CONCERN FOR EQUIPMENT, MATERIALS, AND TOOLS

The surface activity DCGL's are stated in the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses, By-product, Source, or Special Nuclear Materials, (NRC 1987)", and "Termination of Operating Licenses for Nuclear Reactors, Regulatory Guide 1.86, (AEC 1974)."

These DCGL's were applied to incoming and outgoing surveys of equipment used during remediation activities, and surveys of debris and various surfaces (concrete, etc.). Table 8 presents the DCGL's. None of the values in Table 8 were exceeded during any phase of work performed.

Table 8. Surface Activity DCGL's for Equipment, Materials, and Tools

Radionuclide	Removable in dpm/100cm^2	Average [1] in dpm/100cm^2	Maximum [2] in dpm/100cm^2	Radiations Emitted
Th-232	200	1,000	3,000	α/γ

1. Measurements of average contaminant should not be over more than 1 m^2
2. The maximum contamination level applies to an area of not more than 100 cm^2

6.3 DERIVED CONCENTRATION GUIDELINE LIMIT (DCGL) FOR RADIONUCLIDE OF CONCERN FOR SOIL

The DCGL for soils was calculated during the Engineering Evaluation and Cost Analysis (EE/CA) performed by Tetra Tech NUS, Inc. in September of 2010. The objective was to develop a DCGL that corresponded to a cancer risk within the EPA acceptable (or presumably not unacceptable) risk range of 1×10^{-4} (1 in 10,000) and $1\times^{10-6}$ (1 in 1,000,000).

The calculations were performed using the RESRAD Version 6.3 Modeling Code developed by Argonne National Laboratory (ANL) to evaluate doses from exposure to radioactively open land areas. RESRAD is a computer model designed to estimate radiation

doses and risks from residual radioactive materials. It is the only code designated and approved by the Department of Energy (DOE) for the evaluation of radioactively contaminated sites.

NRC has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff. The NRC has a current target dose of 25 mrem/y total effective dose equivalent (TEDE) for unrestricted release, which must be distinguishable from background and includes sources from groundwater, drinking water, and residual activity (10 CFR 20.1402).
.

- The maximum DCGL that resulted in a cancer risk less than 1×10-4 was 3 pCi/g in soil.
- The maximum calculated total dose at this DCGL's level was 17.48 mrem/y at a time of maximum dose accumulation of 25.44 (±0.05) years. This calculated level included all known sources of background radiation, and is considered a very conservative level, and well below the NRC's the TEDE unrestricted release criteria.

6.4 DATA QUALITY OBJECTIVES

A multi-agency committee representing the Department of Defense (DOD), DOE, the U.S. Environmental Protection Agency (EPA), and the Nuclear Regulatory Commission (NRC) has addressed this need by producing a guidance document known as the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

Published in December 1997, MARSSIM provides detailed guidance for planning, implementing and evaluating environmental and facility radiological surveys to demonstrate compliance with a dose-or risk-based regulation. MARSSIM focuses on the demonstration of compliance during the final status survey once scoping, characterization and any necessary remedial actions are completed.

MARSSIM provides a single, nationally consistent guide for verifying that radioactively contaminated sites have been cleaned up to standards. Combining this information into one manual has increased efficiency, and has eliminated the confusion that can result from contractors working from multiple manuals.

The survey of the Site 1 area would require sufficient detail to determine if the release criteria was met. The data from the Final Status Surveys that were performed as defined in MARSSIM, met the data quality objectives.

The final status survey design process for the excavation bottom and sidewall soil began with development of data quality objectives (DQOs) in accordance with the guidelines outlined in Appendix D of MARSSIM and EPA QA/G4 "Guidance for the Data Quality Objectives Process" (EPA, 2006). The DQOs were then used in conjunction with the radiological conditions at the site to calculate the number and locations of measurement and sampling points to demonstrate compliance with the release criterion of 3 pCi/g for Th-232 calculated using the RESRAD Version 6.3 Modeling Code as discussed in Section 6.3. Survey techniques and analytical methodologies were selected to generate the required analytical data. Once the data was received from the surveys and laboratory and was validated, it was evaluated using statistical techniques to test against the hypothesis stated in Section 7.9.2. Sampling, as discussed in this and subsequent sections, refers to the collection of measurement data. "Sampling" includes soil samples for off-site analysis, alpha/beta direct measurements, and swipe samples.

The DQOs, as defined through the seven-step process (EPA 2006), are as follows below:

6.4.1 STATEMENT OF THE PROBLEM

6.4.1.1 Excavation Bottoms/Excavation Sidewalls

For the Final Status Surveys of the excavation area bottom and sidewalls it would be determined if the NRC's unrestricted release limits have been met or if further investigation/remediation is warranted. Therefore, the decision to be made can be stated: "Do the Final Status Survey Units meet the allowable soil concentration release limit of 3 pCi/g". The null hypothesis (H_o) as required by MARSSIM is stated and tested in the negative form: "The median concentration in the survey unit exceeds the soil concentration release limit."

Final Status Surveys are surveys, measurements, and sampling, once performed that describe the radiological conditions of a site, following completion of decontamination/remediation activities (if any) in preparation for unrestricted release.

It was anticipated that successful completion of activities described in the Work Plan would provide sufficient data for the unrestricted release of the areas undergoing survey (AWS, 2015b). Resources available to provide the necessary data included the following:

Activities outlined in the Work Plan (AWS, 2015b).

Guidance provided in the Multi Agency Radiation Survey & Site Investigation Manual (MARSSIM) for performing Final Status Surveys (FSS) (MARSSIM, 2000).

Process knowledge, inspections, and various radiological survey reports previously conducted in the areas.

Statistical analysis of survey data collected during survey activities outlined in the Work Plan (AWS, 2015b).

6.4.1.2 Equipment and Materials

To prevent the spread of radiological contamination, all vehicles, equipment and materials used, packaged, and disposed of were surveyed using the accepted standard methods described in the MARSSIM. The surveys determined if levels were below release criteria for equipment and materials, per applicable agency regulations and MARSSIM guidance.

6.4.2 IDENTIFY THE GOAL OF THE STUDY

The need to provide data for unrestricted release of Site 1 equipment would require the performance of radiological surveys as specified in the Work Plan (AWS, 2015b). The primary uses of the data expected to result from completion of the Work Plan was to provide information and data to support the unrestricted release of excavation bottoms and sidewalls in Site 1 (AWS, 2015b).

6.4.3 IDENTIFY INFORMATION INPUTS

Radiological surveys and sampling required to support the unrestricted release of the areas included:

Locate, survey, and sample background reference area(s) where meaningful background radiation levels can be determined (See Section 7.1 of this report);

100 % gamma scan survey of the removal area excavation bottom (Class 1 areas), sidewalls, and overburden soil with Ludlum Model 2350-1 Data Loggers coupled to Ludlum Model 44-10 2-inch by 2-inch NaI detectors were performed, 50% gamma scan surveys of Class 3 areas with Ludlum Model 2350-1 Data Loggers coupled to Ludlum Model 44-10 2-inch by 2-inch NaI detectors were performed;

Systematic soil samples in the survey units: floor and sidewall excavation extents;

Laboratory data validation and statistical analysis of collected data.

6.4.4 DEFINITION THE BOUNDARIES OF THE STUDY

Spatial Boundaries:

The spatial boundary for this survey effort was the removal areas entire excavation area bottom and sidewalls for Site 1. Each survey unit was 100 % gamma scan surveyed. Systematic soil samples were also collected from each survey unit.

Temporal Boundaries:

None.

6.4.5 DEVELOP THE ANALYTIC APPROACH

6.4.5.1 Excavation Bottom and Sidewalls

The following Decision Rule applied to the excavation bottom and sidewalls after impacted soil removal.

a. If soil was reported as greater than background plus 3 sigma during gamma scans, efforts were made to further remediate the areas until levels were below 3 sigma above background levels. Then a soil sample was collected in the area following remediation sent off-site to be analyzed for Th-232. If soil contamination was not reported as greater than background plus 3 sigma during gamma scans, then the Final Status Survey (FSS) was conducted.

b. If the areas were not remediated below 3 sigma above background levels, then a soil sample was collected in the area and sent off-site to be analyzed for Th-232. If the analytical results exceed the release criteria, then more soil was removed and the area re-sampled. If analytical results were below release criteria, no further removal was required.

c. If the FSS data identified areas that exceed the release criteria, then further soil removal was required. If the FSS data did not identify areas that exceed the release

criteria, no further action was required.

d. A minimum of sixteen soil samples were collected in each survey unit.

6.4.5.2 Debris/ Equipment Surfaces

The following Decision Rules applied to debris and equipment surfaces.

a. If debris/equipment surface contamination was reported above the release criteria during alpha/beta scans, then a swipe sample and a static alpha/beta measurement was collected. If contamination was not reported above the release criteria (exceeding 200 dpm/100 cm^2 alpha removable contamination), no screening was required and the FSS was conducted.

b. If the contamination in a swipe sample exceeded the release criteria for loose contamination (exceeding 200 dpm/100 cm^2 alpha removable contamination), the area was decontaminated using appropriate methods per SOP-014. A swipe sample was collected and analyzed. If contamination was not reported above the release criteria, decontamination activities for the area ceased. If contamination was reported above the release criteria, decontamination activities continued.

c. If a static alpha/beta measurement exceeded the fixed contamination release criteria (1,000 dpm/100 cm^2 alpha), the area was remediated using appropriate methods for the material (e.g., scabbling for concrete). A static alpha/beta measurement was collected in the remediated area. If contamination is not reported above the fixed contamination release criteria, remediation actions ceased in the area and the FSS could proceed. If contamination was reported above the release criteria, remediation activities continued.

d. If the FSS identified areas with contamination above the release criteria (1,000 dpm/100 cm^2 alpha or 200 dpm/100 cm^2 alpha for removable contamination), remediation activities were implemented and the FSS was re-conducted. If the FSS did not identify contamination above the release criteria, the debris/equipment was evaluated for free release.

No debris or equipment surfaces were found to be above the release criteria that required decontamination.

6.4.6 SPECIFY PERFORMANCE OR ACCEPTANCE CRITERIA.

6.4.6.1 Surface Activity Release Limits

The surface activity release limits are presented in Table 8.

If during performance of the FSS the values found were greater than the values presented in Table 8 further investigation and decontamination/remediation was required. If the values found were less than the values presented in Table 8 no further action was required.

6.4.6.2 Soil Concentration Release Limits

The soil concentration limit was 3 pCi/g for Th-232. This criterion includes background levels of Th-232.

6.4.6.3 Investigation Level

Investigation levels are specific levels of radioactivity used to indicate when additional investigation and/or remediation may be necessary. Investigation levels also serve as a Quality Control (QC) check. For example, in addition to indicating potential contamination, a measurement that exceeds the investigation level may indicate a failing instrument.

When determining an investigation level using a statistical-based parameter (e.g., standard deviation), the following may be considered: survey objectives, underlying radionuclide distributions (e.g., normal, log normal, non-parametric), data population descriptors (e.g., standard deviation, mean, median), and prior survey and historical information.

For gamma surveys, the investigation level was established at the reference area mean + 3σ, where σ is the standard deviation of the gamma readings in the reference area.

6.4.6.4 Limits on Decision Errors

Actions to minimize errors need to be implemented during the data collection phase of the radiological survey. Qualified radiation survey personnel perform the survey and record the data. Additional actions, such as instrument calibration, daily instrument source checks, and backup surveys with separate instruments provide the primary steps to be taken to avoid errors in the data collection phase of the survey process.

In order to minimize errors, the applicable requirements of AWS Standard Operating Procedures (SOPs) for performing surveys and instrumentation calibration and use were followed. Copies of the SOPs will be provided upon request.

Data collection and transcribing is the first phase where errors may arise. To avoid data errors for manual surveys, experienced personnel record and transcribe the data. The ongoing on-site analyses and evaluation of survey results provides a final check for errors, which if detected, can be corrected.

There are two types of decision errors that can be made when performing the statistical tests described in this plan. The first type of decision error, called a Type I error, occurs when the null hypothesis is rejected when it is actually true. A Type I error is sometimes called a “false positive.” The probability of a Type I error is usually denoted by α. The Type I error rate is often referred to as the significance level or size of the test.

The second type of decision error, called a Type II error, occurs when the null hypothesis is not rejected when it is actually false. A Type II error is sometimes called a “false negative.” The probability of a Type II error is usually denoted by β. The *power* of a statistical test is defined as the probability of rejecting the null hypotheses when it is false. It is numerically equal to $1-\beta$, where β is the Type II error rate.

The Final Status Surveys were designed to limit Type I and Type II errors to 5%. It is important to minimize the chances that survey units exceeding the release limits will be missed (Type I Error) and survey units meeting the release limits will be rejected as too high (Type II Error). The probability of either of these occurring was set at a maximum of 5%.

6.4.7 DEVELOPING THE PLAN FOR OBTAINING DATA

6.4.7.1 Review Outputs and Existing Data for Consistency

Radioactive source readings were used to check instruments for consistency prior to use in each daily shift. The instruments were only used after readings were compared and agreed within +/- 20 %. The Project Manager reviewed the information each day to verify that the equipment was operating satisfactorily.

The Project Manager reviewed the survey data on a daily basis. This ensured an ongoing independent review for consistency of all survey data collected.

6.4.7.2 Determination of Scan Percentage

100% of the excavated area bottom surface and excavation area sidewall soils were gamma scan surveyed. This would be necessary to determine the extent, if any, of residual contamination that might have been present.

6.4.7.3 Data Collection Decision Alternatives

The data collection design alternatives may change slightly based on conditions found in the field being different than the information furnished based on prior surveys and available information.

In the event that a survey unit classification was revised as a result of detecting unexpected contamination, the customer (U.S. Navy) would be notified and changes to the Work Plan (AWS, 2015b) would have been required prior to resumption of survey activity.

6.4.7.4 Select Most Resource Effective Survey Design

As indicated above, the survey design specified for use in the Work Plan was developed in accordance with best management practices and MARSSIM guidelines and provided the necessary data for a radiological final status survey (AWS, 2015b). Coupled with the use of experienced personnel and proper instrumentation, this design is the most efficient and resource effective.

6.4.7.5 Document Operational Details and Theoretical Assumptions

Operational details for the radiological survey process were developed for and were included as part of the Work Plan (AWS, 2015b). The theoretical assumptions were based on guidelines contained in MARSSIM. Specific assumptions regarding types of radiation measurements, instrument detection capabilities, quantities and locations of data to be collected, and action levels were contained in the Work Plan (AWS, 2015b).

6.4.7.6 Types and Frequencies of Samples

The *types of samples and sampling matrices* for the FSS of the areas were gamma scans and soil samples.

The *sampling frequency* in the areas was set at a minimum of 16 soil samples for each of the survey units.

6.5 ALARA CONSIDERATIONS

Based upon previous surveys performed, dose rates, and anticipated total amount of residual radioactive materials at the NSF-IHwork areas, direct exposure to radiation to the survey workers was minimal during remediation and survey activities. During excavation, surveys and any decontamination activities, worker exposures were well below occupational dose limits per 10 CFR 20.1201 and did not exceed a cumulative dose of 10 mrem. .

The following controls were implemented to keep workers exposure as low as reasonably possible (ALARA) during remediation activities:

- Use of airborne contamination controls (i.e. light wetting of soils during excavation) to ensure that doses to workers were below AWS administrative limits;
- Performing remediation control surveys during excavation activities;
- The use of personnel protective equipment (PPE) when necessary;
- Use of a RWP to provide guidance to workers (See Section 3.1 for details);
- Personnel contamination monitoring (i.e. “frisking”) when exiting radiologically impacted areas;
- Use of temporary fencing and proper radiological posting to control access to radiologically impacted areas during remediation activities;
- Prohibiting eating, drinking, and smoking in radiologically posted areas.

7.0 Implementation Phase of Surveys

7.1 BACKGROUND REFERENCE RADIATION LEVELS

Site background reference areas were chosen that had similar physical, chemical, geological, radiological, and biological characteristics as the survey unit being evaluated. Background reference areas are normally selected from non-impacted areas, but are not limited to natural areas undisturbed by human activities. In some situations, a reference area may be associated with the survey unit being evaluated, but cannot be potentially contaminated by site activities. Generally, reference areas should not be part of the survey unit being evaluated.

The site background count rate levels were established for the final status surveys by obtaining thirty, 1-minute static readings (with each instrument to be used), taken at 4" from the surface of soil for gamma surveys from areas unlikely to be affected by the residual radioactive materials that could be present at the different survey areas. The average value for these readings will be used as the area background radiation levels. The readings were documented on Form AWS QA003 or equivalent electronic spreadsheet.

Twenty-seven background reference area soil samples were collected during previous site investigations. The average Th-232 concentration was 1.15 pCi/g. Figure 11 below presents a map of the sample locations and results.

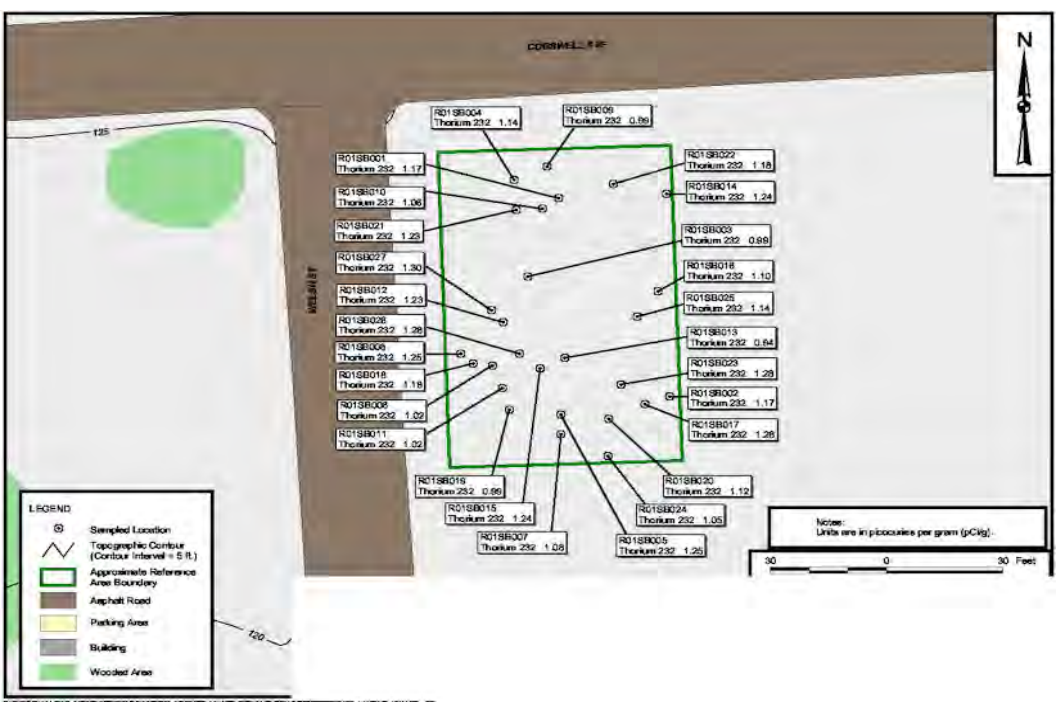


Figure 11 Background Reference Area Soil Sample

Note: The background reference area previously used has been developed and is now a residential housing area, therefore, the Navy directed AWS to choose a different background reference area. This new background reference area was used to establish background levels for the field instruments. No soil samples were collected from this new area.

Figure 12 presents a map of the new background reference area.

The background reference area data is presented in this report in Appendix L.

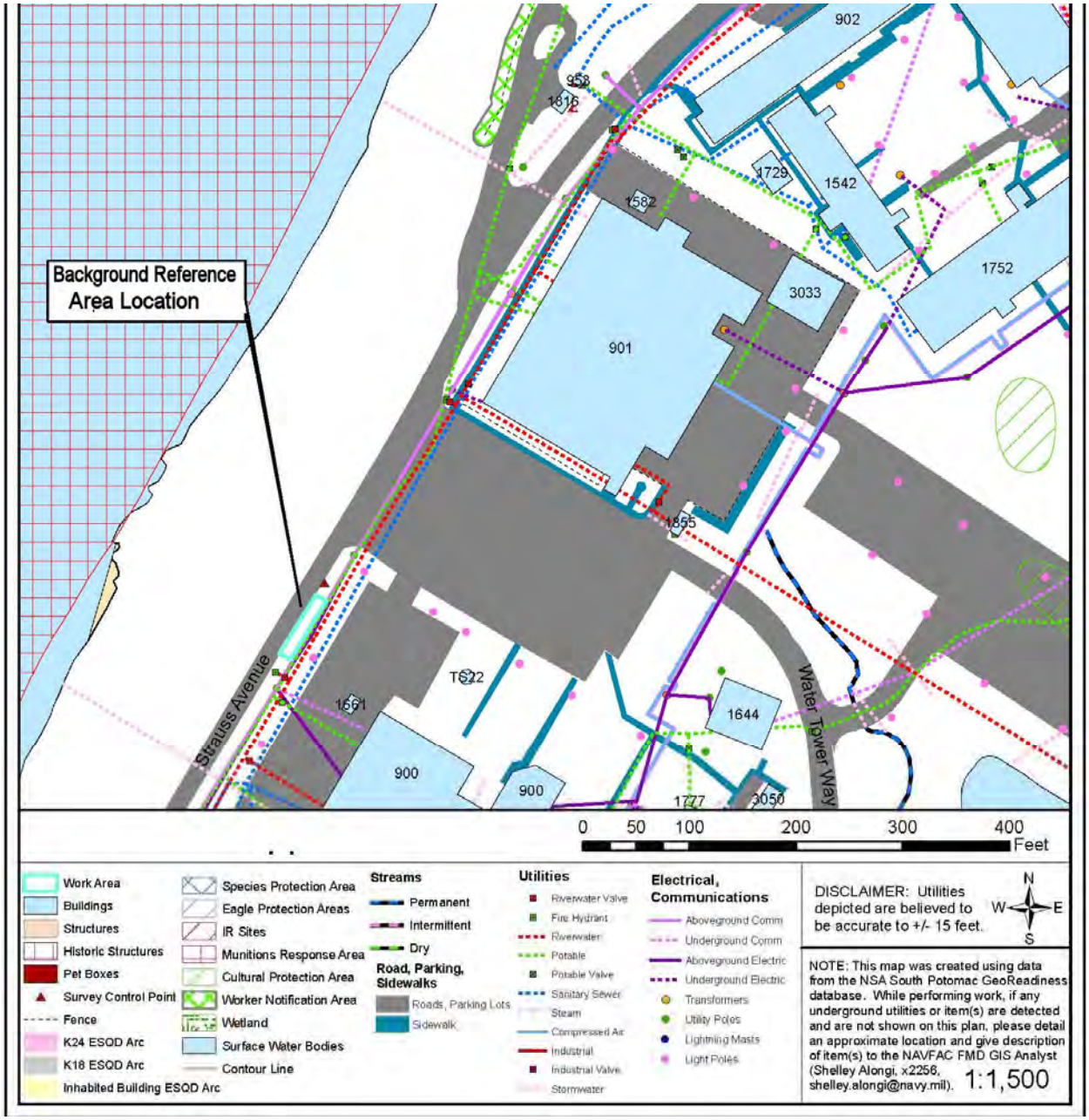


Figure 12. Background Reference Area Map

A summary of the background reference area readings in provided in Table 9 below.

Table 9 Background Reference Area Summary Table

Instrument S/N	# of Readings Collected	Average (Mean) Count Rate in CPM	Standard Deviation of Readings (σ)	Action Level in CPM (3σ x Mean Background Count Rate)
129407	30	4902	516	6452
120588	30	5327	594	7110

7.2 AREA CLASSIFICATIONS

For the purposes of establishing the sampling and measurement frequency and pattern, the excavation bottoms and sidewalls were divided into impacted areas with one of three following classifications:

Class 1 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operational history) or known contamination (based on previous radiation surveys) above the release limits.

Examples of Class 1 areas include:

- site areas previously subjected to remedial actions
- locations where leaks or spills are known (or suspected) to have occurred
- radioactive material storage areas
- areas with contaminants in discrete solid pieces of material or high specific activity

Note: Areas classified as *Class 1 Areas* require 100% scan surveys.

Class 2 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination or known contamination but are not expected to exceed the DCGL's provided in Sections 6.3 and 6.4. To justify changing the classification from Class 1 to Class 2, there should be measurement data that provides a high degree of confidence that no individual measurement would exceed the release limits. Other justifications for reclassifying an area, as Class 2 may be appropriate, based on site-specific considerations. Examples of areas that might be classified as Class 2 include:

- locations where radioactive materials were present in an unsealed form
- areas downwind from the main areas of concern (AOC)
- areas handling radioactive materials
- areas on the perimeter of former contamination control areas

Class 3 Areas: Any impacted areas that are not expected to contain any residual radioactivity, or expected to contain levels of residual radioactivity at a small fraction of the release limits, based on site operating history and previous radiation surveys. Examples of areas that might be classified as Class 3 include buffer zones around Class 1 or Class 2 areas and areas with very low potential for residual contamination but insufficient information to justify a non-impacted classification.

Based upon process knowledge, prior surveys, and operational history, the Site 1 excavation area bottom and sidewalls were classified as *Class 1* areas. The soil laydown area was classified as a *Class 3* area.

Survey units are limited in size based on classification, exposure pathway modeling assumptions, and site-specific conditions. MARSSIM (Rev. 1, August 2000) recommends areas for survey units according to the following:

Classification	**Suggested Area**
Class 1 Open Land Areas	up to 2,000 m^2/21,527 ft^2 land area

Class 2 Open Land Areas	2,000 m^2/21,527 ft^2 to 10,000 m^2/107,639 ft^2
Class 3 Open Land Areas	no limit

Figure 13 below presents a map showing the excavation area boundary..

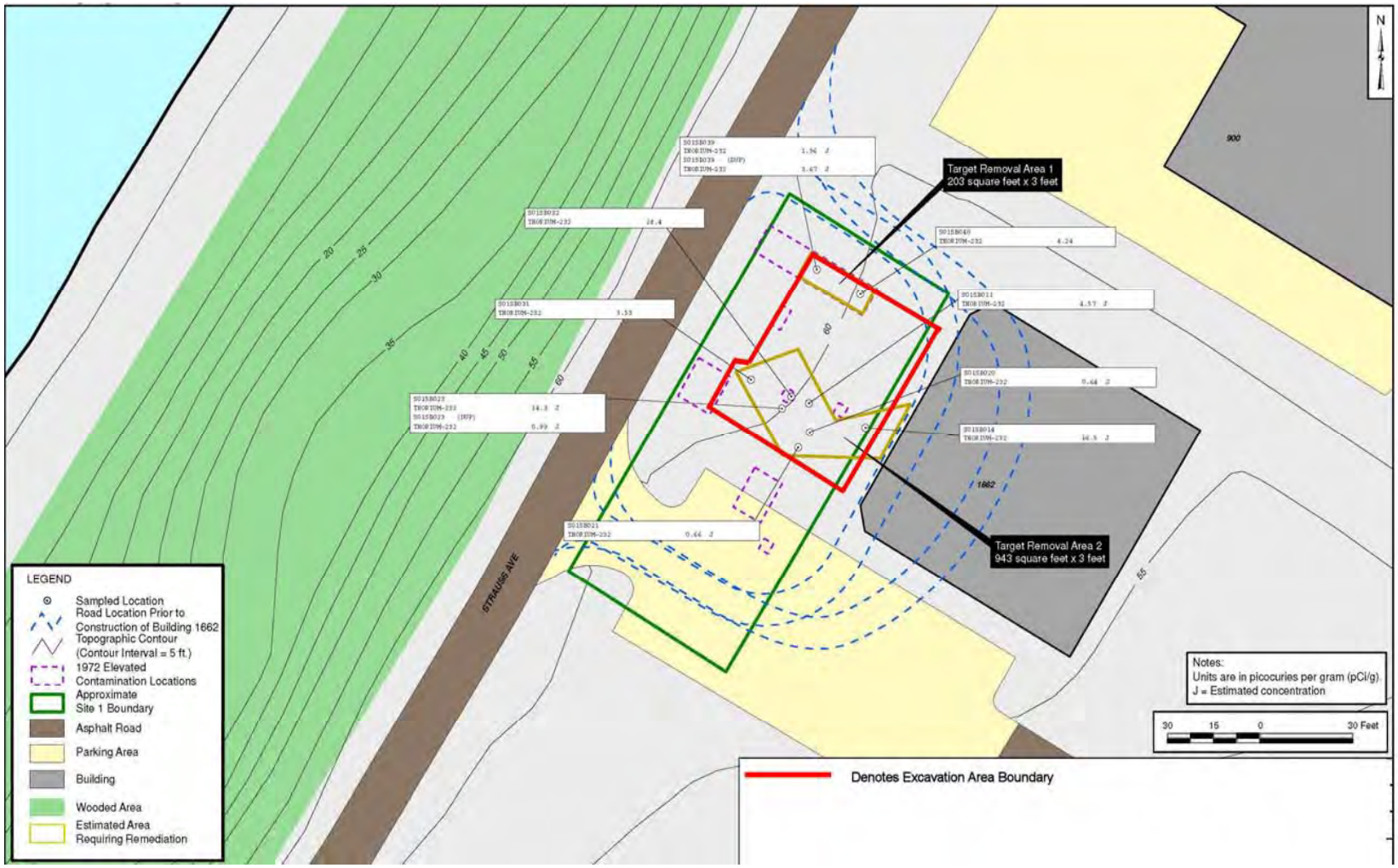


Figure 13. Excavation Area Boundary

Table 10 below presents a summary of the survey units.

Table 10. Area Classification Summary Table

Area/Location	MARSSIM Classification	Total Surface Area (Square meters/Square feet)	Number of Soil Samples Collected	Spacing Interval Between Sample Collection Points (meters/ feet)	Radionuclide of Concern	Number of Survey Units
Removal Area Soil Excavation Bottom	Class 1	~ 275/2,956	24	3.8/12.5	Th-232	1
Removal Area Soil Sidewalls	Class 1	~ 87/940	20	4.4/14.5	Th-232	1
Overburden Soil Laydown Area	Class 3	~ 1,115/12,000	16	~ 9.1/30	Th-232	1

7.3 SYSTEMATIC VS. BIASED SAMPLING

It is important to randomly survey a site, so that each part of the site has an equal chance of being surveyed. This type of survey is called systematic. However, knowledge of the site can identify areas that are more likely to contain contaminants. These should be examined closely. This type of survey is called biased.

Both systematic and biased sampling was used during the final status survey effort. Four biased samples were collected along the eastern sidewall of the excavation. All other soil samples collected were systematic.

7.4 SURVEY INSTRUMENTATION

7.4.1 INSTRUMENTATION SELECTION

Instruments were selected that were suitable for the physical and environmental conditions at the site. The instruments and measurement methods selected were able to detect the radionuclide of concern or radiation types of interest, and are, in relation to the survey or analytical technique, capable of measuring levels that were equal to or less than the release limits.

7.4.2 INSTRUMENT FOR THE SCAN SURVEYS FOR ALPHA AND BETA SURFACE ACTIVITY (CONCRETE/ASPHALT SURFACES, MATERIAL, EQUIPMENT, AND TOOLS)

Surface scan surveys for alpha and beta radiation were conducted with Ludlum Model 43-89 large area scintillation probes or equivalent coupled to Ludlum Model 2360 Data Loggers or equivalent. The probes had 1.2 mg/cm^2 thick Mylar windows. The detector was moved over the surface being surveyed at a rate of 1 cm per second. The detector was held within ¼” of the surface being surveyed. Audible indicators were used during the surveys.

7.4.3 INSTRUMENT FOR THE DIRECT MEASUREMENTS FOR ALPHA AND BETA SURFACE ACTIVITY (CONCRETE/ASPHALT SURFACES, MATERIAL, EQUIPMENT, AND TOOLS)

Direct surface contamination surveys for alpha and beta radiation were conducted with Ludlum Model 43-89 large area scintillation probes or equivalent coupled to Ludlum Model 2360 Data Loggers or equivalent. The probes had 1.2 mg/cm^2 thick Mylar windows. Direct measurements were conducted with the detector on contact with the surface for a period of 2 minutes.

7.4.4 GROSS BETA-GAMMA-ALPHA LOOSE SURFACE CONTAMINATION SURVEYS

Loose surface contamination surveys of alpha and beta/gamma emitters were performed using cloth smears.

The swipe surveys were performed by wiping over an area of 100 cm^2 (~ 4" by 4") with a cloth smear, and applying moderate pressure.

The smears were analyzed with a Ludlum Model-2929 Dual Channel Scaler phoswich detector or equivalent.

7.4.5 INSTRUMENT FOR THE MEASUREMENT OF GAMMA SURFACE ACTIVITY

Static and scan surveys for gamma (photon) radiation were performed using a Ludlum Model 2350-1 data logger. This instrument is equipped with Ludlum Model 44-10 scintillation detector assemblies that featured a 2-inch by 2-inch sodium iodide (NaI) crystal. Capable of detecting gamma photon energies ranging from 60 kilo-electron volts (keV) to 3 mega-electron volts (MeV), the instruments were programmed to respond to the full spectrum of gamma photon energies.

Static gamma measurements require positioning the detector assembly 4 inches (10 centimeters [cm]) above the designated surveillance surface and recording a stationary 60-second integrated count. NaI scintillation detectors are very sensitive to photon gamma radiation and are ideal for locating elevated radiation levels above background when performing gamma scans and static measurements.

Scan measurements of excavation bottoms and sidewall surfaces were obtained by traversing a path at a maximum speed (scan rate) of approximately 0.5 meters per second (m/s) and slowly sweeping the detector assembly in a serpentine (snakelike, S-shaped) pattern, while maintaining the detector between 2.5 to 4 inches (6 to 10 cm) above the area to be surveyed. The probe was held perpendicular to the area being surveyed.

7.5 DETECTION SENSITIVITY—STATIC AND SCAN MINIMUM DETECTABLE CONCENTRATION (MDC), GROSS ALPHA-GROSS BETA SURVEYS

7.5.1 DETERMINATION OF INSTRUMENT EFFICIENCY (E_I) FOR ALPHA AND BETA SURFACE ACTIVITY MEASUREMENTS

The instrument efficiency (ε_I) is determined during calibration and is defined as the ratio between the net count rate (in counts per minute (cpm)) of the instrument and the surface emission rate of the calibration source for a specified geometry. The surface emission rate is the 2π particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the calibration source. Equation 1 was used to calculate the instrument efficiency in counts per particle, although efficiency is typically reported as having no units or unitless.

Equation 1

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\Pi}\left(W_A / S_A\right)}$$

Where:

R_{S+B} = the gross count rate of the calibration measurement (cpm)

R_B = the background count rate in cpm

$q_{2\pi}$ = surface emission rate of the calibration source (NIST traceable)

W_A = Active Area of the detector window (cm^2)

S_A = Area of the source (cm^2)

Note: This equation assumes that the dimensions of the calibration source are sufficient to cover the window of the instrument detector. If the dimensions of the calibration source are smaller than the detector's window, set W_A equal to the dimensions of the calibration source, i.e., set the quotient of W_A and S_A equal to 1.

The instrument efficiency is determined during calibration by obtaining static counts with the detector over a calibration source that has a National Institute of Standards and Technology (NIST) traceable surface emission rate. The 2π particle fluence rate is corrected for decay, attenuation and scatter, then; the surface emission rate of the source must be corrected for the area subtended by the probe. Factors that can also affect the instruments efficiency are discussed below:

<u>Calibration Sources:</u> The calibration sources selected emit alpha or beta radiation with energies similar to those expected from the contaminant in the field, i.e., similar to the expected radionuclide(s) of concern.

Source Geometry Factors: The instrument efficiency is determined with a calibration source equal to or greater than the area of the probe.

Source-to-Detector Distance: The detector is calibrated at a source-to-detector distance that is the same as the detector-to-surface distance used in the field.

Window Density Thickness: The detector is calibrated with a probe window density thickness that is the same as the probe window density thickness used in the field.

Detector-Related Factors - Ambient Conditions: If ambient conditions such as the temperature, pressure, and humidity vary significantly, during calibration and during field use, corrections to the detector's response will be considered.

7.5.2 SURFACE EFFICIENCY (ε_S) FOR SURFACE ACTIVITY MEASUREMENTS

The surface efficiency term in Equation 2 is used to determine the 4π total efficiency for a particular surface and condition. Suitable values are based on the radiation and radiation energy, and are primarily impacted by the backscatter and self-absorption characteristics of the surface on which the contamination exists in the field. Backscatter is most affected by the energy of the radiation and the density of the surface material. Self-absorption characteristics or attenuation are also a function of the radiation's energy and surface condition. Surfaces typically encountered in the field include concrete, wood, dry wall, plaster, carpet, and metal. Surface conditions include both physical effects, such as scabbled concrete, and the effect of surface coatings, i.e., dust, paint, rust, water, and oil.

In the absence of experimentally determined surface efficiencies, ISO-7503-1 and NUREG 1507, provide conservative recommendations for surface efficiencies. ISO-7503-1, recommends a surface efficiency of 0.5 for maximum beta energies exceeding 0.5 MeV, and to use a surface efficiency of 0.25 for beta energies between 0.15 and 0.4 MeV and for alpha emitters (ISO, 1998), (NRC, 1997). NUREG-1507 provides surface efficiencies based on studies performed primarily at ehe Oak Ridge Institute for Science and Education (ORISE). In general, NUREG-1507 indicates that the ISO rule-of-thumb for surface efficiencies is conservative, particularly for beta-emitting radionuclides with end-point energies between 0.25 MeV and 0.4 MeV.

The surface condition on the areas, equipment, materials, and tools will be metal/concrete surfaces that may be slightly covered with dust. The surface efficiency for alpha emitters used in accordance with ISO-7503-1 is 0.25 and for beta emitters is 0.25.

7.5.3 PROBE AREA CORRECTION FACTOR FOR SURFACE ACTIVITY MEASUREMENTS

In Equation 2, W_A is the size of the "active" area of the detector window. If the area of the detector window (cm^2) does not equal 100 cm^2, it is necessary to convert the detector response to units of dpm per 100 cm^2.

7.5.4 STATIC MDC FOR GROSS ALPHA-BETA SURVEYS

The static MDC is the level of radioactivity, on a surface, that is practically achievable by the overall measurement process. The conventional equation, Equation 2, was used to calculate instrument MDCs in dpm per 100 cm^2 when the background and sample were counted for the same time intervals.

Equation 2

$$MDC = \frac{3 + 4.65\sqrt{C_B * T_B}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_B}$$

Where:

C_B = background count rate (cpm)

T_B = background counting time (min)

ε_i = instrument efficiency (count per particle)

ε_s = contaminated surface efficiency (particle per disintegration)

W_A= area of the detector window (cm^2)

If the background and sample were counted for different time intervals, Equation 3 was used to calculate the MDC in dpm per 100 cm^2.

Equation 3

$$MDC = \frac{3 + 3.29\sqrt{R_B T_{S+B}\left(1 + \frac{T_{S+B}}{T_B}\right)}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_{S+B}}$$

Where:

R_B = background count rate (cpm)

T_B = background counting time (min)

T_{S+B} = sample counting time (min)

ε_i = the instrument efficiency (count per particle)

ε_s = the contaminated surface efficiency (particle per disintegration)

W_A = the area of the detector window (cm^2)

7.5.5 SCANNING MINIMAL DETECTABLE COUNT RATE, (MDCR)

The minimum detectable number of net source counts in the scan interval, for an ideal observer, was arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in *d'*) as shown in Equation 4.

Equation 4

$$MDCR = d'\sqrt{b_i} \times 60/i$$

Where:

d' = index of sensitivity (α and β error) – MARSSIM Table 6.5

b_i = number of background counts in scan time interval (count)

i = scan or observation interval (s) (time that a typical source remains under the probe during the scan)

7.5.6 SCAN MDC

The scan MDC was determined from the minimum detectable count rate (MDCR) by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. As discussed above, the MDCR accounts for the background level, performance criteria (d'), and observation interval. The observation interval during scanning is the actual time that the detector can respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity.

The scan MDC for equipment, material, and tool surfaces was calculated using Equation 5 below.

Equation 4

$$Scan\ MDC = \frac{MDCR}{\sqrt{p}\ \varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

Where:

MDCR = discussed in Section 7.5.5

p = surveyor efficiency factor

ε_ι = instrument efficiency (count per particle)

ε_s = contaminated surface efficiency (particles per disintegration)

W_A = area of the detector window (cm^2)

7.5.7 SCAN MDCS FOR ALPHA EMITTERS (125 CM^2 PROBE)

Scanning for alpha emitters differs significantly from scanning for beta and gamma emitters in that the expected background response of most alpha detectors is very close to zero. The following sections cover scanning for alpha emitters and assumes that the surface being surveyed is similar in nature to the material on which the detector was calibrated. In this respect, the approach is purely theoretical. Surveying surfaces that are dirty, non-planar, or weathered can significantly affect the detection efficiency and therefore bias the expected MDC for the scan. The use of reasonable detection efficiency values instead of optimistic values is highly recommended.

Since the time a contaminated area is under the probe varies and the background count rate of some alpha instruments is less than 1 cpm, it is not reasonable to determine a fixed MDC for scanning. Instead, it is more practical to determine the probability of detecting an area of contamination at a predetermined DCGL for given scan rates.

For alpha survey instrumentation with backgrounds ranging from <1 to 3 cpm, a single count provides a surveyor sufficient cause to stop and investigate further. Assuming this to be true, the probability of detecting given levels of alpha surface contamination can be calculated by use of Poisson summation statistics.

Given a known scan rate and a surface contamination release limit, the probability of detecting a single count while passing over the contaminated area was calculated using Equation 6 below.

Equation 5

$$P(n \geq 1) = 1 - e^{\frac{-GEd}{60v}}$$

Where:

P (n≥1)	=	probability of observing a single count
G	=	contamination activity (dpm)
E	=	detector efficiency (4π)
d	=	width of detector in direction of scan (cm)
v	=	scan speed (cm/s)

Once a count is recorded and the guideline level of contamination is present the surveyor should stop and wait until the probability of getting another count is at least 90%. This time interval can be calculated by:

$$t = \frac{13,800}{CAE}$$

Where:

t	=	time period for static count(s)
C	=	contamination guideline (dpm /100cm^2)
A	=	physical probe area (cm^2)
E	=	detector efficiency (4π)

7.5.8 SCAN MDC (ALPHA, 125 CM^2 PROBES)

Using the following equation (Abelquist, 2001), one can calculate the activity of a 100 cm^2 "hot spot" with a 90 % probability of detection using Equation 7 below.

Equation 6

$$\alpha\ scanMDC = \frac{[-\ln(1-P(n \geq 1))]60}{t\varepsilon_s\varepsilon_i}$$

Where:

t	=	dwell time over source (seconds)
ε_i	=	Instrument efficiency (counts per particle)
ε_s	=	contaminated surface efficiency (particles per disintegration)

7.6 DETECTION SENSITIVITY—STATIC AND SCAN MINIMUM DETECTABLE CONCENTRATION (MDC), GAMMA SURVEYS

7.6.1 STATIC MDC

The static MDC represents the smallest level of radioactivity, on a surface, that is statistically detectable by the measurement process. Equation 8 was used to calculate the MDC for gamma radiation.

Equation 7

$$MDC_\gamma = \frac{3+3.29\sqrt{R_B\,T_B}}{T_B}$$

Where:

R_B = background count rate (cpm)
T_B = background counting time (min)

7.6.2 SCANNING MINIMUM DETECTABLE COUNT RATE, GAMMA

The minimum detectable number of net source counts in the scan interval, for an ideal observer, can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in *d'*) as shown in Equation 9 below.

Equation 8

$$MDCR = d'\sqrt{b_i}\left(\frac{60}{i}\right)$$

Where:

d' = index of sensitivity (α and β error)
b_i = number of background counts in scan time interval (count)
i = scan or observation interval(s)

7.6.3 SCAN MDC FOR GAMMA SURVEYS (2-INCH BY 2-INCH NAI PROBE)

The gamma scan MDC (in pCi/g) for land areas is based on the area of elevated activity, depth of contamination, and the radionuclide (i.e., energy and yield of gamma emissions). Table 6.7 of MARSSIM states a scan MDC for a 2” by 2” NaI detector as 1.8 pCi/g for Th-232.

Table 11 presents a summary of the instrumentation that was used while performing the surveys.

7.7 SURVEY DESIGN

7.7.1 CLASS 1 AREAS EXCAVATION AREA BOTTOM/SIDEWALLS, SITE 1

7.7.1.1 Gamma Scan Surveys

The surveys consisted of 100% gamma scan surveys of the excavation bottom and sidewalls using a Ludlum Mode 2350-1 Data Logger coupled to a Ludlum Model-44-10 2-inch by 2-inch NaI detector.

Table 11. Instrumentation for AWS Radiological Surveys

Information	Alpha Measurements		Beta Measurements		Gamma Measurements
Areas Surveyed	Concrete	Metal	Concrete	Metal	Site 1 Soils
Instrument Model	Ludlum 2360	Ludlum 2360	Ludlum 2360	Ludlum 2360	Ludlum 2350
Instrument Serial No.	276986	276986	276986	276986	120588
Instrument Detector	Scintillation 43-93	Scintillation 43-93	Scintillation 43-93	Scintillation 43-93	NaI 44-10
Probe Serial No.	PR 299605	PR 299605	PR 299605	PR 299605	PR 31828
Calibration Source	Th-230 100 cm^2	Th-230 100 cm^2	Tc-99 100 cm^2	Tc-99 100 cm^2	Cs-137 Button
Probe Window Thickness mg/cm^2	1.2	1.2	1.2	1.2	N/A
Probe Size in cm^2	100	100	100	100	2" by 2"
Instrument Efficiency (ε_i)	0.385	.385	.339	.339	N/A
Instrument Background (CPM)	3.8	3.2	154	112	5,327
Static Count Time (Minutes)	2	2	2	2	N/A
Surface Efficiency (ε_s)	0.25	0.25	0.25	0.25	N/A
Total Efficiency (4π) (ε_t)	.088	.102	.070	.081	N/A
Radionuclides of Concern	Th-232	Th-232	Th-232	Th-232	Th-232
Static MDC in $dpm/100cm^2$	82	77	500	429	N/A
Scan Observation Interval (Seconds)	7	7	7	7	2
Scan Probability % Alpha Measurements	100	100	N/A	N/A	N/A
Scan MDC in $dpm/100cm^2$ Beta Measurements	N/A	N/A	1,989	1,696	N/A
Scan MDC in $dpm/100cm^2$ @ 90% Probability Alpha Measurements	205	205	N/A	N/A	N/A
Investigation Level in CPM Gamma	N/A	N/A	N/A	N/A	7,110
Gross DCGL	1,000	1,000	N/A	N/A	3 pCi/g

7.7.1.2 Excavation/Overburden Soil Samples

In each 6” lift below 2’ bgs down to 4’ bgs in the excavation area, a minimum of 16 soil samples were collected from biased and systematic locations following excavation and gamma scan activities. Sixteen surface (0-15 cm below the excavated grade surface) samples were collected from each sampling location within each excavation. Section 5.2 of this report provides a discussion of the soil sample and analysis results.

Sampling equipment and tools were wiped down and surveyed after each sample to ensure no cross contamination occurred during the sampling process. If contamination was found above the minimum detectable count rate of the survey instrument, the equipment was then decontaminated.

Approximately 300 to 500 grams of soil were collected from each sample location. Samples were prepared by removing vegetation, rocks, and foreign objects exceeding ¼ inch in diameter. The samples, once prepared, were placed into an appropriate container. Collection methodology, chain of custody, and analysis requirements are detailed in AWS's SOP’s. Copies of the applicable SOP’s will be furnished upon request.

The samples were sent to an off-site laboratory for isotopic thorium (alpha spectroscopy) analysis. Test Method: A-01-R.

7.7.1.3 Excavation Bottom Soil Samples

Following soil removal down to 4’ bgs in the excavation area, and a 100% gamma scan walkover survey of the excavation bottom, a minimum of 16 soil samples were collected from systematic locations following excavation and gamma scan activities. Twenty four systematic surface (0-15 cm below the excavated grade surface) samples were collected from each sampling location within the excavation bottom.

Sampling equipment and tools were wiped down and surveyed after each sample to ensure no cross contamination occurred during the sampling process. If contamination was found above the minimum detectable count rate of the survey instrument, the equipment was then decontaminated.

Approximately 300 to 500 grams of soil were collected from each sample location. Samples were prepared by removing vegetation, rocks, and foreign objects exceeding ¼ inch in diameter. The samples, once prepared, were placed into an appropriate container. Collection methodology, chain of custody, and analysis requirements are detailed in AWS's SOP’s. Copies of the applicable SOP’s will be furnished upon request.

The samples were sent to an off-site laboratory for isotopic thorium (alpha spectroscopy) analysis. Test Method: A-01-R.

Section 11.1 of this report provides a summary and discussion of the results.

7.7.1.4 Sidewall Soil Samples

Following soil removal down to 4’ bgs in the excavation area, and a 100% gamma scan walkover survey of the excavation sidewalls, a minimum of 16 soil samples were collected from systematic locations following excavation and gamma scan activities.

Sixteen systematic and four biased samples were collected from each sampling location within the excavation sidewalls.

Sampling equipment and tools were wiped down and surveyed after each sample to ensure no cross contamination occurred during the sampling process. If contamination was found above the minimum detectable count rate of the survey instrument, the equipment was then decontaminated.

Approximately 300 to 500 grams of soil were collected from each sample location. Samples were prepared by removing vegetation, rocks, and foreign objects exceeding ¼ inch in diameter. The samples, once prepared, were placed into an appropriate container. Collection methodology, chain of custody, and analysis requirements are detailed in AWS's SOP's. Copies of the applicable SOP's will be furnished upon request.

The samples were sent to an off-site laboratory for isotopic thorium (alpha spectroscopy) analysis. Test Method: A-01-R.

Section 11.2 of this report provides a summary and discussion of the results.

7.7.2 EQUIPMENT, MATERIALS, AND TOOLS

7.7.2.1 Gross Alpha/Gross Beta Scan Surveys

The surveys consisted of 100% direct scan surveys for alpha-beta radiations using a large area scintillation detector system (Ludlum Instruments Model 2360 Data Logger or equivalent coupled to a Ludlum Instruments Model 43-93 scintillation detectors or the equivalent).

7.7.2.2 Gross Alpha/Gross Beta Direct Measurements

The surveys consisted of 2-minute direct measurement surveys for alpha-beta radiations using a large scintillation detector system (Ludlum Instruments Model 2360 Data Logger or equivalent coupled to a Ludlum Instruments Model 43-93 scintillation detectors or the equivalent).

The results of the direct measurements were recorded on form AWS-001RCS, Radiation Contamination Survey Cover Sheet or equivalent electronic spreadsheet.

7.7.2.3 Gross Beta-Gamma-Alpha Loose Surface Contaminations Surveys

Loose surface contamination surveys of alpha and beta/gamma emitters were performed using cloth smears.

The swipe survey was performed by wiping over an area of 100 cm^2 (~ 4" by 4") with a cloth smear, and applying moderate pressure.

The smears were analyzed with a Ludlum Model-2929 Dual Channel Scaler phoswich detector or equivalent in accordance with AWS Instrument Operating Procedure IOP-002, "Operation and Calibration of the Ludlum Model 2929 Dual Channel Scaler".

The results of the smears analysis were recorded on form AWS-006, Smear Counting Analysis Report or equivalent electronic spreadsheet.

8.0 Health and Safety Considerations

The removal of radiologically impacted soils and surveys at the NSF-IH were conducted in accordance with the applicable sections of the AWS Health and Safety Plan (HASP). Excavation health and safety considerations were described in this plan. All on site personnel read and understood the contents of the plan prior to beginning work on the project. All on-site workers signed a statement that they read and understood the requirements of the HASP.

8.1 HAZARD ANALYSIS

The job hazard Analysis identifies potential safety, health and environmental hazards and provides for the protection of personnel, the community, and the environment.

8.1.1 RADIOLOGICAL EXPOSURE

Residual amounts of low-level radioactive material may be present in the soil in the work area at the NSF-IH Site 1 area. Personnel performing the surveys and soil removal wore dosimetry and modified Level D PPE as described in Sections 3.2 and 8.2.2 of this report.

8.2 HAZARD CONTROLS

The following control measures were implemented during the survey activities. The control measures were intended to supplement the HASP.

8.2.1 RADIATION WORK PERMIT

A Radiation Work Permit (RWP) was prepared and specified the activities to be performed and all radiological control requirements and safety requirements for the work. All personnel assigned to site work were required to read and sign the RWP acknowledging that they understood the requirements prior to beginning work.

The RWP was also used as an information document for industrial safety. Hazards other than radiological were included in the RWP so proper protection could be taken for all possible hazards from one controlling document. Implicit in any RWP was the need for a briefing on the radiological conditions present in the work environment.

The RWP listed and specified levels of protection for each worker covered by the RWP. The RWP also detailed the dosimetry requirements, the protective clothing requirements, and the expected radiation and contamination levels to be encountered during the job.

8.2.2 PPE

Personnel performing the work at NSF-IH wore modified Level D PPE in accordance with the PPE selection matrix in the HASP.

The modified Level D PPE consisted of:

- Steel-toed shoes;
- Hard hat;

- Safety glasses;
- Rubber shoe covers;
- Latex or equivalent gloves (when collecting soil samples).

8.2.3 SAFETY EQUIPMENT

In addition to other equipment specified in the HASP, the following safety equipment was staged at the NSF Indian Head temporary office space:

- First aid kit
- Fire extinguisher
- Eye wash kit

8.3 TRAINING

Personnel performing activities associated with the NSF Indian Head work activities received training covering the Work Plan and HASP.

All on-site project personnel shall have completed at least 40 hours of hazardous waste operations-related training, as required by the Occupational Safety and Health administration (OSHA) Regulation 29 CFR Part 1910.120. Those personnel who have completed the 40-hour training more than 12 months prior to start of field activities shall have completed an 8-hour refresher course within the past twelve months.

The Project Manager shall have completed an additional 8 hours of relevant supervisory health and safety training.

Personnel operating the survey detection equipment were qualified ANSI 3.1 Senior Health Physics Technicians based on training and experience outlined in Section 4.4.6 and 4.5.3.2 of ANSI standard ANSI/ANS-3.1-1993 (ANSI/ANS, 1993).

A formal review and documentation of key personnel qualifications to perform the required work was made by management and verified during the pre-job briefing conducted prior to start of operations. Project personnel were familiar with the handling and storage of radioactive materials, contamination controls, and the use of radiation survey equipment.

8.4 HAZARD COMMUNICATIONS

The Project Manager ensured that crewmembers understood their obligation to safety and ensured that members were familiar with the elements of the safety program. A copy of the Health and Safety Plan was maintained in the on-site project office.

Daily tailgate safety meetings were conducted and documented as specified in the Health and Safety Plan. Material Safety Data Sheets (MSDSs) for all hazardous substances and materials that were used on site were maintained in the on-site project office.

9.0 Quality Assurance

9.1 EQUIPMENT

The instruments and systems used for the work effort were calibrated on an annual frequency using the manufacturer's calibration protocol to National Institute of Standards and Technology (NIST) traceable sources.

Survey instruments were source checked daily prior to the start of survey activities.

Copies of the instrument calibration data are presented in this report in Appendix M.

Copies of instrument daily response checks are presented in Appendix N.

9.2 RECORDS AND REPORTS

All survey records and reports were completed in accordance with Section 9.2 of the approved Work Plan (AWS, 2015b).

9.3 QUALITY CONTROL SAMPLES

Paired duplicates of 10 % of the swipe samples were collected and counted on site. The results of the QC duplicate samples were compared to each other. A maximum deviation of ± 20% was the satisfactory objective of the comparison of the samples. All of the results of the duplicate swipe samples were within the ± 20% range and are included in the Radiation/Contamination survey reports in the applicable appendices of this report.

9.4 DATA MANAGEMENT

Data was maintained in the on-site office. Backup copies of data was made routinely and maintained on the computer provided. Further, backup copies of survey and sample results were routinely transferred to CDs or other removable electronic media.

10.0 SURVEY PROCEDURES AND MEASUREMENT DATA INTERPRETATION

10.1 SURFACE ACTIVITY MEASUREMENTS

Measurements to quantify surface activity levels represent the fundamental compliance measurements for buildings and structures. ISO-7503, NUREG-1507, and ASTM were used as technical guidance to ensure the accurate measurement of surface activity.

Equation 12 was used to document and calculate the surface activity in dpm per 100 cm^2.

Equation 9

$$A_S = \frac{R_{S+B} - R_B}{\varepsilon_i \varepsilon_s \frac{W_A}{100\, cm^2}}$$

Where:

A_S = total surface activity (dpm/100 cm^2)

R_{S+B} = the gross count rate of the measurement in cpm,

R_B = the background count rate in cpm

ε_i = the instrument efficiency (counts per particle)

ε_s = the contaminated surface efficiency (particles per disintegration)

W_A = the area of the detector window (cm^2)

This equation has two efficiency terms, which account for differences between the conditions under which the detector is calibrated, and conditions under which the detector is used in the field. The instrument efficiency (ε_i) is discussed in Section 7.5.1, and is determined under ideal conditions in the laboratory. The surface efficiency is discussed in Section 7.5.2 and is used to determine the 4π total efficiency for a particular surface and condition.

10.2 INVESTIGATION LEVEL CALCULATIONS

The gamma scan investigation level in gross cpm, discussed in Section 6.4.6.3 was calculated by using Equation 15 below:

Equation 10

$$\text{Investigation Level in CPM} = R_B + 3\sigma$$

Where:

R_B = Average Background Count Rate

σ = Standard Deviation of Background Count Rate

Table 12 presents a summary of the investigation level values.

Table 12. Investigation Level Values

Dates Of Survey	Type of Survey/Area Surveyed	Instrument Model #/Detector Model #	Instrument Serial #/Detector Serial #	Instrument Mean Background Level in Gross CPM γ	Investigation Level in Gross CPM γ
October, 2015	Gamma Scans/Site 1 Soils	2350-1/44-10	120588/318218	5,327 cpm	7,110 cpm
December, 2015	Gamma Scans/Soil Laydown Area	2350-1/44-10	126172/192589	5,246 cpm	6,216 cpm

10.3 DATA INTERPRETATION

Basic statistical quantities were calculated for the data in order to identify patterns, relationships and any type anomaly.

The Project Manager reviewed the data at the end of each phase of the survey to determine the validity of the results and ensure adequate coverage of the survey areas. The survey results are presented in various appendices of this report.

11.0 Survey Analysis and Results

The survey design always makes use of the statistical tests in helping to assure that the number of sampling points and the instrument measurement sensitivities are adequate, but not excessive, for the decision made. Radiological survey data was obtained in units of cpm and activity that have no intrinsic meaning to the release limits. Soil sample data was converted to pCi/g and surface area readings to dpm/100cm^2 to evaluate results with the release limits and to help identify areas which would require additional remediation.

11.1 SITE 1 EXCAVATION BOTTOM

Following soil removal in the excavation area, a final status survey was performed in the area.

11.1.1 GAMMA SCAN SURVEY

Following soil removal a 100% gamma scan walkover survey was performed. All of the scan results were below the Investigation Level defined Section 6.4.6.3 of this report.

Figure 14 presents a map summarizing the gamma scan results within the excavation area.

The survey report is presented in this report in Appendix O.

The instrument information used during these surveys is as follows:

Instrument Model #: Ludlum Model 2350-1 Data Logger

Instrument Serial Number: 120588

Detector Model #: Ludlum Model 44-10

Detector Serial Number: 318218

Calibration Due Date: 6/19/2016

11.1.2 SOIL SAMPLES

Twenty four soil samples were collected during the effort.

Figure 14 presents a map of the sample locations.

The samples were sent to an off-site laboratory for isotopic thorium analysis by alpha spectroscopy. Test Method: A-01-R.

Table 13 below presents a summary of the soil sample results.

The laboratory data report for the samples is presented in Appendix P of this report.

Table 13 presents a summary of the isotopic thorium analysis results for the three isotopes of thorium. It also presents the 2σ (standard deviation) counting uncertainty error for each of the samples. The average sample concentration and standard deviation of the sample

group is also presented at the bottom of the table. None of the sample results were above the DCGL of 3.0 pCi/g for Th-232.

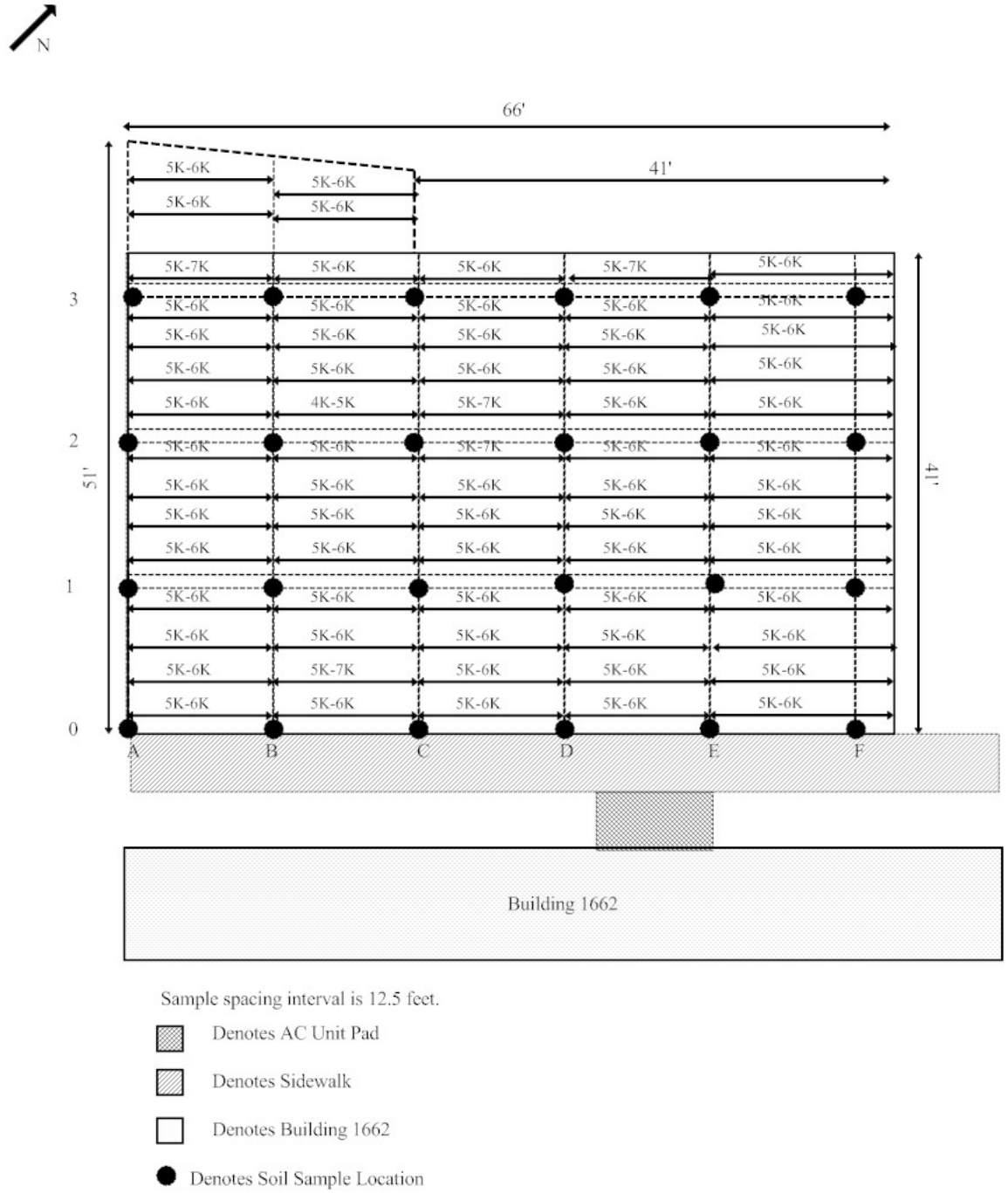


Figure 14. Removal Excavation Area Bottom Survey Map

Table 13. Removal Area Excavation Bottom Sample Summary Table

						Isotopic Thorium/Alpha Spectroscopy						
Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in inches	Sample Matrix	Location/Description	Th-228 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-230 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-232 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Comments/Notes
IHS1EB- A0	10/23/2015	O948	48-54"	Soil	Excavation Bottom	0.537	0.144	0.68	0.16	0.636	0.154	
IHS1EB- A1	10/23/2015	O950	48-54"	Soil	Excavation Bottom	1.05	0.206	0.7	0.162	0.871	0.182	
IHS1EB- A2	10/23/2015	O952	48-54"	Soil	Excavation Bottom	0.923	0.19	0.927	0.188	0.972	0.192	
IHS1EB- A3	10/23/2015	O953	48-54"	Soil	Excavation Bottom	0.779	0.169	0.684	0.155	0.801	0.169	
IHS1EB- B0	10/23/2015	O956	48-54"	Soil	Excavation Bottom	0.663	0.153	0.595	0.142	0.717	0.158	
IHS1EB- B1	10/23/2015	1000	48-54"	Soil	Excavation Bottom	0.585	0.145	0.532	0.137	0.468	0.126	
IHS1EB- B2	10/23/2015	1002	48-54"	Soil	Excavation Bottom	0.764	0.175	0.624	0.153	0.751	0.169	
IHS1EB- B3	10/23/2015	1003	48-54"	Soil	Excavation Bottom	0.743	0.169	0.763	0.171	0.753	0.169	
IHS1EB- C0	10/23/2015	1007	48-54"	Soil	Excavation Bottom	0.612	0.15	0.444	0.123	0.439	0.23	
IHS1EB- C1	10/23/2015	1009	48-54"	Soil	Excavation Bottom	0.791	0.173	0.704	0.161	1.22	0.22	
IHS1EB- C2	10/23/2015	1010	48-54"	Soil	Excavation Bottom	0.712	0.166	0.718	0.166	0.56	0.145	
IHS1EB- C3	10/23/2015	1012	48-54"	Soil	Excavation Bottom	0.71	0.158	0.731	0.159	0.647	0.148	
IHS1EB- D0	10/23/2015	1014	48-54"	Soil	Excavation Bottom	0.781	0.17	0.615	0.147	0.857	0.177	
IHS1EB- D1	10/23/2015	1017	48-54"	Soil	Excavation Bottom	0.778	0.176	0.757	0.169	0.689	0.16	
IHS1EB- D2	10/23/2015	1019	48-54"	Soil	Excavation Bottom	2.24	0.322	0.83	0.173	2.33	0.329	
IHS1EB- D3	10/23/2015	1020	48-54"	Soil	Excavation Bottom	0.767	0.176	0.692	0.165	0.725	0.169	
IHS1EB- E0	10/23/2015	1022	48-54"	Soil	Excavation Bottom	1.29	0.225	0.575	0.14	1	0.191	
IHS1EB- E1	10/23/2015	1024	48-54"	Soil	Excavation Bottom	0.811	0.18	0.715	0.167	0.694	0.163	
IHS1EB- E2	10/23/2015	1026	48-54"	Soil	Excavation Bottom	0.561	0.144	0.756	0.166	0.597	0.145	
IHS1EB- E3	10/23/2015	1028	48-54"	Soil	Excavation Bottom	0.744	0.168	0.669	0.156	0.724	0.162	
IHS1EB- F0	10/23/2015	1030	48-54"	Soil	Excavation Bottom	0.658	0.154	0.733	0.161	0.723	0.159	
IHS1EB- F1	10/23/2015	1032	48-54"	Soil	Excavation Bottom	0.701	0.165	0.822	0.178	0.688	0.161	
IHS1EB- F2	10/23/2015	1034	48-54"	Soil	Excavation Bottom	0.347	0.108	0.542	0.14	0.349	0.108	
IHS1EB- F3	10/23/2015	1040	48-54"	Soil	Excavation Bottom	0.549	0.139	0.493	0.131	0.613	0.146	
					Maximum:	**2.240**		**0.927**		**2.330**		
					Average:	**0.796**		**0.679**		**0.784**		
					Standard Deviation:	**0.358**		**0.112**		**0.378**		

Denotes Sample Result is Between 2.0 and 3.0 pCi/g.

DCGL is 3.0 pCi/g for Th-232.

11.2 SITE 1 EXCAVATION SIDEWALLS

Following soil removal in the excavation area, a final status survey was performed on the sidewalls of the area.

11.2.1 GAMMA SCAN SURVEY

Following soil removal a 100% gamma scan walkover survey was performed. All of the scan results were below the Investigation Level defined in Section 6.4.6.3 of this report, with the exception of four areas which were slightly above (7,500 cpm) the Investigation Level (7,110 cpm). Biased soil samples were collected from these four locations.

Figure 14 presents a map illustrating the locations of the biased soil samples collected where scans were slightly above the Investigation Level.

The survey report is presented in this report in Appendix Q.

The instrument information used during these surveys is as follows:

Instrument Model #: Ludlum Model 2350-1 Data Logger

Instrument Serial Number: 120588

Detector Model #: Ludlum Model 44-10

Detector Serial Number: 318218

Calibration Due Date: 6/19/2016

11.2.2 SOIL SAMPLES

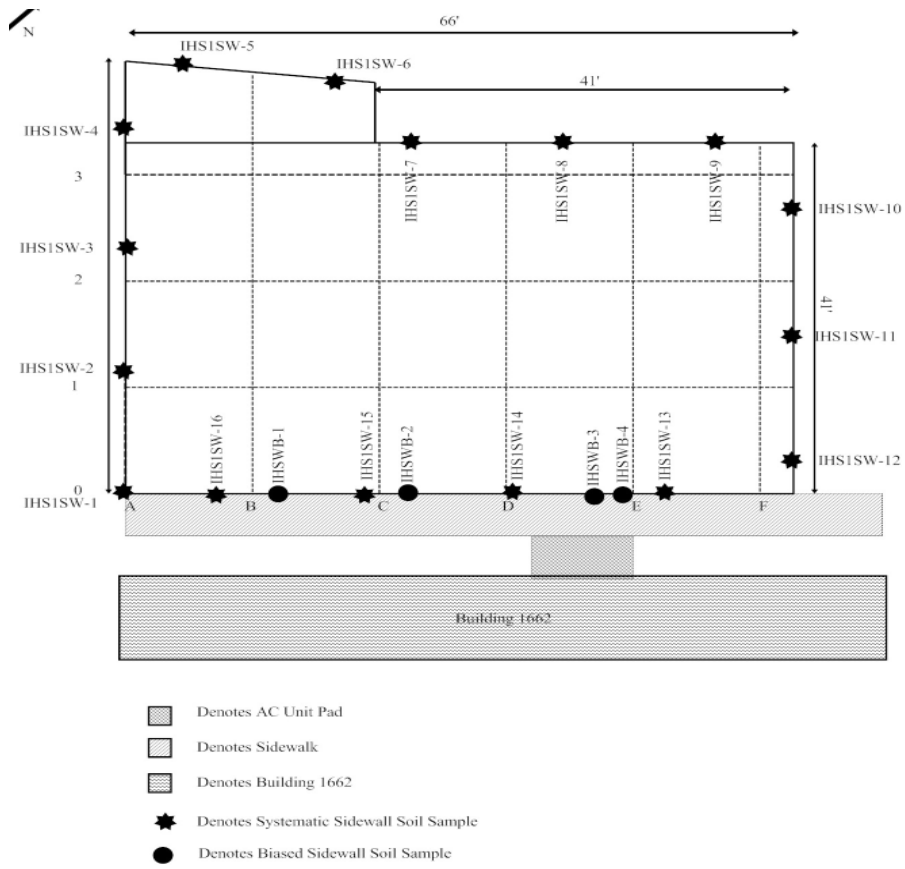
Twenty soil samples were collected during the effort. The samples were sent to an off-site laboratory for isotopic thorium analysis by alpha spectroscopy. Test Method: A-01-R.

Figure 15 presents a map of the sample locations.

Table 14 below presents a summary of the soil sample results.

The laboratory data report for the samples is presented in Appendix R of this report.

Table 14 presents a summary of the isotopic thorium analysis results for the three isotopes of thorium. It also presents the 2σ (standard deviation) counting uncertainty error for each of the samples. The average sample concentration and standard deviation of the sample group is also presented at the bottom of the table. None of the sample results were above the DCGL of 3.0 pCi/g for Th-232.



Comments:

The sidewalls were was 100% gamma scan surveyed.

Action Level: 7,110 cpm.

Results were between 5K and 7.5K cpm.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

#	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000 cpm

Figure 15. Excavation Sidewalls Gamma Scan Survey Map

Table 14. Excavation Area Sidewall Sample Summary Table

						Isotopic Thorium/Alpha Spectroscopy						
Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in inches	Sample Matrix	Location/Description	Th-228 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-230 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-232 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Comments/Notes
IHSWB- 1	10/26/2015	1326	18-24"	Soil	Excavation Sidewall	0.657	0.155	0.671	0.159	0.575	0.143	Biased Sample
IHSWB- 2	10/26/2015	1340	24-30"	Soil	Excavation Sidewall	0.55	0.148	0.609	0.153	0.826	0.18	Biased Sample
IHSWB- 3	10/26/2015	1520	18-24"	Soil	Excavation Sidewall	0.565	0.146	0.734	0.166	0.618	0.15	Biased Sample
IHSWB- 4	10/26/2015	1526	18-24"	Soil	Excavation Sidewall	0.666	0.159	0.544	0.14	0.58	0.144	Biased Sample
IHS1SW- 1	10/27/2015	O748	18-24"	Soil	Excavation Sidewall	0.693	0.165	0.74	0.168	0.748	0.168	
IHS1SW- 2	10/27/2015	O750	24-30"	Soil	Excavation Sidewall	0.886	0.189	0.834	0.18	0.827	0.179	
IHS1SW- 3	10/27/2015	O753	18-24"	Soil	Excavation Sidewall	0.845	0.179	0.625	0.149	0.819	0.172	
IHS1SW- 4	10/27/2015	O755	24-30"	Soil	Excavation Sidewall	0.633	0.152	0.647	0.152	0.643	0.151	
IHS1SW- 5	10/27/2015	O757	24-30"	Soil	Excavation Sidewall	0.654	0.149	0.524	0.131	0.576	0.138	
IHS1SW- 6	10/27/2015	O800	18-24"	Soil	Excavation Sidewall	0.65	0.164	0.818	0.181	0.86	0.185	
IHS1SW- 7	10/27/2015	O802	18-24"	Soil	Excavation Sidewall	0.96	0.191	0.752	0.165	0.984	0.192	
IHS1SW- 8	10/27/2015	O805	30-36"	Soil	Excavation Sidewall	0.829	0.18	0.63	0.143	0.856	0.166	
IHS1SW- 9	10/27/2015	O807	24-30'	Soil	Excavation Sidewall	0.666	0.162	0.82	0.18	0.672	0.16	
IHS1SW- 10	10/27/2015	O810	18-24"	Soil	Excavation Sidewall	1.47	0.249	0.756	0.168	1.31	0.231	
IHS1SW- 11	10/27/2015	O811	24-30"	Soil	Excavation Sidewall	0.886	0.186	0.756	0.168	0.848	0.18	
IHS1SW- 12	10/27/2015	O813	18-24"	Soil	Excavation Sidewall	0.944	0.191	0.766	0.168	0.831	0.176	
IHS1SW- 13	10/27/2015	O815	30-36"	Soil	Excavation Sidewall	0.702	0.17	0.634	0.157	0.628	0.156	
IHS1SW- 14	10/27/2015	O816	18-24"	Soil	Excavation Sidewall	0.886	0.184	0.685	0.159	0.866	0.179	
IHS1SW- 15	10/27/2015	O822	24-30"	Soil	Excavation Sidewall	2.3	0.321	0.593	0.14	1.184	0.276	
IHS1SW- 16	10/27/2015	O826	18-24'	Soil	Excavation Sidewall	0.755	0.169	0.499	0.134	0.64	0.152	
					Maximum:	2.300		0.834		1.310		
					Average:	0.860		0.682		0.795		
					Standard Deviation:	0.395		0.100		0.197		

DCGL is 3.0 pCi/g for Th-232.

11.3 SOIL LAYDOWN AREA

Following site restoration operations, a final status survey was performed in the soil laydown area following removal of the soil stockpiles in the area.

11.3.1 GAMMA SCAN SURVEY

Following stockpile removal a 50% gamma scan walkover survey was performed. All of the scan results were below the Investigation Level defined in Section 6.4.6.3 of this report.

Figure 16 presents a map summarizing the gamma scan results.

The survey report is presented in this report in Appendix S.

11.3.2 SOIL SAMPLES

Sixteen soil samples were collected during the effort. The samples were sent to an off-site laboratory for isotopic thorium analysis by alpha spectroscopy. Test Method: A-01-R.

Figure 17 presents a map of the sample locations. .

The laboratory data report for the samples is presented in Appendix T of this report.

All of the samples results were below the DCGL of 3 pCi/g.

Figure 16. Soil Laydown Area Gamma Scan Survey Map

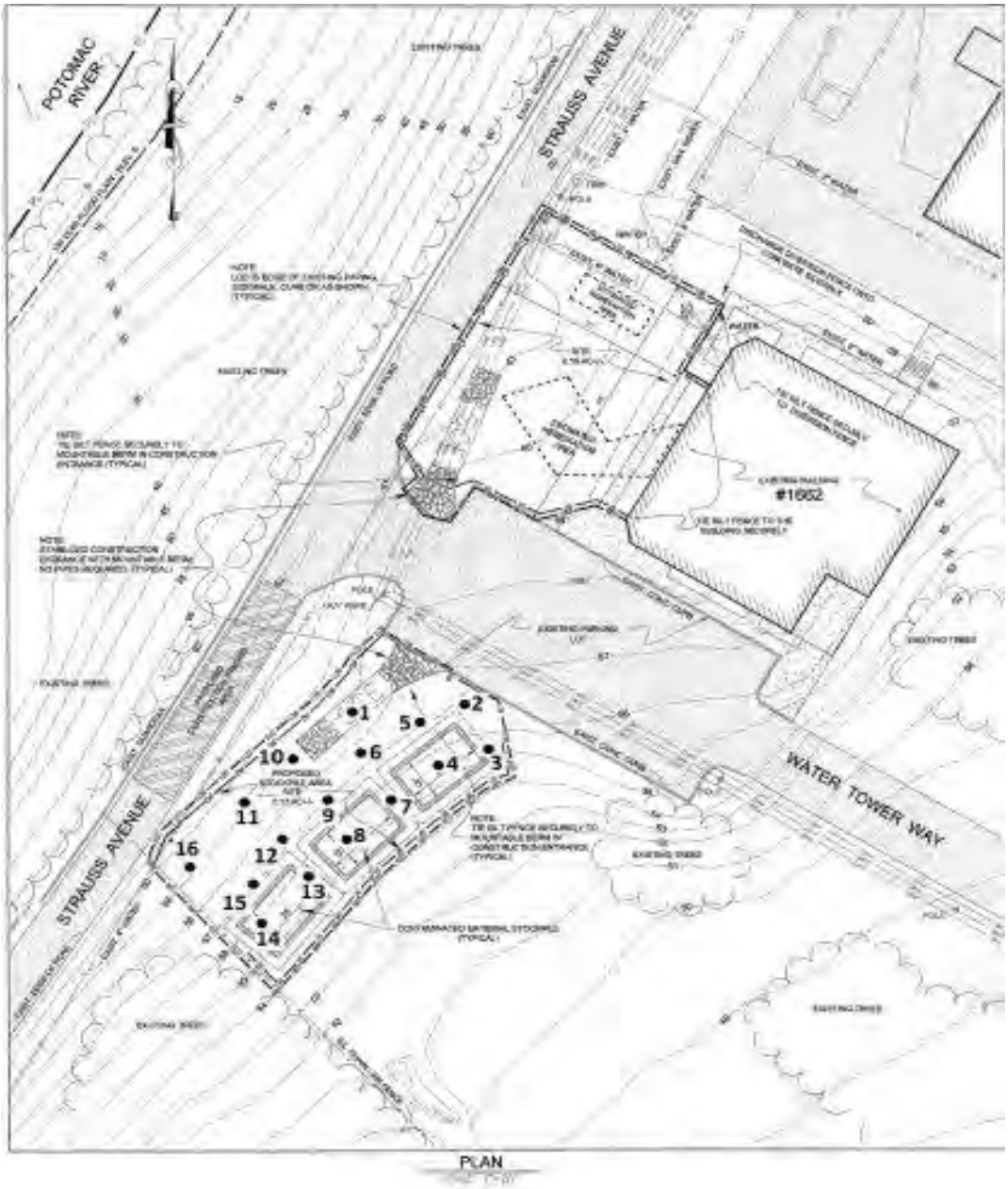


Figure 17. Soil Laydown Area Sample Location Map

Table 15 below presents a summary of the soil sample results.

Table 15. Soil Laydown Area Sample Summary Table

						Isotopic Thorium/Alpha Spectroscopy						
Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in inches	Sample Matrix	Location/Description	Th-228 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-230 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Th-232 Results in pCi/g	2 σ Uncertainty +/- pCi/g	Comments/Notes
IHS1SLD- 1	12/15/2015	0815	0-6"	Soil	Soil Laydown Area	0.587	0.145	0.808	0.172	0.608	0.145	
IHS1SLD- 2	12/15/2015	0820	0-6"	Soil	Soil Laydown Area	0.642	0.162	0.694	0.164	0.589	0.15	
IHS1SLD- 3	12/15/2015	0825	0-6"	Soil	Soil Laydown Area	0.629	0.156	0.807	0.175	0.462	0.129	
IHS1SLD- 4	12/15/2015	0830	0-6"	Soil	Soil Laydown Area	0.458	0.13	0.739	0.164	0.594	0.144	
IHS1SLD- 5	12/15/2015	0835	0-6"	Soil	Soil Laydown Area	0.708	0.158	0.625	0.146	0.585	0.14	
IHS1SLD- 6	12/15/2015	0842	0-6"	Soil	Soil Laydown Area	0.597	0.14	0.479	0.121	0.569	0.132	
IHS1SLD- 7	12/15/2015	0847	0-6"	Soil	Soil Laydown Area	0.652	0.161	0.729	0.166	0.552	0.142	
IHS1SLD- 8	12/15/2015	0855	0-6"	Soil	Soil Laydown Area	0.691	0.166	0.647	0.157	0.776	0.174	
IHS1SLD- 9	12/15/2015	0900	0-6"	Soil	Soil Laydown Area	0.883	0.18	0.662	0.15	0.759	0.162	
IHS1SLD- 10	12/15/2015	0905	0-6"	Soil	Soil Laydown Area	0.768	0.173	0.61	0.15	0.664	0.157	
IHS1SLD- 11	12/15/2015	0910	0-6"	Soil	Soil Laydown Area	0.716	0.164	0.931	0.188	0.69	0.157	
IHS1SLD- 12	12/15/2015	0918	0-6"	Soil	Soil Laydown Area	0.962	0.198	1.26	0.232	0.783	0.175	
IHS1SLD- 13	12/15/2015	0923	0-6"	Soil	Soil Laydown Area	0.773	0.178	0.789	0.177	0.713	0.167	
IHS1SLD- 14	12/15/2015	0929	0-6"	Soil	Soil Laydown Area	0.564	0.143	0.603	0.146	0.605	0.146	
IHS1SLD- 15	12/15/2015	0937	0-6"	Soil	Soil Laydown Area	0.643	0.153	0.84	0.174	0.584	0.141	
IHS1SLD- 16	12/15/2015	0944	0-6"	Soil	Soil Laydown Area	0.661	0.16	0.729	0.164	0.899	0.185	
					Maximum:	0.962		1.260		0.899		
					Average:	0.683		0.747		0.652		
					Standard Deviation:	0.122		0.175		0.111		

U-Result is less than the sample detection limit.

ND- Not detected.

11.4 WASTE PROFILE SAMPLES

Representative composite waste profile soil samples were collected from Site 1 and sent to Test America, Inc. for Toxicity Characteristic Leaching Procedure (TCLP) analysis. In accordance with 40 CFR Part 261.21 through 40 CFR Part 261.24 the samples were analyzed for:

- Volatiles
- Metals
- Semi-Volatiles
- Herbicides
- Pesticides
- Reactive Sulfide
- Reactive Cyanide
- pH
- Ignitability
- Percent Moisture

Based upon review of the sample analysis, there was no RCRA Hazardous waste present other than radioactive material, therefore not a mixed waste. The soils were determined not to contain a RCRA hazardous substance.

The waste profile laboratory sample data is in this report in Appendix U.

The results of these samples were forwarded to the disposal facility for confirmation of the facility Waste Acceptance Criteria (WAC) and approval of the waste streams prior to delivery.

The disposal facility receiving the Indian Head material for disposal was:

U.S. Ecology Idaho, Inc.
20400 Lemley Rd.
Grand View, ID 83624
EPA ID: IDD073114654

12.0 Waste Management

12.1 PACKAGING OF WASTE MATERIALS

The soils were packaged into thirteen 20 cubic yard IP-1 Type containers with hard tops and loaded onto flatbed (ABC) rail cars. Each container was lined with a plastic liner prior to loading. The container(s) met all applicable Department of Transportation (DOT) requirements.

Once loaded, a radiological survey of the container's exterior surface was performed and documented to ensure compliance with applicable DOT regulations. The surveys consisted of exposure rate surveys and loose surface contamination surveys.

- A total of thirteen 20 cubic-yard IP-1 Type containers were shipped during the project. The total volume of the soils shipped was approximately 172 cubic yards.
- All of the container exterior survey results were in compliance with DOT regulations.

Container exterior surveys are provided in Appendix V of this report.

12.2 SHIPMENT AND DISPOSAL OF THE WASTE MATERIALS

The waste materials were shipped shortly after loading to the licensed disposal facility, U.S. Ecology of Grandview, ID, a permitted disposal site for this waste classification by rail.

Chassis trailer trucks were used to transport the loaded containers to a transload facility located in Wampum, PA, approximately 312 miles from the NSF Indian Head site. At the rail facility, the loaded bins were loaded onto the rail cars with a crane.

The waste was classified and shipping manifests, appropriate DOT labeling and shipping documentation was completed by a U.S. Army JMC approved senior waste broker prior to the containers leaving the NSF Indian Head site.

Once the material was received at the disposal facility, manifests, and appropriate documents were completed and sent to AWS by the disposal facility. Copies of the appropriate shipping documents and waste disposal certificates are included in Appendix W.

12.3 LIQUID RADIOACTIVE WASTE

No liquid radioactive waste was generated during NSF Indian Head project activities.

12.4 MIXED WASTE

No mixed waste was generated as defined by 40 CFR Section 261 requirements during NSF Indian Head project activities.

13.0 Site Restoration/Post Job Surveys

13.1 BACKFILL AND SEEDING OF EXCAVATION AREA

The excavation area was backfilled in six inch lifts with select fill with a six inch layer of screened topsoil on top. The area was compacted using a rolling sheepsfoot type compactor. The area was seeded and covered with straw following backfill and compaction.

13.2 REMOVAL OF SILT FENCING AND DIVERSION FENCING

At the time of the writing of this report, the silt fencing and diversion fence installed in accordance with the E & SC Plan remained in place. In the spring (2016), another site visit is scheduled to reseed the areas. Once the vegetation has satisfactorily grown, an additional site visit will be made to remove the silt and diversion fences.

13.3 SOIL LAYDOWN AREA POST JOB SURVEYS

The area underwent a 50% gamma scan survey following completion of work to identify areas of elevated activity from work activities. The result of the survey was compared to the pre job survey results. No areas exceeded the investigation level, established at 3 standard deviations above the pre-determined background levels, or were greater than the results of the pre work survey. All gamma scan results were between 5,000 to 6,000 gross cpm gamma.

The soil laydown area surveys are presented in Appendix X.

13.4 MISCELLANEOUS SURVEYS

Other miscellaneous surveys were performed during the course of work activities. These surveys included material and equipment release surveys. All of the material and equipment release survey results were below the DCGLs presented in Table 8.

The miscellaneous surveys are presented in Appendix Y.

14.0 CONCLUSION

The results of the Final Status Surveys of the excavation bottom and sidewalls of Site 1 met the release criterion and did not exceed natural background radiation levels. The average concentration of the excavation sidewall and bottom samples is 0.79 pCi/g for Th-232 compared to the average background concentration of 1.15 pCi/g for Th-232 collected in the reference area. Based upon these results, it is recommended that the site be radiologically released for unrestricted use.

The RESRAD Version 6.5 Modeling Code was used to calculate the post remediation Total Effective Dose Equivalent (TEDE) dose and cancer risk at the site using the confirmation samples from the NTCRA excavation. This resulted in an average concentration of 0.79 which was used in the RESRAD calculation (see Appendix BB) to determine a conservative total effective dose that considers all potential pathways and background contributions.

The RESRAD recalculation at the 0.79 level was to demonstrate compliance with the EPA OSWER Directive 9200.4-18 (as updated in an EPA memorandum OSWER 9285.6-20, dated 13 July 2014) which recommended TEDE of 12 millirem/yr. and cancer risk levels below $3x\ 10^{-4}$ in support the decision for unrestricted release of Site 1. The resulting TEDE was 8.8 mrem/y over a maximum dose period of 82.6 years, and an excessive cancer risk of 2.1×10^{-4}.

The default "Residential Farmer" scenario parameters were used in the RESRAD calculations with the exception of the following site specific conditions:

"Contaminated Zone" was changed from the default parameter of 10,000 m^2 to the site-specific value of 540 m^2 (size of the Site 1 area rounded up).

"Thickness of Contaminated Zone" was changed from the default value of 2 meters to a site-specific value of 1.2 meters.

"The Length Parallel to Aquifer Flow" was changed from the default value of 100 meters to a site-specific value of 28 meters.

The average input concentration of 0.79 pCi/g for Th-232 was entered as the concentration value.

The pathway selection was set as follows:

- External Gamma Active

- Inhalation (w/o radon) Active
- Plant Ingestion Active
- Meat Ingestion Active
- Milk Ingestion Active
- Aquatic Foods Active
- Drinking Water Active
- Soil Ingestion Active
- Radon Suppressed
- Find peak pathway doses Active

Table 16 below provides a summary of the calculations.

Table 16 RESRAD Calculation Summary Table

Duration in Years	Calculated TEDE in mrem/yr	Cancer Risk
0	0.5	1.5 E-4
1	1.1	1.5 E-4
3	2.4	1.7 E-4
10	6	1.9 E-4
30	8.6	2.1 E-4
82.6 (Peak Dose)	8.8	2.1 E-4
100	8.8	2.1 E-4
300	8.8	2.1 E-4
1,000	6.6	1.5 E-4

15.0 References

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Appendix A

Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING

Between

Naval Sea Systems Command Detachment, Radiological Affairs Support Office;
U.S. Army Joint Munitions Command, Rock Island, Illinois; and
Aleut World Solutions (Contractor)

RE: PERFORMANCE OF RADIOLOGICAL REMEDIAL ACTION UNDER ALEUT WORLD SOLUTIONS NRC LICENSE NO. 50-29273-01 AT NAVAL SUPPORT FACILITY INDIAN HEAD

1. Background

a. The Naval Sea Systems Command Detachment, Radiological Affairs Support Office (NAVSEADET RASO) has requested that Aleut World Solutions (AWS) (in a joint venture with Bering Sea Environmental BSE) provide radiological services in support of remedial and final status survey actions at Installation Restoration Site 1 at Naval Support Activity South Potomac (NSASP), Naval Support Facility Indian Head (NSF IHD), Indian Head, MD, a component of Naval District Washington. These services have been contracted by the U.S. Army Joint Munitions Command (JMC), Rock Island, Illinois, through the Naval Low Level Radioactive Waste (LLRW) Disposal Program which functions as part of the Department of Defense LLRW Disposal Program managed by JMC. As a requirement of the contract W52P1J-08-D-0034, radiological services will be performed under BSE's Nuclear Regulatory Commission (NRC) Radioactive Materials License No. 50-29273-01.

b. For the purposes of this Memorandum Of Understanding (MOU), AWS will perform radiological remediation, final status surveys, and low-level radioactive waste management at IR Site 1 located at NSF IHD. AWS notified NRC Region IV on 16 September 2015 of their intent to perform the contracted work at under their NRC license.

c. The intent of this MOU is to outline the general applicability and responsibilities of each organization as it applies to the performance work statement, approved work practices, health and safety plan, radiation health plan, and license implementation.

2. Organizational Responsibilities. Each organization has distinct areas of responsibility as defined by their respective functions.

a. AWS shall:

(1) Perform work using radiologically sound work practices following standard operating procedures approved under the BSE NRC license, approved work practices in the Work Plan and Final Status Survey Plan - Site 1 Removal Action dated 22 September 2015, health and safety plan, radiation health plan, and performance work statement.

(2) Maintain training and dose records for AWS employees and subcontractors, as appropriate.

(3) Ensure all contractor and subcontractor personnel wear appropriate dosimetry.

(4) Control radioactive materials used for operational checks of radiation detection and laboratory equipment.

(5) Control access to individual work areas under AWS control for activities where radioactive materials are known or suspected of being present, or low-level radioactive waste is stored.

(6) Control waste materials in accordance with the Work Plan.

(7) Issue and maintain Radiation Work Permits for work controlled by AWS.

(8) Maintain inventories of radioactive materials, including low-level radioactive waste, under AWS's control.

(9) Submit reports and other administrative requirements concerning the work, including daily progress reports, to the NAVSEADET RASO, JMC, NSASP, or additional Navy offices as requested. Information will be provided regarding the radiological conditions of all work areas, radioactive contamination found, and status of any identified waste.

b. NAVSEADET RASO shall: Ensure AWS performs work using radiologically sound work practices following standard operating procedures approved under the BSE NRC license, approved work practices, health and safety plan, radiation health plan, and performance work statement.

c. JMC shall: Provide necessary contracting services and oversight to ensure AWS performs radiologically sound work practices following standard operating procedures approved under the BSE NRC license, approved work practices, health and safety plan, radiation health plan, and performance work statement.

3. Responsibilities for Performance of Site Work

a. AWS shall:

(1) Perform radiological remediation in accordance with approved work practices in accordance with the Work Plan, standard operating procedures, and direction from NAVSEADET RASO and JMC.

(2) Secure the AWS work areas allocated by NSF IHD in accordance with the Work Plan by use of a method controlled by AWS during performance of work.

(3) Assess contamination levels, as required, on building materials, outdoor areas and materials and equipment.

(4) Provide a trailer as a temporary office equipped with temporary electrical power.

(5) Free release of all equipment, areas, and spaces used during the performance of this project prior to conclusion of the project.

(6) Control access to all work and storage areas under the BSE NRC license and post, and secure such areas in accordance with the BSE NRC license, standard operating procedures, and NAVSEADET RASO and JMC approved work plan.

(7) Coordinate public health and safety assurance issues with NAVSEADET RASO, JMC and NSASP.

(8) AWS Site Project Manager will be Dan Spicuzza.

b. NAVSEADET RASO shall:

(1) Monitor site work by performing on-site visits, tracking on daily site reports and/or participating in conference calls.

(2) Review all site investigative data.

(3) Work with the contractor, JMC and NSASP to address any unexpected contamination or radiological control issues.

(4) Provide assistance with public health and safety assurance issues, in coordination with NSASP and JMC.

(5) Approve public statements regarding radiological issues before issuance after obtaining approval by the NSASP Public Affairs Officer.

(6) Approve clearance of areas prior to turnover of the areas for unrestricted use to NSASP.

(7) Point of contact for NAVSEADET RASO is Allen Stambaugh.

c. JMC shall:

(1) Monitor site work by performing on-site visits, tracking on daily site reports and/or participating in conference calls.

(2) Work with the contractor (AWS), NAVSEADET RASO, and NSASP to contractually address any unexpected contamination issues.

(3) Point of contact for JMC is Frank Whitaker.

4. Jurisdictional Issues and Changes. Jurisdictional issues or specific situations not covered under this agreement will be discussed between NAVSEADET RASO, JMC, and AWS for resolution and documented by amendment of this memorandum of understanding, field work plans, or the contract.

5. Effective Period: This MOU is effective upon signatures by all parties and will expire in 6 months. Either party may terminate this agreement by giving 90 days advance written notice of the effective date of termination, or upon the written agreement of both parties at a mutually agreeable date.

6. Approval:

STAMBAUGH.ALLEN.RAY.1103541871

Digitally signed by STAMBAUGH.ALLEN.RAY.1103541871
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=STAMBAUGH.ALLEN.RAY.1103541871
Date: 2015.10.01 16:46:01 -04'00'

NAVSEADET RASO Representative — Date

Daniel M. Spicuzza

Daniel Spicuzza, AWS Project Manager — Date 9/30/2015

WHITAKER.FRANK.C.JR.1270398916

Digitally signed by WHITAKER.FRANK.C.JR.1270398916
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=WHITAKER.FRANK.C.JR.1270398916
Date: 2015.09.30 08:22:19 -05'00'

Frank Whitaker, JMC COR — Date

Appendix B

Radiation Work Permit (RWP)

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2015-02 Regular X Extended

SECTION I

Contract # USN-2015-011	Date: 10-9-15	Time: 1000

Location/Project: NSF Indian Head, MD IR Site 1

Exposure Category: D&D Source Transfer Waste Processing Characterization

Job Description: Excavation and remediation of thorium conmtaminated soils, packaging of soils, and transportation of soils for disposal. Perform final status surveys and sampling following remediation.

Estimated Start Date: 10/9/14 Estimated End Date: 11/6/15

SECTION II

Existing Radiological Conditions:

Radiation Survey No. N/A Airborne Survey No. N/A Contamination Survey No. N/A .

Existing General Area Radiation Level(s):	Existing General Contamination Levels:	Airborne DAC Level(s):
.006-.01 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	< 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 100 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	< 10 % P < 10 % P N/A % H_3
Existing Maximum Radiation Level(s):	**Existing Maximum Contamination Level(s)**	**Hot Particle?**
.010 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	< 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 20 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	Yes No

Remarks: None.

SECTION III

Radiological Limits:

Maximum Allowed WB Exposure Rate : 5 mr/hr γ or mrem/hr η

Corrected : N/A mrad/hr Maximum Extremity Exposure Rate: 5 mr/hr

Maximum Allowed Contamination Level : 20 dpm/100cm² α Loose : 200 dpm/100cm² βγ Loose

Maximum Allowed Contamination Level : 100 dpm/100cm² α Fixed : 1,000 dpm/100cm² βγ Fixed

Maximum Allowed Airborne Concentration Level: 10 % DAC

Remarks:

Industrial Hygiene/Safety Concerns: Open excavation, insects, heat/cold stress. Possible UXO present.

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2015-02 Regular ☒ Extended

SECTION IV

WORKER REQUIREMENTS

CLOTHING:	DOSIMETRY:	INSTRUCTIONS:	RESPIRATORY:
☐ Coveralls ☐ Lab Coat ☐ Cloth Hood ☒ Paper Coveralls[1] ☐ Plastic Suit ☒ Plastic Booties[1] ☐ Rubber Shoe Covers ☐ Canvas Shoe Covers ☐ Cotton Gloves ☒ Rubber Gloves[1 2] ☒ Leather Gloves[1] ☐ Beta Goggles/Face Shield ☐ Extra ☐ Other Clothing Stay Time (Heat Stress, Radiaton, Exposure Limits, etc.): 6 hrs.	☒ TLD ☐ Film Badge ☐ SRD ☒ Standard ☐ Elbows ☐ Gonad Pack ☐ Hot Cell Entry ☐ Extremity ☐ Head Pack ☐ Special ☐ Knees ☐ Varying Field ☐ Upper Field ☐ Ground Field ☐ Alarming Dosimetry ☐ None	☒ Contact HP for Line Breaks ☒ Protect Cuts ☒ Pre-Job Briefing ☒ Post-Job Briefing ☒ Contact HP Prior to Work In New Areas ☐ Modesty Required ☒ Site Specific Instructions ☒ Equipment Monitor at Job End ☒ Clean Up Work Area During and After Job ☒ Eating, Drinking, Smoking, Chewing Prohibited ☒ Frisk Upon Exiting Contaminated Area ☒ Have Prescribed HP Coverage or Stop Work ☒ Exit Area Immediately Upon Emergency or Injury. Notify HP Immediately	☐ FFNP ☐ FFAL ☐ SCBA ☐ PAPR ☒ Dust Mask[1] ☐ Half Face ☐ Bubble Hood Cartridges: ☐ Particulate ☐ Vapor ☐ Combination ☐ Other

Special Instructions: [1] Per HP supervision instructions. [2] When collecting soil samples and handling potentially contaminated items.

SECTION V

Health Physics Requirements

1. Job Coverage: Continuous ☐ Intermittent ☒ Start ☐ End of Job ☐
2. Air Sampling: General Area ☒ Breathing Zone ☐ Lapel ☐ AgZ ☐
   Tritium/C-14 ☐ Particulate ☒ Charcoal ☐ LoVol ☒ HiVol ☒
3. Exposure Rate Surveys: Start of Job ☒ Continuous Monitoring ☐ Area Monitoring ☐
   Intermittent Monitoring ☒ End of Job ☒
4. Contamination Surveys: Start of Job ☒ Continuous Monitoring ☐
   Intermittent Monitoring ☒ End of Job ☒
5. Is the ALARA Consideration Complete and Attached? Yes No Why? _____
6. Other: _____

RWP #: NSFIH-2015-02 Regular X Extended

SECTION VI

Personnel Authorized to Perform Work & Acceptance of Responsibility
*My signature verifies that I have read and fully understand the RWP Requirements

Date	Name (Print)	Signature*	Last Four Digits SSN	HPS Init	Year Dose to Date (Rem) TEDE	TODE	LDE	SDE WB	SDE EX
10-9-15	[illegible]	[illegible]	4551	[illegible]	0	0	0	0	0
10-9-15	Harry P Obregon	[illegible]	3122	HPO	0	0	0	0	0
10-9-15	Caleb Pickett 2	[illegible]	5553	[illegible]	0	0	0	0	0
10/9/15	JAMES JOHNSON	[illegible]	7613	[illegible]	Ø	Ø	Ø	Ø	Ø
10/9/15	JOSE TORRES	[illegible]	0671	[illegible]	0	0	0	0	0
10/9/15	W. B. Wydie	[illegible]	1205	[illegible]	0	0	0	0	0
10/9/15	Adolfo Matus Jr	[illegible]	6734	AMJ	0	0	0	0	0
10/9/15	Nathan Molinere	[illegible]	7353	[illegible]	0	0	0	0	0
10/9/15	RICHARD THATCHER	[illegible]	7692	[illegible]	0	0	0	0	0

H	Approvals/Reviews	I	Termination
Technician Generating RWP: William R. Wydie Date/Time: 10-9-15 1000hrs		Date: 12-16-15 Time: 1000	
Industrial Hygiene Approval: Date/Time: N/A		Health Physics Rep: [illegible]	
HP Supervisor Approval: Date/Time:N/A		Reason: (Job Complete) RWP Revision	
RSO Manager Approval: [illegible] Date/Time: 10-9-15 1005		HP Supervisor Review: [illegible] 12-16-15	

PRE-JOB BRIEFING CHECKLIST
(Health Physics)

1.	**Identify Stop Work Authority:** HWS, Senior HP Tech.
2.	**HP Coverage (Intermittent, continuous):** Intermittent.
3.	**Exposure Limitation/Goal:** Stop work if dose rates > 4mrem/hr are encountered.
4.	**Conditions Expected (per RWP):**

Radiation	Contamination	Airborne	Neutron
.004-.010 mrem/hr	<1000dpm (100cm²) <1000dpm (100cm²)	<10% DAC	N/A
Hot Particles	**Potential Changes (debris, line-ups, opening systems, etc.)**		
N/A			

5. **Review:**	Yes	No	N/A
Protective Clothing?	X		
Respiratory Protection?		X	
Special Dosimetry?		X	
Air Sampling?	X		
Laydown Areas Set Up?	X		
Control Point?	X		
Communications Established?	X		
Other?			

6.	**Special Instructions (per RWP)**
7.	**Radiological Hold Points: Identify criterion for each point:**
	After 1' bags, 6" lifts down to 4' bags required
8.	**ALARA Considerations (shielding, decon, hot spots, low dose areas, etc.):**
	A. N/A
	B. N/A
9.	**Job Specific Discussion**
	BPEO donning requirements
10.	**Turnover Frequency (every shift, day, etc):** Daily
	Must cover these topics: RWP requirements, daily & daily safety meeting
	ALL WORKERS MUST SIGN ATTACHED TRAINING ATTENDANCE FORM BSEN-027.
Health Physics Supervisor Review:	
Briefing Conducted By (Print / Sign)	Date / Time
[illegible]	10-9-15 1098

BERING SEA ENVIRONMENTAL FORM BSEN- 026

Appendix C

Bioassay Sample Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-14385-1
Client Project/Site: NSF Indian Head Site 1

For:
Aleut World Solutions
615 E. 82nd Ave.
Suite 200
Anchorage, Alaska 99518

Attn: Daniel Spicuzza

Authorized for release by:
11/19/2015 2:43:56 PM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14385-1

Job ID: 160-14385-1

Laboratory: TestAmerica St. Louis

Narrative

Job Narrative
160-14385-1

Comments
Please see the attached subcontract report for any nonconformances.

Receipt
The samples were received on 10/16/2015 10:15 AM; the samples arrived in good condition, properly preserved and, where required, on ice.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

TestAmerica Richland
2800 George Washington Way

Richland, WA 99354
phone 509.375.3131 fax 509.375.5590

Chain of Custody Record

J5J 2004106
SDG#50510
Due 11/6/15

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10-14-15	COC No: NSFIH-2015-1
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7488	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 1 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.: USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Th-232 Alpha Spectroscopy	Sample Specific Notes:
M7RFA Spicuzza	10/13/2015	0705	G	Urine	1	N	N	X	Bioassay Sample
~~M7F~~ M7RFC Torres	10/13/2015	0710	G	Urine	1	N	N	X	Bioassay Sample
10/20/15 M7RFD Johnson	10/13/2015	0740	G	Urine	1	N	N	X	Bioassay Sample
M7RFE Wylie	10/13/2015	0745	G	Urine	1	N	N	X	Bioassay Sample
M7RFF Kountz	10/13/2015	0735	G	Urine	1	N	N	X	Bioassay Sample
M7RFG Molinero	10/13/2015	0730	G	Urine	1	N	N	X	Bioassay Sample
M7RFH Matus Jr.	10/13/2015	0720	G	Urine	1	N	N	X	Bioassay Sample
M7RFJ Obregon	10/13/2015	0725	G	Urine	1	N	N	X	Bioassay Sample
M7RFK Thatcher	10/13/2015	0715	G	Urine	1	N	N	X	Bioassay Sample

160-14385 Chain of Custody

Preservation Used: 1=Ice, 2=HCl, 3=H2SO4, 4=HNO3, 5=NaOH, 6=Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company: AWS	Date/Time: 10-14-15 1100	Received by: Jack Jbeck	Company: TALR	Date/Time: 10/16/15 1015
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Analytical Data Package Prepared For

Aleut World Solutions

Radiochemical Analysis By

TestAmerica Inc

2800 G.W. Way, Richland Wa, 99354, (509)-375-3131.

Assigned Laboratory Code:

Data Package Contains 20 *Pages*

Report No.: 67607

Results in this report relate only to the sample(s) analyzed.

SDG No.	Order No.	Client Sample ID (List Order)	Lot-Sa No.	Work Order	Report DB ID	Batch No.
50510		JOHNSON	J5J200406-3	M7RFD1AA	9M7RFD10	5293072
		KOUNTZ	J5J200406-5	M7RFF1AA	9M7RFF10	5293072
		MATUS JR.	J5J200406-7	M7RFH1AA	9M7RFH10	5293072
		MOLINERO	J5J200406-6	M7RFG1AA	9M7RFG10	5293072
		OBREGON	J5J200406-8	M7RFJ1AA	9M7RFJ10	5293072
		SPICUZZA	J5J200406-1	M7RFA1AA	9M7RFA10	5293072
		THATCHER	J5J200406-9	M7RFK1AA	9M7RFK10	5293072
		TORRES	J5J200406-2	M7RFC1AA	9M7RFC10	5293072
		WYLIE	J5J200406-4	M7RFE1AA	9M7RFE10	5293072

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Certificate of Analysis

November 17, 2015

Aleut World Solutions
615 E. 82nd Ave, Suite 200
Anchorage, AK 99518

Attention: Daniel Spicuzza

Date Received in Lab	:	October 16, 2015
Sample Type	:	Nine (9) Urine
SDG Number	:	50510
Job Number	:	USN 2015-011
Project Number/Name	:	NSF Indiand Head Site 1 Removal Action/Radiochemistry

CASE NARRATIVE

I. Introduction

On October 16, 2015, nine urine samples were received at the TestAmerica Richland laboratory for radiochemical analysis. Upon receipt the sample was assigned to Lot Number J5J200406 with the laboratory ID number corresponding to the client ID as shown on the cover page.

II. Sample Receipt

The sample was received in good condition and no anomalies noted upon check-in.

III. Analytical Results/Methodology

The analytical results for this report are presented by laboratory sample ID. Each set of data includes sample identification information; analytical results and the appropriate associated statistical uncertainties.

The analyses requested were:

Alpha Spectroscopy
Thorium-232 by method RL-ALP-001

IV. Quality Control

The analytical result for each analysis performed includes a minimum of one laboratory control sample (LCS), and one reagent blank sample analysis. Any exceptions have been noted in the "Comments" section.

V. Comments

Alpha Spectroscopy

Thorium-232 by method RL-ALP-001:
The matrix LCS, matrix batch blank and sample results are within acceptance limits.

I certify that this Certificate of Analysis is in compliance with the SOW and/or NELAC, both technically and for completeness, for other than the conditions detailed above. The Laboratory Manager or a designee, as verified by the following signature has authorized release of the data contained in this hard copy data package.

Reviewed and approved:

Jennifer Bull

Digitally signed by Jennifer Bull
DN: cn=Jennifer Bull, o=TestAmerica Labs, ou=Richland, email=jennifer.bull@testamericainc.com, c=US
Date: 2015.11.17 13:51:02 -08'00'

Jennifer Bull
Project Manager Assistant

Drinking Water Method Cross References

	DRINKING WATER ASTM METHOD CROSS REFERENCES	
Referenced Method	**Isotope(s)**	**TestAmerica Richland's SOP No.**
EPA 901.1	Cs-134, I-131	RL-GAM-001
EPA 900.0	Alpha & Beta	RL-GPC-001
EPA 00-02	Gross Alpha (Coprecipitation)	RL-GPC-002
EPA 903.0	Total Alpha Radium (Ra-226)	RL-RA-002
EPA 903.1	Ra-226	RL-RA-001
EPA 904.0	Ra-228	RL-RA-001
EPA 905.0	Sr-89/90	RL-GPC-003
ASTM D5174	Uranium	RL-KPA-003
EPA 906.0	Tritium	RL-LSC-005

Results in this report relate only to the sample(s) analyzed.

Uncertainty Estimation

TestAmerica Richland has adopted the internationally accepted approach to estimating uncertainties described in “NIST Technical Note 1297, 1994 Edition”. The approach, "Law of Propagation of Errors", involves the identification of all variables in an analytical method which are used to derive a result. These variables are related to the analytical result (R) by some functional relationship, R = constants * f(x,y,z,...). The components (x,y,z) are evaluated to determine their contribution to the overall method uncertainty. The individual component uncertainties (u_i) are then combined using a statistical model that provides the most probable overall uncertainty value. All component uncertainties are categorized as type A, evaluated by statistical methods, or type B, evaluated by other means. Uncertainties not included in the components, such as sample homogeneity, are combined with the component uncertainty as the square root of the sum-of-the-squares of the individual uncertainties. The uncertainty associated with the derived result is the combined uncertainty (u_c) multiplied by the coverage factor (1,2, or 3).

When three or more sample replicates are used to derive the analytical result, the type A uncertainty is the standard deviation of the mean value (S/?n), where S is the standard deviation of the derived results. The type B uncertainties are all other random or non-random components that are not included in the standard deviation.

The derivation of the general "Law of Propagation of Errors" equations and specific example are available on request.

Report Definitions

Action Lev	An agreed upon activity level used to trigger some action when the final result is greater than or equal to the Action Level. Often the Action Level is related to the Decision Limit.
Batch	The QC preparation batch number that relates laboratory samples to QC samples that were prepared and analyzed together.
Bias	Defined by the equation (Result/Expected)-1 as defined by ANSI N13.30.
COC No	Chain of Custody Number assigned by the Client or TestAmerica.
Count Error (#s)	Poisson counting statistics of the gross sample count and background. The uncertainty is absolute and in the same units as the result. For Liquid Scintillation Counting (LSC) the batch blank count is the background.
CSU (#s) ***u_c Combined Standard Uncert.***	All known uncertainties associated with the preparation and analysis of the sample are propagated to give a measure of the uncertainty associated with the result, *u_c the combined standard uncertainty*. The uncertainty is absolute and in the same units as the result.
(#s), Coverage Factor	The coverage factor defines the width of the confidence interval, 1, 2 or 3 standard deviations.
CRDL (RL)	Contractual Required Detection Limit as defined in the Client's Statement Of Work or TestAmerica "default" nominal detection limit. Often referred to the reporting level (RL)
Lc	Decision Level based on instrument background or blank, adjusted by the Efficiency, Chemical Yield, and Volume associated with the sample. The Type I error probability is approximately 5%. Lc=(1.645 * Sqrt(2*(BkgrndCnt/BkgrndCntMin)/SCntMin)) * (ConvFct/(Eff*Yld*Abn*Vol) * IngrFct). For LSC methods the batch blank is used as a measure of the background variability. Lc cannot be calculated when the background count is zero.
Lot-Sample No	The number assigned by the LIMS software to track samples received on the same day for a given client. The sample number is a sequential number assigned to each sample in the Lot.
MDC|MDA	Detection Level based on instrument background or blank, adjusted by the Efficiency, Chemical Yield, and Volume with a Type I and II error probability of approximately 5%. MDC = (4.65 * Sqrt((BkgrndCnt/BkgrndCntMin)/SCntMin) + 2.71/SCntMin) * (ConvFct/(Eff * Yld * Abn * Vol) * IngrFct). For LSC methods the batch blank is used as a measure of the background variability.
Primary Detector	The instrument identifier associated with the analysis of the sample aliquot.
Ratio U-234/U-238	The U-234 result divided by the U-238 result. The U-234/U-238 ratio for natural uranium in NIST SRM 4321C is 1.038.
Rst/MDC	Ratio of the Result to the MDC. A value greater than 1 may indicate activity above background at a high level of confidence. Caution should be used when applying this factor and it should be used in concert with the qualifiers associated with the result.
Rst/TotUcert	Ratio of the Result to the Total Uncertainty. If the uncertainty has a coverage factor of 2 a value greater than 1 may indicate activity above background at approximately the 95% level of confidence assuming a two-sided confidence interval. Caution should be used when applying this factor and it should be used in concert with the qualifiers associated with the result.
Report DB No	Sample Identifier used by the report system. The number is based upon the first five digits of the **Work Order** Number.
RER	The equation Replicate Error Ratio = (S-D)/[sqrt($TPUs^2$ + $TPUd^2$)] as defined by ICPT BOA where S is the original sample result, D is the result of the duplicate, TPUs is the total uncertainty of the original sample and TPUd is the total uncertainty of the duplicate sample.
SDG	Sample Delivery Group Number assigned by the Client or assigned by TestAmerica upon sample receipt.
Sum Rpt Alpha Spec Rst(s)	The sum of the reported alpha spec results for tests derived from the same sample excluding duplicate result where the results are in the same units.
Work Order	The LIMS software assign test specific identifier.
Yield	The recovery of the tracer added to the sample such as Pu-242 used to trace a Pu-239/40 method.

Sample Results Summary

Date: 17-Nov-15

TestAmerica Inc

Ordered by Method, Batch No., Client Sample ID.

Report No. : 67607 **SDG No:** 50510

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RER2
5293072 L#S1									
JOHNSON									
	M7RFD1AA	TH-232	-1.49E-03 +- 7.9E-03	U	pCi/L	66%	1.83E-02	5.00E-02	
KOUNTZ									
	M7RFF1AA	TH-232	1.59E-03 +- 4.5E-03	U	pCi/L	65%	1.22E-02	5.00E-02	
MATUS JR.									
	M7RFH1AA	TH-232	5.46E-03 +- 9.5E-03	U	pCi/L	60%	2.09E-02	5.00E-02	
MOLINERO									
	M7RFG1AA	TH-232	1.77E-03 +- 5.0E-03	U	pCi/L	62%	1.36E-02	5.00E-02	
OBREGON									
	M7RFJ1AA	TH-232	2.55E-03 +- 7.2E-03	U	pCi/L	43%	1.95E-02	5.00E-02	
SPICUZZA									
	M7RFA1AA	TH-232	-5.15E-03 +- 7.7E-03	U	pCi/L	65%	2.11E-02	5.00E-02	
THATCHER									
	M7RFK1AA	TH-232	1.16E-08 +- 4.9E-03	U	pCi/L	62%	1.33E-02	5.00E-02	
TORRES									
	M7RFC1AA	TH-232	-1.95E-03 +- 5.5E-03	U	pCi/L	56%	1.49E-02	5.00E-02	
WYLIE									
	M7RFE1AA	TH-232	4.13E-03 +- 7.2E-03	U	pCi/L	68%	1.58E-02	5.00E-02	

No. of Results: 9

TestAmerica Inc

rptTALRchSaSummary2 V5.4.1 A2002

RER2 - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPUd))] as defined by ICPT BOA.

U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

QC Results Summary

Date: 17-Nov-15

TestAmerica Inc

Ordered by Method, Batch No, QC Type,.

Report No. : 67607 **SDG No.:** 50510

Batch Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
L#S1								
5293072 BLANK QC,								
M7RLF1AA	TH-232	0.00E+00 +- 7.9E-03	U	pCi/L	45%			2.15E-02
M7RLF1AD	TH-232	1.46E-03 +- 5.1E-03	U	pCi/L	65%			1.11E-02
5293072 LCS,								
M7RLF1AC	TH-230	8.20E-01 +- 1.5E-01		pCi/L	67%	98%	0.0	1.11E-02

No. of Results: 3

TestAmerica Inc
rptSTLRchQcSummary V5.4.1 A2002

Bias - (Result/Expected)-1 as defined by ANSI N13.30.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:40:00 AM
Lot-Sample No.:	**J5J200406-3**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**JOHNSON**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFD1AA		**Report DB ID:**	9M7RFD10				
TH-232	**-1.49E-03**	U		7.9E-03	1.83E-02	pCi/L	66%	*-0.08*	11/14/15 08:01 a	1044.6	0.51418	ALP129
						9.26E-03	5.00E-02	*-0.38*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:35:00 AM
Lot-Sample No.:	**J5J200406-5**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**KOUNTZ**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFF1AA		**Report DB ID:**	9M7RFF10				
TH-232	**1.59E-03**	U		4.5E-03	1.22E-02	pCi/L	65%	*0.13*	11/14/15 08:01 a	1021.7	0.53202	ALP259
						6.54E-03	5.00E-02	*0.71*		g	L	

No. of Results: 1 **Comments:**

TestAmerica Inc
rptSTLRchSample
V5.4.1 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:20:00 AM
Lot-Sample No.:	**J5J200406-7**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**MATUS JR.**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFH1AA		**Report DB ID:**	9M7RFH10				
TH-232	**5.46E-03**	U		9.5E-03	2.09E-02	pCi/L	60%	*0.26*	11/14/15 08:03 a	1091.8	0.54004	ALP99
						1.12E-02	5.00E-02	*(1.1)*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:30:00 AM
Lot-Sample No.:	**J5J200406-6**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**MOLINERO**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFG1AA		**Report DB ID:**	9M7RFG10				
TH-232	**1.77E-03**	U		5.0E-03	1.36E-02	pCi/L	62%	*0.13*	11/14/15 08:01 a	1008.6	0.50735	ALP261
						7.28E-03	5.00E-02	*0.71*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:25:00 AM
Lot-Sample No.:	**J5J200406-8**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**OBREGON**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFJ1AA		**Report DB ID:**	9M7RFJ10				
TH-232	**2.55E-03**	U		7.2E-03	1.95E-02	pCi/L	43%	*0.13*	11/14/15 08:03 a	1059.4	0.51255	ALP101
						1.05E-02	5.00E-02	*0.71*		g	L	

No. of Results: 1 **Comments:**

TestAmerica Inc
rptSTLRchSample
V5.4.1 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:05:00 AM
Lot-Sample No.:	**J5J200406-1**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**SPICUZZA**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFA1AA		**Report DB ID:**	9M7RFA10				
TH-232	**-5.15E-03**	U		7.7E-03	2.11E-02	pCi/L	65%	*-0.24*	11/14/15 08:00 a	1046.0	0.51432	ALP127
						1.07E-02	5.00E-02	*-(1.3)*		g	L	

No. of Results: 1 **Comments:**

TestAmerica Inc
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V5.4.1 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:15:00 AM
Lot-Sample No.:	**J5J200406-9**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**THATCHER**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFK1AA		**Report DB ID:**	9M7RFK10				
TH-232	**1.16E-08**	U		4.9E-03	1.33E-02	pCi/L	62%	*0.*	11/14/15 08:03 a	997.6	0.5008	ALP102
						7.15E-03	5.00E-02	*0.*		g	L	

No. of Results: 1 **Comments:**

TestAmerica Inc
rptSTLRchSample
V5.4.1 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:10:00 AM
Lot-Sample No.:	**J5J200406-2**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**TORRES**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFC1AA		**Report DB ID:**	9M7RFC10				
TH-232	**-1.95E-03**	U		5.5E-03	1.49E-02	pCi/L	56%	*-0.13*	11/14/15 08:01 a	1079.0	0.5288	ALP128
						8.01E-03	5.00E-02	*-0.71*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

TestAmerica Inc
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V5.4.1 A2002

FORM I

SAMPLE RESULTS

Date: 17-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50510	**Collection Date:**	10/13/2015 7:45:00 AM
Lot-Sample No.:	**J5J200406-4**	**Report No. :**	67607	**Received Date:**	10/16/2015 10:15:00 AM
Client Sample ID:	**WYLIE**	**COC No. :**	NSFIH-2015-1	**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RFE1AA		**Report DB ID:**	9M7RFE10				
TH-232	**4.13E-03**	U		7.2E-03	1.58E-02	pCi/L	68%	*0.26*	11/14/15 08:01 a	1072.5	0.51437	ALP130
						8.48E-03	5.00E-02	*(1.2)*		g	L	

No. of Results: 1 **Comments:**

TestAmerica Inc
rptSTLRchSample
V5.4.1 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

BLANK RESULTS

Date: 17-Nov-15

Lab Name: TestAmerica Inc

Matrix: URINE

SDG: 50510

Report No. : 67607

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Lc	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RLF1AA		**Report DB ID:**	M7RLF1AB				
TH-232	0.00E+00	U		7.9E-03	2.15E-02	pCi/L	45%	0.	11/14/15 08:04 a		0.55	ALP104
					1.15E-02	5.00E-02		0.			L	
Batch: 5293072	L#S1			**Work Order:**	M7RLF1AD		**Report DB ID:**	M7RLF1DX				
TH-232	1.46E-03	U		5.1E-03	1.11E-02	pCi/L	65%	0.13	11/14/15 08:05 a		0.55	ALP108
					5.98E-03	5.00E-02		0.58			L	

No. of Results: 2 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.

U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

LCS RESULTS

Date: 17-Nov-15

Lab Name: TestAmerica Inc

Matrix: URINE

SDG: 50510

Report No. : 67607

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL	Report Unit	Yield	Expected	Expected Uncert	Recovery, Bias	Analysis, Prep Date	Aliquot Size	Primary Detector
Batch: 5293072	L#S1			**Work Order:**	M7RLF1AC		**Report DB ID:**	M7RLF1CM					
TH-230	8.20E-01			1.5E-01	1.11E-02	pCi/L	67%	8.35E-01	8.6E-03	98%	11/14/15 08:05 a	0.55	ALP106
							Rec Limits:	75	125	0.0		L	

No. of Results: 1 **Comments:**

TestAmerica Inc **Bias** **- (Result/Expected)-1 as defined by ANSI N13.30.**

rptSTLRchLcs
V5.4.1 A2002

TestAmerica Richland
2800 George Washington Way
Richland, WA 99354
Phone 509.375.3131 fax 509.375.5590

Chain of Custody Record

J5J200406
SDG#50510
Due 11/6/15

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10-14-15	COC No: NSFIH-2015-1
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 1 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Th-232 Alpha Spectroscopy	Sample Specific Notes:
M7RFA Spicuzza	10/13/2015	0705	G	Urine	1	N	N	X	Bioassay Sample
~~M7F~~ M7RFC Torres	10/13/2015	0710	G	Urine	1	N	N	X	Bioassay Sample
JF 10/20/15 M7RFD Johnson	10/13/2015	0740	G	Urine	1	N	N	X	Bioassay Sample
M7RFE Wylie	10/13/2015	0745	G	Urine	1	N	N	X	Bioassay Sample
M7RFF Kountz	10/13/2015	0735	G	Urine	1	N	N	X	Bioassay Sample
M7RFG Molinero	10/13/2015	0730	G	Urine	1	N	N	X	Bioassay Sample
M7RFH Matus Jr.	10/13/2015	0720	G	Urine	1	N	N	X	Bioassay Sample
M7RFJ Obregon	10/13/2015	0725	G	Urine	1	N	N	X	Bioassay Sample
M7RFK Thatcher	10/13/2015	0715	G	Urine	1	N	N	X	Bioassay Sample

J5J200406

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10-14-15/1600	Received by: J Beck	Company: TALR	Date/Time: 10/16/15/1015
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

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Sample Check-in List

Date/Time Received: 10-16-15/1015 Container GM Screen Result: (Airlock) 0 cpm Initials [B]
Sample GM Screen Result (Sample Receiving) N/A cpm Initials [B]

Client: STL SDG #: 50510 SAF #: NA [B]

Lot Number: JSJ200406

Chain of Custody # NSFIH-2015-1

Shipping Container ID or Air Bill Number : NA [B]

Samples received inside shipping container/cooler/box Yes [B] Continue with 1 through 4. Initial appropriate response.
No [ ] Go to 5, add comment to #16.

1. Custody Seals on shipping container intact? Yes [B] No [ ] No Custody Seal [ ]
2. Custody Seals dated and signed? Yes [B] No [ ] No Custody Seal [ ]
3. Cooler temperature: _____ °C NA [B]
4. Vermiculite/packing materials is NA [ ] Wet [ ] Dry [B]

Item 5 through 16 for samples. Initial appropriate response.

5. Chain of Custody record present? Yes [B] No [ ]
6. Number of samples received (Each sample may contain multiple bottles): 9
7. Containers received: 9 x 4p
8. Sample holding times exceeded? NA [ ] Yes [ ] No [B]
9. Samples have: [B] tape ____ hazard labels ____ custody seals [B] appropriate sample labels
10. Matrix: ____ A (FLT, Wipe, Solid, Soil) ____ I (Water) ____ S (Air, Niosh 7400) [B] T (Biological, Ni-63)
11. Samples:
    [B] are in good condition ____ are leaking ____ are broken
    ____ have air bubbles (Only for samples requiring no head space) ____ Other ____
12. Sample pH appropriate for analysis requested Yes [ ] No [ ] NA [B]
    (If acidification is necessary go to pH area & document sample ID, initial pH, amount of HNO_3 added and pH after addition on table)
13. Were any anomalies identified in sample receipt? Yes [ ] No [B]
14. Description of anomalies (include sample numbers): NA [B]
15. Sample Location, Sample Collector Listed on COC? * Yes [ ] No [B]
    *For documentation only. No corrective action needed.
16. Additional Information: N/A

[ ] Client/Courier denied temperature check. [ ] Client/Courier unpack cooler.

Sample Check-in List completed by Sample Custodian:
Signature: Julie Bock Date: 10-17-15

Client Notification needed? Yes [ ] No [ ] Date: ____
By: ____
Person contacted: ____

[X] No action necessary; process as is

Project Manager Erika Ford Date 10-20-15

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THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-14608-1
Client Project/Site: NSF Indian Head Site 1

For:
Aleut World Solutions
615 E. 82nd Ave.
Suite 200
Anchorage, Alaska 99518

Attn: Daniel Spicuzza

Rhonda Ridenhower

Authorized for release by:
11/30/2015 4:26:08 PM
Rhonda Ridenhower, Manager of Project Management
rhonda.ridenhower@testamericainc.com

Designee for

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Case Narrative

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14608-1

Job ID: 160-14608-1

Laboratory: TestAmerica St. Louis

Narrative

Job Narrative
160-14608-1

Comments
See subcontract data for any nonconformances.

J5J 300415
SDG# 50581
Due 11/20/15

TestAmerica Richland
2800 George Washington Way
Richland, WA 99354
phone 509.375.3131 fax 509.375.5590

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/27/15	COC No: NSFIH-2015-12
AWS, LLC	Tel/Fax: 412 848-7022/888 795-7488	Lab Contact: Erika Gish	Carrier: Fed Ex	___ of ___ COCs
615 E. 62nd. Ave. Suite 200	Analysis Turnaround Time			Samples: Urine, Hybrid
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.: USN 2015-011
Quote # 19994474-0	☐ 1 day			

Sample Identification		Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Th-232 Alpha Spectroscopy	Sample Specific Notes:
M7T5G	Matus Jr.	10/27/2015	0710	G	Urine	1	N	N	X	Bioassay Sample
M7T5H	Obragon	10/27/2015	0715	G	Urine	1	N	N	X	Bioassay Sample
M7T5J	Torres	10/27/2015	0730	G	Urine	1	N	N	X	Bioassay Sample
M7T5K	Johnsen	10/27/2015	0925	G	Urine	1	N	N	X	Bioassay Sample
M7T5L	Molinero	10/28/2015	0705	G	Urine	1	N	N	X	Bioassay Sample
M7T5M	Kountz	10/28/2015	0710	G	Urine	1	N	N	X	Bioassay Sample
M7T5N	Thatcher	10/28/2015	0714	G	Urine	1	N	N	X	Bioassay Sample
M7T5P	Wylie.	10/28/2015	0840	G	Urine	1	N	N	X	Bioassay Sample
M7T5Q	Spicuzza	10/29/2015	0700	G	Urine	1	N	N	X	Bioassay Sample

160-14608 Chain of Custody

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5= NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ Therm ID No.: ____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Arc	AWS	10/28/15 1600			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-14608-1

Login Number: 14608
List Number: 1
Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14608-1

Method	Method Description	Protocol	Laboratory
alpha spec Th232	General Sub Contract Method	NONE	TAL RCH

Protocol References:

NONE = NONE

Laboratory References:

TAL RCH = TestAmerica Richland, 2800 George Washington Way, Richland, WA 99352, TEL (509)375-3131

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14608-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14608-1	MATUS JR.	Water	10/27/15 07:10	10/30/15 10:35
160-14608-2	OBREGON	Water	10/27/15 07:15	10/30/15 10:35
160-14608-3	TORRES	Water	10/27/15 07:30	10/30/15 10:35
160-14608-4	JOHNSON	Water	10/27/15 09:25	10/30/15 10:35
160-14608-5	MOLINERO	Water	10/28/15 07:05	10/30/15 10:35
160-14608-6	KOUNTZ	Water	10/28/15 07:10	10/30/15 10:35
160-14608-7	THATCHER	Water	10/28/15 07:14	10/30/15 10:35
160-14608-8	WYLIE	Water	10/28/15 08:40	10/30/15 10:35
160-14608-9	SPICUZZA	Water	10/29/15 07:00	10/30/15 10:35

Subcontract Data

Analytical Data Package Prepared For

Aleut World Solutions

Radiochemical Analysis By

TestAmerica Inc

2800 G.W. Way, Richland Wa, 99354, (509)-375-3131.

Assigned Laboratory Code:

Data Package Contains 20 *Pages*

Report No.: 67700

Results in this report relate only to the sample(s) analyzed.

SDG No.	Order No.	Client Sample ID (List Order)	Lot-Sa No.	Work Order	Report DB ID	Batch No.
50581		JOHNSON	J5J300415-4	M7T5K1AA	9M7T5K10	5306045
		KOUNTZ	J5J300415-6	M7T5M2AA	9M7T5M20	5306045
		MATUS JR.	J5J300415-1	M7T5G1AA	9M7T5G10	5306045
		MOLINERO	J5J300415-5	M7T5L2AA	9M7T5L20	5306045
		OBREGON	J5J300415-2	M7T5H1AA	9M7T5H10	5306045
		SPICUZZA	J5J300415-9	M7T5Q2AA	9M7T5Q20	5306045
		THATCHER	J5J300415-7	M7T5N2AA	9M7T5N20	5306045
		TORRES	J5J300415-3	M7T5J1AA	9M7T5J10	5306045
		WYLIE	J5J300415-8	M7T5P2AA	9M7T5P20	5306045

TestAmerica
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Certificate of Analysis

November 30, 2015

Aleut World Solutions
615 E. 82nd Ave, Suite 200
Anchorage, AK 99518

Attention: Daniel Spicuzza

Date Received in Lab	:	October 30, 2015
Sample Type	:	Nine (9) Urine
SDG Number	:	50581
Job Number	:	USN 2015-011
Project Name	:	NSF Indiand Head Site 1 Removal Action
COC Number	:	NSFIH-2015-12

CASE NARRATIVE

I. Introduction

On October 30, 2015, nine urine samples were received at the TestAmerica Richland laboratory for radiochemical analysis. Upon receipt the samples were assigned to Lot Number J5J300415 with the laboratory ID number corresponding to the client ID as shown on the cover page.

II. Sample Receipt

The samples were received in good condition and no anomalies noted upon check-in.

III. Analytical Results/Methodology

The analytical results for this report are presented by laboratory sample ID. Each set of data includes sample identification information; analytical results and the appropriate associated statistical uncertainties.

The analysis requested was:

Alpha Spectroscopy
Thorium-232 by method RL-ALP-001

IV. Quality Control

The analytical result for each analysis performed includes a minimum of one laboratory control sample (LCS), and one reagent blank sample analysis. Any exceptions have been noted in the "Comments" section.

V. Comments

Alpha Spectroscopy

Thorium-232 by method RL-ALP-001:
The matrix LCS, matrix batch blank, and sample results are within acceptance limits.

I certify that this Certificate of Analysis is in compliance with the SOW and/or NELAC, both technically and for completeness, for other than the conditions detailed above. The Laboratory Manager or a designee, as verified by the following signature has authorized release of the data contained in this hard copy data package.

Reviewed and approved:

Jennifer Bull

Digitally signed by Jennifer Bull
DN: cn=Jennifer Bull, o=TestAmerica Labs, ou=Richland, email=jennifer.bull@testamericainc.com, c=US
Date: 2015.11.30 08:14:05 -08'00'

Jennifer Bull
Project Manager Assistant

Drinking Water Method Cross References

	DRINKING WATER ASTM METHOD CROSS REFERENCES	
Referenced Method	**Isotope(s)**	**TestAmerica Richland's SOP No.**
EPA 901.1	Cs-134, I-131	RL-GAM-001
EPA 900.0	Alpha & Beta	RL-GPC-001
EPA 00-02	Gross Alpha (Coprecipitation)	RL-GPC-002
EPA 903.0	Total Alpha Radium (Ra-226)	RL-RA-002
EPA 903.1	Ra-226	RL-RA-001
EPA 904.0	Ra-228	RL-RA-001
EPA 905.0	Sr-89/90	RL-GPC-003
ASTM D5174	Uranium	RL-KPA-003
EPA 906.0	Tritium	RL-LSC-005

Results in this report relate only to the sample(s) analyzed.

Uncertainty Estimation

TestAmerica Richland has adopted the internationally accepted approach to estimating uncertainties described in “NIST Technical Note 1297, 1994 Edition”. The approach, "Law of Propagation of Errors", involves the identification of all variables in an analytical method which are used to derive a result. These variables are related to the analytical result (R) by some functional relationship, R = constants * f(x,y,z,...). The components (x,y,z) are evaluated to determine their contribution to the overall method uncertainty. The individual component uncertainties (u_i) are then combined using a statistical model that provides the most probable overall uncertainty value. All component uncertainties are categorized as type A, evaluated by statistical methods, or type B, evaluated by other means. Uncertainties not included in the components, such as sample homogeneity, are combined with the component uncertainty as the square root of the sum-of-the-squares of the individual uncertainties. The uncertainty associated with the derived result is the combined uncertainty (u_c) multiplied by the coverage factor (1,2, or 3).

When three or more sample replicates are used to derive the analytical result, the type A uncertainty is the standard deviation of the mean value (S/?n), where S is the standard deviation of the derived results. The type B uncertainties are all other random or non-random components that are not included in the standard deviation.

The derivation of the general "Law of Propagation of Errors" equations and specific example are available on request.

Report Definitions

Action Lev	An agreed upon activity level used to trigger some action when the final result is greater than or equal to the Action Level. Often the Action Level is related to the Decision Limit.
Batch	The QC preparation batch number that relates laboratory samples to QC samples that were prepared and analyzed together.
Bias	Defined by the equation (Result/Expected)-1 as defined by ANSI N13.30.
COC No	Chain of Custody Number assigned by the Client or TestAmerica.
Count Error (#s)	Poisson counting statistics of the gross sample count and background. The uncertainty is absolute and in the same units as the result. For Liquid Scintillation Counting (LSC) the batch blank count is the background.
CSU (#s) ***u_c Combined Standard Uncert.***	All known uncertainties associated with the preparation and analysis of the sample are propagated to give a measure of the uncertainty associated with the result, *u_c the combined standard uncertainty*. The uncertainty is absolute and in the same units as the result.
(#s), Coverage Factor	The coverage factor defines the width of the confidence interval, 1, 2 or 3 standard deviations.
CRDL (RL)	Contractual Required Detection Limit as defined in the Client's Statement Of Work or TestAmerica "default" nominal detection limit. Often referred to the reporting level (RL)
Lc	Decision Level based on instrument background or blank, adjusted by the Efficiency, Chemical Yield, and Volume associated with the sample. The Type I error probability is approximately 5%. Lc=(1.645 * Sqrt(2*(BkgrndCnt/BkgrndCntMin)/SCntMin)) * (ConvFct/(Eff*Yld*Abn*Vol) * IngrFct). For LSC methods the batch blank is used as a measure of the background variability. Lc cannot be calculated when the background count is zero.
Lot-Sample No	The number assigned by the LIMS software to track samples received on the same day for a given client. The sample number is a sequential number assigned to each sample in the Lot.
MDC|MDA	Detection Level based on instrument background or blank, adjusted by the Efficiency, Chemical Yield, and Volume with a Type I and II error probability of approximately 5%. MDC = (4.65 * Sqrt((BkgrndCnt/BkgrndCntMin)/SCntMin) + 2.71/SCntMin) * (ConvFct/(Eff * Yld * Abn * Vol) * IngrFct). For LSC methods the batch blank is used as a measure of the background variability.
Primary Detector	The instrument identifier associated with the analysis of the sample aliquot.
Ratio U-234/U-238	The U-234 result divided by the U-238 result. The U-234/U-238 ratio for natural uranium in NIST SRM 4321C is 1.038.
Rst/MDC	Ratio of the Result to the MDC. A value greater than 1 may indicate activity above background at a high level of confidence. Caution should be used when applying this factor and it should be used in concert with the qualifiers associated with the result.
Rst/TotUcert	Ratio of the Result to the Total Uncertainty. If the uncertainty has a coverage factor of 2 a value greater than 1 may indicate activity above background at approximately the 95% level of confidence assuming a two-sided confidence interval. Caution should be used when applying this factor and it should be used in concert with the qualifiers associated with the result.
Report DB No	Sample Identifier used by the report system. The number is based upon the first five digits of the **Work Order** Number.
RER	The equation Replicate Error Ratio = (S-D)/[sqrt($TPUs^2$ + $TPUd^2$)] as defined by ICPT BOA where S is the original sample result, D is the result of the duplicate, TPUs is the total uncertainty of the original sample and TPUd is the total uncertainty of the duplicate sample.
SDG	Sample Delivery Group Number assigned by the Client or assigned by TestAmerica upon sample receipt.
Sum Rpt Alpha Spec Rst(s)	The sum of the reported alpha spec results for tests derived from the same sample excluding duplicate result where the results are in the same units.
Work Order	The LIMS software assign test specific identifier.
Yield	The recovery of the tracer added to the sample such as Pu-242 used to trace a Pu-239/40 method.

Sample Results Summary

Date: 30-Nov-15

TestAmerica Inc

Ordered by Method, Batch No., Client Sample ID.

Report No. : 67700 **SDG No:** 50581

Batch	Client Id Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	MDL	CRDL	RER2
5306045 L#S1									
JOHNSON									
	M7T5K1AA	TH-232	-1.26E-07 +- 5.9E-03	U	pCi/L	46%	1.61E-02	5.00E-02	
KOUNTZ									
	M7T5M2AA	TH-232	3.83E-03 +- 5.1E-03	U	pCi/L	78%	9.76E-03	5.00E-02	
MATUS JR.									
	M7T5G1AA	TH-232	5.10E-03 +- 5.8E-03	U	pCi/L	78%	9.77E-03	5.00E-02	
MOLINERO									
	M7T5L2AA	TH-232	3.20E-03 +- 5.6E-03	U	pCi/L	63%	1.22E-02	5.00E-02	
OBREGON									
	M7T5H1AA	TH-232	3.03E-03 +- 5.3E-03	U	pCi/L	65%	1.16E-02	5.00E-02	
SPICUZZA									
	M7T5Q2AA	TH-232	1.39E-07 +- 6.0E-03	U	pCi/L	65%	1.43E-02	5.00E-02	
THATCHER									
	M7T5N2AA	TH-232	3.69E-03 +- 9.1E-03	U	pCi/L	54%	1.77E-02	5.00E-02	
TORRES									
	M7T5J1AA	TH-232	-2.28E-08 +- 6.8E-03	U	pCi/L	57%	1.64E-02	5.00E-02	
WYLIE									
	M7T5P2AA	TH-232	4.01E-03 +- 8.0E-03	U	pCi/L	48%	1.53E-02	5.00E-02	

No. of Results: 9

TestAmerica Inc

rptTALRchSaSummary2 V5.4.1 A2002

RER2 - Replicate Error Ratio = (S-D)/[sqrt(sq(TPUs)+sq(TPUd))] as defined by ICPT BOA.

U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

QC Results Summary

TestAmerica Inc

Ordered by Method, Batch No, QC Type,.

Date: 30-Nov-15

Report No. : 67700

SDG No.: 50581

Batch Work Order	Parameter	Result +- CSU (2 s)	Qual	Units	Tracer Yield	LCS Recovery	Bias	MDL
L#S1								
5306045 BLANK QC,								
M7T931AD	TH-232	1.58E-03 +- 5.5E-03	U	pCi/L	60%			1.21E-02
M7T931AA	TH-232	0.00E+00 +- 5.8E-03	U	pCi/L	79%			1.56E-02
5306045 LCS,								
M7T931AC	TH-230	8.25E-01 +- 1.6E-01		pCi/L	79%	100%	0.0	9.41E-03

No. of Results: 3

TestAmerica Inc

rptSTLRchQcSummary V5.4.1 A2002

Bias - (Result/Expected)-1 as defined by ANSI N13.30.

U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	TestAmerica Inc	**SDG:**	50581	**Collection Date:**	10/27/2015 9:25:00 AM
Lot-Sample No.:	J5J300415-4	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	JOHNSON	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T5K1AA		**Report DB ID:**	9M7T5K10				
TH-232	**-1.26E-07**	U		5.9E-03	1.61E-02	pCi/L	46%	*0.*	11/19/15 07:38 p	899.4	0.5039	ALP116
						8.63E-03	5.00E-02	*0.*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50581	**Collection Date:**	10/28/2015 7:10:00 AM
Lot-Sample No.:	**J5J300415-6**	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	**KOUNTZ**	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T5M2AA		**Report DB ID:**	9M7T5M20				
TH-232	**3.83E-03**	U		5.1E-03	9.76E-03	pCi/L	78%	*0.39*	11/24/15 08:31 p	981.4	0.50476	ALP111
						5.24E-03	5.00E-02	*(1.5)*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50581	**Collection Date:**	10/27/2015 7:10:00 AM
Lot-Sample No.:	**J5J300415-1**	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	**MATUS JR.**	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:** M7T5G1AA			**Report DB ID:** 9M7T5G10					
TH-232	**5.10E-03**	U		5.8E-03	9.77E-03	pCi/L	78%	*0.52*	11/19/15 07:36 p	990.2	0.5076	ALP110
						5.24E-03	5.00E-02	*(1.8)*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

TestAmerica Inc
rptSTLRchSample
V5.4.1 A2002

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	TestAmerica Inc	**SDG:**	50581	**Collection Date:**	10/28/2015 7:05:00 AM
Lot-Sample No.:	J5J300415-5	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	MOLINERO	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T5L2AA		**Report DB ID:**	9M7T5L20				
TH-232	**3.20E-03**	U		5.6E-03	1.22E-02	pCi/L	63%	*0.26*	11/24/15 08:30 p	951.2	0.49975	ALP110
						6.57E-03	5.00E-02	*(1.1)*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	TestAmerica Inc	**SDG:**	50581	**Collection Date:**	10/27/2015 7:15:00 AM
Lot-Sample No.:	J5J300415-2	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	OBREGON	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T5H1AA		**Report DB ID:**	9M7T5H10				
TH-232	**3.03E-03**	U		5.3E-03	1.16E-02	pCi/L	65%	*0.26*	11/19/15 07:37 p	934.6	0.50697	ALP111
						6.22E-03	5.00E-02	*(1.1)*		g	L	

No. of Results: 1 **Comments:**

TestAmerica Inc
rptSTLRchSample
V5.4.1 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50581	**Collection Date:**	10/29/2015 7:00:00 AM
Lot-Sample No.:	**J5J300415-9**	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	**SPICUZZA**	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T5Q2AA		**Report DB ID:**	9M7T5Q20				
TH-232	**1.39E-07**	U		6.0E-03	1.43E-02	pCi/L	65%	*0.*	11/24/15 08:34 p	951.5	0.5035	ALP117
						7.40E-03	5.00E-02	*0.*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50581	**Collection Date:**	10/28/2015 7:14:00 AM
Lot-Sample No.:	**J5J300415-7**	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	**THATCHER**	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T5N2AA		**Report DB ID:**	9M7T5N20				
TH-232	**3.69E-03**	U		9.1E-03	1.77E-02	pCi/L	54%	*0.21*	11/24/15 08:32 p	817.4	0.49572	ALP114
						9.14E-03	5.00E-02	*0.81*		g	L	

No. of Results: 1 **Comments:**

TestAmerica Inc
rptSTLRchSample
V5.4.1 A2002

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	TestAmerica Inc	**SDG:**	50581	**Collection Date:**	10/27/2015 7:30:00 AM
Lot-Sample No.:	J5J300415-3	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	TORRES	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:** M7T5J1AA			**Report DB ID:** 9M7T5J10					
TH-232	**-2.28E-08**	U		6.8E-03	1.64E-02	pCi/L	57%	*0.*	11/19/15 07:37 p	950.8	0.50619	ALP114
						8.47E-03	5.00E-02	*0.*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM I

SAMPLE RESULTS

Date: 30-Nov-15

Lab Name:	**TestAmerica Inc**	**SDG:**	50581	**Collection Date:**	10/28/2015 8:40:00 AM
Lot-Sample No.:	**J5J300415-8**	**Report No. :**	67700	**Received Date:**	10/30/2015 10:35:00 AM
Client Sample ID:	**WYLIE**	**COC No. :**		**Matrix:**	URINE

Ordered by Client Sample ID, Batch No.

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Action Lev	Rpt Unit, Lc	Yield CRDL(RL)	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:** M7T5P2AA			**Report DB ID:** 9M7T5P20					
TH-232	**4.01E-03**	U		8.0E-03	1.53E-02	pCi/L	48%	*0.26*	11/24/15 08:32 p	909.9	0.50586	ALP116
						8.23E-03	5.00E-02	*1.*		g	L	

No. of Results: 1 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.
U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

BLANK RESULTS

Date: 30-Nov-15

Lab Name: TestAmerica Inc

Matrix: URINE

SDG: 50581

Report No. : 67700

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL, Lc	Rpt Unit, CRDL	Yield	Rst/MDL, Rst/TotUcert	Analysis, Prep Date	Total Sa Size	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T931AA		**Report DB ID:**	M7T931AX				
TH-232	0.00E+00	U		5.8E-03	1.56E-02	pCi/L	79%	0.	11/19/15 07:41 p		0.55	ALP99
					8.36E-03	5.00E-02		0.			L	
Batch: 5306045	L#S1			**Work Order:**	M7T931AD		**Report DB ID:**	M7T931DB				
TH-232	1.58E-03	U		5.5E-03	1.21E-02	pCi/L	60%	0.13	11/19/15 07:43 p		0.5518	ALP108
					6.47E-03	5.00E-02		0.58			L	

No. of Results: 2 **Comments:**

MDC|MDA,Lc - Detection, Decision Level based on instrument background or blank, adjusted by the sample Efficiency, Yield, and Volume.

U Qual - Analyzed for but not detected above limiting criteria, Mdc/Mda/Mdl, Total Uncert, RDL or not identified by gamma scan software.

FORM II

LCS RESULTS

Date: 30-Nov-15

Lab Name: TestAmerica Inc

Matrix: URINE

SDG: 50581

Report No. : 67700

Parameter	Result	Qual	Count Error (2 s)	CSU (2 s)	MDL	Report Unit	Yield	Expected	Expected Uncert	Recovery, Bias	Analysis, Prep Date	Aliquot Size	Primary Detector
Batch: 5306045	L#S1			**Work Order:**	M7T931AC		**Report DB ID:**	M7T931CM					
TH-230	8.25E-01			1.6E-01	9.41E-03	pCi/L	79%	8.27E-01	8.6E-03	100%	11/19/15 07:42 p	0.55	ALP106
							Rec Limits:	75	125	0.0		L	

No. of Results: 1 **Comments:**

TestAmerica Inc **Bias** **- (Result/Expected)-1 as defined by ANSI N13.30.**

rptSTLRchLcs
V5.4.1 A2002

J5J 300415
SDG# 50581
Due 11/20/15

TestAmerica Richland
2800 George Washington Way
Richland, WA 99354
Phone 509.375.3131 fax 509.375.5590

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/27/15	COC No: NSFIH-2015-12
AWS, LLC	Tel/Fax: 412 848-7022/888 795-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	___ of ___ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Samples: ~~Volume Yellow~~
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification		Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Th-232 Alpha Spectroscopy	Sample Specific Notes:
M7T5G	Matus Jr.	10/27/2015	0710	G	Urine	1	N	N	X	Bioassay Sample
M7T5H	Obregon	10/27/2015	0715	G	Urine	1	N	N	X	Bioassay Sample
M7T5J	Torres	10/27/2015	0730	G	Urine	1	N	N	X	Bioassay Sample
M7T5K	Johnson	10/27/2015	0925	G	Urine	1	N	N	X	Bioassay Sample
M7T5L	Molinero	10/28/2015	0705	G	Urine	1	N	N	X	Bioassay Sample
M7T5M	Kountz	10/28/2015	0710	G	Urine	1	N	N	X	Bioassay Sample
M7T5N	Thatcher	10/28/2015	0714	G	Urine	1	N	N	X	Bioassay Sample
M7T5P	Wylie	10/28/2015	0840	G	Urine	1	N	N	X	Bioassay Sample
M7T5Q	Spicuzza	10/29/2015	0700	G	Urine	1	N	N	X	Bioassay Sample

J5J300415

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: ____ Corr'd: ____ Therm ID No.: ____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Sc	AWS	10/29/15 1600			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Check-in List

Date/Time Received: 10/30/15 1035 Container GM Screen Result: (Airlock) 0 cpm Initials[JT
Sample GM Screen Result (Sample Receiving) N/A cpm Initials[JT

Client: STL SDG #: 50581 SAF #: _____ NA [JT

Lot Number: J5J300415

Chain of Custody # N/A

Shipping Container ID or Air Bill Number : _____ NA [JT

Samples received inside shipping container/cooler/box Yes [JT Continue with 1 through 4. Initial appropriate response.
No [ ] Go to 5, add comment to #16.

1. Custody Seals on shipping container intact? Yes [JT No [ ] No Custody Seal [ ]
2. Custody Seals dated and signed? Yes [JT No [ ] No Custody Seal [ ]
3. Cooler temperature: _____ °C NA [ ]
4. Vermiculite/packing materials is NA [ ] Wet [ ] Dry [ ]

Item 5 through 16 for samples. Initial appropriate response.

5. Chain of Custody record present? Yes [ ] No [ ]
6. Number of samples received (Each sample may contain multiple bottles): 9
7. Containers received: 9 x 1P
8. Sample holding times exceeded? NA [ ] Yes [ ] No [JT
9. Samples have: ____ tape ____ hazard labels ____ custody seals JT appropriate sample labels
10. Matrix: ____ A (FLT, Wipe, Solid, Soil) ____ I (Water) ____ S (Air, Niosh 7400) JT T (Biological, Ni-63)
11. Samples:
    JT are in good condition ____ are leaking ____ are broken
    ____ have air bubbles (Only for samples requiring no head space) ____ Other _____
12. Sample pH appropriate for analysis requested Yes [ ] No [ ] NA [JT
    (If acidification is necessary go to pH area & document sample ID, initial pH, amount of HNO_3 added and pH after addition on table)
13. Were any anomalies identified in sample receipt? Yes [ ] No [JT
14. Description of anomalies (include sample numbers): NA [JT
15. Sample Location, Sample Collector Listed on COC? * Yes [ ] No [JT
    *For documentation only. No corrective action needed.
16. Additional Information: N/A

[ ] Client/Courier denied temperature check. [ ] Client/Courier unpack cooler.

Sample Check-in List completed by Sample Custodian:
Signature: _____ Date: 10/30/15

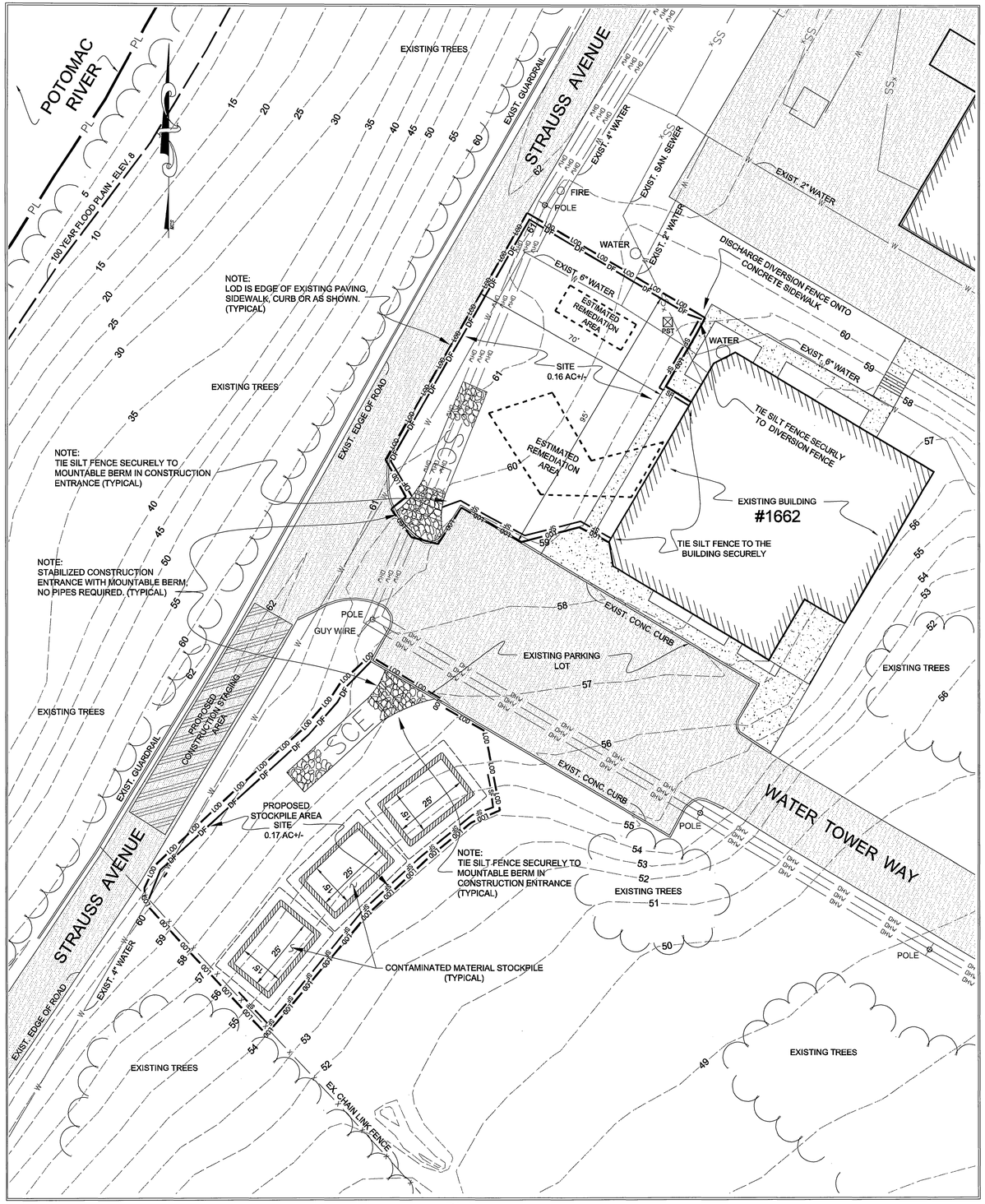
Client Notification needed? Yes [ ] No [ ] Date: _____
By: _____
Person contacted: _____

[✓] No action necessary; process as is

Project Manager Jennifer Bull Date 11/2/15

Appendix D

Erosion and Sediment Control Plan



PLAN

SCALE: 1"=20'

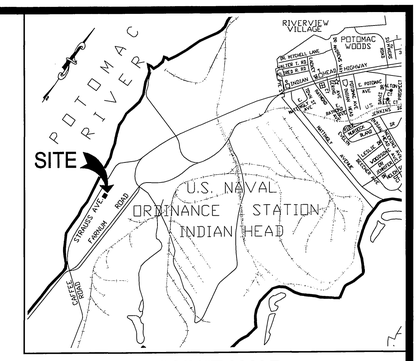
SEQUENCE OF OPERATIONS

1. THE CONTRACTOR SHALL NOTIFY THE NSF INDIAN HEAD BASE ROIC AND

   FEDERAL FACILITIES DIVISION
   LAND RESTORATION PROGRAM
   LAND MANAGEMENT ADMINISTRATION
   1800 WASHINGTON BLVD, SUITE 625
   BALTIMORE MARYLAND 21230-1719
   TELEPHONE: 410-537-3741

   SEVEN (7) DAYS BEFORE COMMENCING ANY LAND DISTURBING ACTIVITY AND, UNLESS WAIVED BY THE ADMINISTRATION, SHALL BE REQUIRED TO HOLD A PRE-CONSTRUCTION MEETING BETWEEN PROJECT REPRESENTATIVES AND A REPRESENTATIVE OF MA.

2. OBTAIN PROPER PERMITS.
3. WITH THE APPROVAL OF THE SEDIMENT CONTROL INSPECTOR, CLEAR AND GRUB FOR SCES AND PERIMETER CONTROLS. INSTALL.
4. DESIGNATE STOCKPILE AREAS FOR RELATED TOPSOIL AND RELATED FILL. DESIGNATE CONTRACTOR'S STAGING AREA.
5. PERFORM SURVEY/EXCAVATION/SOIL TESTING/REMOVAL TASKS WITHN LOD.
6. APPLY TEMP./PERM. STABILIZATION.
7. FINE GRADE PROJECT SITE AND PROVIDE PERMANENT STABILIZATION AS PER STABILIZATION SCHEDULE.
8. WITH PRIOR WRITTEN APPROVAL FROM THE SEDIMENT CONTROL INSPECTOR AND ROIC, REMOVE SEDIMENT CONTROLS AND STABILIZE AREAS DISTURBED BY SEDIMENT CONTROL REMOVAL.



VICINITY MAP

SCALE: 1"=2000'

KEY

- PL — PROPERTY LINE
- EXISTING BUILDING
- EXISTING CONTOURS
- PROP CONTOURS
- LOD — LIMIT OF DISTURBANCE
- DF — DIVERSION FENCE
- SF — SILT FENCE-LATH REINFORCED (1)
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- ESTIMATED REMEDIATION AREA
- OHW — OVERHEAD WIRES
- EXISTING CONCRETE SIDEWALK
- CONTRACTOR STAGING AREA
- EXISTING BITUMINOUS PAVING
- PBT — PORTABLE SEDIMENT TANK

NOTE:
1. THE PROJECT SITE IS OUTSIDE THE 100-YR FLOOD PLAIN.
2. THERE ARE NO WETLANDS OR WETLAND BUFFERS WITHIN THE PROJECT AREA.
3. THE SITE IS IN THE CHESAPEAKE BAY CRITICAL AREA.

NOTE:
SILT FENCE AND LOD ARE SHOWN OFFSET FROM EDGE OF PAVING FOR CLARITY. SILT FENCE SHALL BE PLACED AT EDGE OF PAVEMENT.

NOTE:
"EROSION AND SEDIMENT CONTROL WILL BE STRICTLY ENFORCED."

MDE No. 13-WM-0001

LOD = 13,252 SF+/- = 0.30 AC+/-

EROSION AND SEDIMENT CONTROL PLAN

SITE 1 RADIOLOGICAL REMOVAL ACTION

ADJACENT TO BUILDING #1662

NAVAL SUPPORT FACILITY INDIAN HEAD

CONTRACT NO. W52PIJ-08-D-0034 DO:0054

INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

Colbert Matz Rosenfelt, Inc.

*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

8.17.12

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.

License No. 15104 Expiration Date: 10/11/12

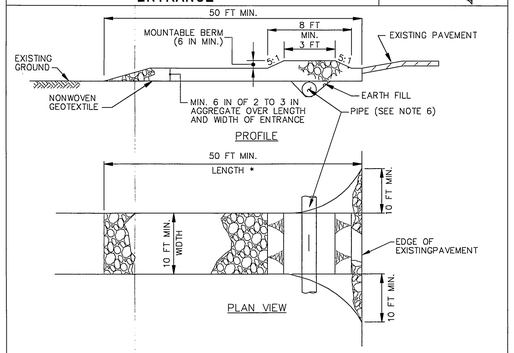
NO.	DATE	REVISIONS:	BY
1	8/17/12	ADDED LATH REINFORCED SILT FENCE AT NAVY REQUEST	KML
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-1

SHEET 1 OF 4

DETAIL B-1 STABILIZED CONSTRUCTION ENTRANCE

STANDARD SYMBOL — SCE



CONSTRUCTION SPECIFICATIONS

1. PLACE STABILIZED CONSTRUCTION ENTRANCE IN ACCORDANCE WITH THE APPROVED PLAN. VEHICLES MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. USE MINIMUM LENGTH OF 50 FEET (*30 FEET FOR SINGLE RESIDENCE LOT). USE MINIMUM WIDTH OF 10 FEET. FLARE SCE 10 FEET MINIMUM AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
2. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PROTECT PIPE INSTALLED THROUGH THE SCE WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 12 INCHES OF STONE OVER THE PIPE. PROVIDE PIPE AS SPECIFIED ON APPROVED PLAN. WHEN THE SCE IS LOCATED AT A HIGH SPOT AND HAS NO DRAINAGE TO CONVEY, A PIPE IS NOT NECESSARY. A MOUNTABLE BERM IS REQUIRED WHEN SCE IS NOT LOCATED AT A HIGH SPOT.
3. PREPARE SUBGRADE AND PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS.
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. MAINTAIN ENTRANCE IN A CONDITION THAT MINIMIZES TRACKING OF SEDIMENT. ADD STONE OR MAKE OTHER REPAIRS AS CONDITIONS DEMAND TO MAINTAIN CLEAN SURFACE, MOUNTABLE BERM, AND SPECIFIED DIMENSIONS. IMMEDIATELY REMOVE STONE AND/OR SEDIMENT SPILLED, DROPPED, OR TRACKED ONTO ADJACENT ROADWAY BY VACUUMING, SCRAPING, AND/OR SWEEPING. WASHING ROADWAY TO REMOVE MUD TRACKED ONTO PAVEMENT IS NOT ACCEPTABLE UNLESS WASH WATER IS DIRECTED TO AN APPROVED SEDIMENT CONTROL PRACTICE.

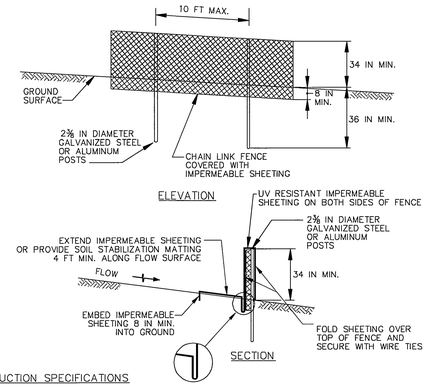
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL C-9 DIVERSION FENCE

STANDARD SYMBOL — DF

MAXIMUM DRAINAGE AREA = 2 ACRES



CONSTRUCTION SPECIFICATIONS

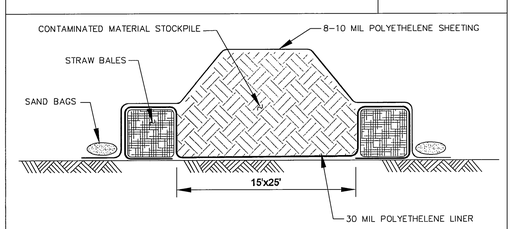
1. USE 42 INCH HIGH, 9 GAUGE OR THICKER CHAIN LINK FENCING (2⅜ INCH MAXIMUM OPENING).
2. USE 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. THE POSTS DO NOT NEED TO BE SET IN CONCRETE.
3. FASTEN CHAIN LINK FENCE SECURELY TO THE FENCE POSTS WITH WIRE TIES.
4. SECURE 10 MIL OR THICKER UV RESISTANT, IMPERMEABLE SHEETING TO CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT TOP, MID SECTION, AND BELOW GROUND SURFACE.
5. EXTEND SHEETING A MINIMUM OF 4 FEET ALONG FLOW SURFACE AND EMBED END A MINIMUM OF 8 INCHES INTO GROUND. SOIL STABILIZATION MATTING MAY BE USED IN LIEU OF IMPERMEABLE SHEETING ALONG FLOW SURFACE.
6. WHEN TWO SECTIONS OF SHEETING ADJOIN EACH OTHER, OVERLAP BY 6 INCHES AND FOLD WITH SEAM FACING DOWNGRADE.
7. KEEP FLOW SURFACE ALONG DIVERSION FENCE AND POINT OF DISCHARGE FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. MAINTAIN POSITIVE DRAINAGE. REPLACE IMPERMEABLE SHEETING IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL CONTAMINATED MATERIAL STOCKPILE

SYMBOL

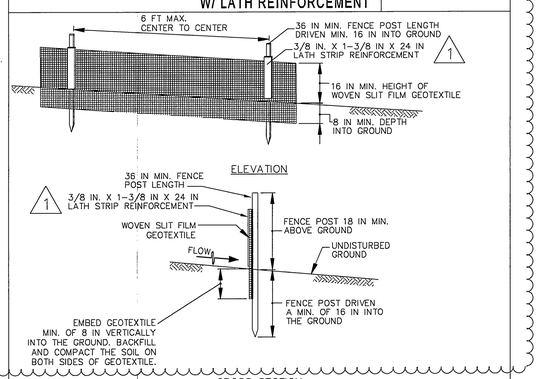


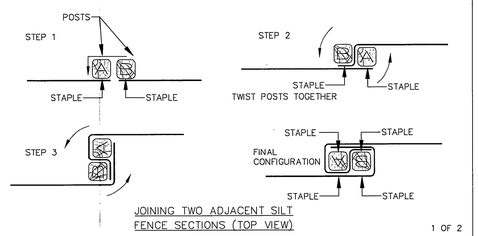
SPECIFICATIONS FOR CONTAMINATED MATERIAL STORAGE

1. THE CONTAINMENT AREA FOR CONTAMINATED MATERIAL STORAGE WILL HAVE SEDIMENT AND EROSION CONTROLS IN PLACE PRIOR TO BEGINNING EXCAVATION.
2. CONTAINMENT AREA MUST HAVE SILT FENCE INSTALLED FOR CONTAINMENT PURPOSES, AND APPROVED BY THE MDE INSPECTOR.
3. ALL EXCAVATED MATERIAL WILL BE PLACED INSIDE THE CONTAINMENT AREA.
4. ALL EXCAVATED MATERIAL WILL BE COVERED IN INCLEMENT WEATHER, END OF WORKING DAY, OR WHEN NOT IN USE. MATERIAL WILL BE COVERED UNTIL REMOVED FROM SITE.
5. EXCAVATED MATERIAL WILL NOT EXCEED 5' IN HEIGHT.
6. ALL HAZARDOUS OR CONTAMINATED MATERIAL WILL BE PLACED IN THE CONTAMINATED MATERIALS STOCKPILE WITHIN THE CONTAINMENT AREA.
   - A. A CONTINUOUS 30 MILI POLYETHYLENE LINER SHALL COVER THE BOTTOM AREA OF THE CONTAMINATED MATERIALS STOCKPILE.
   - B. STRAW BALES SHALL BE PLACED ON THE BOTTOM TARP, AND THE TARP FOLDED OVER INTO THE STOCKPILE AREA TO PREVENT FLOWS FROM INSIDE THE STOCKPILE AREA FROM EXITING THE STOCKPILE AREA.
   - C. CAUTION SHOULD BE TAKEN NOT TO RIP OR TEAR THE BOTTOM POLYETHYLENE LINER WHEN HANDLING OR REMOVING MATERIAL.
   - D. THE MATERIAL WILL BE PLACED ON THE LINER INSIDE THE CONTAMINATED MATERIALS STOCKPILE AREA, NOT TO EXCEED 5 FEET HIGH AND COVERED WITH A 8-10 MIL POLYETHYLENE SHEETING AND SECURED WITH SANDBAGS.
   - E. ALL CONTAMINATED OR HAZARDOUS MATERIAL WILL BE REMOVED FROM SITE AS SOON AS POSSIBLE OR WITHIN 3 WORKING DAYS.
   - F. ALL CONTAMINATED MATERIALS WILL BE DISPOSED OF ACCORDING TO EPA STANDARDS AND SPECIFICATIONS FOR CONTAMINATED OR HAZARDOUS MATERIALS.

MODIFIED DETAIL E-1 SILT FENCE W/ LATH REINFORCEMENT

STANDARD SYMBOL — SF





1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-1 SILT FENCE

STANDARD SYMBOL — SF

CONSTRUCTION SPECIFICATIONS

1. USE WOOD POSTS 1⅜ X 1⅜ ± 1/16 INCH (MINIMUM) SQUARE CUT OF SOUND QUALITY HARDWOOD. AS AN ALTERNATIVE TO WOODEN POST USE STANDARD "T" OR "U" SECTION STEEL POSTS WEIGHING NOT LESS THAN 1 POUND PER LINEAR FOOT.
2. USE 36 INCH MINIMUM POSTS DRIVEN 16 INCH MINIMUM INTO GROUND NO MORE THAN 6 FEET APART.
3. USE WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS AND FASTEN GEOTEXTILE SECURELY TO UPSLOPE SIDE OF FENCE POSTS WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.
4. PROVIDE MANUFACTURER CERTIFICATION TO THE AUTHORIZED REPRESENTATIVE OF THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT THE GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
5. EMBED GEOTEXTILE A MINIMUM OF 8 INCHES VERTICALLY INTO THE GROUND. BACKFILL AND COMPACT THE SOIL ON BOTH SIDES OF FABRIC.
6. WHERE TWO SECTIONS OF GEOTEXTILE ADJOIN: OVERLAP, TWIST, AND STAPLE TO POST IN ACCORDANCE WITH THIS DETAIL.
7. EXTEND BOTH ENDS OF THE SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SILT FENCE.
8. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN SILT FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

NOTE:
LATH STRIP REINFORCED SILT FENCE IS A DELDOT STANDARD PRODUCT. MANUFACTURER: ACF PRODUCT #3036751DE OR APPROVED EQUIVALENT.

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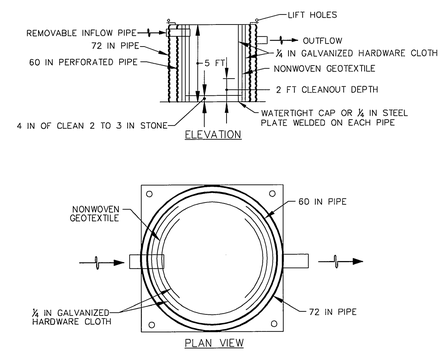
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-3 PORTABLE SEDIMENT TANK

STANDARD SYMBOL — PST



CONSTRUCTION SPECIFICATIONS

1. PROVIDE 1 CUBIC FOOT OF STORAGE FOR EACH GALLON PER MINUTE OF PUMP CAPACITY. REQUIRED STORAGE VOLUME MAY BE ATTAINED BY PLACEMENT OF TANKS IN PARALLEL WITH INFLOW EVENLY DISTRIBUTED AMONG TANKS. OVERTOPPING OF TANKS IS NOT PERMITTED.
2. USE 60 INCH CORRUGATED METAL OR PLASTIC PIPE WITH 1 INCH DIAMETER PERFORATIONS, 6 INCHES ON CENTER FOR THE INNER PIPE. LINE PIPE WITH NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, SANDWICHED BETWEEN, AND ATTACHED TO, ¼ INCH HARDWARE CLOTH.
3. OVERLAP GEOTEXTILE 8 INCHES MINIMUM AT VERTICAL SEAM AND AT THE BOTTOM PLATE.
4. ANCHOR GEOTEXTILE AT BOTTOM OF TANK WITH 4 INCHES OF 2 TO 3 INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE.
5. USE 72 INCH CORRUGATED METAL OR PLASTIC OUTER PIPE WITH PERMANENT OUTFLOW PIPE WITH INVERT LOWER THAN INFLOW PIPE
6. INFLOW PIPE MUST DISCHARGE INTO INNER PIPE AND BE REMOVABLE.
7. PLACE TANK ON LEVEL SURFACE AND DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
8. A PORTABLE SEDIMENT TANK REQUIRES FREQUENT MAINTENANCE. REMOVE ACCUMULATED SEDIMENT FROM INNER PIPE WHEN IT REACHES TWO FEET IN DEPTH. IF SYSTEM CLOGS, PULL OUT INNER PIPE, REMOVE ACCUMULATED SEDIMENT, AND REPLACE GEOTEXTILE. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

MDE No. 13-WM-0001

EROSION AND SEDIMENT CONTROL DETAILS

SITE 1 RADIOLOGICAL REMOVAL ACTION

ADJACENT TO BUILDING #1662

NAVAL SUPPORT FACILITY INDIAN HEAD

CONTRACT NO. W52PIJ-08-D-0034 DO: 0054

INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Colbert Matz Rosenfelt, Inc.
*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

8-17-12

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 15104 Expiration Date: 10/11/12

NO.	DATE	REVISIONS:	BY
1	8/17/12	ADDED LATH REINFORCED SILT FENCE AT NAVY REQUEST	KML
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-2
SHEET 2 OF 4

STANDARD EROSION AND SEDIMENT CONTROL NOTES

1. THE CONTRACTOR SHALL NOTIFY THE FEDERAL FACILITIES DIVISION, LAND RESTORATION PROGRAM, LAND MANAGEMENT ADMINISTRATION, 1800 WASHINGTON BLVD. SUTIE 625 BALTIMORE, MARYLAND 21230-1719 TELEPHONE: 410-537-3791, SEVEN (7) DAYS BEFORE COMMENCING ANY LAND DISTURBING ACTIVITY AND, UNLESS WAIVED BY THE ADMINISTRATION, SHALL BE REQUIRED TO HOLD A PRE-CONSTRUCTION MEETING BETWEEN PROJECT REPRESENTATIVES AND A REPRESENTATIVE OF WMA.

2. THE CONTRACTOR MUST NOTIFY WMA IN WRITING AND BY TELEPHONE AT THE FOLLOWING POINTS:
   A. THE REQUIRED PRE-CONSTRUCTION MEETING.
   B. FOLLOWING INSTALLATION OF SEDIMENT CONTROL MEASURES.
   C. DURING THE INSTALLATION OF SEDIMENT BASINS (TO BE CONVERTED INTO PERMANENT STORMWATER MANAGEMENT STRUCTURES) AT THE REQUIRED INSPECTION POINTS (SEE INSPECTION CHECKLIST ON PLAN). NOTIFICATION PRIOR TO COMMENCING CONSTRUCTION OF EACH STEP IS MANDATORY.
   D. PRIOR TO REMOVAL OR MODIFICATION OF ANY SEDIMENT CONTROL STRUCTURE(S).
   E. PRIOR TO REMOVAL OF ALL SEDIMENT CONTROL DEVICES.
   F. PRIOR TO FINAL ACCEPTANCE.

3. THE CONTRACTOR SHALL CONSTRUCT ALL EROSION AND SEDIMENT CONTROL MEASURES PER THE APPROVED PLAN AND CONSTRUCTION SEQUENCE AND SHALL HAVE THEM INSPECTED AND APPROVED BY THE AGENCY INSPECTOR OR WMA INSPECTOR PRIOR TO BEGINNING ANY OTHER LAND DISTURBANCES. MINOR SEDIMENT CONTROL DEVICE LOCATION ADJUSTMENTS MAY BE MADE IN THE FIELD WITH THE APPROVAL OF THE WMA INSPECTOR. THE CONTRACTOR SHALL ENSURE THAT ALL RUNOFF FROM DISTURBED AREAS IS DIRECTED TO THE SEDIMENT CONTROL DEVICES AND SHALL NOT REMOVE ANY EROSION OR SEDIMENT CONTROL MEASURE WITHOUT PRIOR PERMISSION FROM WMA INSPECTOR AND AGENCY INSPECTOR. THE CONTRACTOR MUST OBTAIN PRIOR AGENCY AND WMA APPROVAL FOR CHANGES TO THE SEDIMENT CONTROL PLAN AND/OR SEQUENCE OF CONSTRUCTION.

4. THE CONTRACTOR SHALL PROTECT ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS TO PREVENT THE DEPOSITION OF MATERIALS ONTO PUBLIC ROADS. ALL MATERIALS DEPOSITED ONTO PUBLIC ROADS SHALL BE REMOVED IMMEDIATELY.

5. THE CONTRACTOR SHALL INSPECT DAILY AND MAINTAIN CONTINUOUSLY IN AN EFFECTIVE OPERATING CONDITION ALL EROSION AND SEDIMENT CONTROL MEASURES UNTIL SUCH TIMES AS THEY ARE REMOVED WITH PRIOR PERMISSION FROM WMA INSPECTOR AND AGENCY INSPECTOR.

6. ALL SEDIMENT BASINS, TRAP EMBANKMENTS AND SLOPES, PERIMETER DIKES, SWALES AND ALL DISTURBED SLOPES STEEPER OR EQUAL TO 3:1 SHALL BE STABILIZED WITH SOD OR SEED AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES, AS SOON AS POSSIBLE BUT NO LATER THAN SEVEN (7) CALENDAR DAYS AFTER ESTABLISHMENT. ALL AREAS DISTURBED OUTSIDE OF THE PERIMETER SEDIMENT CONTROL SYSTEM MUST BE MINIMIZED. MAINTENANCE MUST BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION. (REQUIREMENT FOR STABILIZATION MAY BE REDUCED TO THREE (3) DAYS FOR SENSITIVE AREAS.)

7. THE CONTRACTOR SHALL APPLY SOD OR SEED AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES TO ALL DISTURBED AREAS AND STOCKPILES WITHIN FOURTEEN (14) CALENDAR DAYS AFTER STRIPPING AND GRADING ACTIVITIES HAVE CEASED IN THE AREA. MAINTENANCE SHALL BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION. (REQUIREMENT MAY BE REDUCED TO SEVEN (7) DAYS FOR SENSITIVE AREAS.)

8. PRIOR TO REMOVAL OF SEDIMENT CONTROL MEASURES, THE CONTRACTOR SHALL STABILIZE AND HAVE ESTABLISHED PERMANENT STABILIZATION FOR ALL CONTRIBUTORY DISTURBED AREAS USING SOD OR AN APPROVED PERMANENT SEED MIXTURE WITH REQUIRED SOIL AMENDMENTS AND AN APPROVED ANCHORED MULCH. WOOD FIBER MULCH MAY ONLY BE USED IN SEEDING SEASON WHERE THE SLOPE DOES NOT EXCEED 10% AND GRADING HAS BEEN DONE TO PROMOTE
SHEET FLOW DRAINAGE. AREAS BROUGHT TO FINISHED GRADE DURING THE SEEDING SEASON SHALL BE PERMANENTLY STABILIZED AS SOON AS POSSIBLE, BUT NOT LATER THAN FOURTEEN (14) CALENDAR DAYS AFTER ESTABLISHMENT. WHEN PROPERTY IS BROUGHT TO FINISHED GRADE DURING THE MONTHS OF NOVEMBER THROUGH FEBRUARY, AND PERMANENT STABILIZATION IS FOUND TO BE IMPRACTICAL, TEMPORARY SEED AND ANCHORED STRAW MULCH SHALL BE APPLIED TO DISTURBED AREAS. THE FINAL PERMANENT STABILIZATION OF SUCH PROPERTY SHALL BE APPLIED BY MARCH 15 OR EARLIER IF GROUND AND WEATHER CONDITIONS ALLOW.

9. THE SITE'S APPROVAL LETTER, APPROVED EROSION AND SEDIMENT CONTROL PLANS, DAILY LOG BOOKS, AND TESTS REPORTS SHALL BE AVAILABLE AT THE SITE FOR INSPECTION BY DULY AUTHORIZED OFFICIALS OF WMA AND THE AGENCY RESPONSIBLE FOR PROJECT.

10. SURFACE DRAINAGE FLOWS OVER UNSTABILIZED CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER PREVENTING DRAINAGE FLOWS FROM TRAVERSING THE SLOPES OR BY INSTALLING PROTECTIVE DEVICES TO LOWER THE WATER DOWN SLOPE WITHOUT CAUSING EROSION. DIKES SHALL BE INSTALLED AND MAINTAINED AT THE TOP OF A CUT OR FILL SLOPE UNTIL THE SLOPE AND DRAINAGE AREA TO IT ARE FULLY STABILIZED, AT WHICH TIME THEY MUST BE REMOVED AND FINAL GRADING DONE TO PROMOTE SHEET FLOW DRAINAGE. PROTECTIVE METHODS MUST BE PROVIDED AT POINTS OF CONCENTRATED FLOW WHERE EROSION IS LIKELY TO OCCUR.

11. PERMANENT SWALES OR OTHER POINTS OF CONCENTRATED WATER FLOW SHALL BE STABILIZED WITH SOD OR SEED WITH AN APPROVED EROSION CONTROL MATTING, RIP-RAP, OR BY OTHER APPROVED STABILIZATION MEASURES.

12. TEMPORARY SEDIMENT CONTROL DEVICES MAY BE REMOVED, WITH PERMISSION OF WMA INSPECTOR AND AGENCY INSPECTORS, WITHIN THIRTY (30) CALENDAR DAYS FOLLOWING ESTABLISHMENT OF PERMANENT STABILIZATION IN ALL CONTRIBUTORY DRAINAGE AREAS. STORMWATER MANAGEMENT STRUCTURES USED TEMPORARILY FOR SEDIMENT CONTROL SHALL BE CONVERTED TO THE PERMANENT CONFIGURATION WITHIN THIS TIME PERIOD AS WELL.

13. NO PERMANENT CUT OR FILL SLOPE WITH A GRADIENT STEEPER THAN 3:1 WILL BE PERMITTED IN LAWN MAINTENANCE AREAS. A SLOPE GRADIENT OF UP TO 2:1 WILL BE PERMITTED IN NON-MAINTENANCE AREAS PROVIDED THAT THOSE AREAS ARE INDICATED ON THE EROSION AND SEDIMENT CONTROL PLAN WITH A LOW-MAINTENANCE GROUND COVER SPECIFIED FOR PERMANENT STABILIZATION. SLOPE GRADIENT STEEPER THAN 2:1 WILL NOT BE PERMITTED WITH VEGETATIVE STABILIZATION.

14. FOR FINISHED GRADING, THE CONTRACTOR SHALL PROVIDE ADEQUATE GRADIENTS TO PREVENT WATER FROM PONDING FOR MORE THAN TWENTY-FOUR (24) HOURS AFTER THE END OF A RAINFALL EVENT. DRAINAGE COURSES AND SWALE FLOW AREAS MAY TAKE AS LONG AS FORTY-EIGHT (48) HOURS AFTER THE END OF A RAINFALL EVENT TO DRAIN. AREAS DESIGNED TO HAVE STANDING WATER SHALL NOT BE REQUIRED TO MEET THIS REQUIREMENT.

15. SEDIMENT TRAPS OR BASINS ARE NOT PERMITTED WITHIN 20 FEET OF A FOUNDATION THAT EXISTS OR IS UNDER CONSTRUCTION. NO STRUCTURE MAY BE CONSTRUCTED WITHIN 20 FEET OF AN ACTIVE SEDIMENT TRAP OR BASIN.

16. THE WMA INSPECTOR HAS THE OPTION OF REQUIRING ADDITIONAL SAFETY OR SEDIMENT CONTROL MEASURES, IF DEEMED NECESSARY.

17. ALL TRAP DEPTH DIMENSIONS ARE RELATIVE TO THE OUTLET ELEVATION. ALL TRAPS MUST HAVE A STABLE OUTFALL. ALL TRAPS AND BASINS SHALL HAVE STABLE INFLOW POINTS.

18. VEGETATIVE STABILIZATION SHALL BE PERFORMED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL. REFER TO APPROPRIATE SPECIFICATIONS FOR TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, SODDING AND GROUND COVERS.

19. SEDIMENT SHALL BE REMOVED AND THE TRAP OR BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO ONE QUARTER OF THE TOTAL DEPTH OF THE TRAP OR BASIN. TOTAL DEPTH SHALL BE MEASURED FROM THE TRAP OR BASIN BOTTOM TO THE CREST OF THE OUTLET.

20. SEDIMENT REMOVED FROM TRAPS (AND BASINS) SHALL BE PLACED AND STABILIZED IN APPROVED AREAS, BUT NOT WITHIN A FLOODPLAIN, WETLAND OR TREE-SAVE AREA. WHEN PUMPING SEDIMENT LADEN WATER, THE DISCHARGE MUST BE DIRECTED TO A SEDIMENT TRAPPING DEVICE PRIOR TO RELEASE FROM THE SITE. A SUMP PIT MAY BE USED IF SEDIMENT TRAPS THEMSELVES ARE BEING PUMPED OUT.

21. ALL WATER REMOVED FROM EXCAVATED AREAS (E.G. UTILITY TRENCHES) SHALL BE PASSED THROUGH AN APPROVED DEWATERING PRACTICE OR PUMPED TO A SEDIMENT TRAP OR BASIN PRIOR TO DISCHARGE FROM THE SITE)I.E. VIA FUNCTIONAL STORM DRAIN SYSTEM OR TO STABLE GROUND SURFACE).

22. SEDIMENT CONTROL FOR UTILITY CONSTRUCTION FOR AREAS OUTSIDE OF DESIGNED CONTROLS OR AS DIRECTED BY THE ENGINEER OR WMA INSPECTOR:
   A. CALL "MISS UTILITY" AT 1-800-257-7777 48 HOURS PRIOR TO THE START OF WORK.
   B. EXCAVATED TRENCH MATERIAL SHALL BE PLACED ON THE HIGH SIDE OF THE TRENCH.
   C. TRENCHES FOR UTILITY INSTALLATION SHALL BE BACKFILLED, COMPACTED, AND STABILIZED AT THE END OF EACH WORKING DAY. NO MORE TRENCH SHALL BE OPENED THAT CAN BE COMPLETED THE SAME DAY, UNLESS;
   D. TEMPORARY SILT FENCE SHALL BE PLACED IMMEDIATELY DOWNSTREAM OF ANY DISTURBED AREA INTENDED TO REMAIN DISTURBED FOR MORE THAN ONE DAY.

23. WHERE DEEMED APPROPRIATE BY THE ENGINEER OR INSPECTOR, SEDIMENT BASINS AND TRAPS MAY NEED TO BE SURROUNDED WITH AN APPROVED SAFETY FENCE. THE FENCE MUST CONFORM TO LOCAL ORDINANCES AND REGULATIONS. THE DEVELOPER OR OWNER SHALL CHECK WITH THE LOCAL BUILDING OFFICIALS ON APPLICABLE SAFETY REQUIREMENTS. WHERE SAFETY FENCE IS DEEMED APPROPRIATE AND LOCAL ORDINANCES DO NOT SPECIFY FENCING SIZES OR TYPES, THE FOLLOWING SHALL BE USED AS A MINIMUM STANDARD: THE SAFETY FENCE MUST BE MADE OF WELDED WIRE AND AT LEAST 42 INCHES HIGH, HAVE POSTS SPACED NO FARTHER APART THAN 8 FEET, HAVE MESH OPENINGS NO GREATER THAN 2 INCHES IN WIDTH AND 4 INCHED IN HEIGHT WITH A MINIMUM OF 14 GAUGE WIRE. SAFETY FENCE MUST BE MAINTAINED AND IN GOOD CONDITION AT ALL TIMES.

24. OFF-SITE SPOIL OR BORROW AREAS ON STATE OR FEDERAL PROPERTY MUST HAVE PRIOR APPROVAL BY WMA AND OTHER APPLICABLE STATE, FEDERAL AND LOCAL AGENCIES; OTHERWISE APPROVAL MUST BE GRANTED BY THE LOCAL AUTHORITIES. ALL WASTE AND BORROW AREAS OFF-SITE MUST BE PROTECTED BY SEDIMENT CONTROL MEASURES AND STABILIZED.

25. SITES WHERE INFILTRATION DEVICES ARE USED FOR THE CONTROL OF STORMWATER, EXTREME CARE MUST BE TAKEN TO PREVENT RUNOFF FROM UNSTABILIZED AREAS FROM ENTERING THE STRUCTURE DURING CONSTRUCTION. SEDIMENT CONTROL DEVICES PLACED IN INFILTRATION AREAS MUST HAVE BOTTOM ELEVATIONS AT LEAST TWO (2) FEET HIGHER THAN THE FINISH GRADE BOTTOM ELEVATION OF THE INFILTRATION PRACTICE. WHEN CONVERTING A SEDIMENT TRAP TO AN INFILTRATION DEVICE, ALL ACCUMULATED SEDIMENT MUST BE REMOVED AND DISPOSED OF PRIOR TO FINAL GRADING OF INFILTRATION DEVICE.

26. WHEN A STORM DRAIN SYSTEM OUTFALL IS DIRECTED TO A SEDIMENT TRAP OR SEDIMENT BASIN AND THE SYSTEM IS TO BE USED FOR TEMPORARILY CONVEYING SEDIMENT LADEN WATER, ALL STORM DRAIN INLETS IN NON-SUMP AREAS SHALL HAVE TEMPORARY ASPHALT BERMS CONSTRUCTED AT THE TIME OF BASE PAVING TO DIRECT GUTTER FLOW INTO THE INLETS TO AVOID SURCHARGING AND OVERFLOW OF INLETS IN SUMP AREAS.

27. SITE INFORMATION:

A. TOTAL AREA OF FACILITY (BASE, CAMPUS, PARK, ETC.)	3400	ACRES
B. TOTAL AREA OF PROJECT SITE	0.30	ACRES
C. AREA DISTURBED	0.30	ACRES
D. AREA TO BE ROOFED OR PAVED	0.00	ACRES
E. TOTAL CUT	150	CU. YDS.
F. TOTAL FILL	150	CU. YDS.
G. OFF-SITE WASTE/BORROW AREA LOCATION	TO BE DETERMINED (MUST BE APPROVED BY MDE)	

B-4 STANDARDS AND SPECIFICATIONS FOR VEGETATIVE STABILIZATION

Definition

Using vegetation as cover to protect exposed soil from erosion.

Purpose

To promote the establishment of vegetation on exposed soil.

Conditions Where Practice Applies

On all disturbed areas not stabilized by other methods. This specification is divided into sections on incremental stabilization; soil preparation, soil amendments and topsoiling; seeding and mulching; temporary stabilization; and permanent stabilization.

Effects on Water Quality and Quantity

Stabilization practices are used to promote the establishment of vegetation on exposed soil. When soil is stabilized with vegetation, the soil is less likely to erode and more likely to allow infiltration of rainfall, thereby reducing sediment loads and runoff to downstream areas.

Planting vegetation in disturbed areas will have an effect on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, percolation, and groundwater recharge. Over time, vegetation will increase organic matter content and improve the water holding capacity of the soil and subsequent plant growth.

Vegetation will help reduce the movement of sediment, nutrients, and other chemicals carried by runoff to receiving waters. Plants will also help protect groundwater supplies by assimilating those substances present within the root zone.

Sediment control practices must remain in place during grading, seedbed preparation, seeding, mulching, and vegetative establishment.

Adequate Vegetative Establishment

Inspect seeded areas for vegetative establishment and make necessary repairs, replacements, and reseedings within the planting season.

1. Adequate vegetative stabilization requires 95 percent groundcover.

2. If an area has less than 40 percent groundcover, restabilize following the original recommendations for lime, fertilizer, seedbed preparation, and seeding.

3. If an area has between 40 and 94 percent groundcover, over-seed and fertilize using half of the rates originally specified.

4. Maintenance fertilizer rates for permanent seeding are shown in Table B.6.

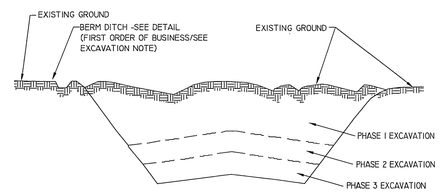


FIGURE B-I: INCREMENTAL STABILIZATION - CUT

B-4-1 STANDARDS AND SPECIFICATIONS FOR INCREMENTAL STABILIZATION

Definition

Establishment of vegetative cover on cut and fill slopes.

Purpose

To provide timely vegetative cover on cut and fill slopes as work progresses.

Conditions Where Practice Applies

Any cut or fill slope greater than 15 feet in height. This practice also applies to stockpiles.

Criteria

A. Incremental Stabilization - Cut Slopes
   1. Excavate and stabilize cut slopes in increments not to exceed 15 feet in height. Prepare seedbed and apply seed and mulch on all cut slopes as the work progresses.
   2. Construction sequence example (Refer to Figure B.1):
      a. Construct and stabilize all temporary swales or dikes that will be used to convey runoff around the excavation.
   b. Perform Phase 1 excavation, prepare seedbed, and stabilize.
   c. Perform Phase 2 excavation, prepare seedbed, and stabilize. Overseed Phase 1 areas as necessary.
   d. Perform final phase excavation, prepare seedbed, and stabilize. Overseed previously seeded areas as necessary.

Note: Once excavation has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

B. Incremental Stabilization - Fill Slopes
   1. Construct and stabilize fill slopes in increments not to exceed 15 feet in height. Prepare seedbed and apply seed and mulch on all slopes as the work progresses.
   2. Stabilize slopes immediately when the vertical height of a lift reaches 15 feet, or when the grading operation ceases as prescribed in the plans.
   3. At the end of each day, install temporary water conveyance practice(s), as necessary, to intercept surface runoff and convey it down the slope in a non-erosive manner.
   4. Construction sequence example (Refer to Figure B.2):
      a. Construct and stabilize all temporary swales or dikes that will be used to divert runoff around the fill. Construct silt fence on low side of fill unless other methods shown on the plans address this area.
      b. At the end of each day, install temporary water conveyance practice(s), as necessary, to intercept surface runoff and convey it down the slope in a non-erosive manner.
      c. Place Phase 1 fill, prepare seedbed, and stabilize.
      d. Place Phase 2 fill, prepare seedbed, and stabilize.
      e. Place final phase fill, prepare seedbed, and stabilize. Overseed previously seeded areas as necessary.

Note: Once the placement of fill has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

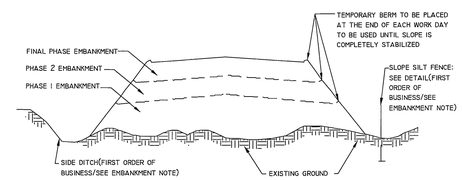


FIGURE B-2: INCREMENTAL STABILIZATION-FILL

MDE No. 13-WM-0001

EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED.

NO DISTURBED AREA SHALL BE LEFT UNSTABILIZED OVERNIGHT UNLESS THE RUNOFF IS DIRECTED TO AN MDE APPROVED SEDIMENT CONTROL DEVICE.

STANDARD STABILIZATION NOTE:

"FOLLOWNG INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN SEVEN (7) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND FOURTEEN DAYS (14) AS TO ALL DISTURBED OR GRADED AREAS ON THE PROJECT SITE."

DESIGN CERTIFICATION

"I HEREBY CERTIFY THAT THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH THE MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL, THE 2000 MARYLAND STORMWATER DESIGN MANUAL, VOLUMES I & II INCLUDING SUPPLEMENTS, THE ENVIRONMENT ARTICLE SECTION 4-101 THROUGH 116 AND SECTIONS 4-201 AND 215, AND THE CODE OF MARYLAND REGULATIONS (COMAR) 26.17.01 COMAR 26.17.02 FOR EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT, RESPECTIVELY."

Kevin Larrowe
NAME

15104
MARYLAND. REGISTRATION NUMBER.
P.E. R.L.S. OR R.L.A. (circle)

SIGNATURE

8.17.12
DATE

EROSION AND SEDIMENT CONTROL NOTES

SITE 1 RADIOLOGICAL REMOVAL ACTION
ADJACENT TO BUILDING #1662
NAVAL SUPPORT FACILITY
INDIAN HEAD
CONTRACT NO. W52PIJ-08-D-0034 DO:0054
INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

STATE OF MARYLAND REGISTERED PROFESSIONAL ENGINEER KEVIN LARROWE 15104
8.17.12

Colbert Matz Rosenfelt, Inc.
*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 15104 Expiration Date: 10/11/12

NO.	DATE	REVISIONS:	BY
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-3
SHEET 3 OF 4

B-4-2 STANDARDS AND SPECIFICATIONS FOR SOIL PREPARATION, TOPSOILING, AND SOIL AMENDMENTS

Definition

The process of preparing the soils to sustain adequate vegetative stabilization.

Purpose

To provide a suitable soil medium for vegetative growth.

Conditions Where Practice Applies

Where vegetative stabilization is to be established.

Criteria

A. Soil Preparation
1. Temporary Stabilization
   a. Seedbed preparation consists of loosening soil to a depth of 3 to 5 inches by means of suitable agricultural or construction equipment, such as disc harrows or chisel plows or rippers mounted on construction equipment. After the soil is loosened, it must not be rolled or dragged smooth but left in the roughened condition. Slopes 3:1 or flatter are to be tracked with ridges running parallel to the contour of the slope.
   b. Apply fertilizer and lime as prescribed on the plans.
   c. Incorporate lime and fertilizer into the top 3 to 5 inches of soil by disking or other suitable means.
2. Permanent Stabilization
   a. A soil test is required for any earth disturbance of 5 acres or more. The minimum soil conditions required for permanent vegetative establishment are:
      i. Soil pH between 6.0 and 7.0.
      ii. Soluble salts less than 500 parts per million (ppm).
      iii. Soil contains less than 40 percent clay but enough fine grained material (greater than 30 percent silt plus clay) to provide the capacity to hold a moderate amount of moisture. An exception: if lovegrass will be planted, then a sandy soil (less than 30 percent silt plus clay) would be acceptable.
      iv. Soil contains 1.5 percent minimum organic matter by weight.
      v. Soil contains sufficient pore space to permit adequate root penetration.
   b. Application of amendments or topsoil is required if on-site soils do not meet the above conditions.
   c. Graded areas must be maintained in a true and even grade as specified on the approved plan, then scarified or otherwise loosened to a depth of 3 to 5 inches.
   d. Apply soil amendments as specified on the approved plan or as indicated by the results of a soil test.
   e. Mix soil amendments into the top 3 to 5 inches of soil by disking or other suitable means. Rake lawn areas to smooth the surface, remove large objects like stones and branches, and ready the area for seed application. Loosen surface soil by dragging with a heavy chain or other equipment to roughen the surface where site conditions will not permit normal seedbed preparation. Track slopes 3:1 or flatter with tracked equipment leaving the soil in an irregular condition with ridges running parallel to the contour of the slope. Leave the top 1 to 3 inches of soil loose and friable. Seedbed loosening may be unnecessary on newly disturbed areas.

B. Topsoiling
1. Topsoil is placed over prepared subsoil prior to establishment of permanent vegetation. The purpose is to provide a suitable soil medium for vegetative growth. Soils of concern have low moisture content, low nutrient levels, low pH, materials toxic to plants, and/or unacceptable soil gradation.
2. Topsoil salvaged from an existing site may be used provided it meets the standards as set forth in these specifications. Typically, the depth of topsoil to be salvaged for a given soil type can be found in the representative soil profile section in the Soil Survey published by USDA-NRCS.
3. Topsoiling is limited to areas having 2:1 or flatter slopes where:
   a. The texture of the exposed subsoil/parent material is not adequate to produce vegetative growth.
   b. The soil material is so shallow that the rooting zone is not deep enough to support plants or furnish continuing supplies of moisture and plant nutrients.
   c. The original soil to be vegetated contains material toxic to plant growth.
   d. The soil is so acidic that treatment with limestone is not feasible.
4. Areas having slopes steeper than 2:1 require special consideration and design.
5. Topsoil Specifications: Soil to be used as topsoil must meet the following criteria:
   a. Topsoil must be a loam, sandy loam, clay loam, silt loam, sandy clay loam, or loamy sand. Other soils may be used if recommended by an agronomist or soil scientist and approved by the appropriate approval authority. Topsoil must not be a mixture of contrasting textured subsoils and must contain less than 5 percent by volume of cinders, stones, slag, coarse fragments, gravel, sticks, roots, trash, or other materials larger than 1½ inches in diameter.
   b. Topsoil must be free of noxious plants or plant parts such as Bermuda grass, quack grass, Johnson grass, nut sedge, poison ivy, thistle, or others as specified.
   c. Topsoil substitutes or amendments, as recommended by a qualified agronomist or soil scientist and approved by the appropriate approval authority, may be used in lieu of natural topsoil.
6. Topsoil Application
   a. Erosion and sediment control practices must be maintained when applying topsoil.
   b. Uniformly distribute topsoil in a 5 to 8 inch layer and lightly compact to a minimum thickness of 4 inches. Spreading is to be performed in such a manner that sodding or seeding can proceed with a minimum of additional soil preparation and tillage. Any irregularities in the surface resulting from topsoiling or other operations must be corrected in order to prevent the formation of depressions or water pockets.
   c. Topsoil must not be placed if the topsoil or subsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper grading and seedbed preparation.

C. Soil Amendments (Fertilizer and Lime Specifications)
1. Soil tests must be performed to determine the exact ratios and application rates for both lime and fertilizer on sites having disturbed areas of 5 acres or more. Soil analysis may be performed by a recognized private or commercial laboratory. Soil samples taken for engineering purposes may also be used for chemical analyses.
2. Fertilizers must be uniform in composition, free flowing and suitable for accurate application by appropriate equipment. Manure may be substituted for fertilizer with prior approval from the appropriate approval authority. Fertilizers must all be delivered to the site fully labeled according to the applicable laws and must bear the name, trade name or trademark and warranty of the producer.
3. Lime materials must be ground limestone (hydrated or burnt lime may be substituted except when hydroseeding) which contains at least 50 percent total oxides (calcium oxide plus magnesium oxide). Limestone must be ground to such fineness that at least 50 percent will pass through a #100 mesh sieve and 98 to 100 percent will pass through a #20 mesh sieve.
4. Lime and fertilizer are to be evenly distributed and incorporated into the top 3 to 5 inches of soil by disking or other suitable means.
5. Where the subsoil is either highly acidic or composed of heavy clays, spread ground limestone at the rate of 4 to 8 tons/acre (200-400 pounds per 1,000 square feet) prior to the placement of topsoil.

Purpose

To protect disturbed soils from erosion during and at the end of construction.

Conditions Where Practice Applies

To the surface of all perimeter controls, slopes, and any disturbed area not under active grading.

Criteria

A. Seeding
1. Specifications
   a. All seed must meet the requirements of the Maryland State Seed Law. All seed must be subject to retesting by a recognized seed laboratory. All seed used must have been tested within the 6 months immediately preceding the date of sowing such material on any project. Refer to Table B.4 regarding the quality of seed. Seed tags must be available upon request to the inspector to verify type of seed and seeding rate.
   b. Mulch alone may be applied between the fall and spring seeding dates only if the ground is frozen. The appropriate seeding mixture must be applied when the ground thaws.
   c. Inoculants: The inoculant for treating legume seed in the seed mixtures must be a pure culture of nitrogen fixing bacteria prepared specifically for the species. Inoculants must not be used later than the date indicated on the container. Add fresh inoculants as directed on the package. Use four times the recommended rate when hydroseeding. Note: It is very important to keep inoculant as cool as possible until used. Temperatures above 75 to 80 degrees Fahrenheit can weaken bacteria and make the inoculant less effective.
   d. Sod or seed must not be placed on soil which has been treated with soil sterilants or chemicals used for weed control until sufficient time has elapsed (14 days min.) to permit dissipation of phyto-toxic materials.
2. Application
   a. Dry Seeding: This includes use of conventional drop or broadcast spreaders.
      i. Incorporate seed into the subsoil at the rates prescribed on Temporary Seeding Table B.1, Permanent Seeding Table B.3, or site-specific seeding summaries.
      ii. Apply seed in two directions, perpendicular to each other. Apply half the seeding rate in each direction. Roll the seeded area with a weighted roller to provide good seed to soil contact.
   b. Drill or Cultipacker Seeding: Mechanized seeders that apply and cover seed with soil.
      i. Cultipacking seeders are required to bury the seed in such a fashion as to provide at least 1/4 inch of soil covering. Seedbed must be firm after planting.
      ii. Apply seed in two directions, perpendicular to each other. Apply half the seeding rate in each direction.
   c. Hydroseeding: Apply seed uniformly with hydroseeder (slurry includes seed and fertilizer).
      i. If fertilizer is being applied at the time of seeding, the application rates should not exceed the following: nitrogen, 100 pounds per acre total of soluble nitrogen; P2O5 (phosphorous), 200 pounds per acre; K2O (potassium), 200 pounds per acre.
      ii. Lime: Use only ground agricultural limestone (up to 3 tons per acre may be applied by hydroseeding). Normally, not more than 2 tons are applied by hydroseeding at any one time. Do not use burnt or hydrated lime when hydroseeding.
      iii. Mix seed and fertilizer on site and seed immediately and without interruption.
      iv. When hydroseeding do not incorporate seed into the soil.

B. Mulching
1. Mulch Materials (in order of preference)
   a. Straw consisting of thoroughly threshed wheat, rye, oat, or barley and reasonably bright in color. Straw is to be free of noxious weed seeds as specified in the Maryland Seed Law and not musty, moldy, caked, decayed, or excessively dusty. Note: Use only sterile straw mulch in areas where one species of grass is desired.
   b. Wood Cellulose Fiber Mulch (WCFM) consisting of specially prepared wood cellulose processed into a uniform fibrous physical state.
      i. WCFM is to be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry.
      ii. WCFM, including dye, must contain no germination or growth inhibiting factors.
      iii. WCFM materials are to be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with seed, fertilizer and other additives to form a homogeneous slurry. The mulch material must form a blotter-like ground cover, on application, having moisture absorption and percolation properties and must cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.
      iv. WCFM material must not contain elements or compounds at concentration levels that will be phyto-toxic.
      v. WCFM must conform to the following physical requirements: fiber length of approximately 10 millimeters, diameter approximately 1 millimeter, pH range of 4.0 to 8.5, ash content of 1.6 percent maximum and water holding capacity of 90 percent minimum.
2. Application
   a. Apply mulch to all seeded areas immediately after seeding.
   b. When straw mulch is used, spread it over all seeded areas at the rate of 2 tons per acre to a uniform loose depth of 1 to 2 inches. Apply mulch to achieve a uniform distribution and depth so that the soil surface is not exposed. When using a mulch anchoring tool, increase the application rate to 2.5 tons per acre.
   c. Wood cellulose fiber used as mulch must be applied at a net dry weight of 1500 pounds per acre. Mix the wood cellulose fiber with water to attain a mixture with a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
3. Anchoring
   a. Perform mulch anchoring immediately following application of mulch to minimize loss by wind or water. This may be done by one of the following methods (listed by preference), depending upon the size of the area and erosion hazard:
      i. A mulch anchoring tool is a tractor drawn implement designed to punch and anchor mulch into the soil surface a minimum of 2 inches. This practice is most effective on large areas, but is limited to flatter slopes where equipment can operate safely. If used on sloping land, this practice should follow the contour.
      ii. Wood cellulose fiber may be used for anchoring straw. Apply the fiber binder at a net dry weight of 750 pounds per acre. Mix the wood cellulose fiber with water at a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
      iii. Synthetic binders such as Acrylic DLR (Agro-Tack), DCAij0, Petroset, Terra Tax II, Terra Tack AR or other approved equal may be used. Follow application rates as specified by the manufacturer. Application of liquid binders needs to be heavier at the edges where wind catches mulch, such as in valleys and on crests of banks. Use of asphalt binders is strictly prohibited.
      iv. Lightweight plastic netting may be stapled over the mulch according to manufacturer recommendations. Netting is usually available in rolls 4 to 15 feet wide and 300 to 3,000 feet long.

B-4-4 STANDARDS AND SPECIFICATIONS FOR TEMPORARY STABILIZATION

Definition

To stabilize disturbed soils with vegetation for up to 6 months.

Purpose

To use fast growing vegetation that provides cover on disturbed soils.

Conditions Where Practice Applies

Exposed soils where ground cover is needed for a period of 6 months or less. For longer duration of time, permanent stabilization practices are required.

Criteria

1. Select one or more of the species or seed mixtures listed in Table B.1 for the appropriate Plant Hardiness Zone (from Figure B.3), and enter them in the Temporary Seeding Summary below along with application rates, seeding dates and seeding depths. If this Summary is not put on the plan and completed, then Table B.1 plus fertilizer and lime rates must be put on the plan.
2. For sites having soil tests performed, use and show the recommended rates by the testing agency. Soil tests are not required for Temporary Seeding.
3. When stabilization is required outside of a seeding season, apply seed and mulch or straw mulch alone as prescribed in Section B-4-3.A.1.b and maintain until the next seeding season.

B-4-5 STANDARDS AND SPECIFICATIONS FOR PERMANENT STABILIZATION

Definition

To stabilize disturbed soils with permanent vegetation.

Purpose

To use long-lived perennial grasses and legumes to establish permanent ground cover on disturbed soils.

Conditions Where Practice Applies

Exposed soils where ground cover is needed for 6 months or more.

Criteria

A. Seed Mixtures
1. General Use
   a. Select one or more of the species or mixtures listed in Table B.3 for the appropriate Plant Hardiness Zone (from Figure B.3) and based on the site condition or purpose found on Table B.2. Enter selected mixture(s), application rates, and seeding dates in the Permanent Seeding Summary. The Summary is to be placed on the plan.
   b. Additional planting specifications for exceptional sites such as shorelines, stream banks, or dunes or for special purposes such as wildlife or aesthetic treatment may be found in USDA-NRCS Technical Field Office Guide, Section 342 Critical Area Planting.
   c. For sites having disturbed area over 5 acres, use and show the rates recommended by the soil testing agency.
   d. For areas receiving low maintenance, apply urea form fertilizer (46-0-0) at 3 ½ pounds per 1000 square feet (150 pounds per acre) at the time of seeding in addition to the soil amendments shown in the Permanent Seeding Summary.
2. Turfgrass Mixtures
   a. Areas where turfgrass may be desired include lawns, parks, playgrounds, and commercial sites which will receive a medium to high level of maintenance.
   b. Select one or more of the species or mixtures listed below based on the site conditions or purpose. Enter selected mixture(s), application rates, and seeding dates in the Permanent Seeding Summary. The summary is to be placed on the plan.
      i. Kentucky Bluegrass: Full Sun Mixture: For use in areas that receive intensive management. Irrigation required in the areas of central Maryland and Eastern Shore. Recommended Certified Kentucky Bluegrass Cultivars Seeding Rate: 1.5 to 2.0 pounds per 1000 square feet. Choose a minimum of three Kentucky bluegrass cultivars with each ranging from 10 to 35 percent of the total mixture by weight.
      ii. Kentucky Bluegrass/Perennial Rye: Full Sun Mixture: For use in full sun areas where rapid establishment is necessary and when turf will receive medium to intensive management. Certified Perennial Ryegrass Cultivars/Certified Kentucky Bluegrass Seeding Rate: 2 pounds mixture per 1000 square feet. Choose a minimum of three Kentucky bluegrass cultivars with each ranging from 10 to 35 percent of the total mixture by weight.
      iii. Tall Fescue/Kentucky Bluegrass: Full Sun Mixture: For use in drought prone areas and/or for areas receiving low to medium management in full sun to medium shade. Recommended mixture includes; Certified Tall Fescue Cultivars 95 to 100 percent, Certified Kentucky Bluegrass Cultivars 0 to 5 percent. Seeding Rate: 5 to 8 pounds per 1000 square feet. One or more cultivars may be blended.
      iv. Kentucky Bluegrass/Fine Fescue: Shade Mixture: For use in areas with shade in Bluegrass lawns. For establishment in high quality, intensively managed turf area. Mixture includes; Certified Kentucky Bluegrass Cultivars 30 to 40 percent and Certified Fine Fescue and 60 to 70 percent. Seeding Rate: 1½ to 3 pounds per 1000 square feet.

   Notes:
   Select turfgrass varieties from those listed in the most current University of Maryland Publication, Agronomy Memo #77, "Turfgrass Cultivar Recommendations for Maryland"

   Choose certified material. Certified material is the best guarantee of cultivar purity. The certification program of the Maryland Department of Agriculture, Turf and Seed Section, provides a reliable means of consumer protection and assures a pure genetic line

   c. Ideal Times of Seeding for Turf Grass Mixtures
   Western MD: March 15 to June 1, August 1 to October 1 (Hardiness Zones: 5b, 6a)

   Central MD: March 1 to May 15, August 15 to October 15 (Hardiness Zone: 6b)

   Southern MD, Eastern Shore: March 1 to May 15, August 15 to October 15 (Hardiness Zones: 7a, 7b)
   d. Till areas to receive seed by disking or other approved methods to a depth of 2 to 4 inches, level and rake the areas to prepare a proper seedbed. Remove stones and debris over 1½ inches in diameter. The resulting seedbed must be in such condition that future mowing of grasses will pose no difficulty.
   e. If soil moisture is deficient, supply new seedings with adequate water for plant growth (½ to 1 inch every 3 to 4 days depending on soil texture) until they are firmly established. This is especially true when seedings are made late in the planting season, in abnormally dry or hot seasons, or on adverse sites.

B. Sod: To provide quick cover on disturbed areas (2:1 grade or flatter).
1. General Specifications
   a. Class of turfgrass sod must be Maryland State Certified. Sod labels must be made available to the job foreman and inspector.
   b. Sod must be machine cut at a uniform soil thickness of ¾ inch, plus or minus ¼ inch, at the time of cutting. Measurement for thickness must exclude top growth and thatch. Broken pads and torn or uneven ends will not be acceptable.
   c. Standard size sections of sod must be strong enough to support their own weight and retain their size and shape when suspended vertically with a firm grasp on the upper 10 percent of the section.
   d. Sod must not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
   e. Sod must be harvested, delivered, and installed within a period of 36 hours. Sod not transplanted within this period must be approved by an agronomist or soil scientist prior to its installation.
2. Sod Installation
   a. During periods of excessively high temperature or in areas having dry subsoil, lightly irrigate the subsoil immediately prior to laying the sod.
   b. Lay the first row of sod in a straight line with subsequent rows placed parallel to it and tightly wedged against each other. Stagger lateral joints to promote more uniform growth and strength. Ensure that sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids which would cause air drying of the roots.
   c. Wherever possible, lay sod with the long edges parallel to the contour and with staggering joints. Roll and tamp, peg or otherwise secure the sod to prevent slippage on slopes. Ensure solid contact exists between sod roots and the underlying soil surface.
   d. Water the sod immediately following rolling and tamping until the underside of the new sod pad and soil surface below the sod are thoroughly wet. Complete the operations of laying, tamping and irrigating for any piece of sod within eight hours.
3. Sod Maintenance
   a. In the absence of adequate rainfall, water daily during the first week or as often and sufficiently as necessary to maintain moist soil to a depth of 4 inches. Water sod during the heat of the day to prevent wilting.
   b. After the first week, sod watering is required as necessary to maintain adequate moisture content.
   c. Do not mow until the sod is firmly rooted. No more than 1/3 of the grass leaf must be removed by the initial cutting or subsequent cuttings. Maintain a grass height of at least 3 inches unless otherwise specified.

Temporary Seeding Summary

Hardiness Zone (from Figure B.3): 7a Seed Mixture (from Table B.1)					Fertilizer Rate (10-20-20)	Lime Rate
Mix	Species	Application Rate (lb/ac)	Seeding Dates	Seeding Depths (in)		
Mix	CEREAL RYE	112	2/15-4/30 8/15-12/15	1.0	436 lb/ac (10 lb/1000 sf)	2 tons/ac (90 lb/1000 sf)
Mix	FOXTAIL MILLET	30	5/1-8/15	0.5		

Permanent Seeding Summary

Hardiness Zone (from Figure B.3): 7a Seed Mixture (from Table B.1)					Fertilizer Rate (10-20-20)			Lime Rate
Mix	Species	Application Rate (lb/ac)	Seeding Dates	Seeding Depths (in)	N	P_2O_5	K_2O	
8	TALL FESCUE	100	2/15-4/30 8/15-11/30	$\frac{1}{4}$ - $\frac{1}{2}$ in	45 lb/ac (1.0 lb/1000 sf)	90 lb/ac (2 lb/1000 sf)	90 lb/ac (2 lb/1000 sf)	2 tons/ac (90 lb/1000 sf)
9	TALL FESCUE OR	60						
	HARD FESCUE AND ADD	40						
	KENTUCKY BLUEGRASS	40						
	AND PERENNIAL RYEGRASS	20						

EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED.

NO DISTURBED AREA SHALL BE LEFT UNSTABILIZED OVERNIGHT UNLESS THE RUNOFF IS DIRECTED TO AN MDE APPROVED SEDIMENT CONTROL DEVICE.

B-4-8 STANDARDS AND SPECIFICATIONS FOR STOCKPILE AREA

Definition

A mound or pile of soil protected by appropriately designed erosion and sediment control measures.

Purpose

To provide a designated location for the temporary storage of soil that controls the potential for erosion, sedimentation, and changes to drainage patterns.

Conditions Where Practice Applies

Stockpile areas are utilized when it is necessary to salvage and store soil for later use.

Criteria

1. The stockpile location and all related sediment control practices must be clearly indicated on the erosion and sediment control plan.
2. The footprint of the stockpile must be sized to accommodate the anticipated volume of material and based on a side slope ratio no steeper than 2:1. Benching must be provided in accordance with Section B-3 Land Grading.
3. Runoff from the stockpile area must drain to a suitable sediment control practice.
4. Access the stockpile area from the upgrade side.
5. Clear water runoff into the stockpile area must be minimized by use of a diversion device such as an earth dike, temporary swale or diversion fence. Provisions must be made for discharging concentrated flow in a non-erosive manner.
6. Where runoff concentrates along the toe of the stockpile fill, an appropriate erosion/sediment control practice must be used to intercept the discharge.
7. Stockpiles must be stabilized in accordance with the 3/7 day stabilization requirement as well as Standard B-4-1 Incremental Stabilization and Standard B-4-4 Temporary Stabilization.
8. If the stockpile is located on an impervious surface, a liner should be provided below the stockpile to facilitate cleanup. Stockpiles containing contaminated material must be covered with impermeable sheeting.

Maintenance

The stockpile area must continuously meet the requirements for Adequate Vegetative Establishment in accordance with Section B-4 Vegetative Stabilization. Side slopes must be maintained at no steeper than a 2:1 ratio. The stockpile area must be kept free of erosion. If the vertical height of a stockpile exceeds 20 feet for 2:1 slopes, 30 feet for 3:1 slopes, or 40 feet for 4:1 slopes, benching must be provided in accordance with Section B-3 Land Grading.

MDE No. 13-WM-0001

EROSION AND SEDIMENT CONTROL NOTES

SITE 1 RADIOLOGICAL REMOVAL ACTION

ADJACENT TO BUILDING #1662

NAVAL SUPPORT FACILITY INDIAN HEAD

CONTRACT NO. W52PIJ-08-D-0034 D0:0054

INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Colbert Matz Rosenfelt, Inc.

*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

8·17·12

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.

License No. 15104 Expiration Date: 10/11/12

NO.	DATE	REVISIONS:	BY
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-4
SHEET 4 OF 4

Appendix E

Import Backfill Sample Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-3051-1
Client Project/Site: NSF Indian Head

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Daniel Spicuzza

Authorized for release by:
8/16/2013 5:35:13 PM

Erika Gish, Project Manager I
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-3051-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: NSF Indian Head

Report Number: 160-3051-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-3051-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 7/19/2013 9:15 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.0º C.

Exception: Encores were received out of hold. Ok to proceed per client.

VOLATILE ORGANIC COMPOUNDS BY GC/MS

Sample 1HBF-5 (160-3051-5) was analyzed for Volatile Organic Compounds by GC/MS in accordance with EPA SW-846 Method 8260C. The samples were prepared and analyzed on 07/30/2013.

Insufficient sample volume was available to perform batch matrix spike/matrix spike duplicate (MS/MSD) associated with batch 64629. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.

2-Butanone (MEK) exceeded the RPD limit for LCSD 160-63739/3-A. The %RPD of the laboratory control sample (LCS) and laboratory control standard duplicate (LCSD) for preparation batch 64629 also recovered outside control limits.

The continuing calibration verification (CCV) for Bromomethane and Chloroethane associated with batch 64629 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

No other difficulties were encountered during the Volatiles analysis.

All other quality control parameters were within the acceptance limits.

Organic Prep

Method 8081

Insufficient sample volume was available to perform batch matrix spike/matrix spike duplicate (MS/MSD) associated with batch _62920. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.

No other analytical or quality issues were noted.

SEMIVOLATILE ORGANIC COMPOUNDS (GC/MS)

Sample 1HBF-6 (160-3051-6) was analyzed for Semivolatile Organic Compounds (GC/MS) in accordance with EPA SW-846 Method 8270D. The samples were prepared on 07/30/2013 and analyzed on 08/05/2013.

Butyl benzyl phthalate was detected in method blank MB 160-63746/1-A at a level that was above the method detection limit but below the reporting limit.

Terphenyl-d14 (Surr) failed the surrogate recovery criteria low for 1HBF-6 (160-3051-6). Terphenyl-d14 (Surr) failed the surrogate recovery criteria low for 1HBF-6MS (160-3051-6MS). Tthe laboratory allows one acid surrogate and/or one base surrogate to be outside acceptance limits; therefore, re-extraction/re-analysis was not performed. These results have been reported and qualified.

4-Nitrophenol failed the recovery criteria low for LCS 160-63746/2-A. A full list spike was utilized for this method. Due to the large number of spiked analytes, there is a high probability that one or more analytes will recover outside acceptance limits. The laboratory's SOP allows for 3 analytes to recover outside criteria for this method when a full list spike is utilized. The LCS associated with batch 65003 had 1 analyte outside control limits; therefore, re-extraction/re-analysis was not performed. These results have been reported and qualified.

No other difficulties were encountered during the Semi-VOA analysis.

All other quality control parameters were within the acceptance limits.

GASOLINE RANGE ORGANICS (GRO)

Sample 1HBF-5 (160-3051-5) was analyzed for gasoline range organics (GRO) in accordance with EPA SW-846 Method 8015B - GRO. The samples were analyzed on 07/30/2013.

Job ID: 160-3051-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

Gasoline Range Organics (C6-C12) was detected in method blank MB 160-63753/1-A at a level that was above the method detection limit but below the reporting limit.

The following samples in batch 64066 contained peaks which were within the Gasoline Range Organics (GRO) retention time window: 1HBF-5 (160-3051-5). These peaks were large enough that there is a reportable concentration; however, there is no resemblance between the reportable peak and the pattern of GRO.

No other difficulties were encountered during the GRO analysis.

All other quality control parameters were within the acceptance limits.

DIESEL RANGE ORGANICS (DRO)

Sample 1HBF-4 (160-3051-4) was analyzed for diesel range organics (DRO) in accordance with EPA SW-846 Method 8015B - DRO. The samples were prepared on 07/22/2013 and analyzed on 07/23/2013.

The CCV surrogate recovery is outside the upper QC limits of greater than 20%D. The surrogate recovery in the associated samples is acceptable; therefore the sample data has been reported with this narrative.

No difficulties were encountered during the DRO analysis.

All quality control parameters were within the acceptance limits.

ORGANOCHLORINE PESTICIDES (GC)

Sample 1HBF-4 (160-3051-4) was analyzed for Organochlorine Pesticides (GC) in accordance with EPA SW-846 Method 8081B. The samples were prepared on 07/25/2013 and analyzed on 07/30/2013.

The %RPD between the primary and confirmation column exceeded 40% for alpha-Chlordane for the following sample: 1HBF-4 (160-3051-4). The lower value has been reported and qualified in accordance with the laboratory's SOP.

The following sample has clear evidence of the presence of chlordane based on the presence of alpha and gamma chlordane; however, the chlordane peaks in the sample do not closely match the laboratory's Technical Chlordane standard: 1HBF-4 (160-3051-4). As a result, there is increased quantitative uncertainty associated with this result. Only 3 of 4 peaks were used to quantitate the compound.

No difficulties were encountered during the pesticides analysis.

All quality control parameters were within the acceptance limits.

CHLORINATED HERBICIDES

Sample 1HBF-2 (160-3051-2) was analyzed for chlorinated herbicides in accordance with EPA SW-846 Method 8151A. The samples were prepared on 08/09/2013 and analyzed on 08/14/2013.

Surrogates are added during the extraction process prior to dilution. When the sample dilution is 5X or greater, surrogate recoveries are diluted out and no corrective action is required.

The matrix spike percent recoveries and %RPD for batch 65908 were outside control limits for Dinoseb, which is a know poor performing analyte. The LCS, MS, and MSD recoveries still meed inhouse limits. The sample is ND for this target analye; therefore the sample data has been reported with this narrative

The continuing calibration verification (CCV) for several compound (MCPA, Dichlorprop, Dinoseb, 2,4,5-T, and 2,4,5-TP on the confirmation column only; and 2,4-D on both columns) associated with batch 65908 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

No other difficulties were encountered during the herbicides analysis.

All other quality control parameters were within the acceptance limits.

Job ID: 160-3051-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

TOTAL METALS (ICP)

Sample 1HBF-3 (160-3051-3) was analyzed for total metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/08/2013 and analyzed on 08/09/2013.

The following samples were diluted due to the nature of the sample matrix. The sample digestates were yellow in color: (160-3051-3 MS), (160-3051-3 MSD), (160-3051-3 SD), 1HBF-3 (160-3051-3). Elevated reporting limits (RLs) are provided.

The matrix spike and/or matrix spike duplicate (MS/MSD) recoveries for batch 65521 were outside control limits for aluminum, calcium, potassium, magnesium, silver, and antimony. The RPD was within method limits indicating a potential matrix interference. The associated laboratory control sample (LCS) recovery met acceptance criteria.

Due to the high concentration of iron, the matrix spike / matrix spike duplicate (MS/MSD) for batch 65521 could not be evaluated for accuracy and precision. The presence of the '4' qualifier in the data indicates analytes where the concentration in the unspiked sample exceeded four times the spiking amount. The associated laboratory control sample (LCS) met acceptance criteria.

The serial dilution performed for the following samples associated with batch 65968 was outside control limits for calcium. All the other target analytes were within control limits indicating a possible matrix interference: (160-3051-3 SD)

No other difficulties were encountered during the metals analysis.

All other quality control parameters were within the acceptance limits.

MERCURY

Sample 1HBF-3 (160-3051-3) was analyzed for mercury in accordance with EPA SW-846 Method 7471B. The samples were prepared on 07/31/2013 and analyzed on 08/01/2013.

No difficulties were encountered during the mercury analysis.

All quality control parameters were within the acceptance limits.

PERCENT SOLIDS

Samples 1HBF-2 (160-3051-2), 1HBF-3 (160-3051-3), 1HBF-4 (160-3051-4), 1HBF-5 (160-3051-5) and 1HBF-6 (160-3051-6) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 07/27/2013.

No difficulties were encountered during the % solids analysis.

All quality control parameters were within the acceptance limits.

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Sample 1HBF-1 (160-3051-1) was analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 07/22/2013, prepared on 07/24/2013 and analyzed on 08/06/2013.

No other difficulties were encountered during the Gamma spec analysis.

All other quality control parameters were within the acceptance limits.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

CUR282

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Spicuzza	Lab PM: Gish, Erika K	Carrier Tracking No(s): Fed Ex	COC No: 160-550-282.1
Client Contact: Daniel Spicuzza	Phone: (412)848-7012	E-Mail: erika.gish@testamericainc.com		Page: Page 1 of 1
Company: Aleut World Solutions				Job #: USN-2011-008
Address: 4300 B Street Suite 402	Due Date Requested: 8-16-2013			
City: Anchorage	TAT Requested (days): 21			
State, Zip: AK, 99503				
Phone: (907)278-1311	PO #: Purchase Order Requested			
Email: radconpro@verizon.net	WO #:			
Project Name: Waste Characterizations	Project #: 16001906			
Site: NSF Indian Head	SSOW#:			

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8015B_GRO - GRO/Total VOC	8151A - Total Herbicides	8015B_DRO, 8081B	8270D - Total SVOC	6010C, 7471B	Y Spec-TL-132	Total Number of containers	Special Instructions/Note:	
			Preservation Code:				N	N	N	N	N	N			
1HBF-1	7-17-13	0835	C	S	N	N						X	1	TL-132	500g
1HBF-2		0840	C	S	N	N		X					1		250g
1HBF-3		0842	C	S	N	N					X		1		60g
1HBF-4		0844	C	S	N	N			X				1		120g
1HBF-5		0846	C	S	N	N	X						1		120g
1HBF-6		0850	C	S	N	N				X			3	3 Containers	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify) IV

Special Instructions/QC Requirements: Level IV

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by:	Date/Time: 7-18-13 1800	Company NSF	Received by:	Date/Time: 7-19-13 0915	Company TASTL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-3051-1

Login Number: 3051

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	False	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
Q	One or more quality control criteria failed.
J	Estimated: The analyte was positively identified; the quantitation is an estimation

GC/MS Semi VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
Q	One or more quality control criteria failed.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
M	Manual integrated compound.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

GC VOA

Qualifier	Qualifier Description
J	Estimated: The analyte was positively identified; the quantitation is an estimation
M	Manual integrated compound.

GC Semi VOA

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
M	Manual integrated compound.

Metals

Qualifier	Qualifier Description
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
U	Undetected at the Limit of Detection.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
4	MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	TAL SL
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL SL
8015B	Gasoline Range Organics - (GC)	SW846	TAL SL
8015B	Diesel Range Organics (DRO) (GC)	SW846	TAL SL
8081B	Organochlorine Pesticides (GC)	SW846	TAL SL
8151A	Herbicides (GC)	SW846	TAL SL
6010C	Metals (ICP)	SW846	TAL SL
7471B	Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-3051-1	1HBF-1	Solid	07/17/13 08:35	07/19/13 09:15
160-3051-2	1HBF-2	Solid	07/17/13 08:40	07/19/13 09:15
160-3051-3	1HBF-3	Solid	07/17/13 08:42	07/19/13 09:15
160-3051-4	1HBF-4	Solid	07/17/13 08:44	07/19/13 09:15
160-3051-5	1HBF-5	Solid	07/17/13 08:46	07/19/13 09:15
160-3051-6	1HBF-6	Solid	07/17/13 08:50	07/19/13 09:15

Detection Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-1 — Lab Sample ID: 160-3051-1

No Detections.

Client Sample ID: 1HBF-2 — Lab Sample ID: 160-3051-2

No Detections.

Client Sample ID: 1HBF-3 — Lab Sample ID: 160-3051-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	3510	J	40.1	28.0	mg/Kg	2	☼	6010C	Total/NA
Arsenic	3.33		2.00	0.635	mg/Kg	2	☼	6010C	Total/NA
Barium	18.0		10.0	0.501	mg/Kg	2	☼	6010C	Total/NA
Calcium	2070	J	501	26.6	mg/Kg	2	☼	6010C	Total/NA
Chromium	14.4		2.00	0.615	mg/Kg	2	☼	6010C	Total/NA
Cobalt	4.51	J	10.0	1.88	mg/Kg	2	☼	6010C	Total/NA
Copper	5.59		5.01	1.46	mg/Kg	2	☼	6010C	Total/NA
Iron	10500	J	20.0	5.95	mg/Kg	2	☼	6010C	Total/NA
Lead	7.07		2.00	0.345	mg/Kg	2	☼	6010C	Total/NA
Magnesium	845	J	200	16.6	mg/Kg	2	☼	6010C	Total/NA
Manganese	86.8		2.00	0.308	mg/Kg	2	☼	6010C	Total/NA
Nickel	5.29	J	8.01	0.451	mg/Kg	2	☼	6010C	Total/NA
Potassium	885	J	1000	675	mg/Kg	2	☼	6010C	Total/NA
Vanadium	15.1		10.0	2.52	mg/Kg	2	☼	6010C	Total/NA
Zinc	19.1		10.0	3.97	mg/Kg	2	☼	6010C	Total/NA
Mercury	0.0481		0.0329	0.0110	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 1HBF-4 — Lab Sample ID: 160-3051-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
alpha-Chlordane	0.668	J	1.89	0.630	ug/Kg	1	☼	8081B	Total/NA
gamma-Chlordane	0.573	J	1.89	0.175	ug/Kg	1	☼	8081B	Total/NA
4,4'-DDD	1.50	J	1.89	0.245	ug/Kg	1	☼	8081B	Total/NA
4,4'-DDE	5.33		1.89	0.433	ug/Kg	1	☼	8081B	Total/NA
Technical Chlordane	5.24	J	18.9	4.14	ug/Kg	1	☼	8081B	Total/NA

Client Sample ID: 1HBF-5 — Lab Sample ID: 160-3051-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Toluene	4.66	J	6.00	0.840	ug/Kg	1	☼	8260C	Total/NA
Gasoline Range Organics (C6-C12)	0.0312	J	0.127	0.0127	mg/Kg	1	☼	8015B	Total/NA

Client Sample ID: 1HBF-6 — Lab Sample ID: 160-3051-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzo[b]fluoranthene	37.3	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Dimethyl phthalate	71.2	J M	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Fluoranthene	48.8	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Phenanthrene	47.6	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Pyrene	47.1	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-1

Lab Sample ID: 160-3051-1

Date Collected: 07/17/13 08:35
Matrix: Solid
Date Received: 07/19/13 09:15

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.518**		0.161	0.170		0.126	pCi/g	07/24/13 15:46	08/06/13 17:08	1
Cesium-137	0.00971	U	0.0336	0.0336	0.200	0.0604	pCi/g	07/24/13 15:46	08/06/13 17:08	1
Thorium-232	**0.518**		0.161	0.170		0.126	pCi/g	07/24/13 15:46	08/06/13 17:08	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.531*		*0.120*	*0.132*		*0.107*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
K-40	*7.13*		*1.12*	*1.34*		*0.600*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
Pb-212	*0.434*		*0.0947*	*0.110*		*0.0997*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
Pb-214	*0.584*		*0.116*	*0.131*		*0.125*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
Tl-208	*0.192*		*0.0598*	*0.0630*		*0.0567*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*

Client Sample ID: 1HBF-2

Lab Sample ID: 160-3051-2

Date Collected: 07/17/13 08:40
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-T	8.79	U H	22.2	8.79	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
2,4-D	24.4	U H	88.7	24.4	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
2,4-DB	48.6	U H	88.7	48.6	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dalapon	42.7	U H	44.3	42.7	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dinoseb	15.1	U H J	27.7	15.1	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dicamba	4.36	U H	44.3	4.36	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dichlorprop	25.9	U H	88.7	25.9	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
MCPA	3400	U H	8870	3400	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Silvex (2,4,5-TP)	3.64	U H	22.2	3.64	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
MCPP	5320	U H	8870	5320	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*83*		*50 - 150*	*08/09/13 15:17*	*08/14/13 01:38*	*1*

Client Sample ID: 1HBF-3

Lab Sample ID: 160-3051-3

Date Collected: 07/17/13 08:42
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**3510**	**J**	40.1	28.0	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Antimony	1.28	U J	2.00	1.28	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Arsenic	**3.33**		2.00	0.635	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Barium	**18.0**		10.0	0.501	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Beryllium	0.339	U	1.00	0.339	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Cadmium	0.200	U	1.00	0.200	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Calcium	**2070**	**J**	501	26.6	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Chromium	**14.4**		2.00	0.615	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Cobalt	**4.51**	**J**	10.0	1.88	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Copper	**5.59**		5.01	1.46	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-3

Lab Sample ID: 160-3051-3
Date Collected: 07/17/13 08:42
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 6010C - Metals (ICP) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Iron	**10500**	**J**	20.0	5.95	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Lead	**7.07**		2.00	0.345	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Magnesium	**845**	**J**	200	16.6	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Manganese	**86.8**		2.00	0.308	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Nickel	**5.29**	**J**	8.01	0.451	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Potassium	**885**	**J**	1000	675	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Selenium	0.579	U	3.00	0.579	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Silver	0.469	U J	2.00	0.469	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Sodium	94.4	U	200	94.4	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Thallium	3.02	U	4.01	3.02	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Vanadium	**15.1**		10.0	2.52	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Zinc	**19.1**		10.0	3.97	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.0481**		0.0329	0.0110	mg/Kg	☼	07/31/13 10:00	08/01/13 06:36	1

Client Sample ID: 1HBF-4

Lab Sample ID: 160-3051-4
Date Collected: 07/17/13 08:44
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10-C28]	0.368	U	27.6	0.368	mg/Kg	☼	07/22/13 16:48	07/23/13 14:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*98*	*M*	*49 - 133*	*07/22/13 16:48*	*07/23/13 14:59*	*1*

Method: 8081B - Organochlorine Pesticides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aldrin	0.340	U	1.89	0.340	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
alpha-BHC	0.205	U	2.22	0.205	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
beta-BHC	0.333	U	1.89	0.333	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
delta-BHC	0.269	U	1.89	0.269	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
gamma-BHC (Lindane)	0.187	U	1.89	0.187	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
alpha-Chlordane	**0.668**	**J**	1.89	0.630	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
gamma-Chlordane	**0.573**	**J**	1.89	0.175	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
4,4'-DDD	**1.50**	**J**	1.89	0.245	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
4,4'-DDE	**5.33**		1.89	0.433	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
4,4'-DDT	0.697	U	1.89	0.697	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Dieldrin	0.239	U	1.89	0.239	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endosulfan I	0.633	U	1.89	0.633	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endosulfan II	0.261	U	1.89	0.261	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endosulfan sulfate	0.378	U	1.89	0.378	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endrin	0.175	U	1.89	0.175	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endrin aldehyde	0.432	U	1.89	0.432	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endrin ketone	0.463	U	1.89	0.463	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Heptachlor	0.227	U	2.22	0.227	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Heptachlor epoxide	0.476	U	1.89	0.476	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Methoxychlor	0.798	U	3.66	0.798	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-4

Lab Sample ID: 160-3051-4
Date Collected: 07/17/13 08:44
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Toxaphene	16.8	U	74.4	16.8	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Technical Chlordane	**5.24**	**J**	18.9	4.14	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*80*	*M*	*29 - 150*	*07/25/13 15:00*	*07/30/13 05:21*	*1*
Tetrachloro-m-xylene	*88*	*M*	*41 - 125*	*07/25/13 15:00*	*07/30/13 05:21*	*1*

Client Sample ID: 1HBF-5

Lab Sample ID: 160-3051-5
Date Collected: 07/17/13 08:46
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	0.516	U	6.00	0.516	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1,2,2-Tetrachloroethane	0.480	U	6.00	0.480	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1,2-Trichloro-1,2,2-trifluoroethane	2.02	U	6.00	2.02	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1,2-Trichloroethane	0.684	U	6.00	0.684	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1-Dichloroethane	0.468	U	6.00	0.468	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1-Dichloroethene	1.93	U	6.00	1.93	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2,4-Trichlorobenzene	0.516	U	6.00	0.516	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dibromo-3-Chloropropane	1.74	U	12.0	1.74	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dichlorobenzene	0.336	U	6.00	0.336	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dichloroethane	1.04	U	6.00	1.04	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dichloropropane	0.456	U	6.00	0.456	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,3-Dichlorobenzene	0.336	U	6.00	0.336	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,4-Dichlorobenzene	0.720	U	6.00	0.720	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
2-Butanone (MEK)	2.30	U Q	24.0	2.30	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
2-Hexanone	2.12	U	24.0	2.12	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
4-Methyl-2-pentanone (MIBK)	0.876	U	24.0	0.876	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Acetone	7.77	U	24.0	7.77	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Benzene	0.300	U	6.00	0.300	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Bromoform	0.444	U	6.00	0.444	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Bromomethane	1.32	U	12.0	1.32	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Carbon disulfide	0.828	U	6.00	0.828	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Carbon tetrachloride	0.612	U	6.00	0.612	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chlorobenzene	0.456	U	6.00	0.456	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Dibromochloromethane	0.492	U	6.00	0.492	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chloroethane	0.624	U	12.0	0.624	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chloroform	0.456	U	6.00	0.456	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chloromethane	0.780	U	12.0	0.780	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
cis-1,2-Dichloroethene	0.720	U	6.00	0.720	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
cis-1,3-Dichloropropene	0.720	U	6.00	0.720	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Cyclohexane	0.432	U	12.0	0.432	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Bromodichloromethane	0.300	U	6.00	0.300	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Dichlorodifluoromethane	1.57	U	12.0	1.57	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Ethylbenzene	0.360	U	6.00	0.360	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dibromoethane (EDB)	0.840	U	6.00	0.840	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Isopropylbenzene	0.312	U	6.00	0.312	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Methyl acetate	1.66	U	30.0	1.66	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Methyl tert-butyl ether	0.576	U	6.00	0.576	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1

Client Sample ID: 1HBF-5

Lab Sample ID: 160-3051-5
Date Collected: 07/17/13 08:46
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methylcyclohexane	0.312	U	12.0	0.312	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Methylene Chloride	1.90	U	6.00	1.90	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
m-Xylene & p-Xylene	0.684	U	6.00	0.684	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
o-Xylene	0.408	U	6.00	0.408	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Styrene	0.420	U	6.00	0.420	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Tetrachloroethene	0.384	U	6.00	0.384	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Toluene	**4.66**	**J**	6.00	0.840	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
trans-1,2-Dichloroethene	1.13	U	6.00	1.13	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
trans-1,3-Dichloropropene	0.420	U	6.00	0.420	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Trichloroethene	0.468	U	6.00	0.468	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Trichlorofluoromethane	0.600	U	6.00	0.600	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Vinyl chloride	0.516	U	6.00	0.516	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Xylenes, Total	1.02	U	12.0	1.02	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*93*		*78 - 133*	*07/30/13 13:17*	*07/30/13 20:55*	*1*
Dibromofluoromethane (Surr)	*102*		*83 - 122*	*07/30/13 13:17*	*07/30/13 20:55*	*1*
4-Bromofluorobenzene (Surr)	*105*		*65 - 140*	*07/30/13 13:17*	*07/30/13 20:55*	*1*
1,2-Dichloroethane-d4 (Surr)	*97*		*78 - 132*	*07/30/13 13:17*	*07/30/13 20:55*	*1*

Method: 8015B - Gasoline Range Organics - (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (C6-C12)	**0.0312**	**J**	0.127	0.0127	mg/Kg	☼	07/30/13 13:04	07/30/13 17:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Trifluorotoluene (Surr)	*110*		*49 - 112*	*07/30/13 13:04*	*07/30/13 17:04*	*1*

Client Sample ID: 1HBF-6

Lab Sample ID: 160-3051-6
Date Collected: 07/17/13 08:50
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Acenaphthylene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Anthracene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[a]anthracene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[b]fluoranthene	**37.3**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[k]fluoranthene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[g,h,i]perylene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[a]pyrene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Bis(2-chloroethoxy)methane	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Bis(2-chloroethyl)ether	37.1	U	366	37.1	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Bis(2-ethylhexyl) phthalate	50.3	U	366	50.3	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Bromophenyl phenyl ether	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Butyl benzyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Carbazole	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Chloroaniline	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Chloro-3-methylphenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Chloronaphthalene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-6
Date Collected: 07/17/13 08:50
Date Received: 07/19/13 09:15

Lab Sample ID: 160-3051-6
Matrix: Solid
Percent Solids: 90.0

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Chlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Chlorophenyl phenyl ether	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Chrysene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Dibenz(a,h)anthracene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Dibenzofuran	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Di-n-butyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,2-Dichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,3-Dichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,4-Dichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
3,3'-Dichlorobenzidine	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dichlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Diethyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dimethylphenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Dimethyl phthalate	**71.2**	**J M**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4,6-Dinitro-2-methylphenol	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dinitrophenol	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dinitrotoluene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,6-Dinitrotoluene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Di-n-octyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Fluoranthene	**48.8**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Fluorene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachlorobutadiene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachlorocyclopentadiene	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachloroethane	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Indeno[1,2,3-cd]pyrene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Isophorone	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Methylnaphthalene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Methylphenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
3 & 4 Methylphenol	73.9	U	732	73.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Naphthalene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Nitroaniline	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
3-Nitroaniline	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Nitroaniline	366	U	366	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Nitrobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Nitrophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Nitrophenol	366	U Q	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
N-Nitrosodiphenylamine	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
N-Nitrosodi-n-propylamine	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
bis (2-chloroisopropyl) ether	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Pentachlorophenol	366	U	732	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Phenanthrene	**47.6**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Phenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Pyrene	**47.1**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,2,4-Trichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4,5-Trichlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4,6-Trichlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Aniline	66.5	U	366	66.5	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,4-Dioxane	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-6

Date Collected: 07/17/13 08:50
Date Received: 07/19/13 09:15

Lab Sample ID: 160-3051-6

Matrix: Solid
Percent Solids: 90.0

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzyl alcohol	57.5	U	366	57.5	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Pyridine	73.9	U	732	73.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorophenol (Surr)	*53*		*43 - 103*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
2,4,6-Tribromophenol (Surr)	*53*		*53 - 111*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
Nitrobenzene-d5 (Surr)	*53*		*47 - 105*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
Phenol-d5 (Surr)	*53*		*52 - 99*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
Terphenyl-d14 (Surr)	*48*	*J*	*58 - 124*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
2-Fluorobiphenyl (Surr)	*56*		*55 - 97*	*07/30/13 12:29*	*08/05/13 17:35*	*1*

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 160-63739/1-A
Matrix: Solid
Analysis Batch: 64629

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 63739

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	0.430	U	5.00	0.430	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1,2,2-Tetrachloroethane	0.400	U	5.00	0.400	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1,2-Trichloro-1,2,2-trifluoroethane	1.68	U	5.00	1.68	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1,2-Trichloroethane	0.570	U	5.00	0.570	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1-Dichloroethane	0.390	U	5.00	0.390	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1-Dichloroethene	1.61	U	5.00	1.61	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2,4-Trichlorobenzene	0.430	U	5.00	0.430	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dibromo-3-Chloropropane	1.45	U	10.0	1.45	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dichlorobenzene	0.280	U	5.00	0.280	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dichloroethane	0.870	U	5.00	0.870	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dichloropropane	0.380	U	5.00	0.380	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,3-Dichlorobenzene	0.280	U	5.00	0.280	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,4-Dichlorobenzene	0.600	U	5.00	0.600	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
2-Butanone (MEK)	1.92	U	20.0	1.92	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
2-Hexanone	1.77	U	20.0	1.77	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
4-Methyl-2-pentanone (MIBK)	0.730	U	20.0	0.730	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Acetone	6.47	U	20.0	6.47	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Benzene	0.250	U	5.00	0.250	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Bromoform	0.370	U	5.00	0.370	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Bromomethane	1.10	U	10.0	1.10	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Carbon disulfide	0.690	U	5.00	0.690	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Carbon tetrachloride	0.510	U	5.00	0.510	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chlorobenzene	0.380	U	5.00	0.380	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Dibromochloromethane	0.410	U	5.00	0.410	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chloroethane	0.520	U	10.0	0.520	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chloroform	0.380	U	5.00	0.380	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chloromethane	0.650	U	10.0	0.650	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
cis-1,2-Dichloroethene	0.600	U	5.00	0.600	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
cis-1,3-Dichloropropene	0.600	U	5.00	0.600	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Cyclohexane	0.360	U	10.0	0.360	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Bromodichloromethane	0.250	U	5.00	0.250	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Dichlorodifluoromethane	1.31	U	10.0	1.31	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Ethylbenzene	0.300	U	5.00	0.300	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dibromoethane (EDB)	0.700	U	5.00	0.700	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Isopropylbenzene	0.260	U	5.00	0.260	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methyl acetate	1.38	U	25.0	1.38	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methyl tert-butyl ether	0.480	U	5.00	0.480	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methylcyclohexane	0.260	U	10.0	0.260	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methylene Chloride	1.58	U	5.00	1.58	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
m-Xylene & p-Xylene	0.570	U	5.00	0.570	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
o-Xylene	0.340	U	5.00	0.340	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Styrene	0.350	U	5.00	0.350	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Tetrachloroethene	0.320	U	5.00	0.320	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Toluene	0.700	U	5.00	0.700	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
trans-1,2-Dichloroethene	0.940	U	5.00	0.940	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
trans-1,3-Dichloropropene	0.350	U	5.00	0.350	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Trichloroethene	0.390	U	5.00	0.390	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Trichlorofluoromethane	0.500	U	5.00	0.500	ug/Kg		07/30/13 10:30	07/30/13 12:07	1

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 160-63739/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64629 — **Prep Batch: 63739**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl chloride	0.430	U	5.00	0.430	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Xylenes, Total	0.850	U	10.0	0.850	ug/Kg		07/30/13 10:30	07/30/13 12:07	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*94*		*78 - 133*	*07/30/13 10:30*	*07/30/13 12:07*	*1*
Dibromofluoromethane (Surr)	*100*		*83 - 122*	*07/30/13 10:30*	*07/30/13 12:07*	*1*
4-Bromofluorobenzene (Surr)	*104*		*65 - 140*	*07/30/13 10:30*	*07/30/13 12:07*	*1*
1,2-Dichloroethane-d4 (Surr)	*102*		*78 - 132*	*07/30/13 10:30*	*07/30/13 12:07*	*1*

Lab Sample ID: LCS 160-63739/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64629 — **Prep Batch: 63739**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1-Trichloroethane	50.0	52.9		ug/Kg		106	85 - 120
1,1,2,2-Tetrachloroethane	50.0	45.7		ug/Kg		91	81 - 115
1,1,2-Trichloroethane	50.0	48.4		ug/Kg		97	85 - 115
1,1-Dichloroethane	50.0	51.3		ug/Kg		103	85 - 115
1,1-Dichloroethene	50.0	50.8		ug/Kg		102	85 - 117
1,2,4-Trichlorobenzene	50.0	51.7		ug/Kg		103	74 - 126
1,2-Dibromo-3-Chloropropane	50.0	50.6		ug/Kg		101	70 - 126
1,2-Dichlorobenzene	50.0	48.1		ug/Kg		96	84 - 115
1,2-Dichloroethane	50.0	50.6		ug/Kg		101	77 - 122
1,2-Dichloropropane	50.0	51.4		ug/Kg		103	85 - 115
1,3-Dichlorobenzene	50.0	48.7		ug/Kg		97	84 - 115
1,4-Dichlorobenzene	50.0	47.3		ug/Kg		95	85 - 115
2-Butanone (MEK)	50.0	49.5		ug/Kg		99	64 - 130
2-Hexanone	50.0	49.6		ug/Kg		99	72 - 119
4-Methyl-2-pentanone (MIBK)	50.0	49.6		ug/Kg		99	75 - 156
Acetone	50.0	53.0		ug/Kg		106	41 - 140
Benzene	50.0	48.7		ug/Kg		97	85 - 110
Bromoform	50.0	46.9		ug/Kg		94	79 - 121
Bromomethane	50.0	63.7		ug/Kg		127	71 - 127
Carbon disulfide	50.0	51.9		ug/Kg		104	85 - 131
Carbon tetrachloride	50.0	53.4		ug/Kg		107	85 - 123
Chlorobenzene	50.0	48.6		ug/Kg		97	83 - 115
Dibromochloromethane	50.0	48.6		ug/Kg		97	85 - 118
Chloroethane	50.0	61.3		ug/Kg		123	71 - 127
Chloroform	50.0	50.3		ug/Kg		101	85 - 115
Chloromethane	50.0	53.1		ug/Kg		106	72 - 127
cis-1,2-Dichloroethene	50.0	50.1		ug/Kg		100	85 - 115
cis-1,3-Dichloropropene	50.0	51.0		ug/Kg		102	85 - 125
Cyclohexane	50.0	53.9		ug/Kg		108	73 - 140
Bromodichloromethane	50.0	49.6		ug/Kg		99	46 - 132
Dichlorodifluoromethane	50.0	49.7		ug/Kg		99	85 - 115
Ethylbenzene	50.0	51.4		ug/Kg		103	85 - 115
1,2-Dibromoethane (EDB)	50.0	49.1		ug/Kg		98	84 - 115
Isopropylbenzene	50.0	53.0		ug/Kg		106	85 - 127

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 160-63739/2-A
Matrix: Solid
Analysis Batch: 64629

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63739

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Methyl acetate	250	249		ug/Kg		100	70 - 137
Methyl tert-butyl ether	50.0	53.5		ug/Kg		107	71 - 116
Methylcyclohexane	50.0	53.2		ug/Kg		106	84 - 138
Methylene Chloride	50.0	48.9		ug/Kg		98	85 - 115
m-Xylene & p-Xylene	50.0	54.0		ug/Kg		108	85 - 115
o-Xylene	50.0	55.5		ug/Kg		111	85 - 117
Styrene	50.0	51.7		ug/Kg		103	85 - 116
Tetrachloroethene	50.0	49.8		ug/Kg		100	85 - 116
Toluene	50.0	51.5		ug/Kg		103	85 - 115
trans-1,2-Dichloroethene	50.0	51.6		ug/Kg		103	85 - 115
trans-1,3-Dichloropropene	50.0	47.3		ug/Kg		95	85 - 127
Trichloroethene	50.0	49.2		ug/Kg		98	85 - 115
Trichlorofluoromethane	50.0	53.1		ug/Kg		106	77 - 125
Vinyl chloride	50.0	51.1		ug/Kg		102	72 - 124
Xylenes, Total	100	110		ug/Kg		110	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*105*		*78 - 133*
Dibromofluoromethane (Surr)	*101*		*83 - 122*
4-Bromofluorobenzene (Surr)	*101*		*65 - 140*
1,2-Dichloroethane-d4 (Surr)	*103*		*78 - 132*

Lab Sample ID: LCSD 160-63739/3-A
Matrix: Solid
Analysis Batch: 64629

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 63739

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1,1-Trichloroethane	50.0	51.7		ug/Kg		103	85 - 120	2	20
1,1,2,2-Tetrachloroethane	50.0	45.3		ug/Kg		91	81 - 115	1	20
1,1,2-Trichloroethane	50.0	46.6		ug/Kg		93	85 - 115	4	20
1,1-Dichloroethane	50.0	49.3		ug/Kg		99	85 - 115	4	20
1,1-Dichloroethene	50.0	49.3		ug/Kg		99	85 - 117	3	20
1,2,4-Trichlorobenzene	50.0	51.9		ug/Kg		104	74 - 126	0	20
1,2-Dibromo-3-Chloropropane	50.0	47.3		ug/Kg		95	70 - 126	7	20
1,2-Dichlorobenzene	50.0	48.3		ug/Kg		97	84 - 115	0	20
1,2-Dichloroethane	50.0	49.5		ug/Kg		99	77 - 122	2	20
1,2-Dichloropropane	50.0	48.8		ug/Kg		98	85 - 115	5	20
1,3-Dichlorobenzene	50.0	48.3		ug/Kg		97	84 - 115	1	20
1,4-Dichlorobenzene	50.0	47.4		ug/Kg		95	85 - 115	0	20
2-Butanone (MEK)	50.0	64.0	Q	ug/Kg		128	64 - 130	26	20
2-Hexanone	50.0	46.8		ug/Kg		94	72 - 119	6	20
4-Methyl-2-pentanone (MIBK)	50.0	48.0		ug/Kg		96	75 - 156	3	20
Acetone	50.0	53.5		ug/Kg		107	41 - 140	1	20
Benzene	50.0	47.7		ug/Kg		95	85 - 110	2	20
Bromoform	50.0	46.2		ug/Kg		92	79 - 121	2	20
Bromomethane	50.0	59.3		ug/Kg		119	71 - 127	7	20
Carbon disulfide	50.0	48.8		ug/Kg		98	85 - 131	6	20
Carbon tetrachloride	50.0	51.9		ug/Kg		104	85 - 123	3	20

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 160-63739/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64629 — **Prep Batch: 63739**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chlorobenzene	50.0	47.9		ug/Kg		96	83 - 115	1	20
Dibromochloromethane	50.0	47.1		ug/Kg		94	85 - 118	3	20
Chloroethane	50.0	60.4		ug/Kg		121	71 - 127	1	20
Chloroform	50.0	49.3		ug/Kg		99	85 - 115	2	20
Chloromethane	50.0	48.6		ug/Kg		97	72 - 127	9	20
cis-1,2-Dichloroethene	50.0	47.9		ug/Kg		96	85 - 115	5	20
cis-1,3-Dichloropropene	50.0	49.3		ug/Kg		99	85 - 125	3	20
Cyclohexane	50.0	51.2		ug/Kg		102	73 - 140	5	20
Bromodichloromethane	50.0	49.7		ug/Kg		99	46 - 132	0	20
Dichlorodifluoromethane	50.0	49.0		ug/Kg		98	85 - 115	1	20
Ethylbenzene	50.0	51.9		ug/Kg		104	85 - 115	1	20
1,2-Dibromoethane (EDB)	50.0	49.1		ug/Kg		98	84 - 115	0	20
Isopropylbenzene	50.0	52.7		ug/Kg		105	85 - 127	1	20
Methyl acetate	250	242		ug/Kg		97	70 - 137	3	20
Methyl tert-butyl ether	50.0	51.4		ug/Kg		103	71 - 116	4	20
Methylcyclohexane	50.0	51.2		ug/Kg		102	84 - 138	4	20
Methylene Chloride	50.0	47.9		ug/Kg		96	85 - 115	2	20
m-Xylene & p-Xylene	50.0	53.3		ug/Kg		107	85 - 115	1	20
o-Xylene	50.0	54.5		ug/Kg		109	85 - 117	2	20
Styrene	50.0	51.6		ug/Kg		103	85 - 116	0	20
Tetrachloroethene	50.0	50.2		ug/Kg		100	85 - 116	1	20
Toluene	50.0	51.8		ug/Kg		104	85 - 115	1	20
trans-1,2-Dichloroethene	50.0	49.1		ug/Kg		98	85 - 115	5	20
trans-1,3-Dichloropropene	50.0	49.0		ug/Kg		98	85 - 127	4	20
Trichloroethene	50.0	49.2		ug/Kg		98	85 - 115	0	20
Trichlorofluoromethane	50.0	50.1		ug/Kg		100	77 - 125	6	20
Vinyl chloride	50.0	49.0		ug/Kg		98	72 - 124	4	20
Xylenes, Total	100	108		ug/Kg		108	70 - 130	2	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*104*		*78 - 133*
Dibromofluoromethane (Surr)	*98*		*83 - 122*
4-Bromofluorobenzene (Surr)	*101*		*65 - 140*
1,2-Dichloroethane-d4 (Surr)	*99*		*78 - 132*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 160-63746/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65003 — **Prep Batch: 63746**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Acenaphthylene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Anthracene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[a]anthracene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[b]fluoranthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[k]fluoranthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 160-63746/1-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 63746

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzo[g,h,i]perylene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[a]pyrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Bis(2-chloroethoxy)methane	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Bis(2-chloroethyl)ether	33.4	U	330	33.4	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Bis(2-ethylhexyl) phthalate	45.3	U	330	45.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Bromophenyl phenyl ether	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Butyl benzyl phthalate	40.3	J	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Carbazole	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Chloroaniline	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Chloro-3-methylphenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Chloronaphthalene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Chlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Chlorophenyl phenyl ether	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Chrysene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Dibenz(a,h)anthracene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Dibenzofuran	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Di-n-butyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,2-Dichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,3-Dichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,4-Dichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
3,3'-Dichlorobenzidine	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dichlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Diethyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dimethylphenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Dimethyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4,6-Dinitro-2-methylphenol	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dinitrophenol	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dinitrotoluene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,6-Dinitrotoluene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Di-n-octyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Fluoranthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Fluorene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachlorobutadiene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachlorocyclopentadiene	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachloroethane	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Indeno[1,2,3-cd]pyrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Isophorone	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Methylnaphthalene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Methylphenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
3 & 4 Methylphenol	66.6	U	660	66.6	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Naphthalene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Nitroaniline	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
3-Nitroaniline	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Nitroaniline	330	U	330	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Nitrobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Nitrophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Nitrophenol	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 160-63746/1-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 63746

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
N-Nitrosodiphenylamine	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
N-Nitrosodi-n-propylamine	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
bis (2-chloroisopropyl) ether	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Pentachlorophenol	330	U	660	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Phenanthrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Phenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Pyrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,2,4-Trichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4,5-Trichlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4,6-Trichlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Aniline	59.9	U	330	59.9	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,4-Dioxane	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzyl alcohol	51.8	U	330	51.8	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Pyridine	66.6	U	660	66.6	ug/Kg		07/30/13 12:29	08/05/13 12:45	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorophenol (Surr)	*75*		*43 - 103*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
2,4,6-Tribromophenol (Surr)	*61*		*53 - 111*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
Nitrobenzene-d5 (Surr)	*71*		*47 - 105*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
Phenol-d5 (Surr)	*75*		*52 - 99*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
Terphenyl-d14 (Surr)	*72*		*58 - 124*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
2-Fluorobiphenyl (Surr)	*73*		*55 - 97*	*07/30/13 12:29*	*08/05/13 12:45*	*1*

Lab Sample ID: LCS 160-63746/2-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	3330	2360		ug/Kg		71	59 - 91
Acenaphthylene	3330	2440		ug/Kg		73	60 - 93
Anthracene	3330	2380		ug/Kg		71	61 - 95
Benzo[a]anthracene	3330	2660		ug/Kg		80	68 - 112
Benzo[b]fluoranthene	3330	2490		ug/Kg		75	63 - 109
Benzo[k]fluoranthene	3330	2660		ug/Kg		80	66 - 107
Benzo[g,h,i]perylene	3330	2650		ug/Kg		79	61 - 113
Benzo[a]pyrene	3330	2450		ug/Kg		74	63 - 101
Bis(2-chloroethoxy)methane	3330	2310		ug/Kg		69	54 - 91
Bis(2-chloroethyl)ether	3330	2420		ug/Kg		73	49 - 98
Bis(2-ethylhexyl) phthalate	3330	2500		ug/Kg		75	60 - 108
4-Bromophenyl phenyl ether	3330	2520		ug/Kg		76	60 - 101
Butyl benzyl phthalate	3330	2510		ug/Kg		75	59 - 105
Carbazole	3330	2360		ug/Kg		71	61 - 97
4-Chloroaniline	3330	1540		ug/Kg		46	32 - 77
4-Chloro-3-methylphenol	3330	2040		ug/Kg		61	52 - 94
2-Chloronaphthalene	3330	2470		ug/Kg		74	57 - 91
2-Chlorophenol	3330	2160		ug/Kg		65	54 - 91
4-Chlorophenyl phenyl ether	3330	2250		ug/Kg		67	58 - 92
Chrysene	3330	2400		ug/Kg		72	60 - 100

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 160-63746/2-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Dibenz(a,h)anthracene	3330	2680		ug/Kg		80	58 - 114
Dibenzofuran	3330	2260		ug/Kg		68	57 - 88
Di-n-butyl phthalate	3330	2320		ug/Kg		70	60 - 99
1,2-Dichlorobenzene	3330	2240		ug/Kg		67	52 - 91
1,3-Dichlorobenzene	3330	2220		ug/Kg		67	52 - 86
1,4-Dichlorobenzene	3330	2180		ug/Kg		65	53 - 85
3,3'-Dichlorobenzidine	3330	1780		ug/Kg		53	41 - 93
2,4-Dichlorophenol	3330	2040		ug/Kg		61	54 - 87
Diethyl phthalate	3330	2160		ug/Kg		65	58 - 94
2,4-Dimethylphenol	3330	2070		ug/Kg		62	52 - 91
Dimethyl phthalate	3330	2270		ug/Kg		68	59 - 96
4,6-Dinitro-2-methylphenol	3330	2010		ug/Kg		60	20 - 102
2,4-Dinitrophenol	3330	1440	J M	ug/Kg		43	20 - 79
2,4-Dinitrotoluene	3330	2300		ug/Kg		69	59 - 97
2,6-Dinitrotoluene	3330	2320		ug/Kg		70	61 - 95
Di-n-octyl phthalate	3330	2440		ug/Kg		73	60 - 107
Fluoranthene	3330	2350		ug/Kg		71	61 - 98
Fluorene	3330	2310		ug/Kg		69	60 - 93
Hexachlorobenzene	3330	2380		ug/Kg		72	60 - 100
Hexachlorobutadiene	3330	2130		ug/Kg		64	50 - 92
Hexachlorocyclopentadiene	3330	2420		ug/Kg		73	44 - 140
Hexachloroethane	3330	2250		ug/Kg		67	53 - 90
Indeno[1,2,3-cd]pyrene	3330	2560		ug/Kg		77	56 - 123
Isophorone	3330	1730		ug/Kg		52	47 - 97
2-Methylnaphthalene	3330	2170		ug/Kg		65	51 - 92
2-Methylphenol	3330	2220		ug/Kg		67	52 - 94
3 & 4 Methylphenol	3330	2560		ug/Kg		77	64 - 103
Naphthalene	3330	2240		ug/Kg		67	56 - 87
2-Nitroaniline	3330	2260		ug/Kg		68	57 - 97
3-Nitroaniline	3330	2100		ug/Kg		63	48 - 94
4-Nitroaniline	3330	2080		ug/Kg		62	52 - 92
Nitrobenzene	3330	2180		ug/Kg		65	54 - 91
2-Nitrophenol	3330	2190		ug/Kg		66	55 - 92
4-Nitrophenol	3330	1570	J Q	ug/Kg		47	49 - 95
N-Nitrosodiphenylamine	3330	3150		ug/Kg		94	76 - 123
N-Nitrosodi-n-propylamine	3330	2560		ug/Kg		77	56 - 102
bis (2-chloroisopropyl) ether	3330	2750		ug/Kg		83	43 - 103
Pentachlorophenol	3330	1610		ug/Kg		48	45 - 97
Phenanthrene	3330	2480		ug/Kg		74	61 - 95
Phenol	3330	2220		ug/Kg		66	47 - 92
Pyrene	3330	2490		ug/Kg		75	59 - 107
1,2,4-Trichlorobenzene	3330	2200		ug/Kg		66	55 - 88
2,4,5-Trichlorophenol	3330	2020		ug/Kg		61	57 - 96
2,4,6-Trichlorophenol	3330	2110		ug/Kg		63	54 - 94

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorophenol (Surr)	*74*		*43 - 103*
2,4,6-Tribromophenol (Surr)	*65*		*53 - 111*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 160-63746/2-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63746

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*70*		*47 - 105*
Phenol-d5 (Surr)	*73*		*52 - 99*
Terphenyl-d14 (Surr)	*64*		*58 - 124*
2-Fluorobiphenyl (Surr)	*75*		*55 - 97*

Lab Sample ID: 160-3051-6 MS
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: 1HBF-6
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	36.9	U	3700	2420		ug/Kg	☼	65	55 - 93
Acenaphthylene	36.9	U	3700	2450		ug/Kg	☼	66	56 - 92
Anthracene	36.9	U	3700	2420		ug/Kg	☼	65	57 - 97
Benzo[a]anthracene	36.9	U	3700	2700		ug/Kg	☼	73	61 - 116
Benzo[b]fluoranthene	37.3	J	3700	2380		ug/Kg	☼	63	51 - 116
Benzo[k]fluoranthene	36.9	U	3700	2580		ug/Kg	☼	70	53 - 111
Benzo[g,h,i]perylene	36.9	U	3700	3140		ug/Kg	☼	85	33 - 137
Benzo[a]pyrene	36.9	U	3700	2480		ug/Kg	☼	67	50 - 109
Bis(2-chloroethoxy)methane	36.9	U	3700	2310		ug/Kg	☼	62	49 - 93
Bis(2-chloroethyl)ether	37.1	U	3700	2240		ug/Kg	☼	61	42 - 95
Bis(2-ethylhexyl) phthalate	50.3	U	3700	2480		ug/Kg	☼	67	55 - 110
4-Bromophenyl phenyl ether	36.9	U	3700	2480		ug/Kg	☼	67	57 - 102
Butyl benzyl phthalate	36.9	U	3700	2550		ug/Kg	☼	69	54 - 105
Carbazole	36.9	U	3700	2420		ug/Kg	☼	65	58 - 98
4-Chloroaniline	36.9	U	3700	1610		ug/Kg	☼	43	32 - 74
4-Chloro-3-methylphenol	36.9	U	3700	2170		ug/Kg	☼	59	48 - 98
2-Chloronaphthalene	36.9	U	3700	2480		ug/Kg	☼	67	51 - 91
2-Chlorophenol	36.9	U	3700	2020		ug/Kg	☼	55	47 - 88
4-Chlorophenyl phenyl ether	36.9	U	3700	2370		ug/Kg	☼	64	55 - 94
Chrysene	36.9	U	3700	2410		ug/Kg	☼	65	52 - 104
Dibenz(a,h)anthracene	36.9	U	3700	3150		ug/Kg	☼	85	40 - 130
Dibenzofuran	36.9	U	3700	2310		ug/Kg	☼	63	54 - 89
Di-n-butyl phthalate	36.9	U	3700	2440		ug/Kg	☼	66	59 - 101
1,2-Dichlorobenzene	36.9	U	3700	2050		ug/Kg	☼	55	35 - 91
1,3-Dichlorobenzene	36.9	U	3700	2050		ug/Kg	☼	55	32 - 87
1,4-Dichlorobenzene	36.9	U	3700	2010		ug/Kg	☼	54	34 - 86
3,3'-Dichlorobenzidine	366	U	3700	1470	J	ug/Kg	☼	40	10 - 96
2,4-Dichlorophenol	36.9	U	3700	2090		ug/Kg	☼	57	48 - 90
Diethyl phthalate	36.9	U	3700	2350		ug/Kg	☼	63	57 - 97
2,4-Dimethylphenol	36.9	U	3700	2190		ug/Kg	☼	59	36 - 95
Dimethyl phthalate	71.2	J M	3700	2460		ug/Kg	☼	64	56 - 99
4,6-Dinitro-2-methylphenol	366	U	3700	2060		ug/Kg	☼	56	10 - 112
2,4-Dinitrophenol	366	U	3700	1680	J M	ug/Kg	☼	45	10 - 92
2,4-Dinitrotoluene	36.9	U	3700	2510		ug/Kg	☼	68	57 - 100
2,6-Dinitrotoluene	36.9	U	3700	2470		ug/Kg	☼	67	59 - 97
Di-n-octyl phthalate	36.9	U	3700	2500		ug/Kg	☼	68	59 - 110
Fluoranthene	48.8	J	3700	2460		ug/Kg	☼	65	49 - 111
Fluorene	36.9	U	3700	2450		ug/Kg	☼	66	57 - 95

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-3051-6 MS
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: 1HBF-6
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Hexachlorobenzene	36.9	U	3700	2420		ug/Kg	☼	65	54 - 103
Hexachlorobutadiene	36.9	U	3700	1980		ug/Kg	☼	54	36 - 92
Hexachlorocyclopentadiene	366	U	3700	1600	J	ug/Kg	☼	43	10 - 141
Hexachloroethane	36.9	U	3700	2020		ug/Kg	☼	55	26 - 93
Indeno[1,2,3-cd]pyrene	36.9	U	3700	3050		ug/Kg	☼	82	31 - 148
Isophorone	36.9	U	3700	1790		ug/Kg	☼	48	40 - 102
2-Methylnaphthalene	36.9	U	3700	2140		ug/Kg	☼	58	41 - 98
2-Methylphenol	36.9	U	3700	2150		ug/Kg	☼	58	45 - 93
3 & 4 Methylphenol	73.9	U	3700	2540		ug/Kg	☼	69	53 - 103
Naphthalene	36.9	U	3700	2180		ug/Kg	☼	59	46 - 88
2-Nitroaniline	36.9	U	3700	2370		ug/Kg	☼	64	55 - 98
3-Nitroaniline	36.9	U	3700	2350		ug/Kg	☼	64	48 - 95
4-Nitroaniline	366	U	3700	2190		ug/Kg	☼	59	47 - 95
Nitrobenzene	36.9	U	3700	2210		ug/Kg	☼	60	41 - 99
2-Nitrophenol	36.9	U	3700	2120		ug/Kg	☼	57	46 - 95
4-Nitrophenol	366	U Q	3700	1650	J	ug/Kg	☼	45	44 - 103
N-Nitrosodiphenylamine	36.9	U	3700	3220		ug/Kg	☼	87	53 - 127
N-Nitrosodi-n-propylamine	36.9	U	3700	2410		ug/Kg	☼	65	51 - 100
bis (2-chloroisopropyl) ether	36.9	U	3700	2650		ug/Kg	☼	72	37 - 98
Pentachlorophenol	366	U	3700	1490		ug/Kg	☼	40	27 - 104
Phenanthrene	47.6	J	3700	2520		ug/Kg	☼	67	56 - 98
Phenol	36.9	U	3700	2110		ug/Kg	☼	57	44 - 89
Pyrene	47.1	J	3700	2490		ug/Kg	☼	66	46 - 110
1,2,4-Trichlorobenzene	36.9	U	3700	2170		ug/Kg	☼	59	41 - 90
2,4,5-Trichlorophenol	36.9	U	3700	2100		ug/Kg	☼	57	53 - 98
2,4,6-Trichlorophenol	36.9	U	3700	2190		ug/Kg	☼	59	49 - 94

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2-Fluorophenol (Surr)	*63*		*43 - 103*
2,4,6-Tribromophenol (Surr)	*64*		*53 - 111*
Nitrobenzene-d5 (Surr)	*64*		*47 - 105*
Phenol-d5 (Surr)	*64*		*52 - 99*
Terphenyl-d14 (Surr)	*56*	*J*	*58 - 124*
2-Fluorobiphenyl (Surr)	*69*		*55 - 97*

Lab Sample ID: 160-3051-6 MSD
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: 1HBF-6
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acenaphthene	36.9	U	3700	2540		ug/Kg	☼	69	55 - 93	5	30
Acenaphthylene	36.9	U	3700	2580		ug/Kg	☼	70	56 - 92	5	30
Anthracene	36.9	U	3700	2570		ug/Kg	☼	70	57 - 97	6	30
Benzo[a]anthracene	36.9	U	3700	2930		ug/Kg	☼	79	61 - 116	8	30
Benzo[b]fluoranthene	37.3	J	3700	2550		ug/Kg	☼	68	51 - 116	7	30
Benzo[k]fluoranthene	36.9	U	3700	2830		ug/Kg	☼	77	53 - 111	9	30
Benzo[g,h,i]perylene	36.9	U	3700	3460		ug/Kg	☼	93	33 - 137	10	30
Benzo[a]pyrene	36.9	U	3700	2700		ug/Kg	☼	73	50 - 109	8	30

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-3051-6 MSD | **Client Sample ID: 1HBF-6**
Matrix: Solid | **Prep Type: Total/NA**
Analysis Batch: 65003 | **Prep Batch: 63746**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Bis(2-chloroethoxy)methane	36.9	U	3700	2520		ug/Kg	☼	68	49 - 93	9	30
Bis(2-chloroethyl)ether	37.1	U	3700	2460		ug/Kg	☼	67	42 - 95	9	30
Bis(2-ethylhexyl) phthalate	50.3	U	3700	2750		ug/Kg	☼	74	55 - 110	10	30
4-Bromophenyl phenyl ether	36.9	U	3700	2680		ug/Kg	☼	72	57 - 102	8	30
Butyl benzyl phthalate	36.9	U	3700	2760		ug/Kg	☼	75	54 - 105	8	30
Carbazole	36.9	U	3690	2610		ug/Kg	☼	71	58 - 98	8	30
4-Chloroaniline	36.9	U	3700	1690		ug/Kg	☼	46	32 - 74	5	30
4-Chloro-3-methylphenol	36.9	U	3700	2380		ug/Kg	☼	64	48 - 98	9	30
2-Chloronaphthalene	36.9	U	3700	2570		ug/Kg	☼	70	51 - 91	4	30
2-Chlorophenol	36.9	U	3700	2240		ug/Kg	☼	61	47 - 88	10	30
4-Chlorophenyl phenyl ether	36.9	U	3700	2480		ug/Kg	☼	67	55 - 94	4	30
Chrysene	36.9	U	3700	2600		ug/Kg	☼	70	52 - 104	8	30
Dibenz(a,h)anthracene	36.9	U	3700	3500		ug/Kg	☼	95	40 - 130	11	30
Dibenzofuran	36.9	U	3700	2440		ug/Kg	☼	66	54 - 89	5	30
Di-n-butyl phthalate	36.9	U	3700	2600		ug/Kg	☼	70	59 - 101	6	30
1,2-Dichlorobenzene	36.9	U	3700	2230		ug/Kg	☼	60	35 - 91	8	30
1,3-Dichlorobenzene	36.9	U	3700	2220		ug/Kg	☼	60	32 - 87	8	30
1,4-Dichlorobenzene	36.9	U	3700	2210		ug/Kg	☼	60	34 - 86	9	30
3,3'-Dichlorobenzidine	366	U	3700	1610	J	ug/Kg	☼	44	10 - 96	9	30
2,4-Dichlorophenol	36.9	U	3700	2260		ug/Kg	☼	61	48 - 90	7	30
Diethyl phthalate	36.9	U	3700	2490		ug/Kg	☼	67	57 - 97	6	30
2,4-Dimethylphenol	36.9	U	3700	2330		ug/Kg	☼	63	36 - 95	6	30
Dimethyl phthalate	71.2	J M	3700	2600		ug/Kg	☼	68	56 - 99	6	30
4,6-Dinitro-2-methylphenol	366	U	3700	2140		ug/Kg	☼	58	10 - 112	4	30
2,4-Dinitrophenol	366	U	3700	1610	J	ug/Kg	☼	43	10 - 92	4	30
2,4-Dinitrotoluene	36.9	U	3700	2630		ug/Kg	☼	71	57 - 100	5	30
2,6-Dinitrotoluene	36.9	U	3700	2590		ug/Kg	☼	70	59 - 97	5	30
Di-n-octyl phthalate	36.9	U	3700	2690		ug/Kg	☼	73	59 - 110	7	30
Fluoranthene	48.8	J	3700	2660		ug/Kg	☼	71	49 - 111	8	30
Fluorene	36.9	U	3700	2540		ug/Kg	☼	69	57 - 95	4	30
Hexachlorobenzene	36.9	U	3700	2610		ug/Kg	☼	71	54 - 103	8	30
Hexachlorobutadiene	36.9	U	3700	2180		ug/Kg	☼	59	36 - 92	10	30
Hexachlorocyclopentadiene	366	U	3700	1690	J	ug/Kg	☼	46	10 - 141	5	30
Hexachloroethane	36.9	U	3700	2270		ug/Kg	☼	61	26 - 93	12	30
Indeno[1,2,3-cd]pyrene	36.9	U	3700	3490		ug/Kg	☼	94	31 - 148	13	30
Isophorone	36.9	U	3700	1910		ug/Kg	☼	52	40 - 102	6	30
2-Methylnaphthalene	36.9	U	3700	2330		ug/Kg	☼	63	41 - 98	8	30
2-Methylphenol	36.9	U	3700	2290		ug/Kg	☼	62	45 - 93	6	30
3 & 4 Methylphenol	73.9	U	3700	2730		ug/Kg	☼	74	53 - 103	7	30
Naphthalene	36.9	U	3700	2340		ug/Kg	☼	63	46 - 88	7	30
2-Nitroaniline	36.9	U	3700	2570		ug/Kg	☼	69	55 - 98	8	30
3-Nitroaniline	36.9	U	3700	2440		ug/Kg	☼	66	48 - 95	4	30
4-Nitroaniline	366	U	3700	2360		ug/Kg	☼	64	47 - 95	8	30
Nitrobenzene	36.9	U	3700	2400		ug/Kg	☼	65	41 - 99	8	30
2-Nitrophenol	36.9	U	3700	2300		ug/Kg	☼	62	46 - 95	8	30
4-Nitrophenol	366	U Q	3700	1910		ug/Kg	☼	52	44 - 103	15	30
N-Nitrosodiphenylamine	36.9	U	3700	3420		ug/Kg	☼	93	53 - 127	6	30
N-Nitrosodi-n-propylamine	36.9	U	3700	2580		ug/Kg	☼	70	51 - 100	7	30

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-3051-6 MSD — **Client Sample ID: 1HBF-6**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65003 — **Prep Batch: 63746**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
bis (2-chloroisopropyl) ether	36.9	U	3700	2850		ug/Kg	☼	77	37 - 98	8	30
Pentachlorophenol	366	U	3700	1760		ug/Kg	☼	48	27 - 104	17	30
Phenanthrene	47.6	J	3700	2690		ug/Kg	☼	71	56 - 98	7	30
Phenol	36.9	U	3700	2290		ug/Kg	☼	62	44 - 89	8	30
Pyrene	47.1	J	3700	2730		ug/Kg	☼	73	46 - 110	9	30
1,2,4-Trichlorobenzene	36.9	U	3690	2310		ug/Kg	☼	63	41 - 90	6	30
2,4,5-Trichlorophenol	36.9	U	3700	2270		ug/Kg	☼	61	53 - 98	8	30
2,4,6-Trichlorophenol	36.9	U	3700	2340		ug/Kg	☼	63	49 - 94	7	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
2-Fluorophenol (Surr)	*69*		*43 - 103*
2,4,6-Tribromophenol (Surr)	*66*		*53 - 111*
Nitrobenzene-d5 (Surr)	*69*		*47 - 105*
Phenol-d5 (Surr)	*68*		*52 - 99*
Terphenyl-d14 (Surr)	*59*		*58 - 124*
2-Fluorobiphenyl (Surr)	*70*		*55 - 97*

Method: 8015B - Gasoline Range Organics - (GC)

Lab Sample ID: MB 160-63753/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (C6-C12)	0.0217	J	0.100	0.0100	mg/Kg		07/30/13 13:04	07/30/13 15:23	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Trifluorotoluene (Surr)	*107*		*49 - 112*	*07/30/13 13:04*	*07/30/13 15:23*	*1*

Lab Sample ID: LCS 160-63753/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Gasoline Range Organics (C6-C12)	1.00	0.998	M	mg/Kg		100	64 - 133

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Trifluorotoluene (Surr)	*100*	*M*	*49 - 112*

Lab Sample ID: LCSD 160-63753/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Gasoline Range Organics (C6-C12)	1.00	1.02	M	mg/Kg		102	64 - 133	2	20

Method: 8015B - Gasoline Range Organics - (GC) (Continued)

Lab Sample ID: LCSD 160-63753/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
Trifluorotoluene (Surr)	102	M	49 - 112

Method: 8015B - Diesel Range Organics (DRO) (GC)

Lab Sample ID: MB 160-61811/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10-C28]	0.333	U	25.0	0.333	mg/Kg		07/22/13 16:48	07/23/13 11:50	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	107		49 - 133	07/22/13 16:48	07/23/13 11:50	1

Lab Sample ID: LCS 160-61811/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Diesel Range Organics [C10-C28]	83.3	57.3	M	mg/Kg		69	48 - 102

Surrogate	LCS %Recovery	LCS Qualifier	Limits
o-Terphenyl	86	M	49 - 133

Lab Sample ID: 160-3051-4 MS — **Client Sample ID: 1HBF-4**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Diesel Range Organics [C10-C28]	0.368	U	92.1	96.4	M	mg/Kg	☼	105	18 - 140

Surrogate	MS %Recovery	MS Qualifier	Limits
o-Terphenyl	106	M	49 - 133

Lab Sample ID: 160-3051-4 MSD — **Client Sample ID: 1HBF-4**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Diesel Range Organics [C10-C28]	0.368	U	92.5	94.2	M	mg/Kg	☼	102	18 - 140	2	30

Surrogate	MSD %Recovery	MSD Qualifier	Limits
o-Terphenyl	103	M	49 - 133

Method: 8081B - Organochlorine Pesticides (GC)

Lab Sample ID: MB 160-62920/1-A
Matrix: Solid
Analysis Batch: 63749

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 62920

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aldrin	0.306	U	1.70	0.306	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
alpha-BHC	0.185	U	2.00	0.185	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
beta-BHC	0.300	U	1.70	0.300	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
delta-BHC	0.242	U	1.70	0.242	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
gamma-BHC (Lindane)	0.168	U	1.70	0.168	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
alpha-Chlordane	0.567	U	1.70	0.567	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
gamma-Chlordane	0.158	U	1.70	0.158	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
4,4'-DDD	0.221	U	1.70	0.221	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
4,4'-DDE	0.390	U	1.70	0.390	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
4,4'-DDT	0.628	U	1.70	0.628	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Dieldrin	0.215	U	1.70	0.215	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endosulfan I	0.570	U	1.70	0.570	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endosulfan II	0.235	U	1.70	0.235	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endosulfan sulfate	0.340	U	1.70	0.340	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endrin	0.158	U	1.70	0.158	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endrin aldehyde	0.389	U	1.70	0.389	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endrin ketone	0.417	U	1.70	0.417	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Heptachlor	0.204	U	2.00	0.204	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Heptachlor epoxide	0.429	U	1.70	0.429	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Methoxychlor	0.719	U	3.30	0.719	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Toxaphene	15.2	U	67.0	15.2	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Technical Chlordane	3.73	U	17.0	3.73	ug/Kg		07/25/13 15:00	07/30/13 02:41	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*76*		*29 - 150*	*07/25/13 15:00*	*07/30/13 02:41*	*1*
Tetrachloro-m-xylene	*87*		*41 - 125*	*07/25/13 15:00*	*07/30/13 02:41*	*1*

Lab Sample ID: LCS 160-62920/2-A
Matrix: Solid
Analysis Batch: 63749

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 62920

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aldrin	16.7	13.8		ug/Kg		83	51 - 116
alpha-BHC	16.7	13.9		ug/Kg		83	50 - 117
beta-BHC	16.7	13.5		ug/Kg		81	50 - 113
delta-BHC	16.7	14.6		ug/Kg		88	53 - 121
gamma-BHC (Lindane)	16.7	13.9		ug/Kg		83	50 - 114
alpha-Chlordane	16.7	14.7		ug/Kg		88	55 - 119
gamma-Chlordane	16.7	14.1		ug/Kg		85	52 - 120
4,4'-DDD	16.7	15.4		ug/Kg		92	53 - 134
4,4'-DDE	16.7	14.6		ug/Kg		88	55 - 123
4,4'-DDT	16.7	15.8		ug/Kg		95	57 - 138
Dieldrin	16.7	14.3		ug/Kg		86	54 - 124
Endosulfan I	16.7	8.33		ug/Kg		50	38 - 99
Endosulfan II	16.7	9.43		ug/Kg		57	42 - 105
Endosulfan sulfate	16.7	14.3		ug/Kg		86	54 - 126
Endrin	16.7	14.6	M	ug/Kg		88	55 - 124
Endrin aldehyde	16.7	13.2		ug/Kg		79	50 - 116

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: LCS 160-62920/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 63749 — **Prep Batch: 62920**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Endrin ketone	16.7	14.6		ug/Kg		87	53 - 129
Heptachlor	16.7	13.0		ug/Kg		78	40 - 140
Heptachlor epoxide	16.7	14.1		ug/Kg		85	53 - 118
Methoxychlor	16.7	16.8		ug/Kg		101	54 - 140

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*82*		*29 - 150*
Tetrachloro-m-xylene	*88*		*41 - 125*

Lab Sample ID: LCSD 160-62920/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 63749 — **Prep Batch: 62920**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aldrin	16.7	13.4		ug/Kg		80	51 - 116	3	30
alpha-BHC	16.7	13.6		ug/Kg		82	50 - 117	2	30
beta-BHC	16.7	12.8		ug/Kg		77	50 - 113	5	30
delta-BHC	16.7	13.6		ug/Kg		82	53 - 121	7	30
gamma-BHC (Lindane)	16.7	13.6		ug/Kg		81	50 - 114	2	30
alpha-Chlordane	16.7	13.9		ug/Kg		84	55 - 119	5	30
gamma-Chlordane	16.7	13.3		ug/Kg		80	52 - 120	6	30
4,4'-DDD	16.7	14.2		ug/Kg		85	53 - 134	8	30
4,4'-DDE	16.7	13.7		ug/Kg		82	55 - 123	7	30
4,4'-DDT	16.7	14.2		ug/Kg		85	57 - 138	11	30
Dieldrin	16.7	13.5		ug/Kg		81	54 - 124	6	30
Endosulfan I	16.7	7.78		ug/Kg		47	38 - 99	7	30
Endosulfan II	16.7	8.72		ug/Kg		52	42 - 105	8	30
Endosulfan sulfate	16.7	13.2		ug/Kg		79	54 - 126	8	30
Endrin	16.7	13.6		ug/Kg		82	55 - 124	7	30
Endrin aldehyde	16.7	12.3		ug/Kg		74	50 - 116	7	30
Endrin ketone	16.7	13.1		ug/Kg		79	53 - 129	11	30
Heptachlor	16.7	12.9		ug/Kg		77	40 - 140	1	30
Heptachlor epoxide	16.7	13.4		ug/Kg		80	53 - 118	5	30
Methoxychlor	16.7	14.1		ug/Kg		84	54 - 140	18	30

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*70*		*29 - 150*
Tetrachloro-m-xylene	*84*		*41 - 125*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 160-65908/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-T	7.93	U	20.0	7.93	ug/Kg		08/09/13 15:17	08/13/13 22:07	1

Method: 8151A - Herbicides (GC) (Continued)

Lab Sample ID: MB 160-65908/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	22.0	U	80.0	22.0	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
2,4-DB	43.8	U	80.0	43.8	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dalapon	38.5	U	40.0	38.5	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dinoseb	13.6	U	25.0	13.6	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dicamba	3.93	U	40.0	3.93	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dichlorprop	23.4	U	80.0	23.4	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
MCPA	3070	U	8000	3070	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Silvex (2,4,5-TP)	3.28	U	20.0	3.28	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
MCPP	4800	U	8000	4800	ug/Kg		08/09/13 15:17	08/13/13 22:07	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*82*		*50 - 150*	*08/09/13 15:17*	*08/13/13 22:07*	*1*

Lab Sample ID: LCS 160-65908/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4,5-T	50.0	37.2		ug/Kg		74	57 - 140
2,4-D	500	382		ug/Kg		76	68 - 140
2,4-DB	500	387		ug/Kg		77	54 - 140
Dalapon	1250	742		ug/Kg		59	25 - 121
Dinoseb	250	67.5		ug/Kg		27	10 - 108
Dicamba	50.0	38.0	J	ug/Kg		76	62 - 140
Dichlorprop	500	443		ug/Kg		89	59 - 140
MCPA	50200	43200		ug/Kg		86	48 - 140
Silvex (2,4,5-TP)	50.0	40.6		ug/Kg		81	51 - 140
MCPP	50100	40900		ug/Kg		82	45 - 140

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*79*		*50 - 150*

Lab Sample ID: 160-3051-2 MS — **Client Sample ID: 1HBF-2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4,5-T	8.79	U H	55.4	41.4		ug/Kg	☼	75	36 - 150
2,4-D	24.4	U H	554	441		ug/Kg	☼	80	29 - 150
2,4-DB	48.6	U H	554	470		ug/Kg	☼	85	35 - 150
Dalapon	42.7	U H	1390	732		ug/Kg	☼	53	14 - 129
Dinoseb	15.1	U H J	277	22.7	J	ug/Kg	☼	8	10 - 108
Dicamba	4.36	U H	55.4	49.8		ug/Kg	☼	90	33 - 150
Dichlorprop	25.9	U H	554	531		ug/Kg	☼	96	27 - 150
MCPA	3400	U H	55700	47600		ug/Kg	☼	85	43 - 150
Silvex (2,4,5-TP)	3.64	U H	55.4	48.9		ug/Kg	☼	88	50 - 150
MCPP	5320	U H	55600	48400		ug/Kg	☼	87	39 - 150

Method: 8151A - Herbicides (GC) (Continued)

Lab Sample ID: 160-3051-2 MS
Matrix: Solid
Analysis Batch: 66551

Client Sample ID: 1HBF-2
Prep Type: Total/NA
Prep Batch: 65908

Surrogate	MS %Recovery	MS Qualifier	Limits
2,4-Dichlorophenylacetic acid	*91*		*50 - 150*

Lab Sample ID: 160-3051-2 MSD
Matrix: Solid
Analysis Batch: 66551

Client Sample ID: 1HBF-2
Prep Type: Total/NA
Prep Batch: 65908

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2,4,5-T	8.79	U H	55.5	45.1		ug/Kg	☼	81	36 - 150	9	30
2,4-D	24.4	U H	555	504		ug/Kg	☼	91	29 - 150	13	30
2,4-DB	48.6	U H	555	546		ug/Kg	☼	98	35 - 150	15	30
Dalapon	42.7	U H	1390	892		ug/Kg	☼	64	14 - 129	20	30
Dinoseb	15.1	U H J	278	33.4	J	ug/Kg	☼	12	10 - 108	38	30
Dicamba	4.36	U H	55.5	47.9		ug/Kg	☼	86	33 - 150	4	30
Dichlorprop	25.9	U H	555	558		ug/Kg	☼	100	27 - 150	5	30
MCPA	3400	U H	55800	49900		ug/Kg	☼	89	43 - 150	5	30
Silvex (2,4,5-TP)	3.64	U H	55.5	50.5		ug/Kg	☼	91	50 - 150	3	30
MCPP	5320	U H	55700	51000		ug/Kg	☼	92	39 - 150	5	30

Surrogate	MSD %Recovery	MSD Qualifier	Limits
2,4-Dichlorophenylacetic acid	*90*		*50 - 150*

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 160-65521/1-A
Matrix: Solid
Analysis Batch: 65968

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 65521

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	12.7	U	18.1	12.7	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Antimony	0.580	U	0.905	0.580	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Arsenic	0.287	U	0.905	0.287	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Barium	0.226	U	4.53	0.226	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Beryllium	0.153	U	0.453	0.153	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Cadmium	0.0905	U	0.453	0.0905	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Calcium	12.0	U	226	12.0	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Chromium	0.278	U	0.905	0.278	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Cobalt	0.850	U	4.53	0.850	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Copper	0.658	U	2.26	0.658	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Iron	2.69	U	9.05	2.69	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Lead	0.156	U	0.905	0.156	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Magnesium	7.52	U	90.5	7.52	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Manganese	0.139	U	0.905	0.139	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Nickel	0.204	U	3.62	0.204	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Potassium	305	U	453	305	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Selenium	0.262	U	1.36	0.262	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Silver	0.212	U	0.905	0.212	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Sodium	42.6	U	90.5	42.6	mg/Kg		08/08/13 09:12	08/09/13 18:42	1

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: MB 160-65521/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Thallium	1.37	U	1.81	1.37	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Vanadium	1.14	U	4.53	1.14	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Zinc	1.79	U	4.53	1.79	mg/Kg		08/08/13 09:12	08/09/13 18:42	1

Lab Sample ID: LCS 160-65521/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	9780	5650		mg/Kg		58	44 - 155
Antimony	121	61.7		mg/Kg		51	21 - 251
Arsenic	109	95.9		mg/Kg		88	70 - 131
Barium	325	285		mg/Kg		88	74 - 125
Beryllium	92.1	81.6		mg/Kg		89	74 - 126
Cadmium	110	98.7		mg/Kg		90	73 - 139
Calcium	6700	5660		mg/Kg		84	74 - 125
Chromium	93.4	82.0		mg/Kg		88	69 - 130
Cobalt	133	126		mg/Kg		94	74 - 125
Copper	74.7	65.0		mg/Kg		87	73 - 126
Iron	13100	9380		mg/Kg		72	32 - 167
Lead	152	137		mg/Kg		90	73 - 126
Magnesium	2980	2280		mg/Kg		77	66 - 134
Manganese	443	374		mg/Kg		84	77 - 124
Nickel	109	100		mg/Kg		92	72 - 126
Potassium	2770	1940		mg/Kg		70	61 - 138
Selenium	207	176		mg/Kg		85	69 - 131
Silver	51.9	43.6		mg/Kg		84	66 - 133
Sodium	724	613		mg/Kg		85	56 - 144
Thallium	171	163		mg/Kg		95	68 - 131
Vanadium	110	89.4		mg/Kg		81	67 - 132
Zinc	299	264		mg/Kg		88	71 - 128

Lab Sample ID: 160-3051-3 MS — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	3510	J	927	7800	J	mg/Kg	☼	463	75 - 125
Antimony	1.28	U J	46.4	25.8	J	mg/Kg	☼	56	75 - 125
Arsenic	3.33		92.7	90.7		mg/Kg	☼	94	75 - 125
Barium	18.0		92.7	112		mg/Kg	☼	101	75 - 125
Beryllium	0.339	U	92.7	87.8		mg/Kg	☼	95	75 - 125
Cadmium	0.200	U	92.7	89.6		mg/Kg	☼	97	75 - 125
Calcium	2070	J	927	2000	J	mg/Kg	☼	-8	75 - 125
Chromium	14.4		92.7	120		mg/Kg	☼	113	75 - 125
Cobalt	4.51	J	92.7	99.9		mg/Kg	☼	103	75 - 125
Copper	5.59		92.7	95.2		mg/Kg	☼	97	75 - 125
Iron	10500	J	927	15900	4	mg/Kg	☼	575	75 - 125
Lead	7.07		92.7	101		mg/Kg	☼	101	75 - 125

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: 160-3051-3 MS — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Magnesium	845	J	927	2460	J	mg/Kg	☼	174	75 - 125
Manganese	86.8		92.7	182		mg/Kg	☼	103	75 - 125
Nickel	5.29	J	92.7	102		mg/Kg	☼	104	75 - 125
Potassium	885	J	927	3000	J	mg/Kg	☼	228	75 - 125
Selenium	0.579	U	92.7	86.7		mg/Kg	☼	94	75 - 125
Silver	0.469	U J	9.27	7.14		mg/Kg	☼	77	75 - 125
Sodium	94.4	U	927	922		mg/Kg	☼	99	75 - 125
Thallium	3.02	U	18.5	19.5		mg/Kg	☼	105	75 - 125
Vanadium	15.1		92.7	109		mg/Kg	☼	101	75 - 125
Zinc	19.1		92.7	115		mg/Kg	☼	104	75 - 125

Lab Sample ID: 160-3051-3 MSD — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	3510	J	994	7010	J	mg/Kg	☼	353	75 - 125	11	30
Antimony	1.28	U J	49.7	30.2	J	mg/Kg	☼	61	75 - 125	16	30
Arsenic	3.33		99.4	93.9		mg/Kg	☼	91	75 - 125	3	30
Barium	18.0		99.4	114		mg/Kg	☼	97	75 - 125	2	30
Beryllium	0.339	U	99.4	92.5		mg/Kg	☼	93	75 - 125	5	30
Cadmium	0.200	U	99.4	92.9		mg/Kg	☼	93	75 - 125	4	30
Calcium	2070	J	994	2140	J	mg/Kg	☼	7	75 - 125	7	30
Chromium	14.4		99.4	118		mg/Kg	☼	104	75 - 125	2	30
Cobalt	4.51	J	99.4	103		mg/Kg	☼	99	75 - 125	3	30
Copper	5.59		99.4	97.8		mg/Kg	☼	93	75 - 125	3	30
Iron	10500	J	994	14600	4	mg/Kg	☼	406	75 - 125	9	30
Lead	7.07		99.4	101		mg/Kg	☼	95	75 - 125	0	30
Magnesium	845	J	994	2310	J	mg/Kg	☼	148	75 - 125	6	30
Manganese	86.8		99.4	194		mg/Kg	☼	108	75 - 125	6	30
Nickel	5.29	J	99.4	104		mg/Kg	☼	99	75 - 125	2	30
Potassium	885	J	994	2960	J	mg/Kg	☼	209	75 - 125	1	30
Selenium	0.579	U	99.4	90.2		mg/Kg	☼	91	75 - 125	4	30
Silver	0.469	U J	9.94	7.35	J	mg/Kg	☼	74	75 - 125	3	30
Sodium	94.4	U	994	969		mg/Kg	☼	97	75 - 125	5	30
Thallium	3.02	U	19.9	20.3		mg/Kg	☼	102	75 - 125	4	30
Vanadium	15.1		99.4	111		mg/Kg	☼	97	75 - 125	2	30
Zinc	19.1		99.4	113		mg/Kg	☼	95	75 - 125	2	30

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Lab Sample ID: MB 160-63941/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0104	U	0.0313	0.0104	mg/Kg		07/31/13 10:00	08/01/13 06:33	1

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique) (Continued)

Lab Sample ID: LCS 160-63941/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	16.3	16.9		mg/Kg		103	51 - 148

Lab Sample ID: 160-3051-3 MS — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.0481		0.857	0.971		mg/Kg	☼	108	80 - 120

Lab Sample ID: 160-3051-3 MSD — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.0481		0.882	1.01		mg/Kg	☼	109	80 - 120	4	30

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-62495/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62943 — **Prep Batch: 62495**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.04266	U	0.102	0.102		0.208	pCi/g	07/24/13 15:46	07/25/13 07:27	1
Cesium-137	-0.003458	U	0.0292	0.0292	0.200	0.0571	pCi/g	07/24/13 15:46	07/25/13 07:27	1
Thorium-232	0.04266	U	0.102	0.102		0.208	pCi/g	07/24/13 15:46	07/25/13 07:27	1

Other Detected Radionuclides	*MB Result*	*MB Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Other Detected Radionuclide	*None*						*pCi/g*	*07/24/13 15:46*	*07/25/13 07:27*	*1*

Lab Sample ID: LCS 160-62495/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62944 — **Prep Batch: 62495**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	103.2		10.8		1.16	pCi/g	106	87 - 116
Cesium-137	31.7	31.51		3.36	0.200	0.325	pCi/g	99	87 - 120
Cobalt-60	25.0	25.05		2.57		0.188	pCi/g	100	87 - 115

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: 160-3051-1 DU
Matrix: Solid
Analysis Batch: 62943

Client Sample ID: 1HBF-1
Prep Type: Total/NA
Prep Batch: 62495

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium-228	0.351		0.4107		0.152		0.160	pCi/g	0.16	1
Cesium-137	0.0239	U	0.01356	U	0.0336	0.200	0.0590	pCi/g	0.11	1
Thorium-232	0.351		0.4107		0.152		0.160	pCi/g	0.16	1

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

GC/MS VOA

Prep Batch: 63739

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	5035	
LCS 160-63739/2-A	Lab Control Sample	Total/NA	Solid	5035	
LCSD 160-63739/3-A	Lab Control Sample Dup	Total/NA	Solid	5035	
MB 160-63739/1-A	Method Blank	Total/NA	Solid	5035	

Analysis Batch: 64629

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	8260C	63739
LCS 160-63739/2-A	Lab Control Sample	Total/NA	Solid	8260C	63739
LCSD 160-63739/3-A	Lab Control Sample Dup	Total/NA	Solid	8260C	63739
MB 160-63739/1-A	Method Blank	Total/NA	Solid	8260C	63739

GC/MS Semi VOA

Prep Batch: 63746

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-6	1HBF-6	Total/NA	Solid	3550C	
160-3051-6 MS	1HBF-6	Total/NA	Solid	3550C	
160-3051-6 MSD	1HBF-6	Total/NA	Solid	3550C	
LCS 160-63746/2-A	Lab Control Sample	Total/NA	Solid	3550C	
MB 160-63746/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 65003

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-6	1HBF-6	Total/NA	Solid	8270D	63746
160-3051-6 MS	1HBF-6	Total/NA	Solid	8270D	63746
160-3051-6 MSD	1HBF-6	Total/NA	Solid	8270D	63746
LCS 160-63746/2-A	Lab Control Sample	Total/NA	Solid	8270D	63746
MB 160-63746/1-A	Method Blank	Total/NA	Solid	8270D	63746

GC VOA

Prep Batch: 63753

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	5030B	
LCS 160-63753/2-A	Lab Control Sample	Total/NA	Solid	5030B	
LCSD 160-63753/3-A	Lab Control Sample Dup	Total/NA	Solid	5030B	
MB 160-63753/1-A	Method Blank	Total/NA	Solid	5030B	

Analysis Batch: 64066

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	8015B	63753
LCS 160-63753/2-A	Lab Control Sample	Total/NA	Solid	8015B	63753
LCSD 160-63753/3-A	Lab Control Sample Dup	Total/NA	Solid	8015B	63753
MB 160-63753/1-A	Method Blank	Total/NA	Solid	8015B	63753

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

GC Semi VOA

Prep Batch: 61811

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	3550C	
160-3051-4 MS	1HBF-4	Total/NA	Solid	3550C	
160-3051-4 MSD	1HBF-4	Total/NA	Solid	3550C	
LCS 160-61811/2-A	Lab Control Sample	Total/NA	Solid	3550C	
MB 160-61811/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 62106

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	8015B	61811
160-3051-4 MS	1HBF-4	Total/NA	Solid	8015B	61811
160-3051-4 MSD	1HBF-4	Total/NA	Solid	8015B	61811
LCS 160-61811/2-A	Lab Control Sample	Total/NA	Solid	8015B	61811
MB 160-61811/1-A	Method Blank	Total/NA	Solid	8015B	61811

Prep Batch: 62920

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	3550C	
LCS 160-62920/2-A	Lab Control Sample	Total/NA	Solid	3550C	
LCSD 160-62920/3-A	Lab Control Sample Dup	Total/NA	Solid	3550C	
MB 160-62920/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 63749

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	8081B	62920
LCS 160-62920/2-A	Lab Control Sample	Total/NA	Solid	8081B	62920
LCSD 160-62920/3-A	Lab Control Sample Dup	Total/NA	Solid	8081B	62920
MB 160-62920/1-A	Method Blank	Total/NA	Solid	8081B	62920

Prep Batch: 65908

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-2	1HBF-2	Total/NA	Solid	8151A	
160-3051-2 MS	1HBF-2	Total/NA	Solid	8151A	
160-3051-2 MSD	1HBF-2	Total/NA	Solid	8151A	
LCS 160-65908/2-A	Lab Control Sample	Total/NA	Solid	8151A	
MB 160-65908/1-A	Method Blank	Total/NA	Solid	8151A	

Analysis Batch: 66551

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-2	1HBF-2	Total/NA	Solid	8151A	65908
160-3051-2 MS	1HBF-2	Total/NA	Solid	8151A	65908
160-3051-2 MSD	1HBF-2	Total/NA	Solid	8151A	65908
LCS 160-65908/2-A	Lab Control Sample	Total/NA	Solid	8151A	65908
MB 160-65908/1-A	Method Blank	Total/NA	Solid	8151A	65908

Metals

Prep Batch: 63941

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	7471B	
160-3051-3 MS	1HBF-3	Total/NA	Solid	7471B	

Metals (Continued)

Prep Batch: 63941 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3 MSD	1HBF-3	Total/NA	Solid	7471B	
LCS 160-63941/2-A	Lab Control Sample	Total/NA	Solid	7471B	
MB 160-63941/1-A	Method Blank	Total/NA	Solid	7471B	

Analysis Batch: 64289

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	7471B	63941
160-3051-3 MS	1HBF-3	Total/NA	Solid	7471B	63941
160-3051-3 MSD	1HBF-3	Total/NA	Solid	7471B	63941
LCS 160-63941/2-A	Lab Control Sample	Total/NA	Solid	7471B	63941
MB 160-63941/1-A	Method Blank	Total/NA	Solid	7471B	63941

Prep Batch: 65521

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	3050B	
160-3051-3 MS	1HBF-3	Total/NA	Solid	3050B	
160-3051-3 MSD	1HBF-3	Total/NA	Solid	3050B	
LCS 160-65521/2-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 160-65521/1-A	Method Blank	Total/NA	Solid	3050B	

Analysis Batch: 65968

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	6010C	65521
160-3051-3 MS	1HBF-3	Total/NA	Solid	6010C	65521
160-3051-3 MSD	1HBF-3	Total/NA	Solid	6010C	65521
LCS 160-65521/2-A	Lab Control Sample	Total/NA	Solid	6010C	65521
MB 160-65521/1-A	Method Blank	Total/NA	Solid	6010C	65521

General Chemistry

Analysis Batch: 63231

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-2	1HBF-2	Total/NA	Solid	Moisture	
160-3051-3	1HBF-3	Total/NA	Solid	Moisture	
160-3051-4	1HBF-4	Total/NA	Solid	Moisture	
160-3051-5	1HBF-5	Total/NA	Solid	Moisture	
160-3051-6	1HBF-6	Total/NA	Solid	Moisture	
160-3069-A-10 DU	Duplicate	Total/NA	Solid	Moisture	
160-3139-A-7 MS	Matrix Spike	Total/NA	Solid	Moisture	
160-3139-A-7 MSD	Matrix Spike Duplicate	Total/NA	Solid	Moisture	

Rad

Leach Batch: 61789

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-1	1HBF-1	Total/NA	Solid	Dry and Grind	
160-3051-1 DU	1HBF-1	Total/NA	Solid	Dry and Grind	

Rad (Continued)

Prep Batch: 62495

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-1	1HBF-1	Total/NA	Solid	Fill_Geo-0	61789
160-3051-1 DU	1HBF-1	Total/NA	Solid	Fill_Geo-0	61789
LCS 160-62495/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-62495/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Surrogate Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	12DCE
Lab Sample ID	Client Sample ID	(78-133)	(83-122)	(65-140)	(78-132)
160-3051-5	1HBF-5	93	102	105	97
LCS 160-63739/2-A	Lab Control Sample	105	101	101	103
LCSD 160-63739/3-A	Lab Control Sample Dup	104	98	101	99
MB 160-63739/1-A	Method Blank	94	100	104	102

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)					
		2FP	TBP	NBZ	PHL	TPH	FBP
Lab Sample ID	Client Sample ID	(43-103)	(53-111)	(47-105)	(52-99)	(58-124)	(55-97)
160-3051-6	1HBF-6	53	53	53	53	48 J	56
160-3051-6 MS	1HBF-6	63	64	64	64	56 J	69
160-3051-6 MSD	1HBF-6	69	66	69	68	59	70
LCS 160-63746/2-A	Lab Control Sample	74	65	70	73	64	75
MB 160-63746/1-A	Method Blank	75	61	71	75	72	73

Surrogate Legend

2FP = 2-Fluorophenol (Surr)
TBP = 2,4,6-Tribromophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPH = Terphenyl-d14 (Surr)
FBP = 2-Fluorobiphenyl (Surr)

Method: 8015B - Gasoline Range Organics - (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		TFT1
Lab Sample ID	Client Sample ID	(49-112)
160-3051-5	1HBF-5	110
LCS 160-63753/2-A	Lab Control Sample	100 M
LCSD 160-63753/3-A	Lab Control Sample Dup	102 M
MB 160-63753/1-A	Method Blank	107

Surrogate Legend

TFT = Trifluorotoluene (Surr)

Surrogate Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Method: 8015B - Diesel Range Organics (DRO) (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		OTPH1
Lab Sample ID	Client Sample ID	(49-133)
160-3051-4	1HBF-4	98 M
160-3051-4 MS	1HBF-4	106 M
160-3051-4 MSD	1HBF-4	103 M
LCS 160-61811/2-A	Lab Control Sample	86 M
MB 160-61811/1-A	Method Blank	107

Surrogate Legend

OTPH = o-Terphenyl

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCB1	DCB2	TCX1	TCX2
Lab Sample ID	Client Sample ID	(29-150)	(29-150)	(41-125)	(41-125)
160-3051-4	1HBF-4	100 M	80 M	97	88 M
LCS 160-62920/2-A	Lab Control Sample	92	82	91	88
LCSD 160-62920/3-A	Lab Control Sample Dup	79	70	87	84
MB 160-62920/1-A	Method Blank	82	76	88	87

Surrogate Legend

DCB = DCB Decachlorobiphenyl (Surr)
TCX = Tetrachloro-m-xylene

Method: 8151A - Herbicides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		DCPA2
Lab Sample ID	Client Sample ID	(50-150)
160-3051-2	1HBF-2	83
160-3051-2 MS	1HBF-2	91
160-3051-2 MSD	1HBF-2	90
LCS 160-65908/2-A	Lab Control Sample	79
MB 160-65908/1-A	Method Blank	82

Surrogate Legend

DCPA = 2,4-Dichlorophenylacetic acid

Appendix F

IR Work Permits

PWD SOUTH POTOMAC EXCAVATION PERMIT

MAXIMO #:	CWAP Tracking #:

Section A - Excavation Information

(Completed by person/contractor performing excavation) **Your Control #**

a. Gov't. Contract #:	b. Contract Delivery Order	c. Title of Contract	
W52P1J-08-D-0034	0092	Site 1 Removal Action, Naval Support Facility, Indian Head	
d. If contract, name of Gov't. Contracting Officer Representative (COR): Mr. Frank Whitaker		e. COR Phone #: (309) 782-5062	f. Cell#: (309) 716-8848
g. Name of Contractor's Project Manager to be on-site during work: Daniel Spicuzza/Adolfo Matus Jr.		h. PM Phone #: (412) 848-7022/(415) 203-0049	i. Cell #: (412) 848-7022/(415) 203-0049
j. Organization and/or Contractor's Name: Aleut World Solutions, LLC		k. Date requested: 9/22/15	l. Date required: 10/5/15

m. Excavation Site: IR Site 1 behind Building 1662.	Bldg #: 1662

n. Description of work, location, and justification:
Remediation of soils impacted with radioactive material behind Building 1662. Maximum depth of excavation is 4' bgs. It is estimated that approximately 298 tons of soil will be packaged and transported off site for disposal. Work will take place from 5 October 2015 to approximately 4 December 2015 when the site is backfilled and restored.

(Identify and attach drawings and sketches clearly showing the location and scope of work)

o. Printed name of Permit Holder (first name, last name) and Signature	p. Telephone #: (412) 848-7022
Daniel Spicuzza [signature]	FAX #: (888) 705-7408

Note: It is the responsibility of all contractors to notify Miss Utility prior to any excavation.

Miss Utility Certification

Miss Utility contact date: 9/29/15 *Ticket #:* 15638115 *Validation Date:* 10/5/15

Section B – Excavation Requirements – (See Clearances, Next Page)

(Approved CWAP Required)

a. Special conditions affecting excavation identified in the CWAP? Yes (No) (If Yes, explain)

b. Building Technician	c. Telephone #:	d. Date:

Section D – Excavation Approval

(Completed by APWO)

This Permit:
1. Does not authorize relocating excavated soils or materials outside the immediate job site unless specifically indicated.
2. Must be at the excavation site and available for inspection by government representatives.
3. Must be signed by APWO to be valid.
4. Permit is good for 90 days from date of approval.

Report all spills (oil, fuel, chemical) to the NDW Fire Department by dialing *301-744-4333*.

If any of the general or special conditions of this permit conflict with contractual requirements, the Contracting Officer must be contacted prior to excavation.

Site APWO Approval Signature:	Date:
[signature]	9.30.15

Wray, Travis W CIV Navfac Wash, Indian Head

From: McQuiston, Richard L CIV Navfac Wash, Indian Head
Sent: Thursday, September 24, 2015 16:41
To: Wray, Travis W CIV Navfac Wash, Indian Head
Subject: RE: dig permit for IR Site 1 Soil Removal
Attachments: IR1 Dig Permit.pdf
Signed By: richard.l.mcquiston@navy.mil

Sounds like a job, ensure they dig with caution.

R/Rick

-----Original Message-----
From: Wray, Travis W CIV Navfac Wash, Indian Head
Sent: Thursday, September 24, 2015 10:12 AM
To: McQuiston, Richard L CIV Navfac Wash, Indian Head; Hayden, Edward M CIV NAVFAC, Washington; Vanasse, Randy J CIV NAVFAC Washington, Public Work Dept; Butler, Shawn A CIV Navfac Wash, Indian Head; Adams, Chris A CIV NDW HQ, N65
Cc: Lindsay, William M CIV Navfac Wash, Indian Head
Subject: dig permit for IR Site 1 Soil Removal

All:

When you get a chance, please review the attached dig permit application for work at IR Site 1 near building 1662. Work involves excavation of the soil and replacement with clean fill. The attached maps shows the proposed location of excavation in red outline and yellow fill.

Randy - please respond for riverwater and potable water since it looks like Eddie is out of the office until early October

Let me know if you have any questions,

Travis Wray
Environmental Planning Multi Media
NSF Indian Head
(301) 744-2262
travis.wray@navy.mil

Wray, Travis W CIV Navfac Wash, Indian Head

From: Butler, Shawn A CIV Navfac Wash, Indian Head
Sent: Thursday, September 24, 2015 10:27
To: Wray, Travis W CIV Navfac Wash, Indian Head
Subject: RE: dig permit for IR Site 1 Soil Removal
Signed By: SHAWN.A.BUTLER@NAVY.MIL

Clear to dig with proper markings

-----Original Message-----
From: Wray, Travis W CIV Navfac Wash, Indian Head
Sent: Thursday, September 24, 2015 10:12 AM
To: McQuiston, Richard L CIV Navfac Wash, Indian Head; Hayden, Edward M CIV NAVFAC, Washington; Vanasse, Randy J CIV NAVFAC Washington, Public Work Dept; Butler, Shawn A CIV Navfac Wash, Indian Head; Adams, Chris A CIV NDW HQ, N65
Cc: Lindsay, William M CIV Navfac Wash, Indian Head
Subject: dig permit for IR Site 1 Soil Removal

All:

When you get a chance, please review the attached dig permit application for work at IR Site 1 near building 1662. Work involves excavation of the soil and replacement with clean fill. The attached maps shows the proposed location of excavation in red outline and yellow fill.

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Let me know if you have any questions,

Travis Wray
Environmental Planning Multi Media
NSF Indian Head
(301) 744-2262
travis.wray@navy.mil

Wray, Travis W CIV Navfac Wash, Indian Head

From: Adams, Chris A CIV NDW HQ, N65
Sent: Thursday, September 24, 2015 10:13
To: Wray, Travis W CIV Navfac Wash, Indian Head; McQuiston, Richard L CIV Navfac Wash, Indian Head; Hayden, Edward M CIV NAVFAC, Washington; Vanasse, Randy J CIV NAVFAC Washington, Public Work Dept; Butler, Shawn A CIV Navfac Wash, Indian Head
Cc: Lindsay, William M CIV Navfac Wash, Indian Head
Subject: RE: dig permit for IR Site 1 Soil Removal
Signed By: chris.a.adams@navy.mil

Ok to dig with proper marking.

V/r,

Chris A. Adams, MBA
Naval Support Activity South Potomac
Telecommunications Specialist

(301) 744-6700 Office
(301) 684-0212 Cell
(301) 744-4913 Fax

-----Original Message-----
From: Wray, Travis W CIV Navfac Wash, Indian Head
Sent: Thursday, September 24, 2015 10:12 AM
To: McQuiston, Richard L CIV Navfac Wash, Indian Head; Hayden, Edward M CIV NAVFAC, Washington; Vanasse, Randy J CIV NAVFAC Washington, Public Work Dept; Butler, Shawn A CIV Navfac Wash, Indian Head; Adams, Chris A CIV NDW HQ, N65
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Subject: dig permit for IR Site 1 Soil Removal

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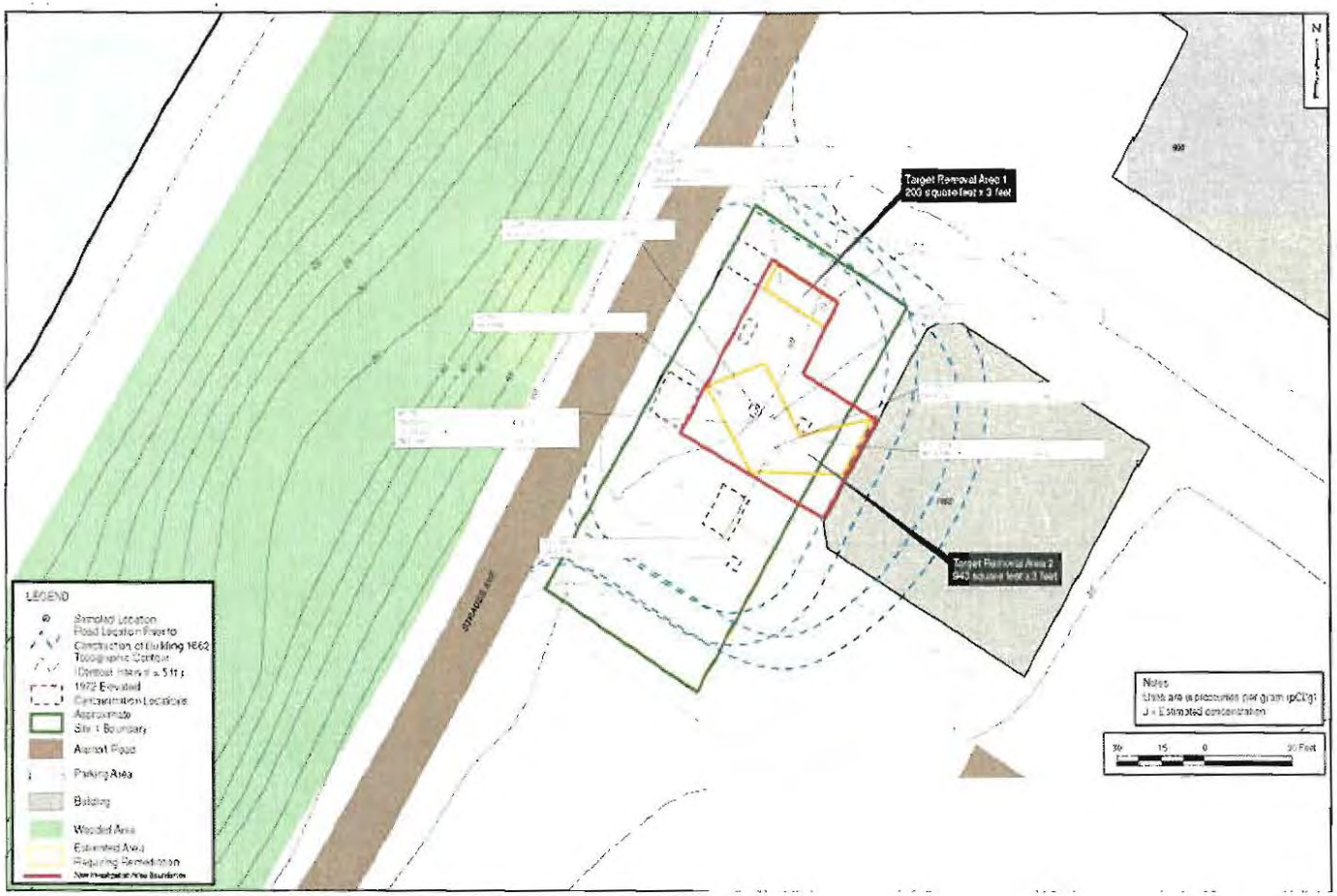
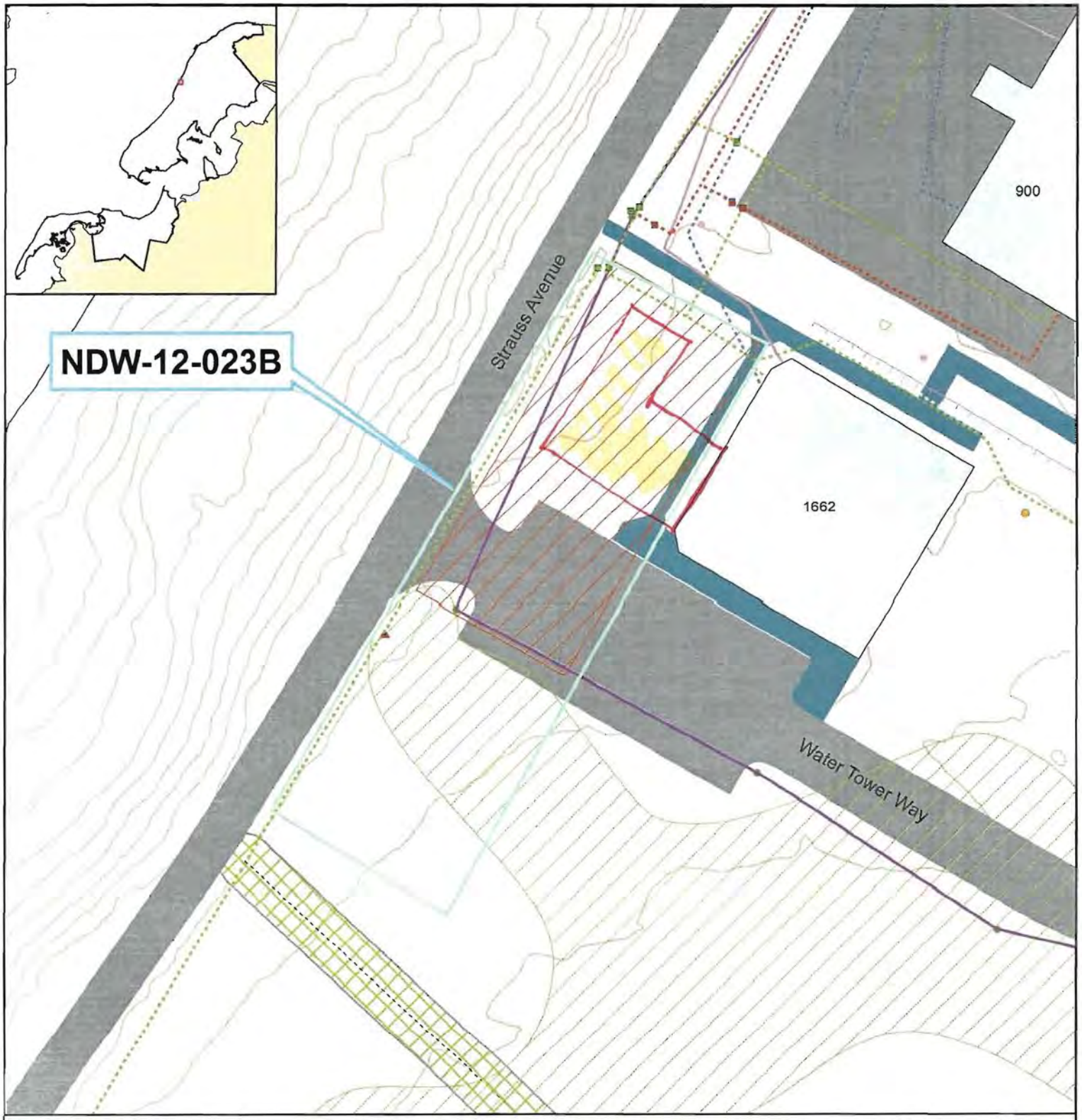
When you get a chance, please review the attached dig permit application for work at IR Site 1 near building 1662. Work involves excavation of the soil and replacement with clean fill. The attached maps shows the proposed location of excavation in red outline and yellow fill.

Randy - please respond for riverwater and potable water since it looks like Eddie is out of the office until early October

Let me know if you have any questions,

Travis Wray
Environmental Planning Multi Media
NSF Indian Head
(301) 744-2262
travis.wray@navy.mil


Target Removal Area 1
200 square feet x 3 feet
Target Removal Area 2
943 square feet x 3 feet
N
LEGEND
Sampling Location
Road Location Prior to
Construction of Building 1662
Topographic Contour
(Contour Interval = 5 ft.)
1972 Excavated
Contamination Locations
Approximate
Site 1 Boundary
Asphalt Road
Parking Area
Building
Wooded Area
Excavated Area
Requiring Remediation
Notes
Units are picocuries per gram (pCi/g)
J = Estimated concentration
30
15
0
30 Feet



NSFIH Work Approval Permit

0 20 40 80 120 160 Feet

Work Area
Buildings
Structures
Historic Structures
Pet Boxes
Survey Control Point
Fence
K24 ESQD Arc
K18 ESQD Arc
Inhabited Building ESQD Arc
Species Protection Area
Eagle Protection Areas
IR Sites
Munitions Response Area
Cultural Protection Area
Worker Notification Area
Wetland
Surface Water Bodies
Contour Line

Streams
Permanent
Intermittent
Dry

Road, Parking, Sidewalks
Roads, Parking Lots
Sidewalk

Utilities
Riverwater Valve
Fire Hydrant
Riverwater
Potable
Potable Valve
Sanitary Sewer
Steam
Compressed Air
Industrial
Industrial Valve
Stormwater

Electrical, Communications
Telephone, Fiber Optic
Aboveground Electric
Underground Electric
Transformers
Utility Poles
Lightning Masts
Light Poles

DISCLAIMER: Utilities depicted are believed to be accurate to +/- 15 feet.

N W E S

NOTE: This map was created using data from the NSA South Potomac GeoReadiness database. While performing work, if any underground utilities or item(s) are detected and are not shown on this plan, please detail an approximate location and give description of item(s) to the NAVFAC FMD GIS Analyst (Shelley Alongi, x2256, shelley.alongi@navy.mil).

1:600

IR Work Approval Permit

1/24/2011 Revision

NSASP Comprehensive Work Approval Planning (CWAP) – NSF Indian Head

Section A. Customer Information

Tracking Number: NDW-12-023D

Project Name: Site 1 Removal Action (Renewal)

Application Date: 8/12/2015 **Building Number(s):** 1662

Organization Submitting Application: NAVFAC **Organization Funding Proposed Action:** NAVFAC

Name of Applicant: Travis Wray **POC from Funding Organization:** Joe Rail

Phone Ext: x2262 **POC Phone Ext:** 202-685-3105

Email: travis.wray@navy.mil **POC Email:** joseph.rail@navy.mil

Anticipated Dates of Work: Start: 10/5/2015 **Completion:** 12/31/2015 **Expiration Date:** 365 Days from Date of Approval

Section B. Site Issues

Checked Issues must be approved by the appropriate Resource Manager.

Work Restriction Area	Approval Date	Work Restriction Area	Approval Date
☐ Explosives Safety		☐ Air Emissions	
☐ Survey Control/Property Points		☑ Waste (Hazard and Non-Hazard)	9/18/2015
☑ Earth Disturbance	9/18/2015	☐ Archeological Area	
☑ Installation Restoration (IR) Site	9/18/2015	☐ Historic Building	
☑ Worker Safety	9/18/2015	☑ Buried Utilities	9/18/2015
☐ Surface Water/Wetlands/Floodplain		☐ Munitions Response (MRP) Site	
☑ Stormwater Management	9/18/2015	☐ Other Pipe Work	
☐ Eagle Nest Buffer		☑ Other Work Restriction Area	9/18/2015
☐ Natural Resources/Species Protection		☐ No Work Restriction Areas	

Land Use Site Approval Required? ○ Yes ● No | Real Estate Package Required? ○ Yes ● No | IMIG/RMIG Review Required? ○ Yes ● No

Conditions Identified for Work Execution

Earth Disturbance Conditions

Work shall be conducted in accordance to the MDE reviewed SEC plans.

Stormwater Management Conditions

Workers must follow MDE reviewed plans.

IR Site Conditions

Work must be conducted in accordance with the work plan.

Worker Safety Conditions

Workers must follow the health and safety work plan and wear the proper PPE.

Waste (Hazard and Non-Hazard) Conditions

Coordinate with the Environmental Office (x2268) for storage and disposal of the IDW.

Buried Utilities Conditions

Utility location required before any earth disturbance.

Other Work Restrictions

- Work will impact the parking next to building 1662. Coordinate with Jerry Welch (743-4163, jerry.j.welch@navy.mil) or Ray Hrynko (743-4162) prior to starting the project.
- Large trucks/equipment shall not be staged along the road running parallel to the shoreline due to issues weight limits associated with the shoreline repair project.

IRT Approval Date: 9/22/2015

Signature of Environmental Division Director or Designee: HOFFMAN.FREDERICK.DAVID.JR.1379284970 Digitally signed by HOFFMAN.FREDERICK.DAVID.JR.1379284970 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=HOFFMAN.FREDERICK.DAVID.JR.1379284970 Date: 2015.09.22 15:29:03 -04'00'

Signature of Facilities Management Division Director or Designee: DAVID.GEORGE.DOWNING.1286155509 Digitally signed by DAVID.GEORGE.DOWNING.1286155509 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=DAVID.GEORGE.DOWNING.1286155509 Date: 2015.09.28 12:01:13 -04'00'

This IR Work Approval Permit identifies the conditions that must be satisfied in order to proceed with project execution.
Note: Signed Work Approval Permit must be on site while all work is being performed.

Section C. Project Details

Project Description:

Project includes removal of soil at Site 1 through the following actions:
- Site mark-out
- Utility Clearance
- Establishment of Soil Stockpile areas
- Excavation of soil in 6" lifts down to a depth of 4' bgs
- Radiological screening of each stockpiled area (a gamma scan survey is conducted to verify that the radiologically impacted soils were removed and soil samples are sent off to a lab to verify as well)
- Disposal of excavated soil (appropriate to its contamination)
- Backfill of excavation to previous grade

Equipment to be used includes motorized vegetation removal equipment, utility location equipment, heavy excavation equipment, portable generators, and radiological detection equipment.

A water truck will be used if dust suppression becomes necessary. Concentrations of radioactive material in air will be determined, as needed, by sampling the air. Air sampling shall be conducted in accordance with (or equivalent to) the guidance provided in NRC Regulatory Guide 8.25, "Air Sampling in the Workplace", July 1992.

Work will be performed by 5-10 contractors from October 2015 - December 2015.

Location Description:

Site 1 is located next to building 1662

Will this project involve removing, breaking or opening any piping, tubing or hoses? ○ Yes ◉ No

Section D. Project Tracking Information

Facility Engineering and Acquisition Division Number: N/A

Estimated Project Cost: **$960,000**

Funding Type: ER'N

Acquisitions Branch Contract Number: USN 2015-011

Delivery Order: N/A

Work Request / Service Ticket Number(s): N/A

Asset Management Project Number: N/A

WebSAR Project Number: N/A

Section E. IRT Contact Information

Seth Berry	Natural Resources	seth.m.berry@navy.mil	x2273	Bldg. 554
Mike Chilton	Asset Management Branch Head	michael.chilton@navy.mil	202-905-9953	Bldg. 182 DL
Robert Collins	NDW Fire Prevention	robert.e.collins3@navy.mil	x4370	Bldg. D-339
George David	Facilities Planning	george.d.david@navy.mil	x2163	Bldg. 351
Billy Fabey	Stormwater	william.fabey@navy.mil	x2275	Bldg. 554
Marissa Fabey	MWR Branch Head	marissa.fabey@navy.mil	x6587	Bldg. D328
Kathy Garcia	NSWC IHEODTD Safety	kathy.m.garcia@navy.mil	x5636	Bldg. 482
David Hartnett	Tank Management	david.j.hartnett@navy.mil	x2259	Bldg. 289
Dave Hoffman	Compliance Manager and Air	frederick.d.hoffman@navy.mi	x1616	Bldg. 289
Dave Jenkins	Utilities Management	david.h.jenkins1@navy.mil	x4480	Bldg. 873
Larry Kijek	NSWC IHEODTD Explosives Safety Officer	lawrence.kijek@navy.mil	x6871	Bldg. 2151
Mike Knutson	N6 - Telecommunciations	michael.l.knutson@navy.mil	540-653-6463	Bldg. 108 DL
Tara Meadows	PWD Environmental Planning Mgr	tara.meadows@navy.mil	x2261	Bldg. 554

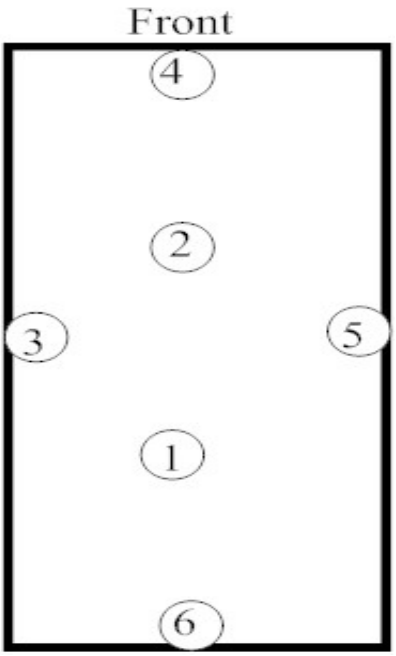
John Mikles	Industrial Wastewater	john.mikles@navy.mil	x2272	Bldg. 289
Adrian Mood	Industrial Wastewater	adrian.mood@navy.mil	x2280	Bldg. 289
Patrick Reitz	NSASP Safety	patrick.reitz@navy.mil	x2469	Bldg. D-339
Diana Rose	Sanitary Wastewater and Potable Water	diana.rose@navy.mil	x2267	Bldg. 289
Jerry Schenemann	Assistant Fire Chief Prevention	jerry.schenemann@navy.mil	540-653-8626	Bldg. 246 DL
John Smallhorn	Solid and Hazardous Waste	john.smallhorn@navy.mil	x2268	Bldg. 289
George Turner	NSASP Explosives Safety Officer	george.w.turner1@navy.mil	540-284-4363	Bldg. 246
Harry Waddle	NAVFAC Safety	harry.waddle@navy.mil	x1298	Bldg. 510
Kenneth Waits	Industrial Hygenist	kenneth.d.waits4.civ@mail.m	x4910	Bldg. 1895
Brian Washburn	Force Protection and Physical Security	brian.washburn@navy.mil	x4414	Bldg. D328
Bob Wetherald	PWD Constructability and Design	bob.wetherald@navy.mil	x2168	Bldg. 551
Travis Wray	IR and MRP	travis.wray@navy.mil	x2262	Bldg. 554
Tommy Wright	NEPA and Cultural Resources	thomas.a.wright@navy.mil	x2260	Bldg. 554

Appendix G

Incoming Container Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/9/2015	TIME: 08:40	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-02	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 8.1	α 0.0
					βγ 36.5%	βγ 9.1%	βγ 180.7	βγ 426.3
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/9/2015	TIME: 09:30	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000018								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-02

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-7.3	64.9	2.7	1.1	Inner Rear Bottom
2				-7.3	-76.7	2.7	12.1	Inner Front Bottom
3				-2.1	64.9	2.7	-97.5	Inner Left Side
4				-12.5	218.3	0.0	44.9	Inner Front Side
5				-2.1	-47.2	0.0	-9.9	Inner Right Side
6				-2.1	106.2	0.0	-53.7	Inner Rear Side
2D						2.7	6.6	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/9/2015 Time: 9:30	

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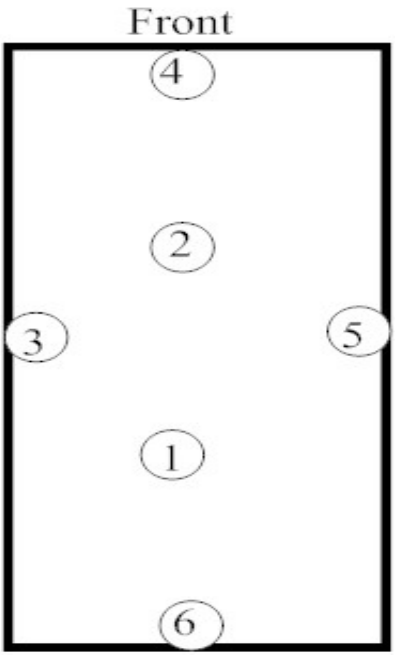
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/13/2015	TIME: 08:20	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-06	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 12.3	α 0.5
					βγ 36.5%	βγ 9.1%	βγ 183.8	βγ 442.7
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/13/2015	TIME: 09:40	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000003								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-06

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				34.3	566.4	15.7	488.8	Inner Rear Bottom
2				107.0	295.0	-0.5	516.2	Inner Front Bottom
3				262.9	955.8	162.3	850.4	Inner Left Side
4				148.6	318.6	42.9	620.3	Inner Front Side
5				216.1	749.3	-0.5	346.3	Inner Right Side
6				486.2	820.1	53.7	488.8	Inner Rear Side
5D						-0.5	318.9	Duplicate Swipe
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/13/2015 Time: 9:40	

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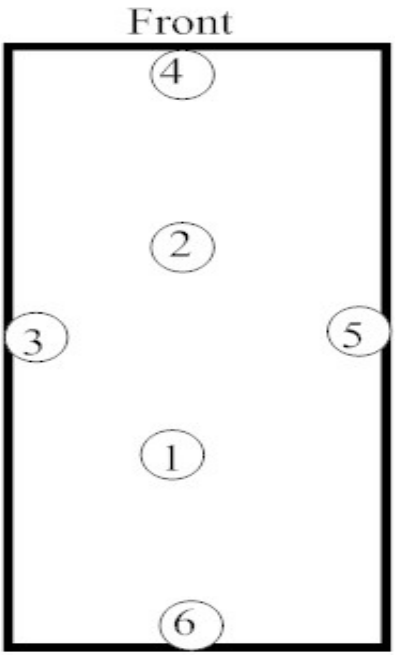
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/13/2015	TIME: 10:30	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-08	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 187.5	βγ 462.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/13/2015	TIME: 11:05	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000009								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-08

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				34.3	171.1	1.6	30.7	Inner Rear Bottom
2				18.7	82.6	-1.1	-35.1	Inner Front Bottom
3				34.3	-29.5	1.6	47.1	Inner Left Side
4				60.3	23.6	1.6	19.7	Inner Front Side
5				23.9	-70.8	-1.1	-40.5	Inner Right Side
6				39.5	53.1	4.3	30.7	Inner Rear Side
3D						1.6	36.2	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/13/2015 Time: 11:05	

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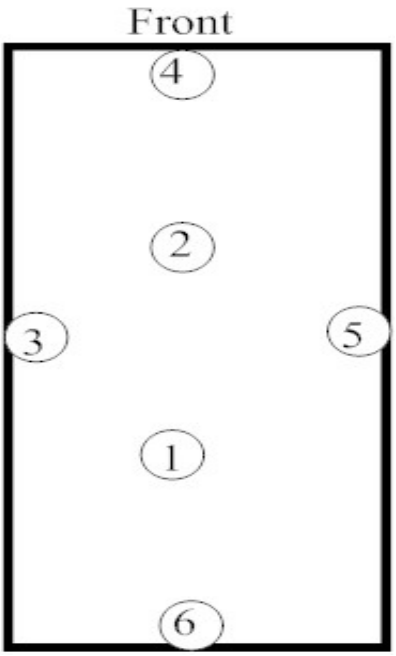
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/15/2015	TIME: 10:22	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-010	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 187.5	βγ 462.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/15/2015	TIME: 11:40	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000020								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-010

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				65.5	495.6	-1.1	-13.2	Inner Rear Bottom
2				112.2	472.0	-1.1	-100.8	Inner Front Bottom
3				39.5	501.5	12.5	30.7	Inner Left Side
4				29.1	554.6	1.6	-2.2	Inner Front Side
5				3.1	123.9	1.6	19.7	Inner Right Side
6				18.7	118.0	1.6	-122.7	Inner Rear Side
4D						1.6	8.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/15/2015 Time: 11:40	

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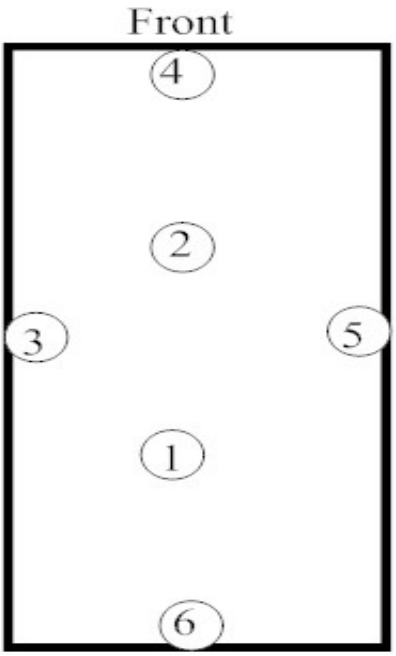
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/16/2015	TIME: 11:10	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-013	2360	268508	7/22/2016	α 36.9%	α 9.2%	α 84.9	α 40.1
		43-93	298435		βγ 28.3%	βγ 7.1%	βγ 526.3	βγ 1667.8
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 12.3	α 0.5
					βγ 36.5%	βγ 9.1%	βγ 181.7	βγ 431.8
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 µR/hr
DATE: 10/16/2015	TIME: 12:50	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Container Incoming Survey: ISEU-000035



Comments:

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
 # / # denotes contact / 1 meter radiation readings.
***** denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
\+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-013

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				127.9	268.6	2.2	-48.2	Inner Rear Bottom
2				46.6	282.7	2.2	39.5	Inner Front Bottom
3				-13.0	148.4	-0.5	83.3	Inner Left Side
4				-18.4	-176.7	2.2	-4.4	Inner Front Side
5				46.6	14.1	-0.5	-31.8	Inner Right Side
6				41.2	0.0	-0.5	50.4	Inner Rear Side
3D						-0.5	77.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
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N/A								
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Reviewer Daniel Spicuzza	Date: 10/16/2015 Time: 12:50	

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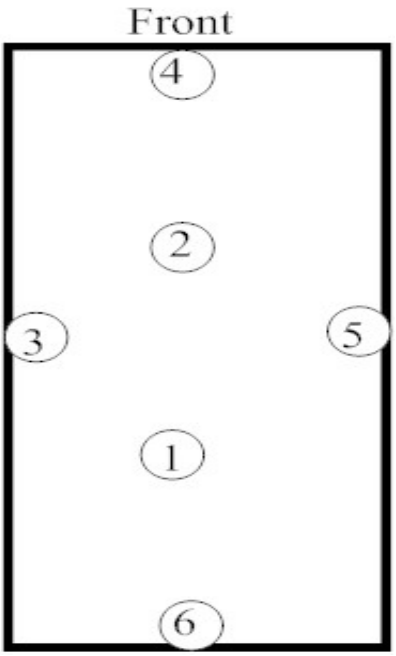
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/19/2015	TIME: 14:05	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-016	2360	268508	7/22/2016	α 36.9%	α 9.2%	α 84.9	α 40.1
		43-93	298435		βγ 28.3%	βγ 7.1%	βγ 526.3	βγ 1667.8
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 183.6	βγ 441.6
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/19/2015	TIME: 14:50	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000019								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-016

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				30.4	155.5	4.3	18.6	Inner Rear Bottom
2				14.1	-106.0	1.6	24.1	Inner Front Bottom
3				268.8	735.0	7.1	-25.2	Inner Left Side
4				106.2	459.4	26.1	2.2	Inner Front Side
5				8.7	106.0	17.9	73.4	Inner Right Side
6				41.2	176.7	26.1	7.7	Inner Rear Side
1D						4.3	13.2	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/19/2015 Time: 14:50	

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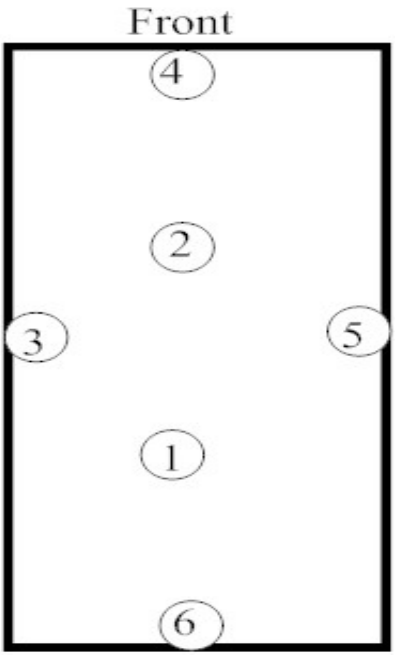
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/20/2015	TIME: 14:00	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-019	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 187.9	βγ 464.7
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/20/2015	TIME: 14:45	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Container Incoming Survey: ISEU-000031



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-019

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				81.0	890.9	12.5	6.6	Inner Rear Bottom
2				200.5	507.4	42.3	94.2	Inner Front Bottom
3				3.1	-35.4	-1.1	34.0	Inner Left Side
4				18.7	82.6	4.3	1.1	Inner Front Side
5				3.1	100.3	1.6	105.2	Inner Right Side
6				13.5	141.6	1.6	-42.7	Inner Rear Side
3D						-1.1	23.0	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/20/2015 Time: 14:45	

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RADIATION/CONTAMINATION SURVEY FORM

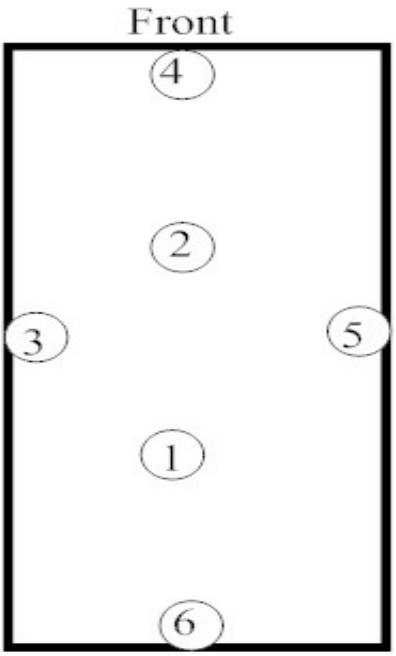
DATE: 10/21/2015	TIME: 14:10	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-22	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 12.3	α 0.5
					βγ 36.5%	βγ 9.1%	βγ 182.1	βγ 434.0
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr

DATE:	TIME:	Reviewed by:
10/21/2015	14:35	Daniel Spicuzza

Isotopes of Concern: Th-232

Static Count Time: 2 Minutes

Container Incoming Survey: ISEU-000025



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-22

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				23.9	283.2	2.2	-6.6	Inner Rear Bottom
2				-2.1	59.0	-0.5	-28.5	Inner Front Bottom
3				8.3	0.0	-0.5	9.9	Inner Left Side
4				23.9	29.5	-0.5	108.5	Inner Front Side
5				-2.1	159.3	-0.5	-17.5	Inner Right Side
6				8.3	188.8	2.2	42.7	Inner Rear Side
6D						2.2	37.3	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/21/2015 Time: 14:35	

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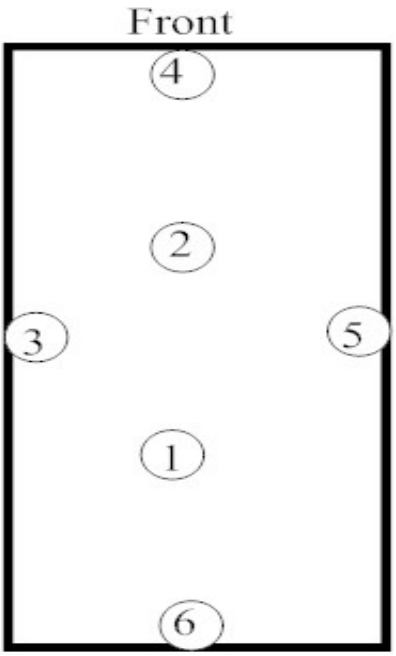
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/22/2015	TIME: 13:50	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-25	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 187.9	βγ 464.7
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/22/2015	TIME: 15:50	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000023								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-25

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				8.3	106.2	-1.1	-37.3	Inner Rear Bottom
2				8.3	-194.7	-1.1	-53.7	Inner Front Bottom
3				18.7	82.6	1.6	-70.1	Inner Left Side
4				18.7	-41.3	1.6	-64.7	Inner Front Side
5				18.7	-29.5	-1.1	-53.7	Inner Right Side
6				23.9	5.9	-1.1	-48.2	Inner Rear Side
2D						-1.1	-59.2	Duplicate Swipe
N/A								
N/A								
N/A								
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Reviewer	Date: 10/22/2015
Daniel Spicuzza	Time: 15:50

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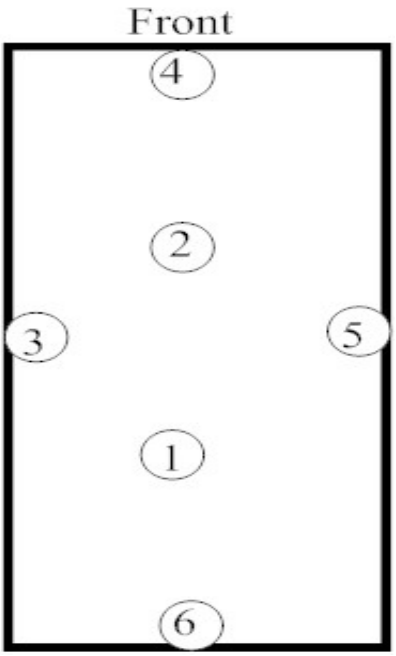
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/23/2015	TIME: 13:30	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-028	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 188.3	βγ 466.8
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/23/2015	TIME: 15:40	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000022								



Comments:

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-028

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				8.3	418.9	4.3	-34.0	Inner Rear Bottom
2				8.3	188.8	1.6	-6.6	Inner Front Bottom
3				3.1	59.0	-1.1	-50.4	Inner Left Side
4				13.5	112.1	-1.1	-66.8	Inner Front Side
5				3.1	0.0	1.6	-55.9	Inner Right Side
6				29.1	112.1	-1.1	-28.5	Inner Rear Side
1D						4.3	-50.4	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/23/2015 Time: 15:40	

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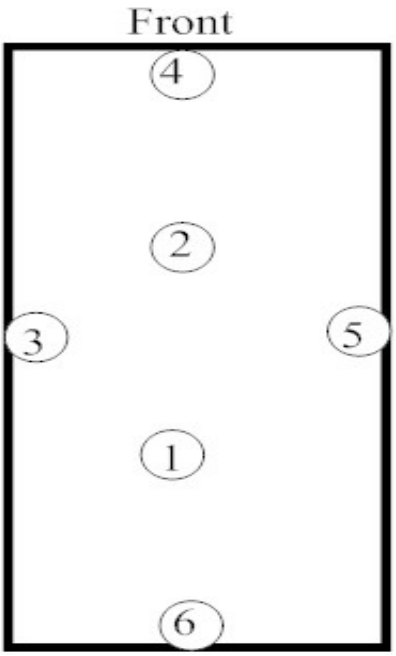
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/26/2015	TIME: 13:40	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-30	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 186.1	βγ 454.8
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/26/2015	TIME: 14:55	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Container Incoming Survey: ISEU-000040



Comments:

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-30

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				29.1	955.8	-1.1	27.4	Inner Rear Bottom
2				8.3	-11.8	1.6	-76.7	Inner Front Bottom
3				18.7	41.3	1.6	-5.5	Inner Left Side
4				8.3	472.0	-1.1	82.2	Inner Front Side
5				44.7	306.8	-1.1	76.7	Inner Right Side
6				-7.3	-135.7	-1.1	38.4	Inner Rear Side
5D						-1.1	65.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/26/2015 Time: 14:55	

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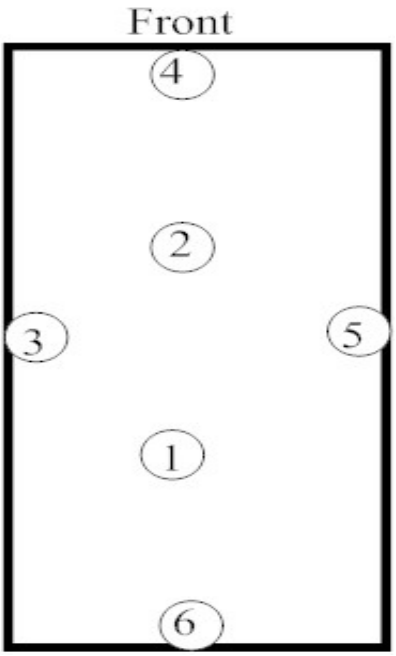
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/27/2015	TIME: 13:25	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-033	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 12.3	α 0.5
					βγ 36.5%	βγ 9.1%	βγ 187.5	βγ 462.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/27/2015	TIME: 13:55	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000027								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-033

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				44.7	135.7	15.7	112.9	Inner Rear Bottom
2				60.3	224.2	10.3	47.1	Inner Front Bottom
3				8.3	348.1	7.6	3.3	Inner Left Side
4				-7.3	17.7	23.9	19.7	Inner Front Side
5				-2.1	118.0	18.5	107.4	Inner Right Side
6				8.3	141.6	-0.5	-46.0	Inner Rear Side
4D						21.2	14.2	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								

Reviewer Daniel Spicuzza	Date: 10/27/2015 Time: 13:55	

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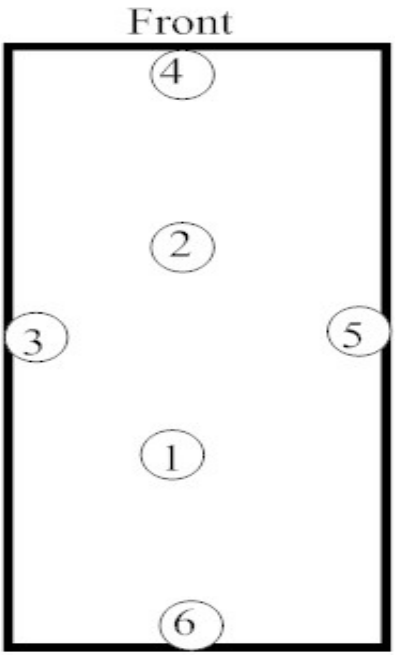
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/28/2015	TIME: 14:20	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-035	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 189.7	βγ 474.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/28/2015	TIME: 14:55	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
Container Incoming Survey: ISEU-000013								



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-035

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				8.3	377.6	-1.1	-25.2	Inner Rear Bottom
2				39.5	-200.6	-1.1	35.1	Inner Front Bottom
3				8.3	94.4	4.3	-58.1	Inner Left Side
4				-2.1	236.0	-1.1	-52.6	Inner Front Side
5				8.3	-59.0	-1.1	35.1	Inner Right Side
6				60.3	-224.2	4.3	-8.8	Inner Rear Side
2D						-1.1	40.5	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 10/28/2015
Daniel Spicuzza	Time: 14:55

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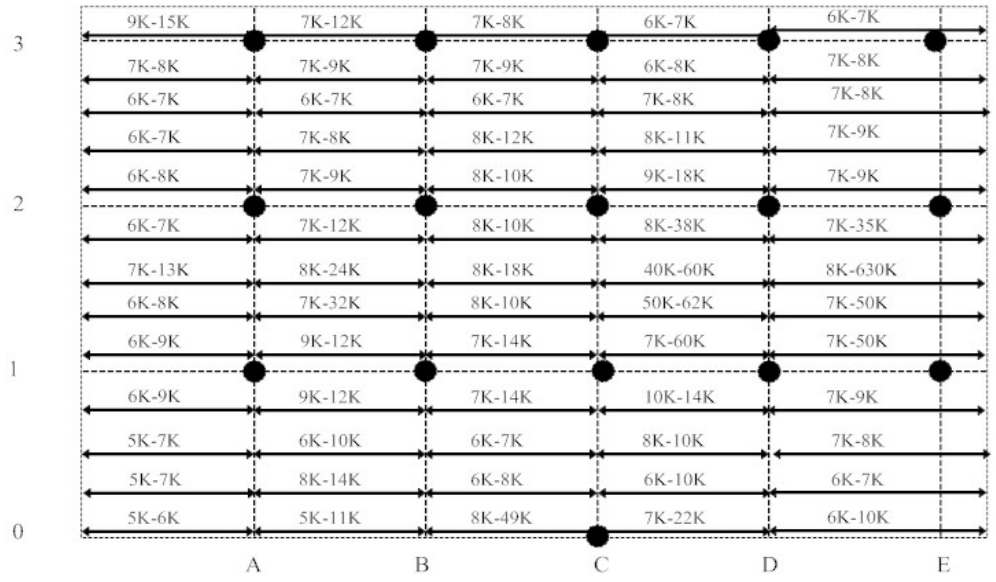
Appendix H

Excavation Area Gamma Scan Surveys

DATE: 10/16/2015	TIME: 10:10	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-012							
LOCATION:	NSF Indian Head Site 1							
SURVEYOR:	William Wylie							
DATE: 10/16/2015	TIME: 14:20 / Reviewed by: Daniel Spicuzza	2350-1 44-10	120588 318218	6/19/2016				5327 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey of 5th Lift



Comments:

The area was 100% gamma scan surveyed.

Action Level: 7,110 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000 cpm

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-012

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/16/2015 Time: 14:20	

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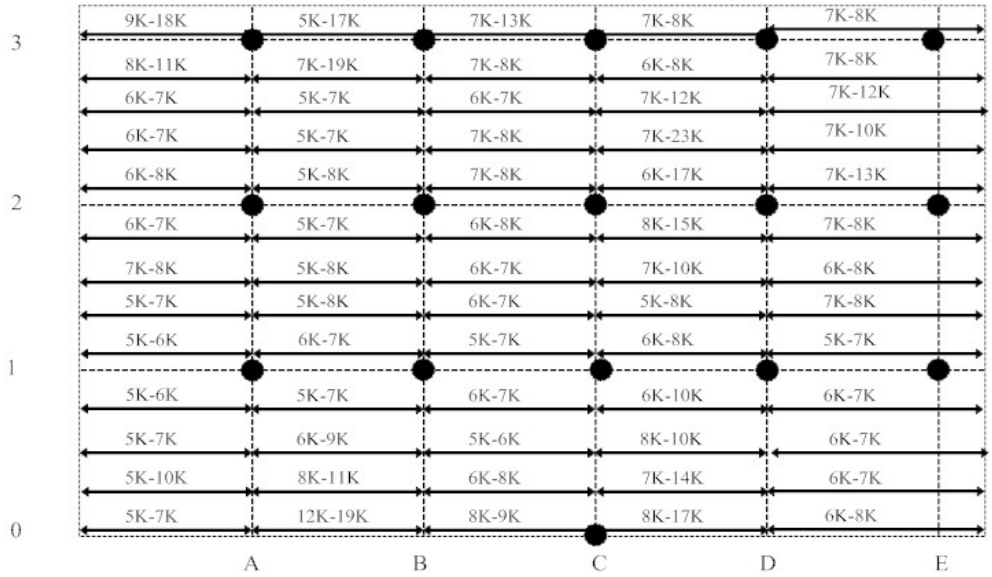
DATE:	TIME:	INSTRUMENTATION USED						
10/20/2015	08:20	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-018							
LOCATION:	NSF Indian Head Site 1							
SURVEYOR:	William Wylie							
DATE: 10/20/2015	TIME: 10:00 / Reviewed by: Daniel Spicuzza	2350-1 44-10	120588 318218	6/19/2016				5327 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey of 6th Lift



Comments:

The area was 100% gamma scan surveyed.

Action Level: 7,110 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000 cpm

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-018

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/20/2015 Time: 10:00	

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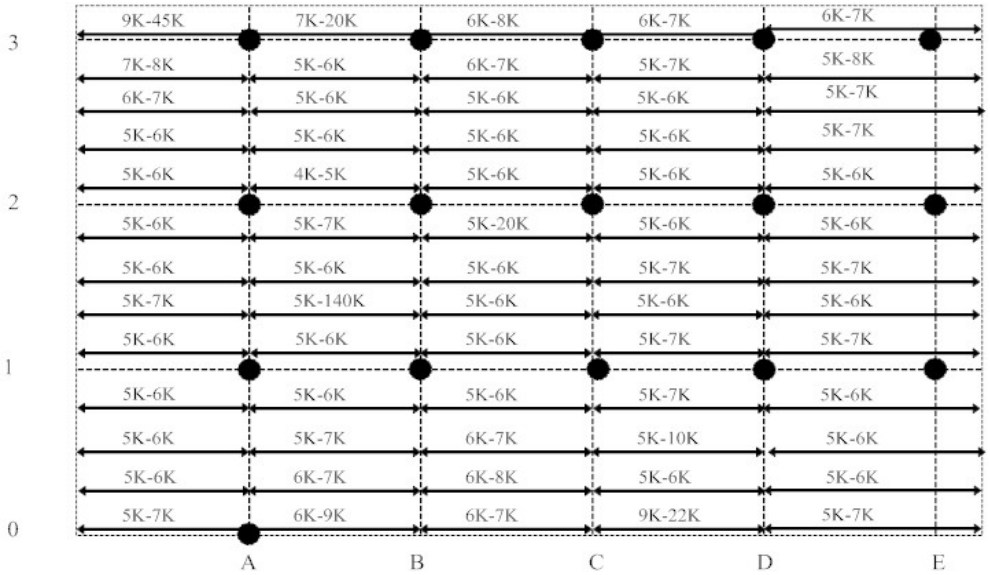
DATE:	TIME:	INSTRUMENTATION USED						
10/21/2015	09:45	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-021							
LOCATION:	NSF Indian Head Site 1							
SURVEYOR:	William Wylie							
DATE: 10/21/2015	TIME: 10:40 / Reviewed by: Daniel Spicuzza	2350-1 44-10	120588 318218	6/19/2016				5327 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey of 7th Lift



Comments:

The area was 100% gamma scan surveyed.

Action Level: 7,110 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000 cpm

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-021

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								
N/A								
N/A								

Reviewer Daniel Spicuzza	Date: 10/21/2015 Time: 10:40	

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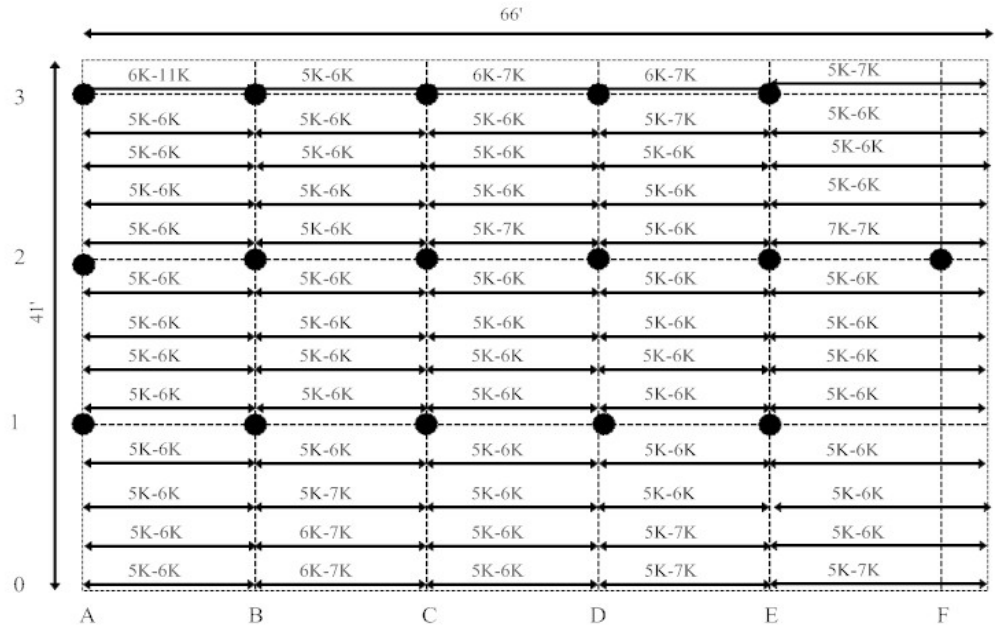
DATE:	TIME:	INSTRUMENTATION USED						
10/22/2015	12:00	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-024							
LOCATION:	NSF Indian Head Site 1							
SURVEYOR:	William Wylie							
DATE: 10/22/2015	TIME: 12:30 / Reviewed by: Daniel Spicuzza	2350-1 44-10	120588 318218	6/19/2016				5327 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Lift #8 Gamma Scan Survey



Comments:

The area was 100% gamma scan surveyed.

Action Level: 7,110 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-024

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/22/2015
	Time: 12:30

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Appendix I

Excavation Area Soil Sample Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-14433-1
Client Project/Site: NSF Indian Head IR Site 1
Revision: 1

For:
Aleut World Solutions
615 E. 82nd Ave.
Suite 200
Anchorage, Alaska 99518

Attn: Daniel Spicuzza

Authorized for release by:
11/12/2015 11:52:15 AM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Table of Contents 2
Case Narrative 3
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Receipt Checklists 8
Definitions/Glossary 9
Method Summary 10
Sample Summary 11
Client Sample Results 12
QC Sample Results 22
QC Association Summary 24
Tracer Carrier Summary 26

Job ID: 160-14433-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: NSF Indian Head IR Site 1

Report Number: 160-14433-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-14433-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

Revision 1: Report was revised to change the project name per client request. No data was affected.

RECEIPT

The samples were received on 10/22/2015 12:55 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.3º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHS1L5-A1 (160-14433-1), IHS1L5-A2 (160-14433-2), IHS1L5-A3 (160-14433-3), IHS1L5-B1 (160-14433-4), IHS1L5-B2 (160-14433-5), IHS1L5-B3 (160-14433-6), IHS1L5-C0 (160-14433-7), IHS1L5-C1 (160-14433-8), IHS1L5-C2 (160-14433-9), IHS1L5-C3 (160-14433-10), IHS1L5-D1 (160-14433-11), IHS1L5-D2 (160-14433-12), IHS1L5-D3 (160-14433-13), IHS1L5-E1 (160-14433-14), IHS1L5-E2 (160-14433-15), IHS1L5-E3 (160-14433-16), IHS1L6-A1 (160-14433-17), IHS1L6-A2 (160-14433-18), IHS1L6-A3 (160-14433-19), IHS1L6-B1 (160-14433-20), IHS1L6-B2 (160-14433-21), IHS1L6-B3 (160-14433-22), IHS1L6-C1 (160-14433-23), IHS1L6-C2 (160-14433-24), IHS1L6-C3 (160-14433-25), IHS1L6-D1 (160-14433-26), IHS1L6-D2 (160-14433-27), IHS1L6-D3 (160-14433-28), IHS1L6-E0 (160-14433-29), IHS1L6-E1 (160-14433-30), IHS1L6-E2 (160-14433-31) and IHS1L6-E3 (160-14433-32) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 10/22/2015, prepared on 10/23/2015 and analyzed on 10/28/2015 and 10/29/2015.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/16/15	COC No: NSFIH-2015-2
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1L5- A1	10/16/2015	1037	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- A2	10/16/2015	1032	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- A3	10/16/2015	1027	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- B1	10/16/2015	1042	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- B2	10/16/2015	1222	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- B3	10/16/2015	1122	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- C0	10/16/2015	1052	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- C1	10/16/2015	1047	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- C2	10/16/2015	1247	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- C3	10/16/2015	1230	G	Soil	1	N	Y	X	5 Day TAT
IHS1L5- D1	10/16/2015	1100	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- D2	10/16/2015	1243	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/16/15 1600	Received by:	Company: TAST	Date/Time: 10-22-15 1255
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

160-14433 Chain of Custody

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/16/15	COC No: NSFIH-2015-3
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Bish	Carrier: Fed Ex	1 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1L5- D3	10/16/2015	1235	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- E1	10/16/2015	1110	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- E2	10/16/2015	1117	G	Soil	1	N	N	X	5 Day TAT
IHS1L5- E3	10/16/2015	1240	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- A1	10/20/2015	0822	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- A2	10/20/2015	0827	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- A3	10/20/2015	0832	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- B1	10/20/2015	0836	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- B2	10/20/2015	0840	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- B3	10/20/2015	0844	G	Soil	1	N	Y	X	5 Day TAT
IHS1L6- C1	10/20/2015	0849	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- C2	10/20/2015	0851	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company: AWS	Date/Time: 10/16/15 1200	Received by: Jill Clark	Company: TA STL	Date/Time: 10-22-15 1255
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/16/15	COC No: NSFIH-2015-4
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	5 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1L6- C3	10/20/2015	0855	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- D1	10/20/2015	0858	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- D2	10/20/2015	0901	G	Soil	1	N	Y	X	5 Day TAT
IHS1L6- D3	10/20/2015	0904	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- E0	10/20/2015	0907	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- E1	10/20/2015	0910	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- E2	10/20/2015	0913	G	Soil	1	N	N	X	5 Day TAT
IHS1L6- E3	10/20/2015	0916	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact? ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by	Company: AWS	Date/Time: 10/20/15 1600	Received by:	Company: TASL	Date/Time: 10-22-15 1255
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-14433-1

Login Number: 14433
List Number: 1
Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14433-1	IHS1L5-A1	Solid	10/16/15 10:37	10/22/15 12:55
160-14433-2	IHS1L5-A2	Solid	10/16/15 10:32	10/22/15 12:55
160-14433-3	IHS1L5-A3	Solid	10/16/15 10:27	10/22/15 12:55
160-14433-4	IHS1L5-B1	Solid	10/16/15 10:42	10/22/15 12:55
160-14433-5	IHS1L5-B2	Solid	10/16/15 12:22	10/22/15 12:55
160-14433-6	IHS1L5-B3	Solid	10/16/15 11:22	10/22/15 12:55
160-14433-7	IHS1L5-C0	Solid	10/16/15 10:52	10/22/15 12:55
160-14433-8	IHS1L5-C1	Solid	10/16/15 10:47	10/22/15 12:55
160-14433-9	IHS1L5-C2	Solid	10/16/15 12:47	10/22/15 12:55
160-14433-10	IHS1L5-C3	Solid	10/16/15 12:30	10/22/15 12:55
160-14433-11	IHS1L5-D1	Solid	10/16/15 11:00	10/22/15 12:55
160-14433-12	IHS1L5-D2	Solid	10/16/15 12:43	10/22/15 12:55
160-14433-13	IHS1L5-D3	Solid	10/16/15 12:35	10/22/15 12:55
160-14433-14	IHS1L5-E1	Solid	10/16/15 11:10	10/22/15 12:55
160-14433-15	IHS1L5-E2	Solid	10/16/15 11:17	10/22/15 12:55
160-14433-16	IHS1L5-E3	Solid	10/16/15 12:40	10/22/15 12:55
160-14433-17	IHS1L6-A1	Solid	10/20/15 08:22	10/22/15 12:55
160-14433-18	IHS1L6-A2	Solid	10/20/15 08:27	10/22/15 12:55
160-14433-19	IHS1L6-A3	Solid	10/20/15 08:32	10/22/15 12:55
160-14433-20	IHS1L6-B1	Solid	10/20/15 08:36	10/22/15 12:55
160-14433-21	IHS1L6-B2	Solid	10/20/15 08:40	10/22/15 12:55
160-14433-22	IHS1L6-B3	Solid	10/20/15 08:44	10/22/15 12:55
160-14433-23	IHS1L6-C1	Solid	10/20/15 08:49	10/22/15 12:55
160-14433-24	IHS1L6-C2	Solid	10/20/15 08:51	10/22/15 12:55
160-14433-25	IHS1L6-C3	Solid	10/20/15 08:55	10/22/15 12:55
160-14433-26	IHS1L6-D1	Solid	10/20/15 08:58	10/22/15 12:55
160-14433-27	IHS1L6-D2	Solid	10/20/15 09:01	10/22/15 12:55
160-14433-28	IHS1L6-D3	Solid	10/20/15 09:04	10/22/15 12:55
160-14433-29	IHS1L6-E0	Solid	10/20/15 09:07	10/22/15 12:55
160-14433-30	IHS1L6-E1	Solid	10/20/15 09:10	10/22/15 12:55
160-14433-31	IHS1L6-E2	Solid	10/20/15 09:13	10/22/15 12:55
160-14433-32	IHS1L6-E3	Solid	10/20/15 09:16	10/22/15 12:55

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L5-A1

Lab Sample ID: 160-14433-1
Date Collected: 10/16/15 10:37
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.958		0.184	0.201	1.00	0.0856	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.734		0.159	0.171	1.00	0.0602	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.739		0.159	0.171	1.00	0.0599	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*83.5*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Client Sample ID: IHS1L5-A2

Lab Sample ID: 160-14433-2
Date Collected: 10/16/15 10:32
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.549		0.131	0.139	1.00	0.0476	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.638		0.143	0.152	1.00	0.0656	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.682		0.146	0.157	1.00	0.0512	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.7*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Client Sample ID: IHS1L5-A3

Lab Sample ID: 160-14433-3
Date Collected: 10/16/15 10:27
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.518		0.140	0.146	1.00	0.0848	pCi/g	10/23/15 11:45	10/29/15 14:21	1
Thorium-230	0.658		0.153	0.163	1.00	0.0494	pCi/g	10/23/15 11:45	10/29/15 14:21	1
Thorium-232	0.652		0.152	0.162	1.00	0.0543	pCi/g	10/23/15 11:45	10/29/15 14:21	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*81.8*		*30 - 110*	*10/23/15 11:45*	*10/29/15 14:21*	*1*

Client Sample ID: IHS1L5-B1

Lab Sample ID: 160-14433-4
Date Collected: 10/16/15 10:42
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.735		0.153	0.165	1.00	0.0716	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.451		0.120	0.126	1.00	0.0627	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.694		0.146	0.157	1.00	0.0426	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L5-B1
Date Collected: 10/16/15 10:42
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-4
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.5		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample ID: IHS1L5-B2
Date Collected: 10/16/15 12:22
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-5
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.13		0.188	0.210	1.00	0.0630	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.707		0.149	0.161	1.00	0.0630	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	1.12		0.187	0.209	1.00	0.0627	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	95.2		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample ID: IHS1L5-B3
Date Collected: 10/16/15 11:22
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-6
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.557		0.139	0.146	1.00	0.0725	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.631		0.145	0.154	1.00	0.0462	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.397		0.115	0.120	1.00	0.0481	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.0		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample ID: IHS1L5-C0
Date Collected: 10/16/15 10:52
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-7
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.29		0.202	0.229	1.00	0.0815	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.663		0.143	0.154	1.00	0.0475	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	1.53		0.217	0.252	1.00	0.0473	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.5		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L5-C1

Lab Sample ID: 160-14433-8
Date Collected: 10/16/15 10:47
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.31		0.204	0.232	1.00	0.0750	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.526		0.129	0.136	1.00	0.0437	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	1.07		0.182	0.203	1.00	0.0434	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.1*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Client Sample ID: IHS1L5-C2

Lab Sample ID: 160-14433-9
Date Collected: 10/16/15 12:47
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	2.69		0.293	0.370	1.00	0.0674	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.665		0.146	0.157	1.00	0.0529	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	2.49		0.281	0.350	1.00	0.0487	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.5*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Client Sample ID: IHS1L5-C3

Lab Sample ID: 160-14433-10
Date Collected: 10/16/15 12:30
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.600		0.136	0.145	1.00	0.0672	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.519		0.125	0.132	1.00	0.0457	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.487		0.120	0.127	1.00	0.0455	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*101*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Client Sample ID: IHS1L5-D1

Lab Sample ID: 160-14433-11
Date Collected: 10/16/15 11:00
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.515		0.127	0.134	1.00	0.0639	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.527		0.127	0.134	1.00	0.0464	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.567		0.130	0.139	1.00	0.0224	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L5-D1
Date Collected: 10/16/15 11:00
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-11
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.5		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample ID: IHS1L5-D2
Date Collected: 10/16/15 12:43
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-12
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.763		0.159	0.171	1.00	0.0782	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.574		0.135	0.144	1.00	0.0443	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.682		0.147	0.158	1.00	0.0416	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.6		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample ID: IHS1L5-D3
Date Collected: 10/16/15 12:35
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-13
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.440		0.118	0.124	1.00	0.0663	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.542		0.129	0.137	1.00	0.0502	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.531		0.126	0.134	1.00	0.0225	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	95.9		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample ID: IHS1L5-E1
Date Collected: 10/16/15 11:10
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-14
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.427		0.122	0.127	1.00	0.0811	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.485		0.125	0.132	1.00	0.0449	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.353		0.107	0.111	1.00	0.0494	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.4		30 - 110	10/23/15 11:45	10/28/15 13:44	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L5-E2

Lab Sample ID: 160-14433-15
Date Collected: 10/16/15 11:17
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.407		0.120	0.125	1.00	0.0820	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.345		0.107	0.110	1.00	0.0454	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.305		0.0996	0.103	1.00	0.0390	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.4*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Client Sample ID: IHS1L5-E3

Lab Sample ID: 160-14433-16
Date Collected: 10/16/15 12:40
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.540		0.142	0.150	1.00	0.0902	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.567		0.143	0.151	1.00	0.0705	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.537		0.139	0.146	1.00	0.0710	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*80.1*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Client Sample ID: IHS1L6-A1

Lab Sample ID: 160-14433-17
Date Collected: 10/20/15 08:22
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.708		0.151	0.162	1.00	0.0721	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.516		0.127	0.134	1.00	0.0514	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.611		0.137	0.146	1.00	0.0371	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.8*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:48*	*1*

Client Sample ID: IHS1L6-A2

Lab Sample ID: 160-14433-18
Date Collected: 10/20/15 08:27
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.433		0.120	0.125	1.00	0.0779	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.454		0.119	0.125	1.00	0.0514	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.588		0.136	0.144	1.00	0.0545	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L6-A2

Lab Sample ID: 160-14433-18
Date Collected: 10/20/15 08:27
Matrix: Solid
Date Received: 10/22/15 12:55

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.7		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample ID: IHS1L6-A3

Lab Sample ID: 160-14433-19
Date Collected: 10/20/15 08:32
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	8.90		0.534	0.919	1.00	0.0767	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.745		0.155	0.167	1.00	0.0447	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	7.07		0.474	0.760	1.00	0.0491	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.4		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample ID: IHS1L6-B1

Lab Sample ID: 160-14433-20
Date Collected: 10/20/15 08:36
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.637		0.142	0.152	1.00	0.0485	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.463		0.121	0.127	1.00	0.0235	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.601		0.137	0.146	1.00	0.0234	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.1		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample ID: IHS1L6-B2

Lab Sample ID: 160-14433-21
Date Collected: 10/20/15 08:40
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.13		0.185	0.208	1.00	0.0731	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.687		0.144	0.155	1.00	0.0526	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.917		0.164	0.182	1.00	0.0221	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.4		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L6-B3

Lab Sample ID: 160-14433-22
Date Collected: 10/20/15 08:44
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.760		0.156	0.168	1.00	0.0559	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.659		0.144	0.154	1.00	0.0381	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.720		0.150	0.162	1.00	0.0235	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*98.5*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:48*	*1*

Client Sample ID: IHS1L6-C1

Lab Sample ID: 160-14433-23
Date Collected: 10/20/15 08:49
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.875		0.172	0.187	1.00	0.0880	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.484		0.125	0.132	1.00	0.0449	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.755		0.155	0.168	1.00	0.0386	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.2*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:48*	*1*

Client Sample ID: IHS1L6-C2

Lab Sample ID: 160-14433-24
Date Collected: 10/20/15 08:51
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.860		0.164	0.179	1.00	0.0707	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.504		0.124	0.131	1.00	0.0365	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.781		0.153	0.167	1.00	0.0225	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*99.4*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:48*	*1*

Client Sample ID: IHS1L6-C3

Lab Sample ID: 160-14433-25
Date Collected: 10/20/15 08:55
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.647		0.142	0.152	1.00	0.0623	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.585		0.134	0.142	1.00	0.0369	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.602		0.135	0.144	1.00	0.0227	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L6-C3
Date Collected: 10/20/15 08:55
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-25
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	98.7		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample ID: IHS1L6-D1
Date Collected: 10/20/15 08:58
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-26
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.775		0.163	0.175	1.00	0.0889	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.762		0.158	0.171	1.00	0.0605	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.633		0.143	0.153	1.00	0.0449	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.0		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample ID: IHS1L6-D2
Date Collected: 10/20/15 09:01
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-27
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.95		0.264	0.311	1.00	0.0995	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.623		0.148	0.157	1.00	0.0488	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	1.82		0.251	0.294	1.00	0.0419	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	84.2		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample ID: IHS1L6-D3
Date Collected: 10/20/15 09:04
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-28
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.611		0.144	0.153	1.00	0.0811	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.587		0.138	0.147	1.00	0.0496	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.524		0.130	0.137	1.00	0.0386	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.2		30 - 110	10/23/15 11:46	10/28/15 13:48	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L6-E0

Lab Sample ID: 160-14433-29
Date Collected: 10/20/15 09:07
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.568		0.140	0.147	1.00	0.0829	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.649		0.145	0.155	1.00	0.0535	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.486		0.124	0.131	1.00	0.0239	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.5*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:48*	*1*

Client Sample ID: IHS1L6-E1

Lab Sample ID: 160-14433-30
Date Collected: 10/20/15 09:10
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.878		0.175	0.190	1.00	0.0880	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.500		0.130	0.137	1.00	0.0514	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.849		0.168	0.182	1.00	0.0400	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.3*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:48*	*1*

Client Sample ID: IHS1L6-E2

Lab Sample ID: 160-14433-31
Date Collected: 10/20/15 09:13
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.623		0.142	0.152	1.00	0.0805	pCi/g	10/23/15 11:46	10/28/15 13:49	1
Thorium-230	0.571		0.132	0.141	1.00	0.0371	pCi/g	10/23/15 11:46	10/28/15 13:49	1
Thorium-232	0.767		0.153	0.166	1.00	0.0490	pCi/g	10/23/15 11:46	10/28/15 13:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.4*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:49*	*1*

Client Sample ID: IHS1L6-E3

Lab Sample ID: 160-14433-32
Date Collected: 10/20/15 09:16
Matrix: Solid
Date Received: 10/22/15 12:55

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.625		0.145	0.155	1.00	0.0808	pCi/g	10/23/15 11:46	10/28/15 13:49	1
Thorium-230	0.569		0.136	0.144	1.00	0.0494	pCi/g	10/23/15 11:46	10/28/15 13:49	1
Thorium-232	0.719		0.152	0.163	1.00	0.0445	pCi/g	10/23/15 11:46	10/28/15 13:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Client Sample ID: IHS1L6-E3
Date Collected: 10/20/15 09:16
Date Received: 10/22/15 12:55

Lab Sample ID: 160-14433-32
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.4		30 - 110	10/23/15 11:46	10/28/15 13:49	1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-218108/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 218819 — **Prep Batch: 218108**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.005654	U	0.00662	0.00664	1.00	0.0477	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-230	0.1694		0.0731	0.0744	1.00	0.0376	pCi/g	10/23/15 11:45	10/28/15 13:44	1
Thorium-232	0.0000	U	0.00386	0.00386	1.00	0.0232	pCi/g	10/23/15 11:45	10/28/15 13:44	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.9*		*30 - 110*	*10/23/15 11:45*	*10/28/15 13:44*	*1*

Lab Sample ID: LCS 160-218108/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 218820 — **Prep Batch: 218108**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	24.69		2.42	1.00	0.0470	pCi/g	101	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*96.1*		*30 - 110*

Lab Sample ID: 160-14433-1 DU — **Client Sample ID: IHS1L5-A1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 218855 — **Prep Batch: 218108**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Thorium-228	0.958		1.045		0.210	1.00	0.0920	pCi/g	0.21	1
Thorium-230	0.734		0.6921		0.166	1.00	0.0782	pCi/g	0.13	1
Thorium-232	0.739		0.8531		0.183	1.00	0.0402	pCi/g	0.32	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*91.6*		*30 - 110*

Lab Sample ID: MB 160-218110/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 218873 — **Prep Batch: 218110**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.002004	U	0.0250	0.0250	1.00	0.0630	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-230	0.08220		0.0536	0.0541	1.00	0.0496	pCi/g	10/23/15 11:46	10/28/15 13:48	1
Thorium-232	0.01396	U	0.0229	0.0229	1.00	0.0386	pCi/g	10/23/15 11:46	10/28/15 13:48	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.5*		*30 - 110*	*10/23/15 11:46*	*10/28/15 13:48*	*1*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-218110/2-A
Matrix: Solid
Analysis Batch: 218875

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 218110

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	23.08		2.27	1.00	0.102	pCi/g	94	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*97.3*		*30 - 110*

Lab Sample ID: 160-14433-17 DU
Matrix: Solid
Analysis Batch: 218877

Client Sample ID: IHS1L6-A1
Prep Type: Total/NA
Prep Batch: 218110

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.708			0.6605		0.159	1.00	0.0669	pCi/g			0.15	1
Thorium-230	0.516			0.6585		0.157	1.00	0.0397	pCi/g			0.49	1
Thorium-232	0.611			0.6535		0.156	1.00	0.0455	pCi/g			0.14	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*86.6*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Rad

Leach Batch: 217926

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14433-1	IHS1L5-A1	Total/NA	Solid	Dry and Grind	
160-14433-1 DU	IHS1L5-A1	Total/NA	Solid	Dry and Grind	
160-14433-2	IHS1L5-A2	Total/NA	Solid	Dry and Grind	
160-14433-3	IHS1L5-A3	Total/NA	Solid	Dry and Grind	
160-14433-4	IHS1L5-B1	Total/NA	Solid	Dry and Grind	
160-14433-5	IHS1L5-B2	Total/NA	Solid	Dry and Grind	
160-14433-6	IHS1L5-B3	Total/NA	Solid	Dry and Grind	
160-14433-7	IHS1L5-C0	Total/NA	Solid	Dry and Grind	
160-14433-8	IHS1L5-C1	Total/NA	Solid	Dry and Grind	
160-14433-9	IHS1L5-C2	Total/NA	Solid	Dry and Grind	
160-14433-10	IHS1L5-C3	Total/NA	Solid	Dry and Grind	
160-14433-11	IHS1L5-D1	Total/NA	Solid	Dry and Grind	
160-14433-12	IHS1L5-D2	Total/NA	Solid	Dry and Grind	
160-14433-13	IHS1L5-D3	Total/NA	Solid	Dry and Grind	
160-14433-14	IHS1L5-E1	Total/NA	Solid	Dry and Grind	
160-14433-15	IHS1L5-E2	Total/NA	Solid	Dry and Grind	
160-14433-16	IHS1L5-E3	Total/NA	Solid	Dry and Grind	
160-14433-17	IHS1L6-A1	Total/NA	Solid	Dry and Grind	
160-14433-17 DU	IHS1L6-A1	Total/NA	Solid	Dry and Grind	
160-14433-18	IHS1L6-A2	Total/NA	Solid	Dry and Grind	
160-14433-19	IHS1L6-A3	Total/NA	Solid	Dry and Grind	
160-14433-20	IHS1L6-B1	Total/NA	Solid	Dry and Grind	
160-14433-21	IHS1L6-B2	Total/NA	Solid	Dry and Grind	
160-14433-22	IHS1L6-B3	Total/NA	Solid	Dry and Grind	
160-14433-23	IHS1L6-C1	Total/NA	Solid	Dry and Grind	
160-14433-24	IHS1L6-C2	Total/NA	Solid	Dry and Grind	
160-14433-25	IHS1L6-C3	Total/NA	Solid	Dry and Grind	
160-14433-26	IHS1L6-D1	Total/NA	Solid	Dry and Grind	
160-14433-27	IHS1L6-D2	Total/NA	Solid	Dry and Grind	
160-14433-28	IHS1L6-D3	Total/NA	Solid	Dry and Grind	
160-14433-29	IHS1L6-E0	Total/NA	Solid	Dry and Grind	
160-14433-30	IHS1L6-E1	Total/NA	Solid	Dry and Grind	
160-14433-31	IHS1L6-E2	Total/NA	Solid	Dry and Grind	
160-14433-32	IHS1L6-E3	Total/NA	Solid	Dry and Grind	

Prep Batch: 218108

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14433-1	IHS1L5-A1	Total/NA	Solid	ExtChrom	217926
160-14433-1 DU	IHS1L5-A1	Total/NA	Solid	ExtChrom	217926
160-14433-2	IHS1L5-A2	Total/NA	Solid	ExtChrom	217926
160-14433-3	IHS1L5-A3	Total/NA	Solid	ExtChrom	217926
160-14433-4	IHS1L5-B1	Total/NA	Solid	ExtChrom	217926
160-14433-5	IHS1L5-B2	Total/NA	Solid	ExtChrom	217926
160-14433-6	IHS1L5-B3	Total/NA	Solid	ExtChrom	217926
160-14433-7	IHS1L5-C0	Total/NA	Solid	ExtChrom	217926
160-14433-8	IHS1L5-C1	Total/NA	Solid	ExtChrom	217926
160-14433-9	IHS1L5-C2	Total/NA	Solid	ExtChrom	217926
160-14433-10	IHS1L5-C3	Total/NA	Solid	ExtChrom	217926
160-14433-11	IHS1L5-D1	Total/NA	Solid	ExtChrom	217926
160-14433-12	IHS1L5-D2	Total/NA	Solid	ExtChrom	217926
160-14433-13	IHS1L5-D3	Total/NA	Solid	ExtChrom	217926

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Rad (Continued)

Prep Batch: 218108 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14433-14	IHS1L5-E1	Total/NA	Solid	ExtChrom	217926
160-14433-15	IHS1L5-E2	Total/NA	Solid	ExtChrom	217926
160-14433-16	IHS1L5-E3	Total/NA	Solid	ExtChrom	217926
LCS 160-218108/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-218108/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 218110

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14433-17	IHS1L6-A1	Total/NA	Solid	ExtChrom	217926
160-14433-17 DU	IHS1L6-A1	Total/NA	Solid	ExtChrom	217926
160-14433-18	IHS1L6-A2	Total/NA	Solid	ExtChrom	217926
160-14433-19	IHS1L6-A3	Total/NA	Solid	ExtChrom	217926
160-14433-20	IHS1L6-B1	Total/NA	Solid	ExtChrom	217926
160-14433-21	IHS1L6-B2	Total/NA	Solid	ExtChrom	217926
160-14433-22	IHS1L6-B3	Total/NA	Solid	ExtChrom	217926
160-14433-23	IHS1L6-C1	Total/NA	Solid	ExtChrom	217926
160-14433-24	IHS1L6-C2	Total/NA	Solid	ExtChrom	217926
160-14433-25	IHS1L6-C3	Total/NA	Solid	ExtChrom	217926
160-14433-26	IHS1L6-D1	Total/NA	Solid	ExtChrom	217926
160-14433-27	IHS1L6-D2	Total/NA	Solid	ExtChrom	217926
160-14433-28	IHS1L6-D3	Total/NA	Solid	ExtChrom	217926
160-14433-29	IHS1L6-E0	Total/NA	Solid	ExtChrom	217926
160-14433-30	IHS1L6-E1	Total/NA	Solid	ExtChrom	217926
160-14433-31	IHS1L6-E2	Total/NA	Solid	ExtChrom	217926
160-14433-32	IHS1L6-E3	Total/NA	Solid	ExtChrom	217926
LCS 160-218110/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-218110/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head IR Site 1

TestAmerica Job ID: 160-14433-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	**Client Sample ID**	**Th-229 (30-110)**						
160-14433-1	IHS1L5-A1	83.5						
160-14433-1 DU	IHS1L5-A1	91.6						
160-14433-2	IHS1L5-A2	95.7						
160-14433-3	IHS1L5-A3	81.8						
160-14433-4	IHS1L5-B1	93.5						
160-14433-5	IHS1L5-B2	95.2						
160-14433-6	IHS1L5-B3	94.0						
160-14433-7	IHS1L5-C0	92.5						
160-14433-8	IHS1L5-C1	94.1						
160-14433-9	IHS1L5-C2	91.5						
160-14433-10	IHS1L5-C3	101						
160-14433-11	IHS1L5-D1	93.5						
160-14433-12	IHS1L5-D2	89.6						
160-14433-13	IHS1L5-D3	95.9						
160-14433-14	IHS1L5-E1	93.4						
160-14433-15	IHS1L5-E2	90.4						
160-14433-16	IHS1L5-E3	80.1						
160-14433-17	IHS1L6-A1	91.8						
160-14433-17 DU	IHS1L6-A1	86.6						
160-14433-18	IHS1L6-A2	94.7						
160-14433-19	IHS1L6-A3	90.4						
160-14433-20	IHS1L6-B1	91.1						
160-14433-21	IHS1L6-B2	97.4						
160-14433-22	IHS1L6-B3	98.5						
160-14433-23	IHS1L6-C1	94.2						
160-14433-24	IHS1L6-C2	99.4						
160-14433-25	IHS1L6-C3	98.7						
160-14433-26	IHS1L6-D1	90.0						
160-14433-27	IHS1L6-D2	84.2						
160-14433-28	IHS1L6-D3	92.2						
160-14433-29	IHS1L6-E0	88.5						
160-14433-30	IHS1L6-E1	90.3						
160-14433-31	IHS1L6-E2	93.4						
160-14433-32	IHS1L6-E3	91.4						
LCS 160-218108/2-A	Lab Control Sample	96.1						
LCS 160-218110/2-A	Lab Control Sample	97.3						
MB 160-218108/1-A	Method Blank	96.9						
MB 160-218110/1-A	Method Blank	89.5						

Tracer/Carrier Legend

Th-229 = Thorium-229

TestAmerica

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-14502-1
Client Project/Site: NSF Indian Head Site 1

For:
Aleut World Solutions
615 E. 82nd Ave.
Suite 200
Anchorage, Alaska 99518

Attn: Daniel Spicuzza

Authorized for release by:
11/17/2015 2:01:08 PM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-14502-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: NSF Indian Head Site 1

Report Number: 160-14502-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-14502-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 10/27/2015 1:40 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.1º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHS1L7-A0 (160-14502-1), IHS1L7-A1 (160-14502-2), IHS1L7-A2 (160-14502-3), IHS1L7-A3 (160-14502-4), IHS1L7-B1 (160-14502-5), IHS1L7-B2 (160-14502-6), IHS1L7-B3 (160-14502-7), IHS1L7-C1 (160-14502-8), IHS1L7-C2 (160-14502-9), IHS1L7-C3 (160-14502-10), IHS1L7-D1 (160-14502-11), IHS1L7-D2 (160-14502-12), IHS1L7-D3 (160-14502-13), IHS1L7-E1 (160-14502-14), IHS1L7-E2 (160-14502-15), IHS1L7-E3 (160-14502-16), IHS1L8-A1 (160-14502-17), IHS1L8-A2 (160-14502-18), IHS1L8-A3 (160-14502-19), IHS1L8-B1 (160-14502-20), IHS1L8-B2 (160-14502-21), IHS1L8-B3 (160-14502-22), IHS1L8-C1 (160-14502-23), IHS1L8-C2 (160-14502-24), IHS1L8-C3 (160-14502-25), IHS1L8-D1 (160-14502-26), IHS1L8-D2 (160-14502-27), IHS1L8-D3 (160-14502-28), IHS1L8-E1 (160-14502-29), IHS1L8-E2 (160-14502-30), IHS1L8-E3 (160-14502-31), IHS1L8-F2 (160-14502-32), IHS1EB-A0 (160-14502-33), IHS1EB-A1 (160-14502-34), IHS1EB-A2 (160-14502-35), IHS1EB-A3 (160-14502-36), IHS1EB-B0 (160-14502-37), IHS1EB-B1 (160-14502-38), IHS1EB-B2 (160-14502-39), IHS1EB-B3 (160-14502-40), IHS1EB-C0 (160-14502-41), IHS1EB-C1 (160-14502-42), IHS1EB-C2 (160-14502-43), IHS1EB-C3 (160-14502-44), IHS1EB-D0 (160-14502-45), IHS1EB-D1 (160-14502-46), IHS1EB-D2 (160-14502-47), IHS1EB-D3 (160-14502-48), IHS1EB-E0 (160-14502-49), IHS1EB-E1 (160-14502-50), IHS1EB-E2 (160-14502-51), IHS1EB-E3 (160-14502-52), IHS1EB-F0 (160-14502-53), IHS1EB-F1 (160-14502-54), IHS1EB-F2 (160-14502-55) and IHS1EB-F3 (160-14502-56) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 10/28/2015, prepared on 10/30/2015 and 11/03/2015 and analyzed on 11/11/2015 and 11/12/2015.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

TestAmerica St. louis
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Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/21/15	COC No: NSFIH-2015-5
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7488	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific N
IHS1L7- A0	10/21/2015	0753	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- A1	10/21/2015	0757	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- A2	10/21/2015	0801	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- A3	10/21/2015	0806	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- B1	10/21/2015	0809	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- B2	10/21/2015	0814	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- B3	10/21/2015	0818	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- C1	10/21/2015	0819	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- C2	10/21/2015	0822	G	Soil	1	N	Y	X	5 Day TAT
IHS1L7- C3	10/21/2015	0826	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- D1	10/21/2015	0843	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- D2	10/21/2015	0851	G	Soil	1	N	N	X	5 Day TAT

160-14502 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/21/15 1600	Received by: Jill Clark	Company: TA SR	Date/Time: 10-27-15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/21/15	COC No: NSFIH-2015-6
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1L7- D3	10/21/2015	0900	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- E1	10/21/2015	846	G	Soil	1	N	Y	X	5 Day TAT
IHS1L7- E2	10/21/2015	0854	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- E3	10/21/2015	0858	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- A1	10/22/2015	1024	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- A2	10/22/2015	1027	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- A3	10/22/2015	1029	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- B1	10/22/2015	1032	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- B2	10/22/2015	1033	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- B3	10/22/2015	1035	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- C1	10/22/2015	1038	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- C2	10/22/2015	1041	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Li	AWS	10/22/15 1600	Qu Clark	TA SR	10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/22/15	COC No: NSFIH-2015-7
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	2 of 2 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1L8- C3	10/22/2015	1043	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- D1	10/22/2015	1047	G	Soil	1	N	Y	X	5 Day TAT
IHS1L8- D2	10/22/2015	1050	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- D3	10/22/2015	1052	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- E1	10/22/2015	1054	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- E2	10/22/2015	1056	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- E3	10/22/2015	1059	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- F2	10/22/2015	1103	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A0	10/23/2015	0948	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A1	10/23/2015	0950	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A2	10/23/2015	0952	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A3	10/23/2015	0953	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/23/15 1600	Received by:	Company: TA SR	Date/Time: 10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories,Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/22/15	COC No: NSFIH-2015-8
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	4 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1EB- B0	10/23/2015	0956	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- B1	10/23/2015	1000	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- B2	10/23/2015	1002	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- B3	10/23/2015	1003	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C0	10/23/2015	1007	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C1	10/23/2015	1009	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C2	10/23/2015	1010	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C3	10/23/2015	1012	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- D0	10/23/2015	1014	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- D1	10/23/2015	1017	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- D2	10/23/2015	1019	G	Soil	1	N	Y	X	5 Day TAT
IHS1EB- D3	10/23/2015	1020	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company: AWS	Date/Time: 10/23/15 1600	Received by: Jill Clark	Company: TA SR	Date/Time: 10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories , Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/22/15	COC No: NSFIH-2015-9
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7403	Lab Contact: Erika Gish	Carrier: Fed Ex	5 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1EB- E0	10/23/2015	1022	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- E1	10/23/2015	1024	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- E2	10/23/2015	1026	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- E3	10/23/2015	1028	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F0	10/23/2015	1030	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F1	10/23/2015	1032	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F2	10/23/2015	1034	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F3	10/23/2015	1040	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/23/15 1600	Received by:	Company: TA STL	Date/Time: 10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/022013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-14502-1

Login Number: 14502
List Number: 1
Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14502-1	IHS1L7-A0	Solid	10/21/15 07:53	10/27/15 13:40
160-14502-2	IHS1L7-A1	Solid	10/21/15 07:57	10/27/15 13:40
160-14502-3	IHS1L7-A2	Solid	10/21/15 08:01	10/27/15 13:40
160-14502-4	IHS1L7-A3	Solid	10/21/15 08:06	10/27/15 13:40
160-14502-5	IHS1L7-B1	Solid	10/21/15 08:09	10/27/15 13:40
160-14502-6	IHS1L7-B2	Solid	10/21/15 08:14	10/27/15 13:40
160-14502-7	IHS1L7-B3	Solid	10/21/15 08:18	10/27/15 13:40
160-14502-8	IHS1L7-C1	Solid	10/21/15 08:19	10/27/15 13:40
160-14502-9	IHS1L7-C2	Solid	10/21/15 08:22	10/27/15 13:40
160-14502-10	IHS1L7-C3	Solid	10/21/15 08:26	10/27/15 13:40
160-14502-11	IHS1L7-D1	Solid	10/21/15 08:43	10/27/15 13:40
160-14502-12	IHS1L7-D2	Solid	10/21/15 08:51	10/27/15 13:40
160-14502-13	IHS1L7-D3	Solid	10/21/15 09:00	10/27/15 13:40
160-14502-14	IHS1L7-E1	Solid	10/21/15 08:46	10/27/15 13:40
160-14502-15	IHS1L7-E2	Solid	10/21/15 08:54	10/27/15 13:40
160-14502-16	IHS1L7-E3	Solid	10/21/15 08:58	10/27/15 13:40
160-14502-17	IHS1L8-A1	Solid	10/22/15 10:24	10/27/15 13:40
160-14502-18	IHS1L8-A2	Solid	10/22/15 10:27	10/27/15 13:40
160-14502-19	IHS1L8-A3	Solid	10/22/15 10:29	10/27/15 13:40
160-14502-20	IHS1L8-B1	Solid	10/22/15 10:32	10/27/15 13:40
160-14502-21	IHS1L8-B2	Solid	10/22/15 10:33	10/27/15 13:40
160-14502-22	IHS1L8-B3	Solid	10/22/15 10:35	10/27/15 13:40
160-14502-23	IHS1L8-C1	Solid	10/22/15 10:38	10/27/15 13:40
160-14502-24	IHS1L8-C2	Solid	10/22/15 10:41	10/27/15 13:40
160-14502-25	IHS1L8-C3	Solid	10/22/15 10:43	10/27/15 13:40
160-14502-26	IHS1L8-D1	Solid	10/22/15 10:47	10/27/15 13:40
160-14502-27	IHS1L8-D2	Solid	10/22/15 10:50	10/27/15 13:40
160-14502-28	IHS1L8-D3	Solid	10/22/15 10:52	10/27/15 13:40
160-14502-29	IHS1L8-E1	Solid	10/22/15 10:54	10/27/15 13:40
160-14502-30	IHS1L8-E2	Solid	10/22/15 10:56	10/27/15 13:40
160-14502-31	IHS1L8-E3	Solid	10/22/15 10:59	10/27/15 13:40
160-14502-32	IHS1L8-F2	Solid	10/22/15 11:03	10/27/15 13:40
160-14502-33	IHS1EB-A0	Solid	10/23/15 09:48	10/27/15 13:40
160-14502-34	IHS1EB-A1	Solid	10/23/15 09:50	10/27/15 13:40
160-14502-35	IHS1EB-A2	Solid	10/23/15 09:52	10/27/15 13:40
160-14502-36	IHS1EB-A3	Solid	10/23/15 09:53	10/27/15 13:40
160-14502-37	IHS1EB-B0	Solid	10/23/15 09:56	10/27/15 13:40
160-14502-38	IHS1EB-B1	Solid	10/23/15 10:00	10/27/15 13:40
160-14502-39	IHS1EB-B2	Solid	10/23/15 10:02	10/27/15 13:40
160-14502-40	IHS1EB-B3	Solid	10/23/15 10:03	10/27/15 13:40
160-14502-41	IHS1EB-C0	Solid	10/23/15 10:07	10/27/15 13:40
160-14502-42	IHS1EB-C1	Solid	10/23/15 10:09	10/27/15 13:40
160-14502-43	IHS1EB-C2	Solid	10/23/15 10:10	10/27/15 13:40
160-14502-44	IHS1EB-C3	Solid	10/23/15 10:12	10/27/15 13:40
160-14502-45	IHS1EB-D0	Solid	10/23/15 10:14	10/27/15 13:40
160-14502-46	IHS1EB-D1	Solid	10/23/15 10:17	10/27/15 13:40
160-14502-47	IHS1EB-D2	Solid	10/23/15 10:19	10/27/15 13:40
160-14502-48	IHS1EB-D3	Solid	10/23/15 10:20	10/27/15 13:40
160-14502-49	IHS1EB-E0	Solid	10/23/15 10:22	10/27/15 13:40
160-14502-50	IHS1EB-E1	Solid	10/23/15 10:24	10/27/15 13:40
160-14502-51	IHS1EB-E2	Solid	10/23/15 10:26	10/27/15 13:40
160-14502-52	IHS1EB-E3	Solid	10/23/15 10:28	10/27/15 13:40
160-14502-53	IHS1EB-F0	Solid	10/23/15 10:30	10/27/15 13:40

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14502-54	IHS1EB-F1	Solid	10/23/15 10:32	10/27/15 13:40
160-14502-55	IHS1EB-F2	Solid	10/23/15 10:34	10/27/15 13:40
160-14502-56	IHS1EB-F3	Solid	10/23/15 10:40	10/27/15 13:40

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-A0

Lab Sample ID: 160-14502-1
Date Collected: 10/21/15 07:53
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.552		0.137	0.145	1.00	0.0738	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.536		0.133	0.140	1.00	0.0500	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.596		0.138	0.147	1.00	0.0241	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.1*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-A1

Lab Sample ID: 160-14502-2
Date Collected: 10/21/15 07:57
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.676		0.147	0.157	1.00	0.0695	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.404		0.113	0.118	1.00	0.0545	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.486		0.122	0.129	1.00	0.0369	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.7*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-A2

Lab Sample ID: 160-14502-3
Date Collected: 10/21/15 08:01
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.538		0.136	0.143	1.00	0.0777	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.564		0.135	0.143	1.00	0.0242	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.536		0.132	0.139	1.00	0.0389	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.8*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-A3

Lab Sample ID: 160-14502-4
Date Collected: 10/21/15 08:06
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.13		0.191	0.213	1.00	0.0824	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.538		0.131	0.138	1.00	0.0520	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	1.09		0.185	0.206	1.00	0.0518	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-A3

Lab Sample ID: 160-14502-4
Matrix: Solid
Date Collected: 10/21/15 08:06
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.5		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-B1

Lab Sample ID: 160-14502-5
Matrix: Solid
Date Collected: 10/21/15 08:09
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.622		0.133	0.143	1.00	0.0438	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.506		0.123	0.130	1.00	0.0679	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.630		0.133	0.143	1.00	0.0340	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-B2

Lab Sample ID: 160-14502-6
Matrix: Solid
Date Collected: 10/21/15 08:14
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.693		0.149	0.160	1.00	0.0663	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.574		0.136	0.144	1.00	0.0586	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.548		0.131	0.139	1.00	0.0435	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.9		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-B3

Lab Sample ID: 160-14502-7
Matrix: Solid
Date Collected: 10/21/15 08:18
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.620		0.139	0.149	1.00	0.0733	pCi/g	10/30/15 10:05	11/11/15 21:49	1
Thorium-230	0.879		0.163	0.179	1.00	0.0557	pCi/g	10/30/15 10:05	11/11/15 21:49	1
Thorium-232	0.687		0.143	0.155	1.00	0.0493	pCi/g	10/30/15 10:05	11/11/15 21:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	10/30/15 10:05	11/11/15 21:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-C1

Lab Sample ID: 160-14502-8
Date Collected: 10/21/15 08:19
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.708		0.148	0.159	1.00	0.0568	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.669		0.146	0.156	1.00	0.0766	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.590		0.134	0.143	1.00	0.0466	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.3*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-C2

Lab Sample ID: 160-14502-9
Date Collected: 10/21/15 08:22
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.665		0.148	0.158	1.00	0.0719	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.687		0.148	0.159	1.00	0.0516	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.629		0.142	0.151	1.00	0.0525	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.7*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-C3

Lab Sample ID: 160-14502-10
Date Collected: 10/21/15 08:26
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.593		0.131	0.140	1.00	0.0655	pCi/g	10/30/15 10:05	11/12/15 16:23	1
Thorium-230	0.577		0.128	0.137	1.00	0.0496	pCi/g	10/30/15 10:05	11/12/15 16:23	1
Thorium-232	0.598		0.130	0.139	1.00	0.0429	pCi/g	10/30/15 10:05	11/12/15 16:23	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*102*		*30 - 110*	*10/30/15 10:05*	*11/12/15 16:23*	*1*

Client Sample ID: IHS1L7-D1

Lab Sample ID: 160-14502-11
Date Collected: 10/21/15 08:43
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.409		0.115	0.120	1.00	0.0823	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.522		0.125	0.133	1.00	0.0635	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.394		0.108	0.112	1.00	0.0479	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-D1
Date Collected: 10/21/15 08:43
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-11
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	98.3		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-D2
Date Collected: 10/21/15 08:51
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-12
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.630		0.141	0.151	1.00	0.0777	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.549		0.129	0.137	1.00	0.0464	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.403		0.110	0.115	1.00	0.0418	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	96.3		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-D3
Date Collected: 10/21/15 09:00
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-13
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.525		0.125	0.133	1.00	0.0613	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.552		0.127	0.135	1.00	0.0404	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.614		0.133	0.143	1.00	0.0402	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	103		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-E1
Date Collected: 10/21/15 08:46
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-14
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.647		0.145	0.155	1.00	0.0596	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.798		0.160	0.173	1.00	0.0445	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.569		0.134	0.142	1.00	0.0237	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-E2

Lab Sample ID: 160-14502-15
Date Collected: 10/21/15 08:54
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.433		0.112	0.118	1.00	0.0674	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.432		0.109	0.115	1.00	0.0422	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.477		0.115	0.121	1.00	0.0420	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*110*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-E3

Lab Sample ID: 160-14502-16
Date Collected: 10/21/15 08:58
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.781		0.159	0.172	1.00	0.0749	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.669		0.146	0.156	1.00	0.0611	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.960		0.173	0.191	1.00	0.0473	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.9*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L8-A1

Lab Sample ID: 160-14502-17
Date Collected: 10/22/15 10:24
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.601		0.141	0.150	1.00	0.0716	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.568		0.136	0.144	1.00	0.0647	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.653		0.146	0.156	1.00	0.0669	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.8*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:56*	*1*

Client Sample ID: IHS1L8-A2

Lab Sample ID: 160-14502-18
Date Collected: 10/22/15 10:27
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.958		0.177	0.194	1.00	0.0630	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.740		0.154	0.166	1.00	0.0241	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.696		0.149	0.160	1.00	0.0240	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-A2

Lab Sample ID: 160-14502-18
Date Collected: 10/22/15 10:27
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.0		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample ID: IHS1L8-A3

Lab Sample ID: 160-14502-19
Date Collected: 10/22/15 10:29
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.881		0.170	0.185	1.00	0.0703	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.859		0.166	0.181	1.00	0.0386	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.845		0.164	0.179	1.00	0.0444	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.0		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample ID: IHS1L8-B1

Lab Sample ID: 160-14502-20
Date Collected: 10/22/15 10:32
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.25		0.201	0.226	1.00	0.0793	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.605		0.139	0.148	1.00	0.0485	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	1.10		0.186	0.208	1.00	0.0482	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.2		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample ID: IHS1L8-B2

Lab Sample ID: 160-14502-21
Date Collected: 10/22/15 10:33
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.688		0.141	0.152	1.00	0.0594	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.691		0.141	0.152	1.00	0.0572	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.567		0.126	0.134	1.00	0.0336	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-B3

Lab Sample ID: 160-14502-22
Date Collected: 10/22/15 10:35
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.544		0.133	0.140	1.00	0.0782	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-230	0.537		0.130	0.137	1.00	0.0620	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-232	0.633		0.139	0.149	1.00	0.0465	pCi/g	10/30/15 13:17	11/11/15 10:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.2*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:57*	*1*

Client Sample ID: IHS1L8-C1

Lab Sample ID: 160-14502-23
Date Collected: 10/22/15 10:38
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.484		0.122	0.128	1.00	0.0626	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-230	0.525		0.126	0.134	1.00	0.0579	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-232	0.377		0.106	0.110	1.00	0.0410	pCi/g	10/30/15 13:17	11/11/15 10:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*98.4*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:57*	*1*

Client Sample ID: IHS1L8-C2

Lab Sample ID: 160-14502-24
Date Collected: 10/22/15 10:41
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.799		0.162	0.175	1.00	0.0743	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.766		0.157	0.170	1.00	0.0563	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.825		0.162	0.176	1.00	0.0487	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.1*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-C3

Lab Sample ID: 160-14502-25
Date Collected: 10/22/15 10:43
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.716		0.150	0.161	1.00	0.0783	pCi/g	10/30/15 13:17	11/12/15 16:21	1
Thorium-230	0.659		0.141	0.151	1.00	0.0495	pCi/g	10/30/15 13:17	11/12/15 16:21	1
Thorium-232	0.781		0.153	0.166	1.00	0.0492	pCi/g	10/30/15 13:17	11/12/15 16:21	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-C3
Date Collected: 10/22/15 10:43
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-25
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	103		30 - 110	10/30/15 13:17	11/12/15 16:21	1

Client Sample ID: IHS1L8-D1
Date Collected: 10/22/15 10:47
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-26
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.30		0.213	0.239	1.00	0.0772	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.849		0.171	0.186	1.00	0.0605	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.870		0.172	0.187	1.00	0.0410	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.3		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample ID: IHS1L8-D2
Date Collected: 10/22/15 10:50
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-27
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.544		0.131	0.139	1.00	0.0482	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.518		0.131	0.138	1.00	0.0747	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.461		0.120	0.126	1.00	0.0373	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.5		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample ID: IHS1L8-D3
Date Collected: 10/22/15 10:52
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-28
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.823		0.165	0.179	1.00	0.0680	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.629		0.144	0.153	1.00	0.0601	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.801		0.160	0.174	1.00	0.0447	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.8		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-E1

Lab Sample ID: 160-14502-29
Date Collected: 10/22/15 10:54
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.806		0.163	0.176	1.00	0.0777	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.706		0.151	0.163	1.00	0.0670	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.692		0.150	0.161	1.00	0.0702	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.9*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-E2

Lab Sample ID: 160-14502-30
Date Collected: 10/22/15 10:56
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.534		0.127	0.135	1.00	0.0552	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.584		0.135	0.144	1.00	0.0745	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.507		0.123	0.130	1.00	0.0453	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*100*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-E3

Lab Sample ID: 160-14502-31
Date Collected: 10/22/15 10:59
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.615		0.140	0.149	1.00	0.0696	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.858		0.163	0.178	1.00	0.0511	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.701		0.147	0.158	1.00	0.0509	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.3*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-F2

Lab Sample ID: 160-14502-32
Date Collected: 10/22/15 11:03
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.771		0.159	0.172	1.00	0.0807	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.662		0.145	0.155	1.00	0.0520	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.461		0.120	0.126	1.00	0.0434	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-F2

Lab Sample ID: 160-14502-32
Date Collected: 10/22/15 11:03
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.8		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample ID: IHS1EB-A0

Lab Sample ID: 160-14502-33
Date Collected: 10/23/15 09:48
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.537		0.137	0.144	1.00	0.0822	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-230	0.680		0.150	0.160	1.00	0.0578	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-232	0.636		0.145	0.154	1.00	0.0574	pCi/g	10/30/15 13:19	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.4		30 - 110	10/30/15 13:19	11/11/15 21:50	1

Client Sample ID: IHS1EB-A1

Lab Sample ID: 160-14502-34
Date Collected: 10/23/15 09:50
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.05		0.186	0.206	1.00	0.0806	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-230	0.700		0.151	0.162	1.00	0.0567	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-232	0.871		0.166	0.182	1.00	0.0384	pCi/g	10/30/15 13:19	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	96.3		30 - 110	10/30/15 13:19	11/11/15 21:50	1

Client Sample ID: IHS1EB-A2

Lab Sample ID: 160-14502-35
Date Collected: 10/23/15 09:52
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.923		0.173	0.190	1.00	0.0879	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.927		0.171	0.188	1.00	0.0678	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.972		0.173	0.192	1.00	0.0511	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.7		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-A3

Lab Sample ID: 160-14502-36
Date Collected: 10/23/15 09:53
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.779		0.156	0.169	1.00	0.0777	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.684		0.144	0.155	1.00	0.0463	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.801		0.155	0.169	1.00	0.0418	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.9*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-B0

Lab Sample ID: 160-14502-37
Date Collected: 10/23/15 09:56
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.663		0.142	0.153	1.00	0.0627	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.595		0.133	0.142	1.00	0.0414	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.717		0.146	0.158	1.00	0.0412	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*102*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-B1

Lab Sample ID: 160-14502-38
Date Collected: 10/23/15 10:00
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.585		0.136	0.145	1.00	0.0582	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.532		0.129	0.137	1.00	0.0435	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.468		0.120	0.126	1.00	0.0232	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.3*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-B2

Lab Sample ID: 160-14502-39
Date Collected: 10/23/15 10:02
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.764		0.163	0.175	1.00	0.0933	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.624		0.143	0.153	1.00	0.0455	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.751		0.157	0.169	1.00	0.0455	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-B2

Lab Sample ID: 160-14502-39
Date Collected: 10/23/15 10:02
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.1		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-B3

Lab Sample ID: 160-14502-40
Date Collected: 10/23/15 10:03
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.743		0.158	0.169	1.00	0.0771	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.763		0.158	0.171	1.00	0.0630	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.753		0.156	0.169	1.00	0.0598	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.9		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-C0

Lab Sample ID: 160-14502-41
Date Collected: 10/23/15 10:07
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.612		0.141	0.150	1.00	0.0761	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.444		0.118	0.123	1.00	0.0433	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.439		0.117	0.123	1.00	0.0474	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.8		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-C1

Lab Sample ID: 160-14502-42
Date Collected: 10/23/15 10:09
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.791		0.160	0.173	1.00	0.0751	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.704		0.150	0.161	1.00	0.0584	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	1.22		0.195	0.220	1.00	0.0474	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.4		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-C2

Lab Sample ID: 160-14502-43
Date Collected: 10/23/15 10:10
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.712		0.154	0.166	1.00	0.0732	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.718		0.154	0.166	1.00	0.0662	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.560		0.137	0.145	1.00	0.0684	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.8*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-C3

Lab Sample ID: 160-14502-44
Date Collected: 10/23/15 10:12
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.710		0.146	0.158	1.00	0.0578	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.731		0.147	0.159	1.00	0.0222	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.647		0.138	0.148	1.00	0.0220	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.6*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-D0

Lab Sample ID: 160-14502-45
Date Collected: 10/23/15 10:14
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.781		0.157	0.170	1.00	0.0672	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.615		0.137	0.147	1.00	0.0369	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.857		0.162	0.177	1.00	0.0425	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*98.2*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-D1

Lab Sample ID: 160-14502-46
Date Collected: 10/23/15 10:17
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.788		0.163	0.176	1.00	0.0812	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.757		0.157	0.169	1.00	0.0496	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.689		0.149	0.160	1.00	0.0494	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-D1

Lab Sample ID: 160-14502-46
Date Collected: 10/23/15 10:17
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-D2

Lab Sample ID: 160-14502-47
Date Collected: 10/23/15 10:19
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	2.24		0.261	0.322	1.00	0.0687	pCi/g	10/30/15 15:00	11/12/15 16:23	1
Thorium-230	0.830		0.159	0.173	1.00	0.0466	pCi/g	10/30/15 15:00	11/12/15 16:23	1
Thorium-232	2.33		0.264	0.329	1.00	0.0225	pCi/g	10/30/15 15:00	11/12/15 16:23	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	99.2		30 - 110	10/30/15 15:00	11/12/15 16:23	1

Client Sample ID: IHS1EB-D3

Lab Sample ID: 160-14502-48
Date Collected: 10/23/15 10:20
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.767		0.164	0.176	1.00	0.0643	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.692		0.154	0.165	1.00	0.0257	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.725		0.157	0.169	1.00	0.0256	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.6		30 - 110	10/30/15 15:00	11/11/15 21:53	1

Client Sample ID: IHS1EB-E0

Lab Sample ID: 160-14502-49
Date Collected: 10/23/15 10:22
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.29		0.197	0.225	1.00	0.0728	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.575		0.131	0.140	1.00	0.0482	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	1.00		0.172	0.191	1.00	0.0390	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.2		30 - 110	10/30/15 15:00	11/11/15 21:53	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-E1

Lab Sample ID: 160-14502-50
Date Collected: 10/23/15 10:24
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.811		0.167	0.180	1.00	0.0631	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.715		0.156	0.167	1.00	0.0562	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.694		0.152	0.163	1.00	0.0351	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.3*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:53*	*1*

Client Sample ID: IHS1EB-E2

Lab Sample ID: 160-14502-51
Date Collected: 10/23/15 10:26
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.561		0.136	0.144	1.00	0.0816	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.756		0.154	0.166	1.00	0.0515	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.597		0.136	0.145	1.00	0.0372	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.9*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:53*	*1*

Client Sample ID: IHS1EB-E3

Lab Sample ID: 160-14502-52
Date Collected: 10/23/15 10:28
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.744		0.156	0.168	1.00	0.0823	pCi/g	10/30/15 15:00	11/11/15 21:51	1
Thorium-230	0.669		0.145	0.156	1.00	0.0519	pCi/g	10/30/15 15:00	11/11/15 21:51	1
Thorium-232	0.724		0.150	0.162	1.00	0.0433	pCi/g	10/30/15 15:00	11/11/15 21:51	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.1*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:51*	*1*

Client Sample ID: IHS1EB-F0

Lab Sample ID: 160-14502-53
Date Collected: 10/23/15 10:30
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.658		0.144	0.154	1.00	0.0809	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-230	0.733		0.148	0.161	1.00	0.0553	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-232	0.723		0.146	0.159	1.00	0.0474	pCi/g	11/03/15 10:56	11/11/15 21:54	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-F0

Lab Sample ID: 160-14502-53
Date Collected: 10/23/15 10:30
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	104		30 - 110	11/03/15 10:56	11/11/15 21:54	1

Client Sample ID: IHS1EB-F1

Lab Sample ID: 160-14502-54
Date Collected: 10/23/15 10:32
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.701		0.154	0.165	1.00	0.0696	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-230	0.822		0.164	0.178	1.00	0.0458	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-232	0.688		0.150	0.161	1.00	0.0456	pCi/g	11/03/15 10:56	11/11/15 21:54	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.9		30 - 110	11/03/15 10:56	11/11/15 21:54	1

Client Sample ID: IHS1EB-F2

Lab Sample ID: 160-14502-55
Date Collected: 10/23/15 10:34
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.347		0.104	0.108	1.00	0.0476	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-230	0.542		0.133	0.140	1.00	0.0738	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-232	0.349		0.104	0.108	1.00	0.0369	pCi/g	11/03/15 10:56	11/12/15 16:20	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.7		30 - 110	11/03/15 10:56	11/12/15 16:20	1

Client Sample ID: IHS1EB-F3

Lab Sample ID: 160-14502-56
Date Collected: 10/23/15 10:40
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.549		0.131	0.139	1.00	0.0641	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-230	0.493		0.124	0.131	1.00	0.0594	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-232	0.613		0.136	0.146	1.00	0.0421	pCi/g	11/03/15 10:56	11/12/15 16:20	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	11/03/15 10:56	11/12/15 16:20	1

QC Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-219235/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221399 — **Prep Batch: 219235**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.004228	U	0.0179	0.0179	1.00	0.0474	pCi/g	10/30/15 10:05	11/11/15 10:48	1
Thorium-230	0.05447		0.0450	0.0452	1.00	0.0474	pCi/g	10/30/15 10:05	11/11/15 10:48	1
Thorium-232	-0.001210	U	0.00319	0.00319	1.00	0.0370	pCi/g	10/30/15 10:05	11/11/15 10:48	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.4*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:48*	*1*

Lab Sample ID: LCS 160-219235/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221400 — **Prep Batch: 219235**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.55		2.50	1.00	0.0482	pCi/g	104	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*94.2*		*30 - 110*

Lab Sample ID: 160-14502-9 MS — **Client Sample ID: IHS1L7-C2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221444 — **Prep Batch: 219235**

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.687		3.98	4.870		0.574	1.00	0.0553	pCi/g	105	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*86.2*		*30 - 110*

Lab Sample ID: 160-14502-9 MSD — **Client Sample ID: IHS1L7-C2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221486 — **Prep Batch: 219235**

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.687		3.98	5.023		0.586	1.00	0.0546	pCi/g	109	76 - 115	0.13	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*87.1*		*30 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14502-14 MS
Matrix: Solid
Analysis Batch: 221453

Client Sample ID: IHS1L7-E1
Prep Type: Total/NA
Prep Batch: 219235

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.798		4.01	4.714		0.557	1.00	0.0456	pCi/g	98	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*87.3*		*30 - 110*

Lab Sample ID: 160-14502-14 MSD
Matrix: Solid
Analysis Batch: 221454

Client Sample ID: IHS1L7-E1
Prep Type: Total/NA
Prep Batch: 219235

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.798		3.98	5.082		0.574	1.00	0.0593	pCi/g	108	76 - 115	0.33	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*99.3*		*30 - 110*

Lab Sample ID: MB 160-219364/1-A
Matrix: Solid
Analysis Batch: 221397

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 219364

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.02489	U	0.0347	0.0348	1.00	0.0566	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-230	0.07423		0.0511	0.0515	1.00	0.0411	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-232	0.007228	U	0.0172	0.0172	1.00	0.0371	pCi/g	10/30/15 13:17	11/11/15 10:57	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*87.2*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:57*	*1*

Lab Sample ID: LCS 160-219364/2-A
Matrix: Solid
Analysis Batch: 221398

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 219364

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.01		2.44	1.00	0.0740	pCi/g	102	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*98.5*		*30 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14502-26 MS
Matrix: Solid
Analysis Batch: 221437

Client Sample ID: IHS1L8-D1
Prep Type: Total/NA
Prep Batch: 219364

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.849		3.99	5.142		0.592	1.00	0.0240	pCi/g	108	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*89.4*		*30 - 110*

Lab Sample ID: 160-14502-26 MSD
Matrix: Solid
Analysis Batch: 221438

Client Sample ID: IHS1L8-D1
Prep Type: Total/NA
Prep Batch: 219364

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.849		3.99	4.748		0.548	1.00	0.0497	pCi/g	98	76 - 115	0.35	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*102*		*30 - 110*

Lab Sample ID: MB 160-219392/1-A
Matrix: Solid
Analysis Batch: 221403

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 219392

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.0002712	U	0.00152	0.00152	1.00	0.0310	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.1295		0.0683	0.0692	1.00	0.0525	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.006335	U	0.0174	0.0174	1.00	0.0409	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*81.6*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:53*	*1*

Lab Sample ID: LCS 160-219392/2-A
Matrix: Solid
Analysis Batch: 221404

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 219392

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.81		2.52	1.00	0.105	pCi/g	105	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*95.2*		*30 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14502-47 MS
Matrix: Solid
Analysis Batch: 221765

Client Sample ID: IHS1EB-D2
Prep Type: Total/NA
Prep Batch: 219392

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.830		4.00	4.423		0.523	1.00	0.0543	pCi/g	90	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*98.4*		*30 - 110*

Lab Sample ID: 160-14502-47 MSD
Matrix: Solid
Analysis Batch: 221766

Client Sample ID: IHS1EB-D2
Prep Type: Total/NA
Prep Batch: 219392

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.830		3.98	5.040		0.584	1.00	0.0241	pCi/g	106	76 - 115	0.56	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*88.8*		*30 - 110*

Lab Sample ID: MB 160-219803/1-A
Matrix: Solid
Analysis Batch: 221400

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 219803

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.008109	U	0.0243	0.0243	1.00	0.0542	pCi/g	11/03/15 10:56	11/11/15 21:55	1
Thorium-230	0.07302		0.0487	0.0491	1.00	0.0243	pCi/g	11/03/15 10:56	11/11/15 21:55	1
Thorium-232	0.0000	U	0.00404	0.00404	1.00	0.0242	pCi/g	11/03/15 10:56	11/11/15 21:55	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.8*		*30 - 110*	*11/03/15 10:56*	*11/11/15 21:55*	*1*

Lab Sample ID: LCS 160-219803/2-A
Matrix: Solid
Analysis Batch: 221401

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 219803

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	26.47		2.58	1.00	0.0904	pCi/g	108	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*88.9*		*30 - 110*

QC Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14374-A-1-H DU
Matrix: Solid
Analysis Batch: 221473

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 219803

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	1.81			1.845		0.295	1.00	0.0844	pCi/g			0.05	1
Thorium-230	1.33			1.492		0.256	1.00	0.0404	pCi/g			0.32	1
Thorium-232	1.50			1.744		0.282	1.00	0.0249	pCi/g			0.46	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*86.5*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Rad

Leach Batch: 218756

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-1	IHS1L7-A0	Total/NA	Solid	Dry and Grind	
160-14502-2	IHS1L7-A1	Total/NA	Solid	Dry and Grind	
160-14502-3	IHS1L7-A2	Total/NA	Solid	Dry and Grind	
160-14502-4	IHS1L7-A3	Total/NA	Solid	Dry and Grind	
160-14502-5	IHS1L7-B1	Total/NA	Solid	Dry and Grind	
160-14502-6	IHS1L7-B2	Total/NA	Solid	Dry and Grind	
160-14502-7	IHS1L7-B3	Total/NA	Solid	Dry and Grind	
160-14502-8	IHS1L7-C1	Total/NA	Solid	Dry and Grind	
160-14502-9	IHS1L7-C2	Total/NA	Solid	Dry and Grind	
160-14502-9 MS	IHS1L7-C2	Total/NA	Solid	Dry and Grind	
160-14502-9 MSD	IHS1L7-C2	Total/NA	Solid	Dry and Grind	
160-14502-10	IHS1L7-C3	Total/NA	Solid	Dry and Grind	
160-14502-11	IHS1L7-D1	Total/NA	Solid	Dry and Grind	
160-14502-12	IHS1L7-D2	Total/NA	Solid	Dry and Grind	
160-14502-13	IHS1L7-D3	Total/NA	Solid	Dry and Grind	
160-14502-14	IHS1L7-E1	Total/NA	Solid	Dry and Grind	
160-14502-14 MS	IHS1L7-E1	Total/NA	Solid	Dry and Grind	
160-14502-14 MSD	IHS1L7-E1	Total/NA	Solid	Dry and Grind	
160-14502-15	IHS1L7-E2	Total/NA	Solid	Dry and Grind	
160-14502-16	IHS1L7-E3	Total/NA	Solid	Dry and Grind	
160-14502-17	IHS1L8-A1	Total/NA	Solid	Dry and Grind	
160-14502-18	IHS1L8-A2	Total/NA	Solid	Dry and Grind	
160-14502-19	IHS1L8-A3	Total/NA	Solid	Dry and Grind	
160-14502-20	IHS1L8-B1	Total/NA	Solid	Dry and Grind	
160-14502-21	IHS1L8-B2	Total/NA	Solid	Dry and Grind	
160-14502-22	IHS1L8-B3	Total/NA	Solid	Dry and Grind	
160-14502-23	IHS1L8-C1	Total/NA	Solid	Dry and Grind	
160-14502-24	IHS1L8-C2	Total/NA	Solid	Dry and Grind	
160-14502-25	IHS1L8-C3	Total/NA	Solid	Dry and Grind	
160-14502-26	IHS1L8-D1	Total/NA	Solid	Dry and Grind	
160-14502-26 MS	IHS1L8-D1	Total/NA	Solid	Dry and Grind	
160-14502-26 MSD	IHS1L8-D1	Total/NA	Solid	Dry and Grind	
160-14502-27	IHS1L8-D2	Total/NA	Solid	Dry and Grind	
160-14502-28	IHS1L8-D3	Total/NA	Solid	Dry and Grind	
160-14502-29	IHS1L8-E1	Total/NA	Solid	Dry and Grind	
160-14502-30	IHS1L8-E2	Total/NA	Solid	Dry and Grind	
160-14502-31	IHS1L8-E3	Total/NA	Solid	Dry and Grind	
160-14502-32	IHS1L8-F2	Total/NA	Solid	Dry and Grind	
160-14502-33	IHS1EB-A0	Total/NA	Solid	Dry and Grind	
160-14502-34	IHS1EB-A1	Total/NA	Solid	Dry and Grind	
160-14502-35	IHS1EB-A2	Total/NA	Solid	Dry and Grind	
160-14502-36	IHS1EB-A3	Total/NA	Solid	Dry and Grind	
160-14502-37	IHS1EB-B0	Total/NA	Solid	Dry and Grind	
160-14502-38	IHS1EB-B1	Total/NA	Solid	Dry and Grind	
160-14502-39	IHS1EB-B2	Total/NA	Solid	Dry and Grind	
160-14502-40	IHS1EB-B3	Total/NA	Solid	Dry and Grind	
160-14502-41	IHS1EB-C0	Total/NA	Solid	Dry and Grind	
160-14502-42	IHS1EB-C1	Total/NA	Solid	Dry and Grind	
160-14502-43	IHS1EB-C2	Total/NA	Solid	Dry and Grind	
160-14502-44	IHS1EB-C3	Total/NA	Solid	Dry and Grind	
160-14502-45	IHS1EB-D0	Total/NA	Solid	Dry and Grind	

Rad (Continued)

Leach Batch: 218756 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-46	IHS1EB-D1	Total/NA	Solid	Dry and Grind	
160-14502-47	IHS1EB-D2	Total/NA	Solid	Dry and Grind	
160-14502-47 MS	IHS1EB-D2	Total/NA	Solid	Dry and Grind	
160-14502-47 MSD	IHS1EB-D2	Total/NA	Solid	Dry and Grind	
160-14502-48	IHS1EB-D3	Total/NA	Solid	Dry and Grind	
160-14502-49	IHS1EB-E0	Total/NA	Solid	Dry and Grind	
160-14502-50	IHS1EB-E1	Total/NA	Solid	Dry and Grind	
160-14502-51	IHS1EB-E2	Total/NA	Solid	Dry and Grind	
160-14502-52	IHS1EB-E3	Total/NA	Solid	Dry and Grind	
160-14502-53	IHS1EB-F0	Total/NA	Solid	Dry and Grind	
160-14502-54	IHS1EB-F1	Total/NA	Solid	Dry and Grind	
160-14502-55	IHS1EB-F2	Total/NA	Solid	Dry and Grind	
160-14502-56	IHS1EB-F3	Total/NA	Solid	Dry and Grind	

Prep Batch: 219235

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-1	IHS1L7-A0	Total/NA	Solid	ExtChrom	218756
160-14502-2	IHS1L7-A1	Total/NA	Solid	ExtChrom	218756
160-14502-3	IHS1L7-A2	Total/NA	Solid	ExtChrom	218756
160-14502-4	IHS1L7-A3	Total/NA	Solid	ExtChrom	218756
160-14502-5	IHS1L7-B1	Total/NA	Solid	ExtChrom	218756
160-14502-6	IHS1L7-B2	Total/NA	Solid	ExtChrom	218756
160-14502-7	IHS1L7-B3	Total/NA	Solid	ExtChrom	218756
160-14502-8	IHS1L7-C1	Total/NA	Solid	ExtChrom	218756
160-14502-9	IHS1L7-C2	Total/NA	Solid	ExtChrom	218756
160-14502-9 MS	IHS1L7-C2	Total/NA	Solid	ExtChrom	218756
160-14502-9 MSD	IHS1L7-C2	Total/NA	Solid	ExtChrom	218756
160-14502-10	IHS1L7-C3	Total/NA	Solid	ExtChrom	218756
160-14502-11	IHS1L7-D1	Total/NA	Solid	ExtChrom	218756
160-14502-12	IHS1L7-D2	Total/NA	Solid	ExtChrom	218756
160-14502-13	IHS1L7-D3	Total/NA	Solid	ExtChrom	218756
160-14502-14	IHS1L7-E1	Total/NA	Solid	ExtChrom	218756
160-14502-14 MS	IHS1L7-E1	Total/NA	Solid	ExtChrom	218756
160-14502-14 MSD	IHS1L7-E1	Total/NA	Solid	ExtChrom	218756
160-14502-15	IHS1L7-E2	Total/NA	Solid	ExtChrom	218756
160-14502-16	IHS1L7-E3	Total/NA	Solid	ExtChrom	218756
LCS 160-219235/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219235/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 219364

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-17	IHS1L8-A1	Total/NA	Solid	ExtChrom	218756
160-14502-18	IHS1L8-A2	Total/NA	Solid	ExtChrom	218756
160-14502-19	IHS1L8-A3	Total/NA	Solid	ExtChrom	218756
160-14502-20	IHS1L8-B1	Total/NA	Solid	ExtChrom	218756
160-14502-21	IHS1L8-B2	Total/NA	Solid	ExtChrom	218756
160-14502-22	IHS1L8-B3	Total/NA	Solid	ExtChrom	218756
160-14502-23	IHS1L8-C1	Total/NA	Solid	ExtChrom	218756
160-14502-24	IHS1L8-C2	Total/NA	Solid	ExtChrom	218756
160-14502-25	IHS1L8-C3	Total/NA	Solid	ExtChrom	218756
160-14502-26	IHS1L8-D1	Total/NA	Solid	ExtChrom	218756

Rad (Continued)

Prep Batch: 219364 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-26 MS	IHS1L8-D1	Total/NA	Solid	ExtChrom	218756
160-14502-26 MSD	IHS1L8-D1	Total/NA	Solid	ExtChrom	218756
160-14502-27	IHS1L8-D2	Total/NA	Solid	ExtChrom	218756
160-14502-28	IHS1L8-D3	Total/NA	Solid	ExtChrom	218756
160-14502-29	IHS1L8-E1	Total/NA	Solid	ExtChrom	218756
160-14502-30	IHS1L8-E2	Total/NA	Solid	ExtChrom	218756
160-14502-31	IHS1L8-E3	Total/NA	Solid	ExtChrom	218756
160-14502-32	IHS1L8-F2	Total/NA	Solid	ExtChrom	218756
160-14502-33	IHS1EB-A0	Total/NA	Solid	ExtChrom	218756
160-14502-34	IHS1EB-A1	Total/NA	Solid	ExtChrom	218756
LCS 160-219364/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219364/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 219392

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-35	IHS1EB-A2	Total/NA	Solid	ExtChrom	218756
160-14502-36	IHS1EB-A3	Total/NA	Solid	ExtChrom	218756
160-14502-37	IHS1EB-B0	Total/NA	Solid	ExtChrom	218756
160-14502-38	IHS1EB-B1	Total/NA	Solid	ExtChrom	218756
160-14502-39	IHS1EB-B2	Total/NA	Solid	ExtChrom	218756
160-14502-40	IHS1EB-B3	Total/NA	Solid	ExtChrom	218756
160-14502-41	IHS1EB-C0	Total/NA	Solid	ExtChrom	218756
160-14502-42	IHS1EB-C1	Total/NA	Solid	ExtChrom	218756
160-14502-43	IHS1EB-C2	Total/NA	Solid	ExtChrom	218756
160-14502-44	IHS1EB-C3	Total/NA	Solid	ExtChrom	218756
160-14502-45	IHS1EB-D0	Total/NA	Solid	ExtChrom	218756
160-14502-46	IHS1EB-D1	Total/NA	Solid	ExtChrom	218756
160-14502-47	IHS1EB-D2	Total/NA	Solid	ExtChrom	218756
160-14502-47 MS	IHS1EB-D2	Total/NA	Solid	ExtChrom	218756
160-14502-47 MSD	IHS1EB-D2	Total/NA	Solid	ExtChrom	218756
160-14502-48	IHS1EB-D3	Total/NA	Solid	ExtChrom	218756
160-14502-49	IHS1EB-E0	Total/NA	Solid	ExtChrom	218756
160-14502-50	IHS1EB-E1	Total/NA	Solid	ExtChrom	218756
160-14502-51	IHS1EB-E2	Total/NA	Solid	ExtChrom	218756
160-14502-52	IHS1EB-E3	Total/NA	Solid	ExtChrom	218756
LCS 160-219392/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219392/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 219803

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14374-A-1-H DU	Duplicate	Total/NA	Solid	ExtChrom	
160-14502-53	IHS1EB-F0	Total/NA	Solid	ExtChrom	218756
160-14502-54	IHS1EB-F1	Total/NA	Solid	ExtChrom	218756
160-14502-55	IHS1EB-F2	Total/NA	Solid	ExtChrom	218756
160-14502-56	IHS1EB-F3	Total/NA	Solid	ExtChrom	218756
LCS 160-219803/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219803/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	Client Sample ID	Th-229 (30-110)						
160-14374-A-1-H DU	Duplicate	86.5						
160-14502-1	IHS1L7-A0	92.1						
160-14502-2	IHS1L7-A1	97.7						
160-14502-3	IHS1L7-A2	88.8						
160-14502-4	IHS1L7-A3	97.5						
160-14502-5	IHS1L7-B1	101						
160-14502-6	IHS1L7-B2	97.9						
160-14502-7	IHS1L7-B3	101						
160-14502-8	IHS1L7-C1	97.3						
160-14502-9	IHS1L7-C2	93.7						
160-14502-9 MS	IHS1L7-C2	86.2						
160-14502-9 MSD	IHS1L7-C2	87.1						
160-14502-10	IHS1L7-C3	102						
160-14502-11	IHS1L7-D1	98.3						
160-14502-12	IHS1L7-D2	96.3						
160-14502-13	IHS1L7-D3	103						
160-14502-14	IHS1L7-E1	88.0						
160-14502-14 MS	IHS1L7-E1	87.3						
160-14502-14 MSD	IHS1L7-E1	99.3						
160-14502-15	IHS1L7-E2	110						
160-14502-16	IHS1L7-E3	93.9						
160-14502-17	IHS1L8-A1	88.8						
160-14502-18	IHS1L8-A2	89.0						
160-14502-19	IHS1L8-A3	94.0						
160-14502-20	IHS1L8-B1	90.2						
160-14502-21	IHS1L8-B2	101						
160-14502-22	IHS1L8-B3	96.2						
160-14502-23	IHS1L8-C1	98.4						
160-14502-24	IHS1L8-C2	90.1						
160-14502-25	IHS1L8-C3	103						
160-14502-26	IHS1L8-D1	88.3						
160-14502-26 MS	IHS1L8-D1	89.4						
160-14502-26 MSD	IHS1L8-D1	102						
160-14502-27	IHS1L8-D2	92.5						
160-14502-28	IHS1L8-D3	94.8						
160-14502-29	IHS1L8-E1	94.9						
160-14502-30	IHS1L8-E2	100						
160-14502-31	IHS1L8-E3	96.3						
160-14502-32	IHS1L8-F2	91.8						
160-14502-33	IHS1EB-A0	89.4						
160-14502-34	IHS1EB-A1	96.3						
160-14502-35	IHS1EB-A2	91.7						
160-14502-36	IHS1EB-A3	95.9						
160-14502-37	IHS1EB-B0	102						
160-14502-38	IHS1EB-B1	90.3						
160-14502-39	IHS1EB-B2	87.1						
160-14502-40	IHS1EB-B3	89.9						
160-14502-41	IHS1EB-C0	97.8						
160-14502-42	IHS1EB-C1	93.4						

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	**Client Sample ID**	**Th-229 (30-110)**						
160-14502-43	IHS1EB-C2	86.8						
160-14502-44	IHS1EB-C3	96.6						
160-14502-45	IHS1EB-D0	98.2						
160-14502-46	IHS1EB-D1	88.0						
160-14502-47	IHS1EB-D2	99.2						
160-14502-47 MS	IHS1EB-D2	98.4						
160-14502-47 MSD	IHS1EB-D2	88.8						
160-14502-48	IHS1EB-D3	83.6						
160-14502-49	IHS1EB-E0	97.2						
160-14502-50	IHS1EB-E1	92.3						
160-14502-51	IHS1EB-E2	96.9						
160-14502-52	IHS1EB-E3	96.1						
160-14502-53	IHS1EB-F0	104						
160-14502-54	IHS1EB-F1	90.9						
160-14502-55	IHS1EB-F2	93.7						
160-14502-56	IHS1EB-F3	101						
LCS 160-219235/2-A	Lab Control Sample	94.2						
LCS 160-219364/2-A	Lab Control Sample	98.5						
LCS 160-219392/2-A	Lab Control Sample	95.2						
LCS 160-219803/2-A	Lab Control Sample	88.9						
MB 160-219235/1-A	Method Blank	89.4						
MB 160-219364/1-A	Method Blank	87.2						
MB 160-219392/1-A	Method Blank	81.6						
MB 160-219803/1-A	Method Blank	93.8						

Tracer/Carrier Legend

Th-229 = Thorium-229

Appendix J

Concrete Slab Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/29/2015	TIME: 13:30	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-040	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 82.2	α 39.5
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 499.4	βγ 1817.1
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 185.4	βγ 451.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/29/2015	TIME: 15:25	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Survey of Concrete Slabs

Comments:

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-040

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-8.3	23.6	7.1	19.7	Concrete Slab Top
2				-3.1	147.5	1.6	30.7	Concrete Slab Bottom
3				2.1	76.7	7.1	14.2	Concrete Slab Top
4				-8.3	-23.6	4.3	25.2	Concrete Slab Bottom
5				2.1	-53.1	7.1	19.7	Concrete Slab Top
6				2.1	76.7	1.6	41.6	Concrete Slab Bottom
7				7.3	17.7	1.6	36.2	Concrete Slab Top
8				2.1	141.6	7.1	8.8	Concrete Slab Bottom
3D								Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								

Reviewer
Daniel Spicuzza

Date: 10/29/2015

Time: 15:25

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-040	Date : 10/29/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Survey of Concrete Slabs	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	115563	5/19/2016	α	18.43%	α	1.09
			β	9.13%	β	451.51
2360 43-93	276986	12/17/2015	α	9.63%	α	39.48
			β	8.48%	β	1817.11

Contamination Levels:

7.3	dpm / 100cm^2 α	**Maximum Fixed**
147.5	dpm / 100cm^2 β	
7.1	dpm / 100cm^2 α	**Maximum Removable**
41.6	dpm / 100cm^2 β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 10/29/2015
	Time: 1330
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 10/29/2015 03:25:00 PM

Appendix K

Air Sample Data

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1					
A/S ID Number:	AS-01	RWP Number:	NSFIH-2015-001	AWS Number:	N/A	
Date Start:	10/13/2015	Date Stop:	10/13/2015			
Time Start:	11:00	Time Stop:	11:25	Total Time:	25	Minutes
Sample Location:	Downwind During Excavation of Soils					

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/13/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.1	CPM
			Beta/Gamma Background:	40.4	CPM

Technician Performing Count: William Wylie — 10/13/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 6.6E-14 µCi/ml Beta/Gamma MDA= 1.7E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1130	2891	10	289.1	0.1	289	0.67	0.737	2.22E+06	2.64E-04
βγ	1130	8750	10	875	40.4	834.6	0.95	0.365	2.22E+06	1.08E-03

Technician Performing Initial Count: William Wylie 10/13/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
25	min	9.63	CFM	6.8E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	2.6E-04	µCi	6.8E+06	milliliters	3.9E-11	µCi/ml α	**3869**	**% DAC Value**
βγ	1.1E-03	µCi	6.8E+06	milliliters	1.6E-10	µCi/ml βγ	**15913**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1330	298	10	29.8	0.1	29.7	0.67	0.737	2.22E+06	2.71E-05
βγ	1330	1148	10	114.8	40.4	74.4	0.95	0.365	2.22E+06	9.67E-05

Technician Performing Decay Count: William Wylie 10/13/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	2.7E-05	µCi	6813224.999	milliliters	4.0E-12	µCi/ml α	**398**	**% DAC Value**
βγ	9.7E-05	µCi	6813224.999	milliliters	1.4E-11	µCi/ml βγ	**1419**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	36.5	Minutes
T 1/2 βγ =	34.4	Minutes

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O730	8	10	0.8	0.1	0.7	0.67	0.737	2.22E+06	6.39E-07
βγ	O730	406	10	40.6	40.4	0.2	0.95	0.365	2.22E+06	2.60E-07

Technician Performing Decay Count: William Wylie — 10/14/2015 (Date)

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	6.39E-07	mCi	6813225	milliliters	9.4E-14	mCi/ml α	9	% DAC Value
βγ	2.60E-07	mCi	6813225	milliliters	3.8E-14	mCi/ml βγ	4	% DAC Value

Technician Performing Calculation: William Wylie — 10/14/2015 (Date)

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \_\_\_\_\_ mCi$$

Technician Performing Calculation: N/A — N/A (Date)

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci = (A_{LL}\mu Ci)(0.67)$

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.83 $\frac{1.89}{2.83}$ = .67

Total long-lived beta activity= .945 + .945 = 1.89

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

$\frac{\quad}{\text{volume}}$ A_{LL} µCi = µCi/ml $[A_{LL}]a$

$\frac{\quad}{\text{volume}}$ A_{LL} µCi = µCi/ml $[A_{LL}]bg$

If: $[A_{LL}]$ > 1E-13 µCi/ml α

$[A_{LL}]$ > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/14/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-02	RWP Number:	NSFIH-2015-001	AWS Number:	N/A
Date Start:	10/13/2015	Date Stop:	10/13/2015		
Time Start:	12:25	Time Stop:	12:35	Total Time:	10 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/13/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.1	CPM
			Beta/Gamma Background:	40.4	CPM

Technician Performing Count: William Wylie — 10/13/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.7E-13 µCi/ml Beta/Gamma MDA= 4.4E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1239	4885	10	488.5	0.1	488.4	0.67	0.737	2.22E+06	4.46E-04
βγ	1239	12737	10	1273.7	40.4	1233.3	0.95	0.365	2.22E+06	1.60E-03

Technician Performing Initial Count: William Wylie 10/13/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
10	min	9.63	CFM	2.7E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	4.5E-04	µCi	2.7E+06	milliliters	1.6E-10	µCi/ml α	**16348**	**% DAC Value**
βγ	1.6E-03	µCi	2.7E+06	milliliters	5.9E-10	µCi/ml βγ	**58788**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1439	579	10	57.9	0.1	57.8	0.67	0.737	2.22E+06	5.27E-05
βγ	1439	1635	10	163.5	40.4	123.1	0.95	0.365	2.22E+06	1.60E-04

Technician Performing Decay Count: William Wylie 10/13/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	5.3E-05	µCi	2725290	milliliters	1.9E-11	µCi/ml α	**1935**	**% DAC Value**
βγ	1.6E-04	µCi	2725290	milliliters	5.9E-11	µCi/ml βγ	**5868**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	39.0	Minutes
T 1/2 βγ =	36.1	Minutes

Technician Performing Calculation: William Wylie 10/13/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O839	3	10	0.3	0.1	0.2	0.67	0.737	2.22E+06	1.82E-07
βγ	O839	405	10	40.5	40.4	0.1	0.95	0.365	2.22E+06	1.30E-07

Technician Performing Decay Count: William Wylie 10/14/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	1.82E-07	mCi	2725290	milliliters	6.7E-14	mCi/ml α	7	**% DAC Value**
βγ	1.30E-07	mCi	2725290	milliliters	4.8E-14	mCi/ml βγ	5	**% DAC Value**

Technician Performing Calculation: William wylie 10/14/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
A_{LL} = long-lived activity which emits alpha
A_{20} = 20 hour decayed activity due to alpha
A_1 = 2 hour decayed activity due to alpha
0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1 mCi \left(e^{-0.0655\,(hrs)}\right)}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{mCi - mCi \left(e^{-0.0655\,(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

= _____ mCi

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/14/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-03	RWP Number:	NSFIH-2015-001	AWS Number:	N/A
Date Start:	10/14/2015	Date Stop:	10/14/2015		
Time Start:	9:45	Time Stop:	10:00	Total Time:	15 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/14/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	42.2	CPM

Technician Performing Count: William Wylie — 10/14/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.4E-13 µCi/ml Beta/Gamma MDA= 3.0E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1002	4612	10	461.2	0.2	461	0.67	0.737	2.22E+06	4.21E-04
βγ	1002	12234	10	1223.4	42.2	1181.2	0.95	0.365	2.22E+06	1.53E-03

Technician Performing Initial Count: William Wylie 10/14/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	4.2E-04	µCi	4.1E+06	milliliters	1.0E-10	µCi/ml α	**10287**	**% DAC Value**
βγ	1.5E-03	µCi	4.1E+06	milliliters	3.8E-10	µCi/ml βγ	**37536**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1202	518	10	51.8	0.2	51.6	0.67	0.737	2.22E+06	4.71E-05
βγ	1202	1399	10	139.9	42.2	97.7	0.95	0.365	2.22E+06	1.27E-04

Technician Performing Decay Count: William Wylie 10/14/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	4.7E-05	µCi	4087934.999	milliliters	1.2E-11	µCi/ml α	**1151**	**% DAC Value**
βγ	1.3E-04	µCi	4087934.999	milliliters	3.1E-11	µCi/ml βγ	**3105**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	38.0	Minutes
T 1/2 βγ =	33.4	Minutes

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O702	6	10	0.6	0.2	0.4	0.67	0.737	2.22E+06	3.65E-07
βγ	O702	424	10	42.4	42.2	0.2	0.95	0.365	2.22E+06	2.60E-07

Technician Performing Decay Count: William Wylie 10/15/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	3.65E-07	mCi	4087935	milliliters	8.9E-14	mCi/ml α	9	% DAC Value
βγ	2.60E-07	mCi	4087935	milliliters	6.4E-14	mCi/ml βγ	6	% DAC Value

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
A_{LL} = long-lived activity which emits alpha
A_{20} = 20 hour decayed activity due to alpha
A_1 = 2 hour decayed activity due to alpha
0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \_\_\_\_\_ mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/15/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-04	RWP Number:	NSFIH-2015-001	AWS Number:	N/A
Date Start:	10/14/2015	Date Stop:	10/14/2015		
Time Start:	13:00	Time Stop:	13:15	Total Time:	15 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/14/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	42.2	CPM

Technician Performing Count: William Wylie — 10/14/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.4E-13 µCi/ml Beta/Gamma MDA= 3.0E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1317	2921	10	292.1	0.2	291.9	0.67	0.737	2.22E+06	2.66E-04
βγ	1317	7598	10	759.8	42.2	717.6	0.95	0.365	2.22E+06	9.32E-04

Technician Performing Initial Count: William Wylie 10/14/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	2.7E-04	µCi	4.1E+06	milliliters	6.5E-11	µCi/ml α	**6514**	**% DAC Value**
βγ	9.3E-04	µCi	4.1E+06	milliliters	2.3E-10	µCi/ml βγ	**22804**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1517	411	10	41.1	0.2	40.9	0.67	0.737	2.22E+06	3.73E-05
βγ	1517	1278	10	127.8	42.2	85.6	0.95	0.365	2.22E+06	1.11E-04

Technician Performing Decay Count: William Wylie 10/14/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	3.7E-05	µCi	4087935.002	milliliters	9.1E-12	µCi/ml α	**913**	**% DAC Value**
βγ	1.1E-04	µCi	4087935.002	milliliters	2.7E-11	µCi/ml βγ	**2720**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	42.3	Minutes
T 1/2 βγ =	39.1	Minutes

Technician Performing Calculation: William Wylie 10/14/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O917	6	10	0.6	0.2	0.4	0.67	0.737	2.22E+06	3.65E-07
βγ	O917	424	10	42.4	42.2	0.2	0.95	0.365	2.22E+06	2.60E-07

Technician Performing Decay Count: William Wylie — 10/15/2015 (Date)

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	3.65E-07	mCi	4087935	milliliters	8.9E-14	mCi/ml α	9	% DAC Value
βγ	2.60E-07	mCi	4087935	milliliters	6.4E-14	mCi/ml βγ	6	% DAC Value

Technician Performing Calculation: William Wylie — 10/15/2015 (Date)

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \_\_\_\_\_ mCi$$

Technician Performing Calculation: N/A — N/A (Date)

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/15/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1					
A/S ID Number:	AS-05	RWP Number:	NSFIH-2015-001	AWS Number:	N/A	
Date Start:	10/15/2015	Date Stop:	10/15/2015			
Time Start:	10:50	Time Stop:	11:05	Total Time:	15	Minutes
Sample Location:	Downwind During Excavation of Soils					

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/15/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	39.9	CPM

Technician Performing Count: William Wylie — 10/15/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.4E-13 µCi/ml Beta/Gamma MDA= 2.9E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1107	1891	10	189.1	0.2	188.9	0.67	0.737	2.22E+06	1.72E-04
βγ	1107	5650	10	565	39.9	525.1	0.95	0.365	2.22E+06	6.82E-04

Technician Performing Initial Count: William Wylie 10/15/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	1.7E-04	µCi	4.1E+06	milliliters	4.2E-11	µCi/ml α	**4215**	**% DAC Value**
βγ	6.8E-04	µCi	4.1E+06	milliliters	1.7E-10	µCi/ml βγ	**16687**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1307	283	10	28.3	0.2	28.1	0.67	0.737	2.22E+06	2.56E-05
βγ	1307	1013	10	101.3	39.9	61.4	0.95	0.365	2.22E+06	7.98E-05

Technician Performing Decay Count: William Wylie 10/15/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	2.6E-05	µCi	4087934.999	milliliters	6.3E-12	µCi/ml α	**627**	**% DAC Value**
βγ	8.0E-05	µCi	4087934.999	milliliters	2.0E-11	µCi/ml βγ	**1951**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	43.6	Minutes
T 1/2 βγ =	38.7	Minutes

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O707	6	10	0.6	0.2	0.4	0.67	0.737	2.22E+06	3.65E-07
βγ	O707	402	10	40.2	39.9	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie — 10/16/2015 (Date)

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	3.65E-07	mCi	4087935	milliliters	8.9E-14	mCi/ml α	**9**	**% DAC Value**
βγ	3.90E-07	mCi	4087935	milliliters	9.5E-14	mCi/ml βγ	**10**	**% DAC Value**

Technician Performing Calculation: William Wylie — 10/16/2015 (Date)

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \_\_\_\_\_ mCi$$

Technician Performing Calculation: N/A — N/A (Date)

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/16/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1					
A/S ID Number:	AS-06	RWP Number:	NSFIH-2015-001	AWS Number:	N/A	
Date Start:	10/15/2015	Date Stop:	10/15/2015			
Time Start:	12:50	Time Stop:	13:05	Total Time:	15	Minutes
Sample Location:	Downwind During Excavation of Soils					

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/15/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	39.9	CPM

Technician Performing Count: William Wylie — 10/15/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.4E-13 µCi/ml Beta/Gamma MDA= 2.9E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1111	1215	10	121.5	0.2	121.3	0.67	0.737	2.22E+06	1.11E-04
βγ	1111	3638	10	363.8	39.9	323.9	0.95	0.365	2.22E+06	4.21E-04

Technician Performing Initial Count: William Wylie 10/15/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	1.1E-04	µCi	4.1E+06	milliliters	2.7E-11	µCi/ml α	**2707**	**% DAC Value**
βγ	4.2E-04	µCi	4.1E+06	milliliters	1.0E-10	µCi/ml βγ	**10293**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1311	162	10	16.2	0.2	16	0.67	0.737	2.22E+06	1.46E-05
βγ	1311	757	10	75.7	39.9	35.8	0.95	0.365	2.22E+06	4.65E-05

Technician Performing Decay Count: William Wylie 10/15/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	1.5E-05	µCi	4087935.002	milliliters	3.6E-12	µCi/ml α	**357**	**% DAC Value**
βγ	4.7E-05	µCi	4087935.002	milliliters	1.1E-11	µCi/ml βγ	**1138**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	41.1	Minutes
T 1/2 βγ =	37.8	Minutes

Technician Performing Calculation: William Wylie 10/15/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O711	5	10	0.5	0.2	0.3	0.67	0.737	2.22E+06	2.74E-07
βγ	O711	402	10	40.2	39.9	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie 10/16/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	2.74E-07	mCi	4087935	milliliters	6.7E-14	mCi/ml α	7	% DAC Value
βγ	3.90E-07	mCi	4087935	milliliters	9.5E-14	mCi/ml βγ	10	% DAC Value

Technician Performing Calculation: William Wylie 10/16/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
A_{LL} = long-lived activity which emits alpha
A_{20} = 20 hour decayed activity due to alpha
A_1 = 2 hour decayed activity due to alpha
0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

= _____ mCi

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/16/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1					
A/S ID Number:	AS-07	RWP Number:	NSFIH-2015-001	AWS Number:	N/A	
Date Start:	10/16/2015	Date Stop:	10/16/2015			
Time Start:	8:25	Time Stop:	8:40	Total Time:	15	Minutes
Sample Location:	Downwind During Excavation of Soils					

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/16/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.1	CPM
			Beta/Gamma Background:	39.4	CPM

Technician Performing Count: William Wylie — 10/16/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.1E-13 µCi/ml Beta/Gamma MDA= 2.9E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/16/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O842	3987	10	398.7	0.1	398.6	0.67	0.737	2.22E+06	3.64E-04
βγ	O842	11048	10	1104.8	39.4	1065.4	0.95	0.365	2.22E+06	1.38E-03

Technician Performing Initial Count: William Wylie 10/16/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/16/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	3.6E-04	µCi	4.1E+06	milliliters	8.9E-11	µCi/ml α	**8895**	**% DAC Value**
βγ	1.4E-03	µCi	4.1E+06	milliliters	3.4E-10	µCi/ml βγ	**33856**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/16/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1042	395	10	39.5	0.1	39.4	0.67	0.737	2.22E+06	3.59E-05
βγ	1042	1286	10	128.6	39.4	89.2	0.95	0.365	2.22E+06	1.16E-04

Technician Performing Decay Count: William Wylie 10/16/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	3.6E-05	µCi	4087934.999	milliliters	8.8E-12	µCi/ml α	**879**	**% DAC Value**
βγ	1.2E-04	µCi	4087934.999	milliliters	2.8E-11	µCi/ml βγ	**2835**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/16/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	35.9	Minutes
T 1/2 βγ =	33.5	Minutes

Technician Performing Calculation: William Wylie 10/16/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O742	5	10	0.5	0.1	0.4	0.67	0.737	2.22E+06	3.65E-07
βγ	O742	396	10	39.6	39.4	0.2	0.95	0.365	2.22E+06	2.60E-07

Technician Performing Decay Count: William Wylie 10/19/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	3.65E-07	mCi	4087935	milliliters	8.9E-14	mCi/ml α	9	% DAC Value
βγ	2.60E-07	mCi	4087935	milliliters	6.4E-14	mCi/ml βγ	6	% DAC Value

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/19/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-08	RWP Number:	NSFIH-2015-001	AWS Number:	N/A
Date Start:	10/19/2015	Date Stop:	10/19/2015		
Time Start:	8:25	Time Stop:	8:50	Total Time:	25 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/19/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	40.3	CPM

Technician Performing Count: William Wylie — 10/19/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 8.3E-14 µCi/ml Beta/Gamma MDA= 1.7E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O852	4354	10	435.4	0.2	435.2	0.67	0.737	2.22E+06	3.97E-04
βγ	O852	12143	10	1214.3	40.3	1174	0.95	0.365	2.22E+06	1.53E-03

Technician Performing Initial Count: William Wylie 10/19/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
25	min	9.63	CFM	6.8E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	4.0E-04	µCi	6.8E+06	milliliters	5.8E-11	µCi/ml α	**5827**	**% DAC Value**
βγ	1.5E-03	µCi	6.8E+06	milliliters	2.2E-10	µCi/ml βγ	**22384**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1052	527	10	52.7	0.2	52.5	0.67	0.737	2.22E+06	4.79E-05
βγ	1052	1516	10	151.6	40.3	111.3	0.95	0.365	2.22E+06	1.45E-04
		#######								

Technician Performing Decay Count: William Wylie 10/19/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	4.8E-05	µCi	6813224.999	milliliters	7.0E-12	µCi/ml α	**703**	**% DAC Value**
βγ	1.4E-04	µCi	6813224.999	milliliters	2.1E-11	µCi/ml βγ	**2122**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	39.3	Minutes
T 1/2 βγ =	35.3	Minutes

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O752	8	10	0.8	0.2	0.6	0.67	0.737	2.22E+06	5.47E-07
βγ	O752	408	10	40.8	40.3	0.5	0.95	0.365	2.22E+06	6.50E-07

Technician Performing Decay Count: William Wylie 10/20/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	5.47E-07	mCi	6813225	milliliters	8.0E-14	mCi/ml α	**8**	**% DAC Value**
βγ	6.50E-07	mCi	6813225	milliliters	9.5E-14	mCi/ml βγ	**10**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/20/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/20/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1					
A/S ID Number:	AS-09	RWP Number:	NSFIH-2015-001	AWS Number:	N/A	
Date Start:	10/19/2015	Date Stop:	10/19/2015			
Time Start:	12:35	Time Stop:	13:00	Total Time:	25	Minutes
Sample Location:	Downwind During Excavation of Soils					

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/19/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	40.3	CPM

Technician Performing Count: William Wylie — 10/19/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 8.3E-14 µCi/ml Beta/Gamma MDA= 1.7E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1301	1352	10	135.2	0.2	135	0.67	0.737	2.22E+06	1.23E-04
βγ	1301	3869	10	386.9	40.3	346.6	0.95	0.365	2.22E+06	4.50E-04

Technician Performing Initial Count: William Wylie 10/19/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
25	min	9.63	CFM	6.8E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	1.2E-04	µCi	6.8E+06	milliliters	1.8E-11	µCi/ml α	**1808**	**% DAC Value**
βγ	4.5E-04	µCi	6.8E+06	milliliters	6.6E-11	µCi/ml βγ	**6609**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1501	102	10	10.2	0.2	10	0.67	0.737	2.22E+06	9.12E-06
βγ	1501	702	10	70.2	40.3	29.9	0.95	0.365	2.22E+06	3.88E-05

Technician Performing Decay Count: William Wylie 10/19/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	9.1E-06	µCi	6813224.999	milliliters	1.3E-12	µCi/ml α	**134**	**% DAC Value**
βγ	3.9E-05	µCi	6813224.999	milliliters	5.7E-12	µCi/ml βγ	**570**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	32.0	Minutes
T 1/2 βγ =	33.9	Minutes

Technician Performing Calculation: William Wylie 10/19/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O901	7	10	0.7	0.2	0.5	0.67	0.737	2.22E+06	4.56E-07
βγ	O901	406	10	40.6	40.3	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie 10/20/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	4.56E-07	mCi	6813225	milliliters	6.7E-14	mCi/ml α	7	% DAC Value
βγ	3.90E-07	mCi	6813225	milliliters	5.7E-14	mCi/ml βγ	6	% DAC Value

Technician Performing Calculation: William Wylie 10/20/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/20/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location: NSF Indian Head, IR Site 1

A/S ID Number: AS-010 RWP Number: NSFIH-2015-001 AWS Number: N/A

Date Start: 10/20/2015 Date Stop: 10/20/2015

Time Start: 8:00 Time Stop: 8:15 Total Time: 15 Minutes

Sample Location: Downwind During Excavation of Soils

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie 10/20/2015
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: HiVol

Sampler I.D.: 003734

Cal. Date: 9/29/2015

Cal. Due Date: 9/29/2016

Flow Rate Start: 9.63 CFM
LPM

Flow Rate Stop: 9.63 CFM
LPM

Average Flow Rate: 9.63 CFM
LPM

Type Counter: Model-2929

Counter I.D.: 115563

Probe I.D.: 127216

Cal. Date: 5/19/2015

Cal. Due Date: 5/19/2016

Count Time: 10 Minutes

Alpha Eff: 73.7 %

Beta/Gamma Eff: 36.5 %

Alpha Background: 0.2 CPM

Beta/Gamma Background: 42.4 CPM

Technician Performing Count: William Wylie 10/20/2015
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.4E-13 µCi/ml Beta/Gamma MDA= 3.0E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/20/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O818	3784	10	378.4	0.2	378.2	0.67	0.737	2.22E+06	3.45E-04
βγ	O818	9991	10	999.1	42.4	956.7	0.95	0.365	2.22E+06	1.24E-03

Technician Performing Initial Count: William Wylie 10/20/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/20/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	3.5E-04	µCi	4.1E+06	milliliters	8.4E-11	µCi/ml α	**8440**	**% DAC Value**
βγ	1.2E-03	µCi	4.1E+06	milliliters	3.0E-10	µCi/ml βγ	**30402**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/20/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1018	149	10	14.9	0.2	14.7	0.67	0.737	2.22E+06	1.34E-05
βγ	1018	764	10	76.4	42.4	34	0.95	0.365	2.22E+06	4.42E-05

Technician Performing Decay Count: William Wylie 10/20/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	1.3E-05	µCi	4087934.999	milliliters	3.3E-12	µCi/ml α	**328**	**% DAC Value**
βγ	4.4E-05	µCi	4087934.999	milliliters	1.1E-11	µCi/ml βγ	**1080**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/20/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	25.6	Minutes
T 1/2 βγ =	24.9	Minutes

Technician Performing Calculation: William Wylie 10/20/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O718	5	10	0.5	0.2	0.3	0.67	0.737	2.22E+06	2.74E-07
βγ	O718	426	10	42.6	42.4	0.2	0.95	0.365	2.22E+06	2.60E-07

Technician Performing Decay Count: William Wylie — 10/21/2015 (Date)

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	2.74E-07	mCi	4087935	milliliters	6.7E-14	mCi/ml α	7	% DAC Value
βγ	2.60E-07	mCi	4087935	milliliters	6.4E-14	mCi/ml βγ	6	% DAC Value

Technician Performing Calculation: William Wylie — 10/21/2015 (Date)

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:

A_{LL} = long-lived activity which emits alpha

A_{20} = 20 hour decayed activity due to alpha

A_1 = 2 hour decayed activity due to alpha

0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.

T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A — N/A (Date)

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/21/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1					
A/S ID Number:	AS-011	RWP Number:	NSFIH-2015-001	AWS Number:	N/A	
Date Start:	10/21/2015	Date Stop:	10/21/2015			
Time Start:	8:15	Time Stop:	8:35	Total Time:	20	Minutes
Sample Location:	Downwind During Excavation of Soils					

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/21/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.1	CPM
			Beta/Gamma Background:	39.6	CPM

Technician Performing Count: William Wylie — 10/21/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 8.3E-14 µCi/ml Beta/Gamma MDA= 2.2E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O837	10264	10	1026.4	0.1	1026.3	0.67	0.737	2.22E+06	9.36E-04
βγ	O837	25944	10	2594.4	39.6	2554.8	0.95	0.365	2.22E+06	3.32E-03

Technician Performing Initial Count: William Wylie 10/21/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
20	min	9.63	CFM	5.5E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	9.4E-04	µCi	5.5E+06	milliliters	1.7E-10	µCi/ml α	**17177**	**% DAC Value**
βγ	3.3E-03	µCi	5.5E+06	milliliters	6.1E-10	µCi/ml βγ	**60890**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1037	1097	10	109.7	0.1	109.6	0.67	0.737	2.22E+06	1.00E-04
βγ	1037	2778	10	277.8	39.6	238.2	0.95	0.365	2.22E+06	3.09E-04

Technician Performing Decay Count: William Wylie 10/21/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	1.0E-04	µCi	5450580.001	milliliters	1.8E-11	µCi/ml α	**1834**	**% DAC Value**
βγ	3.1E-04	µCi	5450580.001	milliliters	5.7E-11	µCi/ml βγ	**5677**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	37.2	Minutes
T 1/2 βγ =	35.0	Minutes

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O737	3	10	0.3	0.1	0.2	0.67	0.737	2.22E+06	1.82E-07
βγ	O737	399	10	39.9	39.6	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie 10/22/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	1.82E-07	mCi	5450580	milliliters	3.3E-14	mCi/ml α	3	% DAC Value
βγ	3.90E-07	mCi	5450580	milliliters	7.2E-14	mCi/ml βγ	7	% DAC Value

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/22/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-012	RWP Number:	NSFIH-2015-001	AWS Number:	N/A
Date Start:	10/21/2015	Date Stop:	10/21/2015		
Time Start:	12:30	Time Stop:	12:50	Total Time:	20 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/21/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.1	CPM
			Beta/Gamma Background:	39.6	CPM

Technician Performing Count: William Wylie — 10/21/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 8.3E-14 µCi/ml Beta/Gamma MDA= 2.2E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1251	6326	10	632.6	0.1	632.5	0.67	0.737	2.22E+06	5.77E-04
βγ	1251	16906	10	1690.6	39.6	1651	0.95	0.365	2.22E+06	2.14E-03

Technician Performing Initial Count: William Wylie 10/21/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
20	min	9.63	CFM	5.5E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	5.8E-04	µCi	5.5E+06	milliliters	1.1E-10	µCi/ml α	**10586**	**% DAC Value**
βγ	2.1E-03	µCi	5.5E+06	milliliters	3.9E-10	µCi/ml βγ	**39349**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1451	590	10	59	0.1	58.9	0.67	0.737	2.22E+06	5.37E-05
βγ	1451	1662	10	166.2	39.6	126.6	0.95	0.365	2.22E+06	1.64E-04

Technician Performing Decay Count: William Wylie 10/21/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	5.4E-05	µCi	5450579.998	milliliters	9.9E-12	µCi/ml α	**986**	**% DAC Value**
βγ	1.6E-04	µCi	5450579.998	milliliters	3.0E-11	µCi/ml βγ	**3017**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	35.0	Minutes
T 1/2 βγ =	32.4	Minutes

Technician Performing Calculation: William Wylie 10/21/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O851	6	10	0.6	0.1	0.5	0.67	0.737	2.22E+06	4.56E-07
βγ	O851	399	10	39.9	39.6	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie 10/22/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	4.56E-07	mCi	5450580	milliliters	8.4E-14	mCi/ml α	8	% DAC Value
βγ	3.90E-07	mCi	5450580	milliliters	7.2E-14	mCi/ml βγ	7	% DAC Value

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/22/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location: NSF Indian Head, IR Site 1

A/S ID Number: AS-013 RWP Number: NSFIH-2015-001 AWS Number: N/A

Date Start: 10/22/2015 Date Stop: 10/22/2015

Time Start: 8:40 Time Stop: 9:00 Total Time: 20 Minutes

Sample Location: Downwind During Excavation of Soils

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie 10/22/2015
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.1	CPM
			Beta/Gamma Background:	41.1	CPM

Technician Performing Count: William Wylie 10/22/2015
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 8.3E-14 µCi/ml Beta/Gamma MDA= 2.2E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O901	12553	10	1255.3	0.1	1255.2	0.67	0.737	2.22E+06	1.15E-03
βγ	O901	31121	10	3112.1	41.1	3071	0.95	0.365	2.22E+06	3.99E-03

Technician Performing Initial Count: William Wylie 10/22/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
20	min	9.63	CFM	5.5E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	1.1E-03	µCi	5.5E+06	milliliters	2.1E-10	µCi/ml α	**21008**	**% DAC Value**
βγ	4.0E-03	µCi	5.5E+06	milliliters	7.3E-10	µCi/ml βγ	**73193**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1101	1620	10	162	0.1	161.9	0.67	0.737	2.22E+06	1.48E-04
βγ	1101	3668	10	366.8	41.1	325.7	0.95	0.365	2.22E+06	4.23E-04

Technician Performing Decay Count: William Wylie 10/22/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	1.5E-04	µCi	5450580.001	milliliters	2.7E-11	µCi/ml α	**2710**	**% DAC Value**
βγ	4.2E-04	µCi	5450580.001	milliliters	7.8E-11	µCi/ml βγ	**7763**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	40.6	Minutes
T 1/2 βγ =	37.1	Minutes

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O701	5	10	0.5	0.1	0.4	0.67	0.737	2.22E+06	3.65E-07
βγ	O701	412	10	41.2	41.1	0.1	0.95	0.365	2.22E+06	1.30E-07

Technician Performing Decay Count: William Wylie 10/23/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	3.65E-07	mCi	5450580	milliliters	6.7E-14	mCi/ml α	7	% DAC Value
βγ	1.30E-07	mCi	5450580	milliliters	2.4E-14	mCi/ml βγ	2	% DAC Value

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
A_{LL} = long-lived activity which emits alpha
A_{20} = 20 hour decayed activity due to alpha
A_1 = 2 hour decayed activity due to alpha
0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/23/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-014	RWP Number:	NSFIH-2015-001	AWS Number:	N/A
Date Start:	10/22/2015	Date Stop:	10/22/2015		
Time Start:	13:03	Time Stop:	13:23	Total Time:	20 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/22/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.1	CPM
			Beta/Gamma Background:	41.1	CPM

Technician Performing Count: William Wylie — 10/22/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 8.3E-14 µCi/ml Beta/Gamma MDA= 2.2E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1324	6929	10	692.9	0.1	692.8	0.67	0.737	2.22E+06	6.32E-04
βγ	1324	18344	10	1834.4	41.1	1793.3	0.95	0.365	2.22E+06	2.33E-03

Technician Performing Initial Count: William Wylie 10/22/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
20	min	9.63	CFM	5.5E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	6.3E-04	µCi	5.5E+06	milliliters	1.2E-10	µCi/ml α	**11595**	**% DAC Value**
βγ	2.3E-03	µCi	5.5E+06	milliliters	4.3E-10	µCi/ml βγ	**42741**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1524	1245	10	124.5	0.1	124.4	0.67	0.737	2.22E+06	1.13E-04
βγ	1524	3341	10	334.1	41.1	293	0.95	0.365	2.22E+06	3.81E-04

Technician Performing Decay Count: William Wylie 10/22/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	1.1E-04	µCi	5450580.001	milliliters	2.1E-11	µCi/ml α	**2082**	**% DAC Value**
βγ	3.8E-04	µCi	5450580.001	milliliters	7.0E-11	µCi/ml βγ	**6983**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	48.4	Minutes
T 1/2 βγ =	45.9	Minutes

Technician Performing Calculation: William Wylie 10/22/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O924	6	10	0.6	0.1	0.5	0.67	0.737	2.22E+06	4.56E-07
βγ	O924	414	10	41.4	41.1	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie 10/23/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	4.56E-07	mCi	5450580	milliliters	8.4E-14	mCi/ml α	8	% DAC Value
βγ	3.90E-07	mCi	5450580	milliliters	7.2E-14	mCi/ml βγ	7	% DAC Value

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \_\_\_\_\_ mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/23/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location: NSF Indian Head, IR Site 1

A/S ID Number: AS-015 RWP Number: NSFIH-2015-001 AWS Number: N/A

Date Start: 10/23/2015 Date Stop: 10/23/2015

Time Start: 10:15 Time Stop: 10:30 Total Time: 15 Minutes

Sample Location: Downwind During Excavation of Soils

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie 10/23/2015
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: HiVol

Sampler I.D.: 003734

Cal. Date: 9/29/2015

Cal. Due Date: 9/29/2016

Flow Rate Start: 9.63 CFM
LPM

Flow Rate Stop: 9.63 CFM
LPM

Average Flow Rate: 9.63 CFM
LPM

Type Counter: Model-2929

Counter I.D.: 115563

Probe I.D.: 127216

Cal. Date: 5/19/2015

Cal. Due Date: 5/19/2016

Count Time: 10 Minutes

Alpha Eff: 73.7 %

Beta/Gamma Eff: 36.5 %

Alpha Background: 0.2 CPM

Beta/Gamma Background: 42.6 CPM

Technician Performing Count: William Wylie 10/23/2015
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.4E-13 µCi/ml Beta/Gamma MDA= 3.0E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1032	3383	10	338.3	0.2	338.1	0.67	0.737	2.22E+06	3.08E-04
βγ	1032	8669	10	866.9	42.6	824.3	0.95	0.365	2.22E+06	1.07E-03

Technician Performing Initial Count: William Wylie 10/23/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	3.1E-04	µCi	4.1E+06	milliliters	7.5E-11	µCi/ml α	**7545**	**% DAC Value**
βγ	1.1E-03	µCi	4.1E+06	milliliters	2.6E-10	µCi/ml βγ	**26195**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1232	95	10	9.5	0.2	9.3	0.67	0.737	2.22E+06	8.48E-06
βγ	1232	541	10	54.1	42.6	11.5	0.95	0.365	2.22E+06	1.49E-05

Technician Performing Decay Count: William Wylie 10/23/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	8.5E-06	µCi	4087934.999	milliliters	2.1E-12	µCi/ml α	**208**	**% DAC Value**
βγ	1.5E-05	µCi	4087934.999	milliliters	3.7E-12	µCi/ml βγ	**365**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	23.1	Minutes
T 1/2 βγ =	19.5	Minutes

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O732	3	10	0.3	0.2	0.1	0.67	0.737	2.22E+06	9.12E-08
βγ	O732	429	10	42.9	42.6	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie 10/26/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	9.12E-08	mCi	4087935	milliliters	2.2E-14	mCi/ml α	2	% DAC Value
βγ	3.90E-07	mCi	4087935	milliliters	9.5E-14	mCi/ml βγ	10	% DAC Value

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
A_{LL} = long-lived activity which emits alpha
A_{20} = 20 hour decayed activity due to alpha
A_1 = 2 hour decayed activity due to alpha
0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/26/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location: NSF Indian Head, IR Site 1

A/S ID Number: AS-016 RWP Number: NSFIH-2015-001 AWS Number: N/A

Date Start: 10/23/2015 Date Stop: 10/23/2015

Time Start: 13:13 Time Stop: 13:23 Total Time: 10 Minutes

Sample Location: Downwind During Excavation of Soils

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie 10/23/2015
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler: HiVol

Sampler I.D.: 003734

Cal. Date: 9/29/2015

Cal. Due Date: 9/29/2016

Flow Rate Start: 9.63 CFM
LPM

Flow Rate Stop: 9.63 CFM
LPM

Average Flow Rate: 9.63 CFM
LPM

Type Counter: Model-2929

Counter I.D.: 115563

Probe I.D.: 127216

Cal. Date: 5/19/2015

Cal. Due Date: 5/19/2016

Count Time: 10 Minutes

Alpha Eff: 73.7 %

Beta/Gamma Eff: 36.5 %

Alpha Background: 0.2 CPM

Beta/Gamma Background: 42.6 CPM

Technician Performing Count: William Wylie 10/23/2015
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 2.1E-13 µCi/ml Beta/Gamma MDA= 4.5E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1325	1964	10	196.4	0.2	196.2	0.67	0.737	2.22E+06	1.79E-04
βγ	1325	5541	10	554.1	42.6	511.5	0.95	0.365	2.22E+06	6.64E-04

Technician Performing Initial Count: William Wylie 10/23/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
10	min	9.63	CFM	2.7E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	1.8E-04	µCi	2.7E+06	milliliters	6.6E-11	µCi/ml α	**6567**	**% DAC Value**
βγ	6.6E-04	µCi	2.7E+06	milliliters	2.4E-10	µCi/ml βγ	**24382**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1525	217	10	21.7	0.2	21.5	0.67	0.737	2.22E+06	1.96E-05
βγ	1525	899	10	89.9	42.6	47.3	0.95	0.365	2.22E+06	6.14E-05

Technician Performing Decay Count: William Wylie 10/23/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	2.0E-05	µCi	2725290	milliliters	7.2E-12	µCi/ml α	**720**	**% DAC Value**
βγ	6.1E-05	µCi	2725290	milliliters	2.3E-11	µCi/ml βγ	**2255**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	37.6	Minutes
T 1/2 βγ =	34.9	Minutes

Technician Performing Calculation: William Wylie 10/23/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O925	3	10	0.3	0.2	0.1	0.67	0.737	2.22E+06	9.12E-08
βγ	O925	427	10	42.7	42.6	0.1	0.95	0.365	2.22E+06	1.30E-07

Technician Performing Decay Count: William Wylie 10/26/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	9.12E-08	mCi	2725290	milliliters	3.3E-14	mCi/ml α	3	% DAC Value
βγ	1.30E-07	mCi	2725290	milliliters	4.8E-14	mCi/ml βγ	5	% DAC Value

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/26/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1					
A/S ID Number:	AS-017	RWP Number:	NSFIH-2015-001	AWS Number:	N/A	
Date Start:	10/26/2015	Date Stop:	10/26/2015			
Time Start:	8:05	Time Stop:	8:20	Total Time:	15	Minutes
Sample Location:	Downwind During Excavation of Soils					

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/26/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	41.5	CPM

Technician Performing Count: William Wylie — 10/26/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.4E-13 µCi/ml Beta/Gamma MDA= 2.9E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O822	2318	10	231.8	0.2	231.6	0.67	0.737	2.22E+06	2.11E-04
βγ	O822	6935	10	693.5	41.5	652	0.95	0.365	2.22E+06	8.47E-04

Technician Performing Initial Count: William Wylie 10/26/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
15	min	9.63	CFM	4.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	2.1E-04	µCi	4.1E+06	milliliters	5.2E-11	µCi/ml α	**5168**	**% DAC Value**
βγ	8.5E-04	µCi	4.1E+06	milliliters	2.1E-10	µCi/ml βγ	**20719**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1022	117	10	11.7	0.2	11.5	0.67	0.737	2.22E+06	1.05E-05
βγ	1022	614	10	61.4	41.5	19.9	0.95	0.365	2.22E+06	2.59E-05

Technician Performing Decay Count: William Wylie 10/26/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	1.0E-05	µCi	4087934.999	milliliters	2.6E-12	µCi/ml α	**257**	**% DAC Value**
βγ	2.6E-05	µCi	4087934.999	milliliters	6.3E-12	µCi/ml βγ	**632**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	27.7	Minutes
T 1/2 βγ =	23.8	Minutes

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O722	5	10	0.5	0.2	0.3	0.67	0.737	2.22E+06	2.74E-07
βγ	O722	418	10	41.8	41.5	0.3	0.95	0.365	2.22E+06	3.90E-07

Technician Performing Decay Count: William Wylie 10/27/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	2.74E-07	mCi	4087935	milliliters	6.7E-14	mCi/ml α	7	% DAC Value
βγ	3.90E-07	mCi	4087935	milliliters	9.5E-14	mCi/ml βγ	10	% DAC Value

Technician Performing Calculation: William Wylie 10/27/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/27/2015

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Isotope	DAC Value	
Th-232	1.00E-12	µCi/ml

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-018	RWP Number:	NSFIH-2015-001	AWS Number:	N/A
Date Start:	10/26/2015	Date Stop:	10/26/2015		
Time Start:	13:10	Time Stop:	13:30	Total Time:	20 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:						
	Breathing Zone		General Area	X	Other	
	High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: William Wylie — 10/26/2015 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003734		Counter I.D.:	115563	
Cal. Date:	9/29/2015		Probe I.D.:	127216	
Cal. Due Date:	9/29/2016		Cal. Date:	5/19/2015	
Flow Rate Start:	9.63	CFM	Cal. Due Date:	5/19/2016	
		LPM			
Flow Rate Stop:	9.63	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	9.63	CFM			
		LPM	Alpha Eff:	73.7	%
			Beta/Gamma Eff:	36.5	%
			Alpha Background:	0.2	CPM
			Beta/Gamma Background:	41.5	CPM

Technician Performing Count: William Wylie — 10/26/2015 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.0E-13 µCi/ml Beta/Gamma MDA= 2.2E-12 µCi/ml

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1332	1291	10	129.1	0.2	128.9	0.67	0.737	2.22E+06	1.18E-04
βγ	1332	4077	10	407.7	41.5	366.2	0.95	0.365	2.22E+06	4.76E-04

Technician Performing Initial Count: William Wylie 10/26/2015
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
20	min	9.63	CFM	5.5E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity			
α	1.2E-04	µCi	5.5E+06	milliliters	2.2E-11	µCi/ml α	**2157**	**% DAC Value**
βγ	4.8E-04	µCi	5.5E+06	milliliters	8.7E-11	µCi/ml βγ	**8728**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1532	153	10	15.3	0.2	15.1	0.67	0.737	2.22E+06	1.38E-05
βγ	1532	816	10	81.6	41.5	40.1	0.95	0.365	2.22E+06	5.21E-05

Technician Performing Decay Count: William Wylie 10/26/2015
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity			
α	1.4E-05	µCi	5450580.001	milliliters	2.5E-12	µCi/ml α	**253**	**% DAC Value**
βγ	5.2E-05	µCi	5450580.001	milliliters	9.6E-12	µCi/ml βγ	**956**	**% DAC Value**

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	38.8	Minutes
T 1/2 βγ =	37.6	Minutes

Technician Performing Calculation: William Wylie 10/26/2015
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O932	6	10	0.6	0.2	0.4	0.67	0.737	2.22E+06	3.65E-07
βγ	O932	416	10	41.6	41.5	0.1	0.95	0.365	2.22E+06	1.30E-07

Technician Performing Decay Count: William Wylie 10/27/2015
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity			
α	3.65E-07	mCi	5450580	milliliters	6.7E-14	mCi/ml α	7	% DAC Value
βγ	1.30E-07	mCi	5450580	milliliters	2.4E-14	mCi/ml βγ	2	% DAC Value

Technician Performing Calculation: William Wylie 10/27/2015
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a

volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg

volume

If: [A_{LL}] > 1E-13 µCi/ml α

[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 10/27/2015

Date

Appendix L

Background Reference Area Data

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1				
Instrument Model:	2360		Instrument Serial No.	276986	
Last Calibration Date:	12/17/2014				
Detector Model:	43-93		Detector Serial No.:	299605	
Today's Date:	10/8/2015		Data Collected by:	William Wylie	

X	Alpha		Beta-Gamma		Gamma	
Remarks:	Instrument Ambient Background			Instrument Efficiency:	0.385	
Type of Surface:		Metal		Count Time:	2	Minutes

Count Number	Counts	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	6	3	-0.25		0.06
2	14	7	3.75		14.06
3	5	2.5	-0.75		0.56
4	10	5	1.75		3.06
5	8	4	0.75		0.56
6	2	1	-2.25		5.06
7	4	2	-1.25		1.56
8	4	2	-1.25		1.56
9	12	6	2.75		7.56
10	9	4.5	1.25		1.56
11	8	4	0.75		0.56
12	5	2.5	-0.75		0.56
13	3	1.5	-1.75		3.06
14	2	1	-2.25		5.06
15	4	2	-1.25		1.56
16	8	4	0.75		0.56
Mean Count: $\bar{x}$		3.25		SUM	47.00
Standard Deviation (σ)		1.77		Variance:	1.62
Background Count Rate:			3.25	CPM + -	3.54

Background in dpm/100cm^2	
33.77	
CPM Low	CPM High
-0.29	6.79

Calculations Completed by:	William Wylie	Date:	10/8/2015
Reviewed by:	Daniel Spicuzza	Date:	10/8/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2360		Instrument Serial No.		276986	
Last Calibration Date:		12/17/2014					
Detector Model:		43-93		Detector Serial No.:		299605	
Today's Date:		10/8/2015		Data Collected by:		William Wylie	
	Alpha	X	Beta-Gamma			Gamma	
Remarks:	Instrument Ambient Background			Instrument Efficiency: 0.339			
Type of Surface:		Metal		Count Time:	2	Minutes	

Count Number	Counts	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	206	103	-9.75		95.06
2	221	110.5	-2.25		5.06
3	255	127.5	14.75		217.56
4	216	108	-4.75		22.56
5	216	108	-4.75		22.56
6	212	106	-6.75		45.56
7	218	109	-3.75		14.06
8	233	116.5	3.75		14.06
9	230	115	2.25		5.06
10	207	103.5	-9.25		85.56
11	230	115	2.25		5.06
12	219	109.5	-3.25		10.56
13	245	122.5	9.75		95.06
14	192	96	-16.75		280.56
15	249	124.5	11.75		138.06
16	259	129.5	16.75		280.56
Mean Count: $\bar{x}$		112.75		SUM	1337.00
Standard Deviation (σ)		9.44		Variance:	46.10
Background Count Rate:			112.75	CPM + -	18.88

Background in dpm/100cm^2	
1330.38	
CPM Low	CPM High
93.87	131.63

Calculations Completed by:	William Wylie	Date:	10/8/2015
Reviewed by:	Daniel Spicuzza	Date:	10/8/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:		NSF Indian Head site 1					
Instrument Model:		2360		Instrument Serial No.		268508	
Last Calibration Date:		7/22/2015					
Detector Model:		43-93		Detector Serial No.:		298435	
Today's Date:		10/7/2015		Data Collected by:		William Wylie	
X	Alpha		Beta-Gamma			Gamma	
Remarks:	Instrument Ambient Background				Instrument Efficiency: 0.369		
Type of Surface:		Metal		Count Time:	2	Minutes	

Count Number	Counts	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	4	2	-1.72		2.95
2	3	1.5	-2.22		4.92
3	11	5.5	1.78		3.17
4	12	6	2.28		5.20
5	12	6	2.28		5.20
6	10	5	1.28		1.64
7	5	2.5	-1.22		1.49
8	8	4	0.28		0.08
9	9	4.5	0.78		0.61
10	10	5	1.28		1.64
11	5	2.5	-1.22		1.49
12	8	4	0.28		0.08
13	3	1.5	-2.22		4.92
14	2	1	-2.72		7.39
15	6	3	-0.72		0.52
16	11	5.5	1.78		3.17
Mean Count: $\bar{x}$		3.72		SUM	44.48
Standard Deviation (σ)		1.72		Variance:	1.53
Background Count Rate:			3.72	CPM + -	3.44

Background in dpm/100cm^2	
40.31	
CPM Low	CPM High
0.27	7.16

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:		NSF Indian Head site 1					
Instrument Model:		2360		Instrument Serial No.		268508	
Last Calibration Date:		7/22/2015					
Detector Model:		43-93		Detector Serial No.:		298435	
Today's Date:		10/7/2015		Data Collected by:		William Wylie	
	Alpha	X	Beta-Gamma			Gamma	
Remarks:	Instrument Ambient Background				Instrument Efficiency: 0.283		
Type of Surface:		Metal		Count Time:	2	Minutes	

Count Number	Counts	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	259	129.5	11.09		123.07
2	253	126.5	8.09		65.51
3	230	115	-3.41		11.60
4	259	129.5	11.09		123.07
5	215	107.5	-10.91		118.95
6	242	121	2.59		6.73
7	236	118	-0.41		0.17
8	270	135	16.59		275.35
9	220	110	-8.41		70.67
10	237	118.5	0.09		0.01
11	240	120	1.59		2.54
12	226	113	-5.41		29.23
13	210	105	-13.41		179.73
14	230	115	-3.41		11.60
15	238	119	0.59		0.35
16	224	112	-6.41		41.04
Mean Count: $\bar{x}$		118.41		SUM	1059.61
Standard Deviation (σ)		8.40		Variance:	36.54
Background Count Rate:			118.41	CPM + -	16.81

Background in dpm/100cm^2	
1673.59	
CPM Low	CPM High
101.60	135.22

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1				
Instrument Model:	2350-1		Instrument Serial No.	129407	
Last Calibration Date:	1/22/2015				
Detector Model:	44-10		Detector Serial No.:	196022	
Today's Date:	10/7/2015		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background		Soil		
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	5411	508.83		258911.36
2	5216	313.83		98491.36
3	5578	675.83		456750.69
4	5432	529.83		280723.36
5	5060	157.83		24911.36
6	4989	86.83		7540.03
7	4871	-31.17		971.36
8	4866	-36.17		1308.03
9	4935	32.83		1078.03
10	4233	-669.17		447784.03
11	4492	-410.17		168236.69
12	4876	-26.17		684.69
13	4889	-13.17		173.36
14	4690	-212.17		45014.69
15	4269	-633.17		400900.03
16	4178	-724.17		524417.36
17	4433	-469.17		220117.36
18	4126	-776.17		602434.69
19	4370	-532.17		283201.36
20	3789	-1113.17		1239140.03
21	4442	-460.17		211753.36
22	4879	-23.17		536.69
23	5214	311.83		97240.03
24	5030	127.83		16341.36
25	4964	61.83		3823.36
26	5387	484.83		235063.36
27	5432	529.83		280723.36
28	5502	599.83		359800.03
29	5834	931.83		868313.36
30	5678	775.83		601917.36
Mean Count: $\bar{x}$	4902.17		SUM	7738302.17
Standard Deviation (σ)	516.56		Variance:	266838.01
Background Count Rate:		4902.17	CPM + -	1033.13 CPM

Action Level
6452

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions

Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1				
Instrument Model:	2350-1		Instrument Serial No.	120588	
Last Calibration Date:	6/19/2015				
Detector Model:	44-10		Detector Serial No.:	318218	
Today's Date:	10/7/2015		Data Collected by:	Richard Thatcher	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background		Soil\		
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	5389	61.97		3839.87
2	4687	-640.03		409642.67
3	3978	-1349.03		1819890.93
4	3568	-1759.03		3094198.27
5	4373	-954.03		910179.60
6	4680	-647.03		418652.13
7	4974	-353.03		124632.53
8	5253	-74.03		5480.93
9	5398	70.97		5036.27
10	4889	-438.03		191873.20
11	5109	-218.03		47538.53
12	5873	545.97		298079.60
13	6129	801.97		643150.53
14	6201	873.97		763817.73
15	5569	241.97		58547.87
16	5478	150.97		22790.93
17	5368	40.97		1678.27
18	5296	-31.03		963.07
19	5460	132.97		17680.13
20	5431	103.97		10809.07
21	5523	195.97		38402.93
22	5475	147.97		21894.13
23	5637	309.97		96079.33
24	5876	548.97		301364.40
25	5556	228.97		52425.73
26	5625	297.97		88784.13
27	5658	330.97		109538.93
28	5595	267.97		71806.13
29	5873	545.97		298079.60
30	5890	562.97		316931.47
Mean Count: $\bar{x}$	5327.03		SUM	10243788.97
Standard Deviation (σ)	594.34		Variance:	353234.10
Background Count Rate:		5327.03	CPM + -	1188.67 CPM

Action Level
7110

Calculations Completed by:	Richard Thatcher	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1				
Instrument Model:	2350-1		Instrument Serial No.	126172	
Last Calibration Date:	6/19/2015				
Detector Model:	44-10		Detector Serial No.:	192589	
Today's Date:	12/1/2015		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background		Soil		
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	5532	286.10		81853.21
2	5012	-233.90		54709.21
3	5237	-8.90		79.21
4	5098	-147.90		21874.41
5	5052	-193.90		37597.21
6	5231	-14.90		222.01
7	5044	-201.90		40763.61
8	4987	-258.90		67029.21
9	4935	-310.90		96658.81
10	4969	-276.90		76673.61
11	5067	-178.90		32005.21
12	5216	-29.90		894.01
13	5321	75.10		5640.01
14	5672	426.10		181561.21
15	5035	-210.90		44478.81
16	4765	-480.90		231264.81
17	5110	-135.90		18468.81
18	5367	121.10		14665.21
19	5370	124.10		15400.81
20	4732	-513.90		264093.21
21	5987	741.10		549229.21
22	5578	332.10		110290.41
23	5432	186.10		34633.21
24	5030	-215.90		46612.81
25	4689	-556.90		310137.61
26	5387	141.10		19909.21
27	5575	329.10		108306.81
28	5679	433.10		187575.61
29	5834	588.10		345861.61
30	5434	188.10		35381.61
Mean Count: $\bar{x}$	5245.90		SUM	3033870.70
Standard Deviation (σ)	323.44		Variance:	104616.23
Background Count Rate:		5245.90	CPM + -	646.89 CPM

Action Level
6216

Calculations Completed by:	William Wylie	Date:	12/1/2015
Reviewed by:	Daniel Spicuzza	Date:	12/1/2015

Appendix M

Instrument Calibration Data

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

Customer Information		Instrument Information	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2929	Serial Number: 115563
Contact Name: Tony Riggs		Probe: 43-10-1	Serial Number: 127216
Customer Purchase Order Number: N/A	Work Order Number: 2015-14240	Calibration Method: Electronic And Source	

Instrument Calibration Information

M&TE	ID Number	Calibration Due Date	Environmental Conditions	
Thermometer	3076	01/16/2016	Temperature (°C)	20.2
Barometer	3076	01/16/2016	Pressure (mmHg)	745
Hygrometer	958670	01/30/2016	Humidity (%)	36.5
Pulse Generator	112860	10/09/2015	Calibrated in accordance with CP-IN-WI-235	
DVM	94710023	02/03/2016		

Isotope	Source ID Number	Decayed Activity (dpm)	2Pi Emissions (EPM)	Source Cert. Date
Pu^{239}	071201	20,574	10,390/ min	05/01/2012
Tc^{99}	099608	21,311	10,500 / min	08/08/1996
Th^{230}	119738	18,600	8,640 / min	10/20/1997
Sry^{90}	129676	11,177	8,371 /min	05/12/2003

Frequency Calibration

Desired (cpm)	Tolerances (cpm)	Alpha As Found (cpm)	Alpha As Left (cpm)	Beta As Found (cpm)	Beta As Left (cpm)
40	40	40	40	40	40
400	(392 - 408)	399	399	398	398
4,000	(3,920 - 4,080)	3,986	3,986	3,972	3,972
40,000	(39.2K - 40.8K)	39,871	39,871	39,794	39,794
400,000	(392K - 408K)	399,214	399,214	397,821	397,821

Background Determination	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Counts, C_b	14	14	863	854
Time, T_b (min)	20	20	20	20
Rate, R_b (cpm)	0.70	0.70	43.2	47.7

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument). Calibrated in accordance with ANSI N323B – 2003.

Calibrated By:	Reviewed By:	Date: 5/20/15
Calibration Date: 5/19/2015	* Calibration Due (6 mo.): 11/19/2015	
	* Calibration Due (12 mo.): 5/19/2016	

* Calibration due date is dependent on users regulatory requirements.

CROSS TALK & EFFICIENCY SHEET

Instrument ID: 115563

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
170	170

Alpha Source: Cross Talk – Performed using Pu^{239} #071201

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	27,781	27,781	789	789
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]}$ = 5556.2	$R_{s[\alpha]}$ = 5556.2	$R_{s[\beta]}$ = 157.8	$R_{s[\beta]}$ = 157.8
4π EFF (% Net cpm/dpm) (>25%)	27.0%	27.0%	N/A	N/A
2π EFF (% Net cpm/emissions)	53.5%	53.5%	N/A	N/A
%Crosstalk |α to β| (< 10%)	$\frac{R_{s[\beta]} - R_{b[\beta]}}{R_{s[\alpha]} - R_{b[\alpha]}} = \frac{157.8 - 47.7}{5556.2 - 0.70} = 2.80\%$			

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
4.0 mV	4.0 mV	50 mV	50 mV

Beta Source: Cross Talk Performed Using Tc^{99} #099608

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	4	4	19,427	19,427
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]}$ =	$R_{s[\alpha]}$ =	$R_{s[\beta]}$ = 3,885.4	$R_{s[\beta]}$ = 3,885.4
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	18.0%	18.0%
2π EFF (% Net cpm/emissions)	N/A	N/A	36.5%	36.5%
%Crosstalk |β to α| (< 1%)	$\frac{R_{s[\alpha]} - R_{b[\alpha]}}{R_{s[\beta]} - R_{b[\beta]}} = \frac{0.80 - 0.70}{3885.4 - 47.7} = 0.0261\%$			

High Voltage Power Supply Calibration

Desired Voltage	Tolerance	DVM As Found	DVM As Left	2929 Meter As Found	2929 Meter As Left
600	540 - 660	600	600	600	600
800	720 - 880	807	807	800	800
1,000	900 - 1,100	989	989	1,000	1,000
1,200	1,080 - 1,320	1,153	1,153	1,200	1,200
1,300	1,170 - 1,430	1,316	1,316	1,300	1,300

High Voltage	As Found	Vern Dial Reading	As Left	Vern Dial Reading
	850V	3.46	850V	3.46

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology (We are not responsible for damage incurred during shipment or use of this instrument). Calibrated in accordance with ANSI N323B – 2003.

Calibrated By: [signature] Reviewed By: [signature] Date: 5/25/15

Calibration Date: 5/19/2015

* Calibration Due (6 mo.): 11/19/2015

* Calibration Due (12 mo.): 5/19/2016

* Calibration due date is dependent on users regulatory requirements.

EFFICIENCY SHEET

Instrument ID: 115563

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
170	170

Alpha Source: Efficiency determined using Th^{230} #119738

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	31,818	31,818	2,313	2,313
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 6363.6$	$R_{s[\alpha]} = 6363.6$	$R_{s[\beta]} = 462.6$	$R_{s[\beta]} = 462.6$
4π EFF (% Net cpm/dpm) (>25%)	34.2%	34.2%	N/A	N/A
2π EFF (% Net cpm/emissions)	73.7%	73.7%	N/A	N/A

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
4.0 mV	4.0 mV	50 mV	50 mV

Beta Source: Efficiency determined using Sr^{90} #129676

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	31	31	18,202	18,202
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 6.2$	$R_{s[\alpha]} = 6.2$	$R_{s[\beta]} = 3640.4$	$R_{s[\beta]} = 3640.4$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	32.1%	32.1%
2π EFF (% Net cpm/emissions)	N/A	N/A	42.9%	42.9%

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument). Calibrated in accordance with ANSI N323B – 2003.

Calibrated By: [signature] Reviewed By: [signature] Date: 5/25/15

Calibration Date: 5/19/2015

* Calibration Due (6 mo.): 11/19/2015

* Calibration Due (12 mo.): 5/19/2016

* Calibration due date is dependent on users regulatory requirements.

Instrument ID: 115563

Source and Background Plateau Worksheet								
High Voltage	**Background**		**Alpha Source**		**Beta Source**		**Cross Talk**	
	Alpha	**Beta**	**Alpha**	**Beta**	**Alpha**	**Beta**	**α to β**	**β to α**
600								
650								
700								
750								
800								
850		**Plateau not required—All As Founds within tolerance**						
900								
950			**As Found HV = As Left HV**					
1000								
1050								
1100								
1150								

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument). Calibrated in accordance with ANSI N323B – 2003.

Instrument Calibrated By:	**Reviewed By:**	**Date:** 5/25/15
Calibration Date: 5/19/2015	*** Calibration Due (6 mo.): 11/19/2015**	
	*** Calibration Due (12 mo.): 5/19/2016**	

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Kingston, TN 37763
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: F&J Specialty Products	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: HV-1	Serial Number: 003734
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase: Order Number: N/A	Work Order Number: 2015-14480	Calibration Method: Venturi	

INSTRUMENT CALIBRATION INFORMATION

Rotometer Value (CFM)	Tolerance (±10%) (CFM)	Calibrator Response		Comments
		As Found Flow Rate	As Left Flow Rate	Calibrated in accordance with CP-IN-WI-303
Variable Flow				Flow Calibrator: 2525 Cal Due: 02/10/2016
9	8.1 – 9.9	*N/A	9.38	Pressure: 3076 Cal Due: 01/06/2016
8	7.2 – 8.8	*N/A	8.41	Humidity: 958670 Cal Due: 01/30/2016
7	6.3 – 7.7	*N/A	7.28	
6	5.4 – 6.6	7.90	6.07	Temperature: 22.5 °C
5	4.5 – 5.5	6.28	5.12	Humidity: 40 %
4	3.6 - 4.4	4.99	4.26	Pressure: 741 mmHg
				Previous Media: FP47M
				Current Media: FP47M
Fixed High Flow Rate		9.81	9.63	Limited Use: Calibrated with FP-47M filter media. Calibrated for variable flow rates from 4 to 9 CFM.
*Bad rotometer replaced on 8/25/2015				

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument). Calibrated in accordance with ANSI N323C - 2009

Instrument Calibrated By: M. Pa[illegible]	Reviewed By: [illegible]	Date: 9/29/15
Certification Date: 09/29/2015	*Certification Due (6mo): 03/29/2016	
	*Certification Due (12mo): 09/29/2016	

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2360	Serial Number: 276986
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2014-14006	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value	Ratemeter Response (± 10% of Standard Values)		Calibration Standard Value CPM	Time Base (minutes)	Tolerances (cpm) ± 2%	Scaler Response	
		As Found	As Left				As Found	As Left
X 1	100	100	100	40,000 CPM	0.1	3920-4080	4,009	4,009
X 1	250	250	250	40,000 CPM	0.5	19.6K-20.4K	20,043	20,043
X 1	400	400	400	40,000 CPM	1	39.2K-40.8K	40,087	40,087
X 10	1,000	1,000	1,000	40,000 CPM	2	78.4K-81.6K	80,173	80,173
X 10	2,500	2,500	2,500					
X 10	4,000	4,000	4,000					
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: [signature] Date: 12/17/14
Calibration Date: 12/17/2014	*Calibration Due (6mo): 06/17/2015 *Calibration Due (12mo): 12/17/2015

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 276986

M&TE					Environmental Conditions		
Volt Meter	ID#	97960214	Cal Due:	06/27/2015	Barometer	ID# 2551	Cal Due: 01/27/15
Pulser	ID#	100272	Cal Due:	03/17/2015	Thermometer	ID# 2551	Cal Due: 01/27/15
Humidity	ID#	992290	Cal Due:	03/12/2015	Temp: 21.6°C	Pressure: 745 mmHg	Humidity: 30 %

Special Test

Mechanical Zero	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
BAT Check	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)							
Voltage	Tolerance	As Found	As Left	Alpha Sensitivity =	125 mv	Alpha Sensitivity =	120 mv
				Beta Sensitivity =	3.5 mv	Beta Sensitivity =	3.5 mv
500	450-550	512	512	Beta Window =	30 mv	Beta Window =	30 mv
1000	900-1100	996	996	Beta Setpoints--Pulser counts detected at 3.5mv ± 1mv and shut off at 30mv for beta. For Alpha channel counts detected at 120mv and above.			
1500	1350-1650	1,491	1,491				
H.V. Set With Detector Not Connected				Overload to be set with detector to be used			

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5ft cable

Instrument Calibrated By: M. Paul	Reviewed By: Date: 12/17/14
Calibration Date: 12/17/2014	*Calibration Due (6mo): 06/17/2015 *Calibration Due (12mo): 12/17/2015

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 299605
Customer Purchase Order Number: N/A	Work Order Number: 2014-14006	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	119738	18,597	8,639 / min	3,324	17.9	38.5
Tc-99	099608	21,311	10,499 / min	3,555	16.7	33.9
Pu^{239}	071201	20,574	10,390 / min	3,602	17.5	34.7
SrY-90	129676	12,032	8,476 / min	3,405	28.3	40.2

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	276986	12/17/2015	1.0	775 V	Alpha (120 mV)
2360	276986	12/17/2015	187.2	775 V	Beta (3.5 – 30 mV)

ATTACHMENTS

Voltage Plateau: √ YES NO

MDA/Cross Talk Evaluation: √ YES NO

COMMENTS	LINEARITY TEST (Gross Counts)	
Calibrated with 5 ft. cable	Count 1 (Toe)	3,641
Linearity test performed with Tc-99 #099608.	Count 2 (Mid)	3,690
Calibrated in accordance with original equipment technical manual.	Count 3 (Heel)	3,895
	Average	3,742
	Pass/Fail	PASS (+/-10% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul

Reviewed By: [signature] Date: 12/17/14

Certification Date: 12/17/2014

* Certification Due (6 mo.): 06/17/2015
* Certification Due (12 mo.): 12/17/2015

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd., Oak Ridge, TN			Model:	2360	S.N.	276986
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	299605
Customer PO No.:	N/A	Work Order Number:	2014-14006	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,574
β Source	Tc-99	099608	8/8/96	21,312

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	725	0	108	3,128	306	2	2,627	6.56%	0.08%	15.20%	11.82%
	750	0	158	3,487	337	3	3,116	5.38%	0.10%	16.95%	13.88%
SET	**775**	**0**	**185**	**3,662**	**397**	**3**	**3,714**	**6.10%**	**0.09%**	**17.80%**	**16.56%**
	800	2	225	3,741	454	1	4,115	6.51%	0.00	18.17%	18.25%
	825	5	212	3,811	575	2	4,252	10.09%	0.00	18.50%	18.96%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: M. Paul Reviewed By: [signature] Date: 12/17/14

Calibration Date: 12/17/14 Calibration Due: 12/17/15

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		**Manufacturer:** Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		**Model:** 2360	**Serial Number:** 268508
Contact Name: Tony Riggs		**Probe:** N/A	**Serial Number:** N/A
Customer Purchase Order Number: N/A	**Work Order Number:** 2015-14357	**Calibration Method:** Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Ratemeter Response (cpm) (Tolerance ±10% of Calibration Standard Values)		Calibration Standard Value	Time Base (minutes)	Tolerance (counts) ± 2%	Scaler Response (counts)	
		As Found	As Left				As Found	As Left
X 1	100	100	100	40,000 cpm	0.1	3.92K - 4.08K	3,989	3,989
X 1	250	250	250	40,000 cpm	0.5	19.6K - 20.4K	19,928	19,928
X 1	400	400	400	40,000 cpm	1	39.2K - 40.8K	39,855	39,855
X 10	1,000	1,000	1,000	40,000 cpm	2	78.4K - 81.6K	79,710	79,710
X 10	2,500	2,500	2,500					
X 10	4,000	4,000	4,000					
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Pa[illegible]	**Reviewed By:** [illegible] **Date:** 7/22/15
Calibration Date: 07/22/2015	* **Calibration Due (6 mo.):** 01/22/2016 * **Calibration Due (12 mo.):** 07/22/2016

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 268508

M&TE				Environmental Conditions			
Volt Meter	ID#:	92260808	Cal Due: 06/18/2016	Barometer	ID#:	3076	Cal Due: 01/20/16
Pulser	ID#:	120935	Cal Due: 02/04/2016	Thermometer	ID#:	3076	Cal Due: 01/20/16
Humidity	ID#:	958670	Cal Due: 01/30/2016	Temp: 20.9 °C	Pressure: 738 mmHg		Humidity: 37 %

Special Test

Mechanical Zero	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
BAT Check	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (±10%)				Alpha Sensitivity = 135 mV	Alpha Sensitivity = 120 mV
Voltage	Tolerance	As Found	As Left	Beta Sensitivity = 3.5 mV	Beta Sensitivity = 3.5 mV
500	450 - 550	497	497	Beta Window = 32.3 mV	Beta Window = 30.0 mV
1,000	900 - 1,100	1,005	1,005	Beta Setpoints -- Pulser counts detected at 3.5 mV ±1mV and shut off at 30 mV for beta. For Alpha channel counts detected at 120 mV and above.	
1,500	1,350 - 1,650	1,508	1,508		
H.V. Set With Detector Not Connected				Overload to be set with detector to be used	

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

** Calibrated with 5 ft. cable **

Instrument Calibrated By: M. Paul	Reviewed By: Jeff Pickerinso Date: 7/22/15
Calibration Date: 07/22/2015	* Calibration Due (6 mo.): 01/22/2016
	* Calibration Due (12 mo.): 07/22/2016

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 298435
Customer Purchase: Order Number: N/A	Work Order Number: 2015-14357	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	119738	18,597	8,639 / min	3,192	17.2	36.9
Tc-99	099608	21,311	10,499 / min	2,968	13.9	28.3
Pu-239	071201	20,573	10,389 / min	3,481	16.9	33.5
SrY-90	129676	11,855	8,350 / min	2,950	24.9	35.3

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	268508	07/22/2016	0.4	800 V	Alpha (120 mV)
2360	268508	07/22/2016	142.2	800 V	Beta (3.5 - 30 mV)

ATTACHMENTS

Voltage Plateau: √ YES NO

Cross Talk Evaluation: √ YES NO

COMMENTS	LINEARITY TEST (Gross Counts)	
Calibrated with 5 ft. cable	Count 1 (Toe)	2,988
Linearity test performed with Tc-99, #099608.	Count 2 (Mid)	3,009
Calibrated in accordance with original equipment technical manual.	Count 3 (Heel)	3,333
	Average	3,110
Background counts were performed using a 5 minute count.	Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	Reviewed By: Jeff Dickerson	Date: 11/2/15
Certification Date: 07/22/2015	* Certification Due (6 mo.): 01/22/2016	
	* Certification Due (12 mo.): 07/22/2016	

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd. Oak Ridge, TN 37830			Model:	2360	S.N.	268508
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	298435
Customer PO No.:	N/A	Work Order Number:	2015-14357	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,574
β Source	Tc-99	099608	8/8/96	21,312

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	750	1.0	73.0	2,951.0	252.0	0.0	1,822.0	6.22%	0.00	14.34%	8.21%
	775	1	103	3,270	297	1	2,475	6.13%	0.00%	15.89%	11.13%
SET	**800**	**1**	**160**	**3,486**	**383**	**0**	**3,018**	**6.70%**	**0.00**	**16.94%**	**13.41%**
	825	2	169	3,665	476	2	3,410	8.78%	0.00%	17.80%	15.21%
	850	0	207	3,632	739	1	3,778	15.53%	0.03%	17.65%	16.76%
	875										

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: M. Paul Reviewed By: [illegible] Date: 7/22/15

Calibration Date: 7/22/15 Calibration Due: 7/22/16

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

011403

CERTIFICATE OF CALIBRATION
BETA STANDARD SOURCE

Radionuclide:	Tc-99	**Customer:**	ENERGYSOLUTIONS (ENVIROCARE)
Half-life:	(2.13 ± 0.05)E+05 years	**P.O. No.:**	639313
Catalog No.:	EAB-099-47U	**Reference Date:**	15-Feb-14 12:00 PST
Source No.:	L1-618	**Contained Radioactivity:**	9.862 **nCi** 364.9 **Bq**

Physical Description:

A. Capsule type:	Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded Technetium metal
C. Active diameter/volume:	45 mm
D. Backing:	Stainless steel
E. Cover:	None

Radioimpurities:

None detected

Method of Calibration:

This source was assayed using a windowless internal gas flow proportional counter.

Uncertainty of Measurement:

A. Type A (random) uncertainty:	±	0.3	%
B. Type B (systematic) uncertainty:	±	3.0	%
C. Uncertainty in aliquot weighing:	±	0.0	%
D. Total uncertainty at the 99% confidence level:	±	3.0	%

Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a surface emission rate of 12040 β/min in 2π on 15-Jan-14.

Daniel James Van Dalsem
Quality Control

17-Jan-14
Date

EZIP Ref. No.: 1703-75

THE LEAK TEST(S) INDICATED BY THE CHECKED BOX(ES) WAS(WERE) APPLIED TO DETERMINE THE INTEGRITY OF SOURCE DESCRIBED ON THE FRONT SIDE. THE LEAK TESTS INDICATED BELOW WERE EITHER TAKEN DIRECTLY ISO 9978:1992 OR DERIVED FROM THE LEAK TEST METHODS LISTED IN ISO 9978:1992. THE REGULATORY LIMIT LEAK TEST RESULTS IS <5 nCi (185 Bq) FOR BOTH ALPHA AND BETA-GAMMA ACTIVITY. LEAK TEST RESULTS BELOW CONTAINED <5 nCi (185 Bq) OF REMOVABLE ACTIVITY UNLESS OTHERWISE STATED ON THIS CERTIFICATE.

☑ **Standard Wipe Test**

The source was wiped over its entire surface with a moistened filter paper disk. After drying, the disk was checked for activity using a scintillation detector.

☐ **Special Wipe Test**

The source was wiped over its entire surface with moistened polystyrene. The polystyrene was then dissolved in a liquid scintillation cocktail and counted in a liquid scintillation counter.

☐ **Distilled Water Soak Test**

The source was immersed in distilled water and maintained at (50 ± 5)°C for a minimum of four hours or room temperature (20 ± 5)°C for 24 hours. After removal of the source, the liquid was a) checked for activity using a liquid scintillation counter, or b) evaporated in a planchet and the residue checked for activity using a windowless proportional counter or end-window G.M. tube.

☐ **Liquid Scintillation Soak Test**

The source was immersed for a minimum of 3 hours at room temperature(20 ± 5)°C in a liquid scintillation cocktail, which does not attack the source's outer surface material. The source was stored away from light to avoid photoluminescence. The sealed source was then removed and the activity of the liquid scintillation cocktail was measured.

☐ **Gas Source Test**

The source was placed in a vacuum desiccator and maintained at a pressure of <10 mm Hg for not less than 12 hours. The activity was checked by introducing air into the desiccator and monitoring the air with an end-window G.M. tube.

☐ **Ampoule Leak Test**

The ampoule was kept in an inverted position on a filter paper disk or polystyrene wipe for a minimum of 16 hours. The wipe was then checked for activity using a scintillation detector or liquid scintillation counter.

☐ **Bubble Leak Test**

The container was pressurized to its fill pressure; then soapy water was applied over its valve and neck or, the valve and neck of the vessel were immersed in water. If no growing bubbles were observed, the container was considered leak free.

☐ **Wipe Test for Industrial Ni-63 Sources**

The sources were wipe tested by an approved sampling plan, which called for either 100% of the batch to be individually wipe tested, or, a subset thereof. The wipe test(s) used to test for removable contamination and the results of those tests are recorded on the front of this form.

☐ **Pressure Test for Triotech Kr-85 Sources**

Prior to filling the vessel with Kr-85 gas, the vessel was evacuated to <5 mm Hg, the gas manifold system shut off and the system allowed to stand for a minimum of 30 minutes. A vacuum difference not greater than the known vacuum loss of the manifold system itself signified the vessel did not leak.

☐ **Leak Test Not Applicable**

The active area of the source is uncovered or is protected by a very thin coating. Although the deposit is adherent, it is not designed or certified to pass a standard leak test. The inactive portions of the source have been checked using the standard wipe test or special wipe test depending on the nuclide.

☐ **Other Leak Test**

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

011404

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOURCE

Radionuclide:	Th-230	**Customer:**	ENERGYSOLUTIONS (ENVIROCARE)
Half-life:	(7.54 ± 0.03)E+04 years	**P.O. No.:**	639313
Catalog No.:	EAB-230-47U	**Reference Date:**	15-Feb-14 12:00 PST
Source No.:	L1-640	**Contained Radioactivity:**	7.383 **nCi** 273.2 **Bq**

Physical Description:

A. Capsule type:	Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxide
C. Active diameter/volume:	45 mm
D. Backing:	Stainless steel
E. Cover:	None

Radioimpurities:

None detected

Method of Calibration:

This source was assayed using a windowless internal gas flow proportional counter.

Uncertainty of Measurement:

A. Type A (random) uncertainty:	± 0.5 %
B. Type B (systematic) uncertainty:	± 3.0 %
C. Uncertainty in aliquot weighing:	± 0.0 %
D. Total uncertainty at the 99% confidence level:	± 3.0 %

Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a surface emission rate of 8278 α/min in 2π on 15-Jan-14.

Daniel Howard Van Dalsem
Quality Control

17-Jan-14
Date

EZIP Ref. No.: 1703-75

THE LEAK TEST(S) INDICATED BY THE CHECKED BOX(ES) WAS(WERE) APPLIED TO DETERMINE THE INTEGRITY OF SOURCE DESCRIBED ON THE FRONT SIDE. THE LEAK TESTS INDICATED BELOW WERE EITHER TAKEN DIRECTLY ISO 9978:1992 OR DERIVED FROM THE LEAK TEST METHODS LISTED IN ISO 9978:1992. THE REGULATORY LIMIT LEAK TEST RESULTS IS <5 nCi (185 Bq) FOR BOTH ALPHA AND BETA-GAMMA ACTIVITY. LEAK TEST RESULTS IN BELOW CONTAINED <5 nCi (185 Bq) OF REMOVABLE ACTIVITY UNLESS OTHERWISE STATED ON THIS CERTIFICATE

☑ **Standard Wipe Test**

The source was wiped over its entire surface with a moistened filter paper disk. After drying, the disk was checked for activity using a scintillation detector.

☐ **Special Wipe Test**

The source was wiped over its entire surface with moistened polystyrene. The polystyrene was then dissolved in a liquid scintillation cocktail and counted in a liquid scintillation counter.

☐ **Distilled Water Soak Test**

The source was immersed in distilled water and maintained at (50 ± 5)°C for a minimum of four hours or room temperature (20 ± 5)°C for 24 hours. After removal of the source, the liquid was a) checked for activity using a liquid scintillation counter, or b) evaporated in a planchet and the residue checked for activity using a windowless proportional counter or end-window G.M. tube.

☐ **Liquid Scintillation Soak Test**

The source was immersed for a minimum of 3 hours at room temperature(20 ± 5)°C in a liquid scintillation cocktail, which does not attack the source's outer surface material. The source was stored away from light to avoid photoluminescence. The sealed source was then removed and the activity of the liquid scintillation cocktail was measured.

☐ **Gas Source Test**

The source was placed in a vacuum desiccator and maintained at a pressure of <10 mm Hg for not less than 12 hours. The activity was checked by introducing air into the desiccator and monitoring the air with an end-window G.M. tube.

☐ **Ampoule Leak Test**

The ampoule was kept in an inverted position on a filter paper disk or polystyrene wipe for a minimum of 16 hours. The wipe was then checked for activity using a scintillation detector or liquid scintillation counter.

☐ **Bubble Leak Test**

The container was pressurized to its fill pressure; then soapy water was applied over its valve and neck or, the valve and neck of the vessel were immersed in water. If no growing bubbles were observed, the container was considered leak free.

☐ **Wipe Test for Industrial Ni-63 Sources**

The sources were wipe tested by an approved sampling plan, which called for either 100% of the batch to be individually wipe tested, or, a subset thereof. The wipe test(s) used to test for removable contamination and the results of those tests are recorded on the front of this form.

☐ **Pressure Test for Triotech Kr-85 Sources**

Prior to filling the vessel with Kr-85 gas, the vessel was evacuated to <5 mm Hg, the gas manifold system shut off and the system allowed to stand for a minimum of 30 minutes. A vacuum difference not greater than the known vacuum loss of the manifold system itself signified the vessel did not leak.

☐ **Leak Test Not Applicable**

The active area of the source is uncovered or is protected by a very thin coating. Although the deposit is adherent, it is not designed or certified to pass a standard leak test. The inactive portions of the source have been checked using the standard wipe test or special wipe test depending on the nuclide.

☐ **Other Leak Test**

SFG 039401

CERTIFICATE OF CALIBRATION

CUSTOM BETA STANDARD[1]

Radionuclide Tc-99 Activity 14.32 nCi Serial Number B397

Reference Date Feb. 1, 1994 Half-Life[2] $(2.13 \pm 0.05) \times 10^5$ years

Beta Flux Rate (2 pi emission rate) 18279.5 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
beta	E_{max} = 294 E_{avg} = 85	100

SOURCE DESCRIPTION
The activity is homogenously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and beta flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

Systematic uncertainty	± 3.08%
Weighing uncertainty	± 1.66%
Total uncertainty	± 4.74%

Calibration Laboratory

2-24-94
Date

ORIGINAL

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

SEG # 035402

CERTIFICATE OF CALIBRATION

CUSTOM ALPHA STANDARD[1]

Radionuclide Th-230 Activity 2.617 nCi Serial Number B401

Reference Date Feb. 1, 1994 Half-Life[2] $(7.54 \pm 0.03) \times 10^4$ years

Alpha Flux Rate (2 pi emission rate) 2904.9 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
alpha	4621.1	23.4
	4687.6	76.3

SOURCE DESCRIPTION
The activity is homogenously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and alpha flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

ORIGINAL

Systematic uncertainty	± 1.56%
Random uncertainty	± 1.19%
Total uncertainty	± 2.75%

Daniel J Zhla — 7-24-94

Calibration Laboratory — Date

Notes

COPY

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

-LEAK TEST CERTIFICATION ON REVERSE-

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 19	Serial Number: 98100
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2014-14016	Calibration Method: Electronic And Source	

INSTRUMENT CALIBRATION INFORMATION

Range (µR/hr)	Calibration Standard Value	Tolerances (µR/hr)	Instrument Response		Comments
			As Found (µR/hr)	As Left (µR/hr)	Calibrated in accordance with CP-IN-WI-211
5000 Black	4,000 µR/hr	3,600 - 4,400	4,000	4,000	Pulser: 100272 Cal Due: 03/17/2015
	2,500 µR/hr	2,250 - 2,750	2,550	2,550	DVM: 97960214 Cal Due: 06/27/2015
	1,000 µR/hr	900 - 1,100	1,000	1,000	Temp/Press: 2551 Cal Due: 01/27/2015
500 Black	400 µR/hr	360 - 440	400	400	Humidity: 992290 Cal Due: 03/12/2015
	250 µR/hr	225 - 275	250	250	Temp: 22.7 °C Humidity: 27 % Pressure: 741 mmHg
	Input cpm = 18,400	90 - 110	100	100	
250 Red	Input cpm = 37,800	180 - 220	195	195	
	Input cpm = 22,700	108 - 132	120	120	Geotropism: SAT Over Range: SAT
	Input cpm = 9,450	45 - 55	50	50	Batteries: SAT Mech. Zero: SAT
50 Black	Input cpm = 7,530	36 - 44	40	40	F/S Response: SAT Audio: SAT
	Input cpm = 4,720	22.5 - 27.5	25	25	Light: SAT
	Input cpm = 1,840	9 - 11	10	10	
25 Red	Input cpm = 3,780	18 - 22	19.5	19.5	Source: Cs137# 049711 Due Date: 09/09/2015
	Input cpm = 2,270	10.8 - 13.2	12	12	High Voltage As Found: 750V As Left: 750V
	Input cpm = 945	4.5 - 5.5	5	5	cpm/µR/hr: As Found: 190 As Left: 189

Precision Test---Reading 1: 250µR/hr 2: 250µR/hr 3: 250µR/hr Mean: 250µR/hr Precision Test: SAT

COMMENTS

Special Remarks: High Voltage: 675 Volts cpm/µR/hr: 189

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By:	Date: 12/22/14
Certification Date: 12/22/2014	*Certification Due (6 mo.): 06/22/2015	
	*Certification Due (12 mo.): 12/22/2015	

*Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 266272
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: N/A	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-219	
X0.1	100	100	100	Pulser: 120935	Cal Due: 02/04/16
X0.1	250	250	250	DVM: 92260808	Cal Due: 06/18/16
X0.1	400	390	390	Temp/Press: 3076	Cal Due: 01/06/16
X 1	1,000	1,000	1,000	Humidity: 958670	Cal Due: 01/30/16
X 1	2,500	2,500	2,500	Temp: 21.1 ° C Humidity: 37% Pressure: 738 mmHg	
X 1	4,000	3,950	3,950		
X 10	10,000	10,000	10,000		
X 10	25,000	25,000	25,000	Reset: SAT	Sensitivity: SAT
X 10	40,000	39,500	39,500	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT: SAT
X 100	250,000	250,000	250,000	Limited Use: X100 scale for info only. Use with GM pancake detector.	
X 100	400,000	395,000	395,000		
Mech. Zero	0	0	0		
HV Verification					
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT			
				Precision Test Reading 1 = 44,000 Reading 2 = 44,500 Reading 3 = 45,000 Mean = 44,500 ☒ SAT ☐ UNSAT	

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By:	Date: 9/10/15
Certification Date: 09/10/2015	*Certification Due (6 mo.): 03/10/2016 *Certification Due (12 mo.): 09/10/2016	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 44-9
Contact Name: Tony Riggs		Serial Number: 101566
Customer Purchase Order Number: N/A	Work Order Number: N/A	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	Serial Number: 119720	Original Activity (dpm): 2,562	Certification Date: 10/14/1997
2) Source Nuclide: Tc-99	Serial Number: 119718	Original Activity (dpm): 20,520	Certification Date: 10/14/1997
3) Source Nuclide: Tc-99	Serial Number: 069507	Original Activity (dpm): 237,960	Certification Date: 04/01/1995

Efficiency determined using 180-2 jig @ 1/8" geometry

Source #	Gross CPM	Net CPM	4pi Efficiency				
Source 1	330	280	10.9%				
Source 2	2,550	2,500	12.2%				
Source 3	44,500	44,450	18.7%				

INSTRUMENT INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
3	266272	09/10/2016	50	900 Volts	27 mV

COMMENTS

Detectors calibrated with a Model 3 or 12 and may be used with any Model 3 or 12 provided that the instrument is in calibration and the Instrument was previously set up to be used with a GM detector (operating voltage 900Volts)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M Paul	Reviewed By: Craig Date: 9/14/15
Certification Date: 09/10/2015	* Certification Due (6 mo.): 03/10/2016 * Certification Due (12 mo.): 09/10/2016

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 294545
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: 2015-14398	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%) Before Calibration	Instrument Response (± 10%) After Calibration	Comments: Calibrated in accordance with CP-IN-WI-219	
X0.1	100	100	100	Pulser: 120935	Cal Due: 02/04/16
X0.1	250	250	250	DVM: 92260808	Cal Due: 06/18/16
X0.1	400	400	400	Temp/Press: 3076	Cal Due: 01/06/16
X 1	1,000	1,000	1,000	Humidity: 958670	Cal Due: 01/30/16
X 1	2,500	2,500	2,500	Temp: 20.9 ° C Humidity: 34% Pressure: 743 mmHg	
X 1	4,000	4,000	4,000		
X 10	10,000	10,000	10,000		
X 10	25,000	25,000	25,000	Reset: SAT	Sensitivity: SAT
X 10	40,000	40,000	40,000	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT: SAT
X 100	250,000	250,000	250,000	Limited Use: X100 scale for info only. Use with GM Detector.	
X 100	400,000	400,000	400,000		
Mech. Zero	0	0	0		
HV Verification					
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT		HV Set at 900 volts to be used with GM detectors.	
				Precision Test Reading 1 = 35,500 Reading 2 = 36,000 Reading 3 = 36,500 Mean = 36,000 ☒ SAT ☐ UNSAT	

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M Powell	Reviewed By: Cliff Dickerson	Date: 8/17/15
Certification Date: 08/17/2015	*Certification Due (6 mo.): 02/17/2016	
	*Certification Due (12 mo.): 08/17/2016	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37831
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 44-9
Contact Name: Tony Riggs		Serial Number: ES0048
Customer Purchase Order Number: N/A	Work Order Number: 2015-14398	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	Serial Number: 119720	Original Activity (dpm): 2,562	Certification Date: 10/14/97
2) Source Nuclide: Tc-99	Serial Number: 119718	Original Activity (dpm): 20,520	Certification Date: 10/14/97
3) Source Nuclide: Tc-99	Serial Number: 069507	Original Activity (dpm): 237,960	Certification Date: 04/01/95

Efficiency determined using 180-2 jig @1/8" geometry

Source #	Gross CPM	Net CPM	Efficiency				
Source 1	330	295	11.5%				
Source 2	2,450	2,415	11.8%				
Source 3	36,000	35,965	15.1%				

INSTRUMENT USED TO DETERMINE EFFICIENCY			DETECTOR INFORMATION	
Model	Serial Number	Due Date	Background (cpm)	Operating Voltage
3	294545	08/17/2016	35	900V

COMMENTS

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M Ra[illegible]	Reviewed By: [illegible] Date: 8/17/15
Certification Date: 08/17/2015	Certification Due: 08/17/2016

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 120588
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2015-14307	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (Tolerance ±10% of Calibration Std. Values) Before Calibration	After Calibration	Comments	
				Calibrated in accordance with CP-IN-WI-239	
400	400	403	403	Pulser: 112860	Cal Due: 10/09/15
4,000	4,000	4,028	4,028	DVM: 88020324	Cal Due: 02/07/16
40,000	40,000	40,247	40,247	Temp/Press: 3076	Cal Due: 01/06/16
400,000	400,000	402,193	402,193	Humidity: 958670	Cal Due: 01/30/16
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N21 I/O Firmware Version: 37123N05	
500	(490 - 510)	499	499		
1,500	(1,498 - 1,502)	1,500	1,500	Temp: 21.0 °C Pressure: 742 mmHg Humidity: 36.1 %	
2,000	(1,940 - 2,060)	1,992	1,992		
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	10.0	10.0	BAT > 4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	49.8	49.8	Volume: SAT	ACK/Scroll: SAT
Threshold T = 1000	100 ± (90 to 110) mVDC	97	97	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 / 10 mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By:	Date: 6/19/15
Calibration Date: 06/19/2015	* Certification Due (6 mo.): 12/19/2015 * Certification Due (12 mo.): 06/19/2016	

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 318218
Customer Purchase Order Number: N/A	Work Order Number: 2015-14307	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Cs^{137}	Serial Number: 019455	Activity: 5µCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 09/09/2015

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#120588	Count 1	2.01
Due Date	06/19/2015	Count 2	2.00
Threshold	T=100 (10mV)	Count 3	2.00
Cable Length	5ft	Average	2.003
Temp/Press: 3076	Cal Due: 01/06/2016	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 01/30/2016	Pass/Fail	
Temp: 21.0 °C		Humidity: 36.1 %	Press: 742 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 68,757	High Sample Activity (2mR/hr) Using Source #2 = 257,777	Dead Time (DT): 1.455794E-05	Calibration Constant (CC): 5.626067E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.402	0.402
Voltage Plateau:	√YES	NO	1.00	0.900-1.100	0.988	0.988
High Voltage: 1000V			2	1.8-2.2	2.01	2.01

COMMENTS

****Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1 to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector****

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By:	Reviewed By:	Date: 6/19/15
Certification Date: 06/19/2015	*Certification Due (6mo): 12/19/2015	
	*certification Due (12mo): 06/19/2016	

* Calibration due date is dependant on users regulatory requirements.

BACKGROUND PLATEAU 44-10 #318218

700	104
750	192
800	338
850	537
900	760
950	930
1000	1027
1050	961
1100	1056
1150	972
1200	969
1250	990
1300	1033
1350	1063

SOURCE PLATEAU CS137 BUTTON #09240

700	1108
750	1803
800	2440
850	3200
900	3810
950	3986
1000	4111
1050	4275
1100	4120
1150	4408
1200	4369
1250	4463
1300	4325
1350	4339

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 06/19/2015.
The current time of day is: 06:47:23.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: JM

Comments:

Model 2350 Serial # =	120588.
User I.D. =	
High Voltage =	1000 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.455794E-05.
Detector Calibration Constant =	5.626067E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	318218.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.2 volts.

DET1 Generated: 06/19/2015 06:48:25.

Model 2350 Serial #120588

H1000$E
Set High Voltage: 1000

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.455794E-05$0
Set Dead Time: 1.455794E-05

SC5.626067E+10$W
Set Calibration Constant: 5.626067E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N318218$%
Set Detector Serial #: 318218

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 06/19/2015.
The current time of day is: 06:47:46.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: _____

Comments:

Model 2350 Serial # =	120588.
User I.D. =	
High Voltage =	1000 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.455794E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	318218.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.2 volts.

DET2 Generated: 06/19/2015 06:49:00.

Model 2350 Serial #120588

H1000$E
Set High Voltage: 1000

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.455794E-05$0
Set Dead Time: 1.455794E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N318218$%
Set Detector Serial #: 318218

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 129407
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-239	
400	400	399	399	Pulser: 100272	Cal Due: 03/17/2015
4,000	4,000	4,003	4,003	DVM: 97960214	Cal Due: 06/27/2015
40,000	40,000	40,007	40,007	Temp/Press: 3076	Cal Due: 01/06/2016
400,000	400,000	400,204	400,204	Humidity: 992290	Cal Due: 03/12/2015
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N21 I/O Firmware Version: 37123N05	
500	(490-510)	499	499		
1,500	(1,498-1,502)	1,500	1,500	Temp: 21.6 °C Pressure: 748 mmHg Humidity: 21 %	
2,000	(1,940-2,060)	1,995	1,995		
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	12	10.4	BAT > 4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	60	48	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	115	102	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10 mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Powell	Reviewed By: Jeff Dickinson	Date: 1/22/15	
Calibration Date: 01/22/2015	*Certification Due (6mo): 07/22/2015		
	*Certification Due (12mo): 01/22/2016		

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 196022
Customer Purchase Order Number: N/A	Work Order Number: 2015-14275	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Cs^{137}	Serial Number: 1296115	Activity: 10µCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 09/09/2015

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#79037	Count 1	2.01
Due Date	6/05/2016	Count 2	2.00
Threshold	T=100 (10mV)	Count 3	1.99
Cable Length	5ft.	Average	2.00
Temp/Press: 3076	Cal Due: 01/16/2016	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 01/30/2016	Pass/Fail	
Temp: 20.6 °C		Humidity: 35.5 %	Press: 742 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 68,423	High Sample Activity (2mR/hr) Using Source #2 = 253,663	Dead Time (DT): 1.528867E-05	Calibration Constant (CC): 5.621809E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.401	0.401
Voltage Plateau:	√YES	NO	1.00	0.900-1.100	0.984	0.984
High Voltage: 1100V			2	1.8-2.2	2.00	2.00

COMMENTS

Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By:	Reviewed By:	Date: 6/8/15
Certification Date: 06/05/2015	*Certification Due (6mo): 12/06/2015	
	*certification Due (12mo): 06/05/2016	

* Calibration due date is dependant on users regulatory requirements.

background plateau 44-10 #196022 6/5/15 5ft cable

700	72
750	170
800	276
850	490
900	730
950	872
1000	985
1050	1060
→ 1100	1071
1150	1097
1200	1049
1250	1077
1300	1151
1350	1122

source plateau cs137 10uCi button #1296115

700	805
750	1683
800	2722
850	3495
900	4366
950	4858
1000	5074
1050	5181
→ 1100	5360
1150	5249
1200	5318
1250	5373
1300	5542
1350	5632

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 09/28/2015.
The current time of day is: 07:29:20.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	129407.
User I.D. =	
High Voltage =	1100 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.528867E-05.
Detector Calibration Constant =	5.621807E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	196022.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.3 volts.

DET1 Generated: 09/28/2015 07:32:00.

Model 2350 Serial #129407

H1100$F
Set High Voltage: 1100

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.528867E-05$2
Set Dead Time: 1.528867E-05

SC5.621807E+10$T
Set Calibration Constant: 5.621807E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N196022$$
Set Detector Serial #: 196022

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 09/28/2015.
The current time of day is: 07:31:23.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	129407.
User I.D. =	
High Voltage =	1100 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.528867E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	196022.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.3 volts.

DET2 Generated: 09/28/2015 07:32:36.

Model 2350 Serial #129407

H1100$F
Set High Voltage: 1100

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.528867E-05$2
Set Dead Time: 1.528867E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N196022$$
Set Detector Serial #: 196022

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

099605

Amersham Buchler
GmbH & Co KG
Gieselweg 1
D-38110 Braunschweig
Postfach 11 49
D-38001 Braunschweig

Tel. (05307) 930-0
Fax (05307) 930-293
Fax-Zentrale 930-237

Amersham
The Health Science Group

CERTIFICATE

No. 215395

for a Sealed Radioactive Source

Source Type: Alpha Wide Area Reference Source

Product Code	TZRX1922
Drawing	VZ-1368
Dimensions of Active Surface	Ø 36 mm
Overall Dimensions	Ø 47 mm x 3 mm
Source No.	FD 763
Nuclide	Thorium-230

Measurement Data

Activity	339 Bq
Overall Uncertainty*	± 10 %
Alpha Surface Emission Rate	158 s^{-1} ± 5 % in 2 π steradian
Reference Date	3 September 1996
Traceability*	Defined on page 2

Leakage and Contamination Test(s)

Test Method(s)*	I
Test(s) passed on	10 September 1996

Additional Information

ISO Classification*	C.34645
Recommended Working Life*	10 years
Remark	---

* see page 2 for explanation

Amersham Buchler

(Production Manager)

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

051303

CERTIFICATE OF CALIBRATION
BETA STANDARD SOURCE

Radionuclide:	Tc-99	**Customer:**	ENERGYSOLUTIONS (ENVIROCARE)
Half-life:	(2.13 ± 0.05)E+05 years	**P.O. No.:**	633593
Catalog No.:	EAB-099-47U	**Reference Date:**	15-May-13 12:00 PST
Source No.:	K3-991	**Contained Radioactivity:**	10.50 **nCi** 388.5 **Bq**

Physical Description:

A. Capsule type:	Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded Technetium metal
C. Active diameter/volume:	45 mm
D. Backing:	Stainless steel
E. Cover:	None

Radioimpurities:

None detected

Method of Calibration:

This source was assayed using a windowless internal gas flow proportional counter.

Uncertainty of Measurement:

A. Type A (random) uncertainty:	±	0.5	%
B. Type B (systematic) uncertainty:	±	3.0	%
C. Uncertainty in aliquot weighing:	±	0.0	%
D. Total uncertainty at the 99% confidence level:	±	3.0	%

Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a surface emission rate of 12820 β/min in 2π on 23-Apr-13.

Daniel James Van Dalsem
Quality Control

25 Apr-13
Date

EZIP Ref. No.: 1652-78

CERTIFICATE OF CALIBRATION

CUSTOM ALPHA STANDARD[1]

Radionuclide Th-230 Activity 2.585 nCi Serial Number B403

Reference Date Feb. 1, 1994 Half-Life[2] $(7.54 \pm 0.03) \times 10^4$ years

Alpha Flux Rate (2 pi emission rate) 2869.4 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
alpha	4621.1	23.4
	4687.6	76.3

SOURCE DESCRIPTION
The activity is homogenously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and alpha flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

ORIGINAL

Systematic uncertainty	± 1.56%
Random uncertainty	± 0.97%
Total uncertainty	± 2.53%

Calibration Laboratory

2-24-94
Date

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

SEE # 049410

CERTIFICATE OF CALIBRATION

CUSTOM BETA STANDARD[1]

Radionuclide Tc-99 Activity 9.504 nCi Serial Number B399

Reference Date April 1, 1994 Half-Life[2] $(2.13 \pm 0.05) \times 10^5$ years

Beta Flux Rate (2 pi emission rate) 12131.9 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
beta	E_{max} = 294 E_{avg} = 85	100

SOURCE DESCRIPTION
The activity is homogeneously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and beta flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

Systematic uncertainty	± 3.08%
Weighing uncertainty	± 0.72%
Total uncertainty	± 3.80%

ORIGINAL

Daniel Kh
Calibration Laboratory

4-8-94
Date

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

Radioactive Source Leak Test Record

Form CP-HP-PR-507-F1
Rev. 0

Field Test Information:

HP/Instrument Tech: Mike Paul Date of Leak Test 11/20/2015

Source ID No. 049410 Storage/Transfer Location 15F

Isotope Tc-99 Activity (μCi) 0.009504

Field Survey Results (dpm) <1000 dpm B-γ & <100 dpm α (>1000 dpm B-γ or >100 dpm α notify RPM)

Model/ID: Instrument 177 # 124586 12 # 57828 Detector 44-9 # 096211 43-5 # 127373

Calibration Due Date 177/44-9 Due 7-16-16 / 12/43-5 Due 7-16-16

If Field Test only, sign Field Test is Complete. Mike Paul and date 11/20/2015

If Field Test is in preparation for Semi-Annual or Initial Receipt leak test complete the following:

Date of Transfer to Lab: N/A Received by: N/A

Laboratory Leak Test Results:

Enter data below or check this box ☐ to note lab analysis is attached.

Date of Analysis	B-γ * (μCi)	α * (μCi)	Total * (μCi)	MDA (μCi)
←		N/A	→	

* If not less than 0.005 (μCi) notify RPM and I&C Leader.

Leak test counted by N/A Date N/A

Leak test reviewed by Jeff Dickinson Date 11/20/15

HP/Instrument Tech action:

Verify Lab Leak Test results are less than 0.005(μCi).

If Lab tests are below 0.005 (μCi) submit form to the Health Physics Leader for review.

Health Physics Leader submits form to I& C Leader to update History Record (CP-HP-PR-106-F9) and file this form in the source file.

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the intraweb or the document control authority for the current revision.

Radioactive Source Leak Test Record

Form CP-HP-PR-507-F1
Rev. 0

Field Test Information:

HP/Instrument Tech: Mike Paul Date of Leak Test 11/20/2015

Source ID No. 099605 Storage/Transfer Location 15F

Isotope Th-230 Activity (μCi) 0.009162

Field Survey Results (dpm) <1000 dpm B-γ & <100 dpm α (>1000 dpm B-γ or >100 dpm α notify RPM)

Model/ID: Instrument 177 # 124586 / 12 # 87828 Detector 44-9 # 096211 / 43-5 # 127373

Calibration Due Date 177/44-9 Due 7-16-16 / 12/43-5 Due 7-16-16

If Field Test only, sign Field Test is Complete. Mike Paul and date 11/20/2015

If Field Test is in preparation for Semi-Annual or Initial Receipt leak test complete the following:

Date of Transfer to Lab: N/A Received by: N/A

Laboratory Leak Test Results:

Enter data below or check this box ☐ to note lab analysis is attached.

Date of Analysis	B-γ * (μCi)	α * (μCi)	Total * (μCi)	MDA (μCi)
←		N/A	→	

* If not less than 0.005 (μCi) notify RPM and I&C Leader.

Leak test counted by N/A Date N/A

Leak test reviewed by Jeff Dukinson Date 11/20/15

HP/Instrument Tech action:

Verify Lab Leak Test results are less than 0.005(μCi).

If Lab tests are below 0.005 (μCi) submit form to the Health Physics Leader for review.

Health Physics Leader submits form to I& C Leader to update History Record (CP-HP-PR-106-F9) and file this form in the source file.

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the intraweb or the document control authority for the current revision.

Radioactive Source Leak Test Record

Form CP-HP-PR-507-F1
Rev. 0

Field Test Information:

HP/Instrument Tech: Mike Paul Date of Leak Test 11/20/2015

Source ID No. 051303 Storage/Transfer Location 15F

Isotope Tc-99 Activity (μCi) 0.0105

Field Survey Results (dpm) <1000 dpm B-γ & <100 dpm α (>1000 dpm B-γ or >100 dpm α notify RPM)

Model/ID: Instrument 177 # 124586 / 12 # 57828 Detector 44-9 # 096211 / 43-5 # 127373

Calibration Due Date 177/44-9 Due 7-16-16 / 12/43-5 Due 7-16-16

If Field Test only, sign Field Test is Complete. Mike Paul and date 11/20/2015

If Field Test is in preparation for Semi-Annual or Initial Receipt leak test complete the following:

Date of Transfer to Lab: N/A Received by: N/A

Laboratory Leak Test Results:

Enter data below or check this box ☐ to note lab analysis is attached.

Date of Analysis	B-γ * (μCi)	α * (μCi)	Total * (μCi)	MDA (μCi)
←		N/A	→	

* If not less than 0.005 (μCi) notify RPM and I&C Leader.

Leak test counted by N/A Date N/A

Leak test reviewed by J. Dickinson Date 11/20/15

HP/Instrument Tech action:

Verify Lab Leak Test results are less than 0.005(μCi).

If Lab tests are below 0.005 (μCi) submit form to the Health Physics Leader for review.

Health Physics Leader submits form to I& C Leader to update History Record (CP-HP-PR-106-F9) and file this form in the source file.

Electronic documents, once printed, are uncontrolled and may become outdated Refer to the intraweb or the document control authority for the current revision

Radioactive Source Leak Test Record

Form CP-HP-PR-507-F1
Rev. 0

Field Test Information:

HP/Instrument Tech: Mike Paul Date of Leak Test 11/20/2015

Source ID No. 119311 Storage/Transfer Location 15F

Isotope Cs-137 Activity (µCi) 2.9619

Field Survey Results (dpm) <1000 dpm β-γ & <100 dpm α (>1000 dpm B-γ or >100 dpm α notify RPM)

Model/ID: Instrument 177 # 124586 / 12 # 87828 Detector 44-9 # 096211 / 43-5 # 122373

Calibration Due Date 177/44-9 Due 7-16-16 / 12/43-5 Due 7-16-16

If Field Test only, sign Field Test is Complete. Mike Paul and date 11/20/2015

If Field Test is in preparation for Semi-Annual or Initial Receipt leak test complete the following:

Date of Transfer to Lab: N/A Received by: N/A

Laboratory Leak Test Results:

Enter data below or check this box ☐ to note lab analysis is attached.

Date of Analysis	B-γ * (µCi)	α * (µCi)	Total * (µCi)	MDA (µCi)
←		N/A	→	

* If not less than 0.005 (µCi) notify RPM and I&C Leader.

Leak test counted by N/A Date N/A

Leak test reviewed by Jeff Dickerson Date 11/20/15

HP/Instrument Tech action:

Verify Lab Leak Test results are less than 0.005(µCi).

If Lab tests are below 0.005 (µCi) submit form to the Health Physics Leader for review.

Health Physics Leader submits form to I& C Leader to update History Record (CP-HP-PR-106-F9) and file this form in the source file.

Electronic documents, once printed, are uncontrolled and may become outdated. Refer to the intraweb or the document control authority for the current revision.

Radioactive Source Leak Test Record

Form CP-HP-PR-507-F1
Rev. 0

Field Test Information:

HP/Instrument Tech: Mike Paul Date of Leak Test 11/20/2015

Source ID No. D39404 Storage/Transfer Location 15F

Isotope Th-230 Activity (µCi) 0.002585

Field Survey Results (dpm) <1000 dpm B-γ & <100 dpm α (>1000 dpm B-γ or >100 dpm α notify RPM)

Model/ID: Instrument 177 # 124586 / 12 # 57828 Detector 44-9 # 096211 / 43-5 # 127373

Calibration Due Date 177/44-9 Due 7-16-16 / 12/43-5 Due 7-16-16

If Field Test only, sign Field Test is Complete. Mike Paul and date 11/20/2015

If Field Test is in preparation for Semi-Annual or Initial Receipt leak test complete the following:

Date of Transfer to Lab: N/A Received by: N/A

Laboratory Leak Test Results:

Enter data below or check this box ☐ to note lab analysis is attached.

Date of Analysis	B-γ * (µCi)	α * (µCi)	Total * (µCi)	MDA (µCi)
←		N/A	→	

* If not less than 0.005 (µCi) notify RPM and I&C Leader.

Leak test counted by N/A Date N/A

Leak test reviewed by [signature] Date 11/20/15

HP/Instrument Tech action:

Verify Lab Leak Test results are less than 0.005(µCi).

If Lab tests are below 0.005 (µCi) submit form to the Health Physics Leader for review.

Health Physics Leader submits form to I& C Leader to update History Record (CP-HP-PR-106-F9) and file this form in the source file.

Electronic documents, once printed, are uncontrolled and may become outdated Refer to the intraweb or the document control authority for the current revision

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 269208
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: 2015-14235	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-219	
X0.1	100	100	100	Pulser: 120935	Cal Due: 02/04/16
X0.1	250	250	250	DVM: 97960214	Cal Due: 06/27/15
X0.1	400	400	400	Temp/Press: 3076	Cal Due: 01/06/16
X 1	1,000	1,000	1,000	Humidity: 958670	Cal Due: 01/30/16
X 1	2,500	2,500	2,500	Temp: 21.6 ° C Humidity: 36% Pressure: 742 mmHg	
X 1	4,000	4,000	4,000		
X 10	10,000	10,000	10,000		
X 10	25,000	25,000	25,000	Reset: SAT	Sensitivity: SAT
X 10	40,000	40,000	40,000	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT: SAT
X 100	250,000	250,000	250,000	Limited Use: X100 scale for info only. Use with GM Detector.	
X 100	400,000	400,000	400,000		
Mech. Zero	0	0	0		
HV Verification				HV Set at 900 volts to be used with GM detectors.	
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT			
				Precision Test Reading 1 = 32,000 Reading 2 = 31,500 Reading 3 = 32,000 Mean = 31,833 ☒ SAT ☐ UNSAT	

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By:	Date: 5/11/15
Certification Date: 05/11/2015	*Certification Due (6 mo.): 11/11/2015 *Certification Due (12 mo.): 05/11/2016	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 44-9
Contact Name: Tony Riggs		Serial Number: 150446
Customer Purchase Order Number: N/A	Work Order Number: 2015-14235	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	Serial Number: 119720	Original Activity (dpm): 2,562	Certification Date: 10/14/97
2) Source Nuclide: Tc-99	Serial Number: 119718	Original Activity (dpm): 20,520	Certification Date: 10/14/97
3) Source Nuclide: Tc-99	Serial Number: 069507	Original Activity (dpm): 237,960	Certification Date: 04/01/95

Efficiency determined using 180-2 jig @ 1/8" geometry

Source #	Gross CPM	Net CPM	Efficiency				
Source 1	340	305	11.9%				
Source 2	2,350	2,315	11.3%				
Source 3	31,500	31,465	13.2%				

INSTRUMENT INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
3	269208	05/11/2016	35	900 Volts	35mV

COMMENTS

Detectors calibrated with a Model 3 or 12 and may be used with any Model 3 or 12 provided that the instrument is in calibration and the Instrument was previously set up to be used with a GM detector (operating voltage 900 Volts)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Pani	Reviewed By: [signature] Date: 5/11/15
Certification Date: 05/11/2015	Certification Due (6 mo.): 11/11/2015 Certification Due (12 mo.): 05/11/2016

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

Customer Information		Instrument Information	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2929	Serial Number: 61549
Contact Name: Tony Riggs		Probe: 43-10-1	Serial Number: 024319
Customer Purchase Order Number: N/A	Work Order Number: 2015-14240	Calibration Method: Electronic And Source	

Instrument Calibration Information

M&TE	ID Number	Calibration Due Date	Environmental Conditions	
Thermometer	3076	1/6/16	Temperature (°C)	22.7
Barometer	3076	1/6/16	Pressure (mmHg)	745
Hygrometer	958670	1/30/16	Humidity (%)	37.0
Pulse Generator	43855	6/4/16	Calibrated in accordance with CP-IN-WI-235	
DVM	92260808	5/31/15		

Isotope	Source ID Number	Decayed Activity (dpm)	2Pi Emissions (EPM)	Source Cert. Date
Pu^{239}	071201	20,574	10,390/ min	05/01/2012
Tc^{99}	099608	21,311	10,500 / min	08/08/1996
Th^{230}	119738	18,600	8,640 / min	10/20/1997
Sry^{90}	129676	11,177	8,371 /min	05/12/2003

Frequency Calibration

Desired (cpm)	Tolerances (cpm)	Alpha As Found (cpm)	Alpha As Left (cpm)	Beta As Found (cpm)	Beta As Left (cpm)
40	40	40	40	40	40
400	(392 - 408)	399	399	399	399
4,000	(3,920 - 4,080)	3978	3978	3994	3994
40,000	(39.2K - 40.8K)	39802	39802	39819	39819
400,000	(392K - 408K)	398200	398200	398194	398194

Background Determination	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Counts, C_b	8	7	856	967
Time, T_b (min)	20	20	20	20
Rate, R_b (cpm)	.4	.35	42.8	48.35

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By:	Reviewed By:	Date: 5/19/15
Calibration Date: 5/18/15	* Calibration Due (6 mo.): 11/18/15	
	* Calibration Due (12 mo.): 5/18/16	

* Calibration due date is dependent on users regulatory requirements.

CROSS TALK & EFFICIENCY SHEET

Instrument ID: 61549

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
165	165

Alpha Source: Cross Talk – Performed using Pu^{239} #071201

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	27962	28736	920	1158
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 5592$	$R_{s[\alpha]} = 5747$	$R_{s[\beta]} = 184$	$R_{s[\beta]} = 231.6$
4π EFF (% Net cpm/dpm) (>25%)	25.1%	27.9%	N/A	N/A
2π EFF (% Net cpm/emissions)	49.7%	55.3%	N/A	N/A
%Crosstalk [α to β] (< 10%)	$\frac{R_{s[\beta]} - R_{b[\beta]}}{R_{s[\alpha]} - R_{b[\alpha]}} = 3.38\%$			

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
6 mV	6 mV	58 mV	58 mV

Beta Source: Cross Talk Performed Using Tc^{99} #099608

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	4	3	26094	27760
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = .8$	$R_{s[\alpha]} = .6$	$R_{s[\beta]} = 5218$	$R_{s[\beta]} = 5552$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	24.49%	26.05%
2π EFF (% Net cpm/emissions)	N/A	N/A	49.7%	52.8%
%Crosstalk [β to α] (< 1%)	$\frac{R_{s[\alpha]} - R_{b[\alpha]}}{R_{s[\beta]} - R_{b[\beta]}} = .05\%$			

High Voltage Power Supply Calibration

Desired Voltage	Tolerance	DVM As Found	DVM As Left	2929 Meter As Found	2929 Meter As Left
600	540 - 660	610.8	610.8	600	600
800	720 - 880	836.9	836.9	800	800
1,000	900 - 1,100	1,083.2	1,083.2	1,000	1,000
1,200	1,080 - 1,320	1,282.2	1,282.2	1,200	1,200
1,300	1,170 - 1,430	1,386.8	1,386.8	1,300	1,300

High Voltage	As Found	Vern Dial Reading	As Left	Vern Dial Reading
	891.1V	3.76	900.1V	4.10

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: [signature] **Reviewed By:** [signature] **Date:** 5/18/15

Calibration Date: 5/18/15

*** Calibration Due (6 mo.): 11/18/15**

*** Calibration Due (12 mo.): 5/18/16**

* Calibration due date is dependent on users regulatory requirements.

EFFICIENCY SHEET

Instrument ID: 61549

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
165	165

Alpha Source: Efficiency determined using Th^{230} #119738

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	31511	31965	2648	2974
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 6302$	$R_{s[\alpha]} = 6393$	$R_{s[\beta]} = 529.6$	$R_{s[\beta]} = 594.8$
4π EFF (% Net cpm/dpm) (>25%)	33.89%	34.4%	N/A	N/A
2π EFF (% Net cpm/emissions)	72.9%	74.0%	N/A	N/A

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
6 mV	6 mV	58 mV	58 mV

Beta Source: Efficiency determined using Sry^{90} #129676

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	22	88	20108	18416
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 4.4$	$R_{s[\alpha]} = 17.6$	$R_{s[\beta]} = 4021.6$	$R_{s[\beta]} = 3683.2$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	35.99%	32.96%
2π EFF (% Net cpm/emissions)	N/A	N/A	48.04%	44.0%

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: **Reviewed By:** **Date:** 5/18/15

Calibration Date: 5/18/15

*** Calibration Due (6 mo.): 11/18/15**

*** Calibration Due (12 mo.): 5/18/16**

* Calibration due date is dependent on users regulatory requirements.

Instrument ID: 61549

Source and Background Plateau Worksheet								
High Voltage	Background		Alpha Source		Beta Source		Cross Talk	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α
600								
650								
700								
750								
800								
850		See attached plateau page with crosstalk info added						
900								
950			As Found HV =891V As Left HV: 900V					
1000								
1050								
1100								
1150								

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By:	Date: 5/18/15
Calibration Date: 5/18/15	* Calibration Due (6 mo.): 11/18/15	
	* Calibration Due (12 mo.): 5/18/16	

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: Isfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions Services, Inc.			Manufacturer:	Ludlum		
Address:	1570 Bear Creek Road, Oak Ridge, TN			Model:	2929	S.N.	61549
Contact Name:	Tony Riggs			Probe:	43-10-1	S.N.	024319
Customer PO No.:	N/A	Work Order Number:	2015-14240	Calibration Method:	Electronic & Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,573
β Source	Tc-99	099608	8/8/96	21,311

Ludlum Model 2929 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	800	1	34	6,261	392	0	4,315	5.75%	0.00	30.43%	20.09%
	825	0	29	5,630	171	1	4,861	2.54%	0.02%	27.37%	22.67%
	850	0	35	5,710	180	2	5,564	2.56%	0.04%	27.75%	25.94%
	875	1	40	5,583	163	3	5,581	2.22%	0.04%	27.13%	26.00%
SET	**900**	**0**	**38**	**5,745**	**231**	**3**	**5,552**	**3.38%**	**0.05%**	**27.92%**	**25.87%**
	925	0	51	5,732	274	2	5,306	3.93%	0.04%	27.86%	24.66%
	950	1	61	5,785	465	1	4,942	7.06%	0.00%	28.11%	22.90%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: _____ Reviewed By: _____ Date: 5/19/15

Calibration Date: 5/18/15 Calibration Due: 5/18/16

Computer Equivalent of Form IN-WI-235-F1 (Page 4 of 6)

Alpha Source Chi-Square Test

Ludlum Model 2929	Serial Number:	61549	Source Nuclide Th-230	Source ID 99603

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	6411	-3.80	14.44
2	6304	-110.80	12276.64
3	6596	181.20	32833.44
4	6596	181.20	32833.44
5	6334	-80.80	6528.64
6	6567	152.20	23164.84
7	6364	-50.80	2580.64
8	6355	-59.80	3576.04
9	6415	0.20	0.04
10	6347	-67.80	4596.84
11	6401	-13.80	190.44
12	6387	-27.80	772.84
13	6475	60.20	3624.04
14	6359	-55.80	3113.64
15	6591	176.20	31046.44
16	6288	-126.80	16078.24
17	6429	14.20	201.64
18	6327	-87.80	7708.84
19	6429	14.20	201.64
20	6321	-93.80	8798.44
Σ=	128296	(x-Mean)² =	190141.20

Mean = 6414.80

Chi² = 29.64

σ = 100.04

2σ= 200.074302

Reduce Chi Square= 1.560054

3σ= 300.11

Reduced Chi Pass/Fail= PASS

Performed By/Date _____ / 5/18/15

Reviewed By/Date _____ / 5/18/15

Computer Equivalent of Form IN-WI-235-F1 (Page 4 of 6)

Beta Source Chi-Square Test

Ludlum Model 2929 Serial Number: 61549 Tc-99 119715

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	5636	59.45	3534.30
2	5613	36.45	1328.60
3	5497	-79.55	6328.20
4	5563	-13.55	183.60
5	5584	7.45	55.50
6	5469	-107.55	11567.00
7	5562	-14.55	211.70
8	5472	-104.55	10930.70
9	5628	51.45	2647.10
10	5555	-21.55	464.40
11	5672	95.45	9110.70
12	5605	28.45	809.40
13	5558	-18.55	344.10
14	5607	30.45	927.20
15	5614	37.45	1402.50
16	5710	133.45	17808.90
17	5593	16.45	270.60
18	5532	-44.55	1984.70
19	5540	-36.55	1335.90
20	5521	-55.55	3085.80
Σ=	111531	(x-Mean)² =	74330.95

Mean = 5576.55 Chi² = 13.33

σ = 62.55 2σ= 125.0944

Reduce Chi Square= 0.701537 3σ= 187.64

Reduced Chi Pass/Fail= PASS

Performed By/Date _____ / 5/18/15

Reviewed By/Date _____ / 5/19/15

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		**Manufacturer: Ludlum**	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		**Model: 2360**	**Serial Number: 297826**
Contact Name: Tony Riggs		**Probe: N/A**	**Serial Number: N/A**
Customer Purchase Order Number: N/A	**Work Order Number: N/A**	**Calibration Method: Electronic**	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Ratemeter Response (cpm) (Tolerance ±10% of Calibration Standard Values)		Calibration Standard Value	Time Base (min.)	Tolerances (counts) ± 2%	Scaler Response (counts)	
		As Found	As Left				As Found	As Left
X 1	100	105	105	40,000 CPM	0.1	3,920 - 4,080	4,023	4,023
X 1	250	250	250	40,000 CPM	0.5	19.6K - 20.4K	20,118	20,118
X 1	400	400	400	40,000 CPM	1	39.2K - 40.8K	40,237	40,237
X 10	1,000	1,050	1,050	40,000 CPM	2	78.4K - 81.6K	80,474	80,474
X 10	2,500	2,500	2,500					
X 10	4,000	4,000	4,000					
X 100	10,000	10,500	10,500					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	105,000	105,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: Mike Yonce	**Reviewed By:** [illegible] **Date:** [illegible]
Calibration Date: 01/30/2015	*** Calibration Due (6 mo.): 07/30/2015**
	*** Calibration Due (12 mo.): 01/30/2016**

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: Isfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	Energy Solutions			Manufacturer:			
Address:	1570 Bear Creek Road, Oak Ridge, TN			Model:	2360	S.N.	297826
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	323053
Customer PO No.:	N/A	Work Order Number:	N/A	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,572
β Source	Tc-99	099608	8/8/96	21,311

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	775	1	82	3,038	207	2	1,965	4.23%	0.05%	14.76%	8.84%
	800	1	114	3,199	221	3	2,578	3.47%	0.08%	15.55%	11.56%
SET	**825**	**0**	**160**	**3,356**	**252**	**3**	**3,033**	**2.88%**	**0.10%**	**16.31%**	**13.48%**
	850	1	182	3,455	340	1	3,344	4.83%	0.00%	16.79%	14.84%
	875	0	204	3,441	436	2	3,754	7.17%	0.06%	16.73%	16.66%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: Mike Yoxie Reviewed By: [illegible] Date: 1/30/15

Calibration Date: 1/30/15 Calibration Due: 1/30/16

ENERGYSOLUTIONS

Model: 2360 Serial Number: 297826

M&TE				Environmental Conditions			
Volt Meter	ID#:	83880126	Cal Due: 05/31/15	Barometer	ID#:	3076	Cal Due: 01/06/16
Pulser	ID#:	61754	Cal Due: 02/11/15	Thermometer	ID#:	3076	Cal Due: 01/06/16
Humidity	ID#:	992290	Cal Due: 03/12/15	Temp: 21.7 °C	Pressure: 748 mmHg		Humidity: 22.5 %

Special Test

Mechanical Zero	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
BAT Check	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (±10%)				Alpha Sensitivity = 100 mV	Alpha Sensitivity = 120 mV
Voltage	Tolerance	As Found	As Left	Beta Sensitivity = 3.2 mV	Beta Sensitivity = 3.5 mV
500	450 - 550	510	507	Beta Window = 28.0 mV	Beta Window = 30.0 mV
1000	900 - 1,100	1,005	1,000	Beta Setpoints -- Pulser counts detected at 3.5 mV ± 1 mV and shut off at 30 mV for beta. For Alpha channel counts detected at 120 mV and above.	
1,500	1,350 - 1,650	1,512	1,504		
H.V. Set With Detector Not Connected				Overload to be set with detector to be used	

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

** Calibrated with 5 ft. cable **

Instrument Calibrated By: Mike Young	Reviewed By: [illegible] Date: 1/30/15
Calibration Date: 01/30/2015	* Calibration Due (6 mo.): 07/30/2015 * Calibration Due (12 mo.): 01/30/2016

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 323053
Customer Purchase: Order Number: N/A	Work Order Number: N/A	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4 pi Eff (%)	2 pi Eff (%)
Th-230	119738	18,597	8,639 / min	2,957	15.9	34.2
Tc-99	099608	21,311	10,499 / min	2,682	12.6	25.5
Pu-239	071201	20,572	10,389 / min	3,350	16.3	32.2
SrY-90	129676	11,969	8,431 / min	2,961	24.7	35.1

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	297826	01/30/16	2	825V	Alpha (120 mV)
2360	297826	01/30/16	158	825V	Beta (3.5 - 30 mV)

ATTACHMENTS

Voltage Plateau: √YES NO

COMMENTS	LINEARITY TEST (Gross Counts)	
Calibrated with 5 ft. cable Linearity test performed with Tc-99, #099608. Calibrated in accordance with original equipment technical manual.	Count 1 (Toe)	2,748
	Count 2 (Mid)	2,946
	Count 3 (Heel)	2,826
	Average	2,840
	Pass / Fail	PASS (+/-10% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector

Certified By: Mike Jones Reviewed By: [illegible] Date: [illegible]

Certification Date: 01/30/2015

* Certification Due (6 mo.): 07/30/2015
* Certification Due (12 mo.): 01/30/2016

Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 126172
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2015-14307	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (Tolerance ±10% of Calibration Std. Values) Before Calibration	After Calibration	Comments: Calibrated in accordance with CP-IN-WI-239	
400	400	399	399	Pulser: 112860	Cal Due: 10/09/15
4,000	4,000	3,987	3,987	DVM: 88020324	Cal Due: 02/07/16
40,000	40,000	39,876	39,876	Temp/Press: 3076	Cal Due: 01/06/16
400,000	400,000	399,012	399,012	Humidity: 958670	Cal Due: 01/30/16
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N21 I/O Firmware Version: 37123N05	
500	(490 - 510)	497	497		
1,500	(1,498 - 1,502)	1,501	1,501	Temp: 21.0 °C Pressure: 742 mmHg Humidity: 36.1 %	
2,000	(1,940 - 2,060)	1,998	1,998		
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	10.0	10.0	BAT > 4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	49.2	49.2	Volume: SAT	ACK/Scroll: SAT
Threshold T = 1000	100 ± (90 to 110) mVDC	98	98	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 / 10 mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By:	Date: 6/19/15
Calibration Date: 06/19/2015	* Certification Due (6 mo.): 12/19/2015 * Certification Due (12 mo.): 06/19/2016	

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISI Staff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 192589
Customer Purchase Order Number: N/A	Work Order Number: 2015-14307	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION			
1) Source Nuclide: Cs^{137}	Serial Number: 019455	Activity: 5µCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 09/09/2015

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#126172	Count 1	2.01
Due Date	06/19/2015	Count 2	2.01
Threshold	T=100 (10mV)	Count 3	2.01
Cable Length	5ft	Average	2.01
Temp/Press: 3076	Cal Due: 01/06/2016	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 01/30/2016	Pass/Fail	
Temp: 21.0 °C		Humidity: 36.1 %	Press: 742 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 68,409	High Sample Activity (2mR/hr) Using Source #2 = 256,378	Dead Time (DT): 1.465350E-05	Calibration Constant (CC): 5.598340E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.405	0.405
Voltage Plateau:	√YES	NO	1.00	0.900-1.100	0.981	0.981
High Voltage: 1250V			2	1.8-2.2	2.01	2.01

COMMENTS

Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1 to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By:	Reviewed By:	Date:
Certification Date: 06/19/2015	*Certification Due (6mo): 12/19/2015	
	*certification Due (12mo): 06/19/2016	

* Calibration due date is dependant on users regulatory requirements.

BACKGROUND PLATEAU 44-10 #192589 6/18/2015

700	31
750	64
800	166
850	251
900	435
950	579
1000	771
1050	889
1100	985
1150	954
1200	956
1250	982
1300	1035
1350	958

SOURCE PLATEAU CS137 BUTTON #09240

700	78
750	282
800	1143
850	1671
900	2218
950	2663
1000	3115
1050	3313
1100	3449
1150	3514
1200	3686
1250	3675
1300	3713
1350	3764

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 06/19/2015.
The current time of day is: 06:50:38.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: TR

Comments:

Model 2350 Serial # =	126172.
User I.D. =	.
High Voltage =	1250 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.465350E-05.
Detector Calibration Constant =	5.598340E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	192589.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.3 volts.

DET1 Generated: 06/19/2015 06:51:58.

Model 2350 Serial #126172

H1250$L
Set High Voltage: 1250

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.465350E-05$W
Set Dead Time: 1.465350E-05

SC5.598340E+10$Y
Set Calibration Constant: 5.598340E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N192589$A
Set Detector Serial #: 192589

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 06/19/2015.
The current time of day is: 06:51:01.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: Th

Comments:

Model 2350 Serial # =	126172.
User I.D. =	
High Voltage =	1250 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.465350E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	192589.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.3 volts.

DET2 Generated: 06/19/2015 06:52:34.

Model 2350 Serial #126172

H1250$L
Set High Voltage: 1250

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.465350E-05$W
Set Dead Time: 1.465350E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N192589$A
Set Detector Serial #: 192589

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

Appendix N

Daily Instrument Response Checks

Ambient Background Data

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1				
Instrument Model:	2350-1		Instrument Serial No.	129407	
Last Calibration Date:	1/22/2015				
Detector Model:	44-10		Detector Serial No.:	196022	
Today's Date:	10/7/2015		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background				
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	4675	141.57		20041.12
2	4660	126.57		16019.12
3	4551	17.57		308.59
4	4637	103.57		10726.05
5	4338	-195.43		38194.19
6	4419	-114.43		13094.99
7	4653	119.57		14296.19
8	4521	-12.43		154.59
9	4465	-68.43		4683.12
10	4706	172.57		29779.25
11	4456	-77.43		5995.92
12	4553	19.57		382.85
13	4460	-73.43		5392.45
14	4664	130.57		17047.65
15	4439	-94.43		8917.65
16	4408	-125.43		15733.52
17	4517	-16.43		270.05
18	4540	6.57		43.12
19	4612	78.57		6172.72
20	4485	-48.43		2345.79
21	4596	62.57		3914.59
22	4455	-78.43		6151.79
23	4563	29.57		874.19
24	4437	-96.43		9299.39
25	4405	-128.43		16495.12
26	4615	81.57		6653.12
27	4514	-19.43		377.65
28	4621	87.57		7667.92
29	4563	29.57		874.19
30	4475	-58.43		3414.45
Mean Count: $\bar{x}$	4533.43		SUM	265321.37
Standard Deviation (σ)	95.65		Variance:	9149.01
Background Count Rate:		4533.43	CPM + -	191.30 CPM

CPM Low	CPM High
4342	4725

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1				
Instrument Model:	2350-1		Instrument Serial No.	120588	
Last Calibration Date:	6/19/2015				
Detector Model:	44-10		Detector Serial No.:	318218	
Today's Date:	10/7/2015		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background				
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	4047	-28.57		816.05
2	4134	58.43		3414.45
3	3961	-114.57		13125.52
4	4070	-5.57		30.99
5	3942	-133.57		17840.05
6	4006	-69.57		4839.52
7	4031	-44.57		1986.19
8	3933	-142.57		20325.25
9	4018	-57.57		3313.92
10	4022	-53.57		2869.39
11	4148	72.43		5246.59
12	4074	-1.57		2.45
13	4094	18.43		339.79
14	4964	888.43		789313.79
15	4214	138.43		19163.79
16	4064	-11.57		133.79
17	4214	138.43		19163.79
18	4087	11.43		130.72
19	4020	-55.57		3087.65
20	3996	-79.57		6330.85
21	4066	-9.57		91.52
22	3994	-81.57		6653.12
23	3985	-90.57		8202.32
24	4047	-28.57		816.05
25	3970	-105.57		11144.32
26	4007	-68.57		4701.39
27	3956	-119.57		14296.19
28	4115	39.43		1554.99
29	4098	22.43		503.25
30	3990	-85.57		7321.65
Mean Count: $\bar{x}$	4075.57		SUM	966759.37
Standard Deviation (σ)	182.58		Variance:	33336.53
Background Count Rate:		4075.57	CPM + -	365.17 CPM

CPM Low	CPM High
3710	4441

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indiand Head Site 1				
Instrument Model:	2929		Instrument Serial No.	115563	
Last Calibration Date:	5/19/2015				
Detector Model:	43-10-1		Detector Serial No.:	127216	
Today's Date:	10/7/2015		Data Collected by:	William Wylie	
X	Alpha		Beta-Gamma		Gamma
Remarks:	Instrument Ambient Background			Instrument Efficiency: 0.737	
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number	CPM	$(x - \overline{x})$		$(x - \overline{x})^2$
1	0	-0.17		0.03
2	0	-0.17		0.03
3	0	-0.17		0.03
4	1	0.83		0.69
5	0	-0.17		0.03
6	0	-0.17		0.03
7	0	-0.17		0.03
8	0	-0.17		0.03
9	1	0.83		0.69
10	0	-0.17		0.03
11	0	-0.17		0.03
12	0	-0.17		0.03
13	0	-0.17		0.03
14	1	0.83		0.69
15	0	-0.17		0.03
16	0	-0.17		0.03
17	0	-0.17		0.03
18	0	-0.17		0.03
19	0	-0.17		0.03
20	0	-0.17		0.03
21	1	0.83		0.69
22	0	-0.17		0.03
23	0	-0.17		0.03
24	0	-0.17		0.03
25	0	-0.17		0.03
26	0	-0.17		0.03
27	0	-0.17		0.03
28	0	-0.17		0.03
29	1	0.83		0.69
30	0	-0.17		0.03
Mean Count: $\overline{x}$	0.17		SUM	4.17
Standard Deviation (σ)	0.38		Variance:	0.14
Background Count Rate:		0.17	CPM + -	0.76 CPM

Background in dpm/100cm^2	
0.90	
CPM Low	CPM High
-0.59	0.92

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indiand Head Site 1					
Instrument Model:	2929		Instrument Serial No.	115563		
Last Calibration Date:	5/19/2015					
Detector Model:	43-10-1		Detector Serial No.:	127216		
Today's Date:	10/7/2015		Data Collected by:	William Wylie		
	Alpha	X	Beta-Gamma		Gamma	
Remarks:	Instrument Ambient Background			Instrument Efficiency: 0.365		
Type of Surface:	Ambient		Count Time:	1	Minutes	

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	46	6.53		42.68
2	46	6.53		42.68
3	34	-5.47		29.88
4	42	2.53		6.42
5	39	-0.47		0.22
6	33	-6.47		41.82
7	36	-3.47		12.02
8	38	-1.47		2.15
9	40	0.53		0.28
10	48	8.53		72.82
11	34	-5.47		29.88
12	32	-7.47		55.75
13	38	-1.47		2.15
14	37	-2.47		6.08
15	52	12.53		157.08
16	36	-3.47		12.02
17	43	3.53		12.48
18	38	-1.47		2.15
19	32	-7.47		55.75
20	50	10.53		110.95
21	32	-7.47		55.75
22	31	-8.47		71.68
23	44	4.53		20.55
24	29	-10.47		109.55
25	47	7.53		56.75
26	38	-1.47		2.15
27	39	-0.47		0.22
28	42	2.53		6.42
29	45	5.53		30.62
30	43	3.53		12.48
Mean Count: $\bar{x}$	39.47		SUM	1061.47
Standard Deviation (σ)	6.05		Variance:	36.60
Background Count Rate:		39.47	CPM + -	12.10 CPM

Background in dpm/100cm^2	
432.51	
CPM Low	CPM High
27	52

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1		
Instrument Model:	2360	Instrument Serial No.	276986
Last Calibration Date:	12/17/2014		
Detector Model:	43-93	Detector Serial No.:	299605
Today's Date:	10/7/2015	Data Collected by:	William Wylie

X	Alpha		Beta-Gamma		Gamma

Remarks: Instrument Ambient Background Instrument Efficiency: 0.385

Type of Surface:	Ambient		Count Time:	1	Minutes
Count Number	**CPM**	$(x - \overline{x})$		$(x - \overline{x})^2$	
1	1	-1.67		2.78	
2	2	-0.67		0.44	
3	2	-0.67		0.44	
4	4	1.33		1.78	
5	3	0.33		0.11	
6	5	2.33		5.44	
7	4	1.33		1.78	
8	0	-2.67		7.11	
9	4	1.33		1.78	
10	1	-1.67		2.78	
11	3	0.33		0.11	
12	2	-0.67		0.44	
13	5	2.33		5.44	
14	6	3.33		11.11	
15	2	-0.67		0.44	
16	5	2.33		5.44	
17	1	-1.67		2.78	
18	5	2.33		5.44	
19	2	-0.67		0.44	
20	1	-1.67		2.78	
21	4	1.33		1.78	
22	1	-1.67		2.78	
23	2	-0.67		0.44	
24	2	-0.67		0.44	
25	2	-0.67		0.44	
26	2	-0.67		0.44	
27	3	0.33		0.11	
28	0	-2.67		7.11	
29	1	-1.67		2.78	
30	5	2.33		5.44	
Mean Count: $\overline{x}$	2.67		SUM	80.67	
Standard Deviation (σ)	1.67		Variance:	2.78	
Background Count Rate:		2.67	CPM + -	3.34	CPM

Background in dpm/100cm^2	
27.71	
CPM Low	CPM High
-0.67	6.00

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1					
Instrument Model:	2360		Instrument Serial No.	276986		
Last Calibration Date:	12/17/2014					
Detector Model:	43-93		Detector Serial No.:	299605		
Today's Date:	10/7/2015		Data Collected by:	William Wylie		
	Alpha	X	Beta-Gamma		Gamma	
Remarks:	Instrument Ambient Background			Instrument Efficiency: 0.339		
Type of Surface:	Ambient		Count Time:	1	Minutes	

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	134	2.07		4.27
2	122	-9.93		98.67
3	124	-7.93		62.94
4	115	-16.93		286.74
5	116	-15.93		253.87
6	133	1.07		1.14
7	138	6.07		36.80
8	127	-4.93		24.34
9	139	7.07		49.94
10	128	-3.93		15.47
11	140	8.07		65.07
12	123	-8.93		79.80
13	126	-5.93		35.20
14	141	9.07		82.20
15	127	-4.93		24.34
16	141	9.07		82.20
17	127	-4.93		24.34
18	122	-9.93		98.67
19	156	24.07		579.20
20	136	4.07		16.54
21	119	-12.93		167.27
22	139	7.07		49.94
23	149	17.07		291.27
24	137	5.07		25.67
25	118	-13.93		194.14
26	131	-0.93		0.87
27	141	9.07		82.20
28	140	8.07		65.07
29	129	-2.93		8.60
30	140	8.07		65.07
Mean Count: $\bar{x}$	131.93		SUM	2871.87
Standard Deviation (σ)	9.95		Variance:	99.03
Background Count Rate:		131.93	CPM + -	26.39

Background in dpm/100cm^2	
1556.74	
CPM Low	CPM High
106	158

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head site 1					
Instrument Model:	2360		Instrument Serial No.	268508		
Last Calibration Date:	7/22/2015					
Detector Model:	43-93		Detector Serial No.:	298435		
Today's Date:	10/7/2015		Data Collected by:	William Wylie		
	Alpha	X	Beta-Gamma		Gamma	
Remarks:	Instrument Ambient Background			Instrument Efficiency: 0.283		
Type of Surface:	Ambient		Count Time:	1	Minutes	
Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$		
1	117	-13.33		177.78		
2	161	30.67		940.44		
3	126	-4.33		18.78		
4	127	-3.33		11.11		
5	138	7.67		58.78		
6	126	-4.33		18.78		
7	136	5.67		32.11		
8	131	0.67		0.44		
9	128	-2.33		5.44		
10	139	8.67		75.11		
11	137	6.67		44.44		
12	128	-2.33		5.44		
13	118	-12.33		152.11		
14	124	-6.33		40.11		
15	118	-12.33		152.11		
16	146	15.67		245.44		
17	112	-18.33		336.11		
18	119	-11.33		128.44		
19	135	4.67		21.78		
20	138	7.67		58.78		
21	122	-8.33		69.44		
22	128	-2.33		5.44		
23	124	-6.33		40.11		
24	134	3.67		13.44		
25	131	0.67		0.44		
26	124	-6.33		40.11		
27	141	10.67		113.78		
28	136	5.67		32.11		
29	128	-2.33		5.44		
30	138	7.67		58.78		Background in dpm/100cm^2
Mean Count: $\bar{x}$	130.33		SUM	2902.67		1842.17
Standard Deviation (σ)	10.00		Variance:	100.09		CPM Low / CPM High
Background Count Rate:		130.33	CPM + -	26.07	CPM	104 / 156
Calculations Completed by:		William Wylie				Date: 10/7/2015
Reviewed by:		Daniel Spicuzza				Date: 10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head site 1					
Instrument Model:	2360		Instrument Serial No.		268508	
Last Calibration Date:	7/22/2015					
Detector Model:	43-93		Detector Serial No.:		298435	
Today's Date:	10/7/2015		Data Collected by:		William Wylie	
X	Alpha		Beta-Gamma			Gamma
Remarks:	Instrument Ambient Background			Instrument Efficiency: 0.369		
Type of Surface:	Ambient		Count Time:	1	Minutes	

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	2	-0.03		0.00
2	3	0.97		0.93
3	2	-0.03		0.00
4	1	-1.03		1.07
5	1	-1.03		1.07
6	2	-0.03		0.00
7	0	-2.03		4.13
8	3	0.97		0.93
9	2	-0.03		0.00
10	3	0.97		0.93
11	0	-2.03		4.13
12	4	1.97		3.87
13	3	0.97		0.93
14	2	-0.03		0.00
15	4	1.97		3.87
16	3	0.97		0.93
17	0	-2.03		4.13
18	2	-0.03		0.00
19	2	-0.03		0.00
20	2	-0.03		0.00
21	2	-0.03		0.00
22	4	1.97		3.87
23	1	-1.03		1.07
24	2	-0.03		0.00
25	2	-0.03		0.00
26	4	1.97		3.87
27	2	-0.03		0.00
28	1	-1.03		1.07
29	2	-0.03		0.00
30	0	-2.03		4.13
Mean Count: $\bar{x}$	2.03		SUM	40.97
Standard Deviation (σ)	1.19		Variance:	1.41
Background Count Rate:		2.03	CPM + -	2.38

Background in dpm/100cm^2	22.04
CPM Low	CPM High
0	4.4

Calculations Completed by:	William Wylie	Date:	10/7/2015
Reviewed by:	Daniel Spicuzza	Date:	10/7/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head Site 1					
Instrument Model:	2350-1		Instrument Serial No.	126172		
Last Calibration Date:	6/19/2015					
Detector Model:	44-10		Detector Serial No.:	192589		
Today's Date:	11/30/2015		Data Collected by:	William Wylie		
	Alpha		Beta-Gamma	X	Gamma	
Remarks:	Instrument Ambient Background					
Type of Surface:	Ambient		Count Time:	1	Minutes	

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	3801	17.37		301.60
2	3862	78.37		6141.33
3	3858	74.37		5530.40
4	3854	70.37		4951.47
5	3870	86.37		7459.20
6	3844	60.37		3644.13
7	3723	-60.63		3676.40
8	3840	56.37		3177.20
9	3781	-2.63		6.93
10	3944	160.37		25717.47
11	3737	-46.63		2174.67
12	3678	-105.63		11158.40
13	3824	40.37		1629.47
14	3889	105.37		11102.13
15	3816	32.37		1047.60
16	3748	-35.63		1269.73
17	3710	-73.63		5421.87
18	3738	-45.63		2082.40
19	3684	-99.63		9926.80
20	3797	13.37		178.67
21	3768	-15.63		244.40
22	3711	-72.63		5275.60
23	3662	-121.63		14794.67
24	3798	14.37		206.40
25	3724	-59.63		3556.13
26	3820	36.37		1322.53
27	3846	62.37		3889.60
28	3750	-33.63		1131.20
29	3768	-15.63		244.40
30	3664	-119.63		14312.13
Mean Count: $\bar{x}$	3783.63		SUM	151574.97
Standard Deviation (σ)	72.30		Variance:	5226.72
Background Count Rate:		3783.63	CPM + -	144.59 CPM

CPM Low	CPM High
3639	3928

Calculations Completed by:	William Wylie	Date:	11/30/2015
Reviewed by:	Daniel Spicuzza	Date:	11/30/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indiand Head Site 1				
Instrument Model:	2929		Instrument Serial No.	61549	
Last Calibration Date:	5/18/2015				
Detector Model:	43-10-1		Detector Serial No.:	24319	
Today's Date:	11/30/2015		Data Collected by:	William Wylie	
X	Alpha		Beta-Gamma		Gamma
Remarks:	Instrument Ambient Background			Instrument Efficiency: 0.74	
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	1	-0.60		0.36
2	3	1.40		1.96
3	2	0.40		0.16
4	1	-0.60		0.36
5	2	0.40		0.16
6	0	-1.60		2.56
7	2	0.40		0.16
8	0	-1.60		2.56
9	4	2.40		5.76
10	1	-0.60		0.36
11	1	-0.60		0.36
12	2	0.40		0.16
13	1	-0.60		0.36
14	1	-0.60		0.36
15	1	-0.60		0.36
16	2	0.40		0.16
17	1	-0.60		0.36
18	1	-0.60		0.36
19	1	-0.60		0.36
20	4	2.40		5.76
21	0	-1.60		2.56
22	2	0.40		0.16
23	3	1.40		1.96
24	3	1.40		1.96
25	3	1.40		1.96
26	0	-1.60		2.56
27	0	-1.60		2.56
28	1	-0.60		0.36
29	2	0.40		0.16
30	3	1.40		1.96
Mean Count: $\bar{x}$	1.60		SUM	39.20
Standard Deviation (σ)	1.16		Variance:	1.35
Background Count Rate:		1.60	CPM + -	2.33

Background in dpm/100cm^2	8.65
CPM Low	CPM High
-0.73	3.93

Calculations Completed by:	William Wylie	Date:	11/30/2015
Reviewed by:	Daniel Spicuzza	Date:	11/30/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indiand Head Site 1					
Instrument Model:	2929		Instrument Serial No.		61549	
Last Calibration Date:	5/18/2015					
Detector Model:	43-10-1		Detector Serial No.:		24319	
Today's Date:	11/30/2015		Data Collected by:		William Wylie	
	Alpha	X	Beta-Gamma			Gamma
Remarks:	Instrument Ambient Background			Instrument Efficiency:	0.528	
Type of Surface:	Ambient		Count Time:	1	Minutes	

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	54	2.43		5.92
2	46	-5.57		30.99
3	47	-4.57		20.85
4	52	0.43		0.19
5	47	-4.57		20.85
6	52	0.43		0.19
7	58	6.43		41.39
8	50	-1.57		2.45
9	56	4.43		19.65
10	61	9.43		88.99
11	45	-6.57		43.12
12	61	9.43		88.99
13	48	-3.57		12.72
14	67	15.43		238.19
15	46	-5.57		30.99
16	40	-11.57		133.79
17	45	-6.57		43.12
18	47	-4.57		20.85
19	58	6.43		41.39
20	48	-3.57		12.72
21	57	5.43		29.52
22	49	-2.57		6.59
23	39	-12.57		157.92
24	50	-1.57		2.45
25	49	-2.57		6.59
26	64	12.43		154.59
27	49	-2.57		6.59
28	58	6.43		41.39
29	50	-1.57		2.45
30	54	2.43		5.92
Mean Count: $\bar{x}$	51.57		SUM	1311.37
Standard Deviation (σ)	6.72		Variance:	45.22
Background Count Rate:		51.57	CPM + -	13.45

Background in dpm/100cm^2	
390.66	
CPM Low	CPM High
38	65

Calculations Completed by:	William Wylie	Date:	11/30/2015
Reviewed by:	Daniel Spicuzza	Date:	11/30/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head site 1				
Instrument Model:	2360		Instrument Serial No.	297826	
Last Calibration Date:	1/30/2015				
Detector Model:	43-93		Detector Serial No.:	323053	
Today's Date:	11/30/2015		Data Collected by:	William Wylie	
	Alpha	X	Beta-Gamma		Gamma
Remarks:	Instrument Ambient Background		Instrument Efficiency:	0.255	
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	154	-17.07		291.27
2	148	-23.07		532.07
3	169	-2.07		4.27
4	167	-4.07		16.54
5	153	-18.07		326.40
6	183	11.93		142.40
7	190	18.93		358.47
8	202	30.93		956.87
9	157	-14.07		197.87
10	188	16.93		286.74
11	197	25.93		672.54
12	167	-4.07		16.54
13	179	7.93		62.94
14	171	-0.07		0.00
15	183	11.93		142.40
16	154	-17.07		291.27
17	175	3.93		15.47
18	179	7.93		62.94
19	169	-2.07		4.27
20	187	15.93		253.87
21	160	-11.07		122.47
22	179	7.93		62.94
23	173	1.93		3.74
24	133	-38.07		1449.07
25	172	0.93		0.87
26	163	-8.07		65.07
27	195	23.93		572.80
28	162	-9.07		82.20
29	151	-20.07		402.67
30	172	0.93		0.87
Mean Count: $\bar{x}$	171.07		SUM	7397.87
Standard Deviation (σ)	15.97		Variance:	255.10
Background Count Rate:		171.07	CPM + -	31.94

Background in dpm/100cm^2	
2683.40	
CPM Low	CPM High
139	203

CPM

Calculations Completed by:	William Wylie	Date:	11/30/2015
Reviewed by:	Daniel Spicuzza	Date:	11/30/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head site 1					
Instrument Model:	2360		Instrument Serial No.	297826		
Last Calibration Date:	1/30/2015					
Detector Model:	43-93		Detector Serial No.:	323053		
Today's Date:	11/30/2015		Data Collected by:	William Wylie		
X	Alpha		Beta-Gamma		Gamma	
Remarks: Instrument Ambient Background				Instrument Efficiency: 0.342		
Type of Surface:	Ambient		Count Time:	1	Minutes	

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	0	-0.40		0.16
2	1	0.60		0.36
3	0	-0.40		0.16
4	0	-0.40		0.16
5	1	0.60		0.36
6	1	0.60		0.36
7	0	-0.40		0.16
8	0	-0.40		0.16
9	0	-0.40		0.16
10	1	0.60		0.36
11	1	0.60		0.36
12	0	-0.40		0.16
13	1	0.60		0.36
14	0	-0.40		0.16
15	0	-0.40		0.16
16	0	-0.40		0.16
17	0	-0.40		0.16
18	0	-0.40		0.16
19	0	-0.40		0.16
20	0	-0.40		0.16
21	1	0.60		0.36
22	0	-0.40		0.16
23	0	-0.40		0.16
24	2	1.60		2.56
25	0	-0.40		0.16
26	1	0.60		0.36
27	1	0.60		0.36
28	0	-0.40		0.16
29	0	-0.40		0.16
30	1	0.60		0.36
Mean Count: $\bar{x}$	0.40		SUM	9.20
Standard Deviation (σ)	0.56		Variance:	0.32
Background Count Rate:		0.40	CPM + -	1.13 CPM

Background in dpm/100cm^2	
4.68	
CPM Low	CPM High
-1	1.5

Calculations Completed by:	William Wylie	Date:	11/30/2015
Reviewed by:	Daniel Spicuzza	Date:	11/30/2015

Chi-Square Tests

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NAS Pensacola					
Instrument Model:		2350-1			Instrument Serial No.	129407	
Last Calibration Date:		1/22/2015			Background Count Rate:	4533	C_B
Detector Model:		44-10			Detector Serial No.:	196022	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	019464	Activity		dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**131225**	126692		64.45	4153.80	
2		**131060**	126527		-100.55	10110.30	
3		**131047**	126514		-113.55	12893.60	
4		**131585**	127052		424.45	180157.80	
5		**131099**	126566		-61.55	3788.40	
6		**131786**	127253		625.45	391187.70	
7		**131224**	126691		63.45	4025.90	
8		**131471**	126938		310.45	96379.20	
9		**130759**	126226		-401.55	161242.40	
10		**130745**	126212		-415.55	172681.80	
11		**130883**	126350		-277.55	77034.00	
12		**131212**	126679		51.45	2647.10	
13		**131565**	127032		404.45	163579.80	
14		**131231**	126698		70.45	4963.20	
15		**130838**	126305		-322.55	104038.50	
16		**130917**	126384		-243.55	59316.60	
17		**130920**	126387		-240.55	57864.30	
18		**131459**	126926		298.45	89072.40	
19		**131027**	126494		-133.55	17835.60	
20		**131158**	126625		-2.55	6.50	
Total		2623211	2532551		SUM	1612978.95	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			126628				
Chi Squared Value (C^2):		12.74	10.11 - 30.14	Standard Deviation:	291		
+ 20% Value:	151953	- 20% Value:	101302				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2350-1			Instrument Serial No.	120588	
Last Calibration Date:		6/19/2015			Background Count Rate:	4075	C_B
Detector Model:		44-10			Detector Serial No.:	318218	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	019464	Activity		dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**139996**	135921		426.95	182286.30	
2		**138631**	134556		-938.05	879937.80	
3		**138843**	134768		-726.05	527148.60	
4		**139209**	135134		-360.05	129636.00	
5		**139887**	135812		317.95	101092.20	
6		**139762**	135687		192.95	37229.70	
7		**139545**	135470		-24.05	578.40	
8		**139603**	135528		33.95	1152.60	
9		**139339**	135264		-230.05	52923.00	
10		**139639**	135564		69.95	4893.00	
11		**139393**	135318		-176.05	30993.60	
12		**139707**	135632		137.95	19030.20	
13		**139692**	135617		122.95	15116.70	
14		**140162**	136087		592.95	351589.70	
15		**138827**	134752		-742.05	550638.20	
16		**139415**	135340		-154.05	23731.40	
17		**140238**	136163		668.95	447494.10	
18		**139950**	135875		380.95	145122.90	
19		**140094**	136019		524.95	275572.50	
20		**139449**	135374		-120.05	14412.00	
Total		2791381	2709881		SUM	3790578.95	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			135494				
Chi Squared Value (C^2):		27.98	10.11 - 30.14	Standard Deviation:	447		
+ 20% Value:	162593	- 20% Value:	108395				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2929			Instrument Serial No.	115563	
Last Calibration Date:		5/19/2015			Background Count Rate:	0.1	C_B
Detector Model:		43-10-1			Detector Serial No.:	127216	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	011404	Activity	8,278	alphas/min	Efficiency:	73.7 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**5370**	5369.9		51.05	2606.10	
2		**5261**	5260.9		-57.95	3358.20	
3		**5320**	5319.9		1.05	1.10	
4		**5291**	5290.9		-27.95	781.20	
5		**5243**	5242.9		-75.95	5768.40	
6		**5339**	5338.9		20.05	402.00	
7		**5269**	5268.9		-49.95	2495.00	
8		**5342**	5341.9		23.05	531.30	
9		**5314**	5313.9		-4.95	24.50	
10		**5286**	5285.9		-32.95	1085.70	
11		**5337**	5336.9		18.05	325.80	
12		**5201**	5200.9		-117.95	13912.20	
13		**5362**	5361.9		43.05	1853.30	
14		**5478**	5477.9		159.05	25296.90	
15		**5373**	5372.9		54.05	2921.40	
16		**5326**	5325.9		7.05	49.70	
17		**5261**	5260.9		-57.95	3358.20	
18		**5392**	5391.9		73.05	5336.30	
19		**5341**	5340.9		22.05	486.20	
20		**5273**	5272.9		-45.95	2111.40	
Total		106379	106377		SUM	72704.95	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			5319				
Chi Squared Value (C^2):		13.67	10.11 - 30.14	Standard Deviation:	62		
+ 20% Value:	6383	- 20% Value:	4255				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2929			Instrument Serial No.	115563	
Last Calibration Date:		5/19/2015			Background Count Rate:	39	C_B
Detector Model:		43-10-1			Detector Serial No.:	127216	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	011403	Activity	12,040	betas/min	Efficiency:	36.5 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**3621**	3582		43.25	1870.56	
2		**3648**	3609		70.25	4935.06	
3		**3640**	3601		62.25	3875.06	
4		**3635**	3596		57.25	3277.56	
5		**3617**	3578		39.25	1540.56	
6		**3616**	3577		38.25	1463.06	
7		**3567**	3528		-10.75	115.56	
8		**3563**	3524		-14.75	217.56	
9		**3590**	3551		12.25	150.06	
10		**3557**	3518		-20.75	430.56	
11		**3601**	3562		23.25	540.56	
12		**3659**	3620		81.25	6601.56	
13		**3539**	3500		-38.75	1501.56	
14		**3525**	3486		-52.75	2782.56	
15		**3548**	3509		-29.75	885.06	
16		**3407**	3368		-170.75	29155.56	
17		**3580**	3541		2.25	5.06	
18		**3568**	3529		-9.75	95.06	
19		**3516**	3477		-61.75	3813.06	
20		**3558**	3519		-19.75	390.06	
Total		71555	70775		SUM	63645.75	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			3539				
Chi Squared Value (C^2):		17.99	10.11 - 30.14	Standard Deviation:	58		
+ 20% Value:	4247	- 20% Value:	2831				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2360			Instrument Serial No.	276986	
Last Calibration Date:		12/17/2014			Background Count Rate:		C_B
Detector Model:		43-93			Detector Serial No.:	299605	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	039402	Activity	2,904	alphas/min	Efficiency:	38.5 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**945**	945		15.30	234.09	
2		**946**	946		16.30	265.69	
3		**907**	907		-22.70	515.29	
4		**946**	946		16.30	265.69	
5		**934**	934		4.30	18.49	
6		**905**	905		-24.70	610.09	
7		**900**	900		-29.70	882.09	
8		**923**	923		-6.70	44.89	
9		**946**	946		16.30	265.69	
10		**908**	908		-21.70	470.89	
11		**909**	909		-20.70	428.49	
12		**926**	926		-3.70	13.69	
13		**993**	993		63.30	4006.89	
14		**916**	916		-13.70	187.69	
15		**944**	944		14.30	204.49	
16		**973**	973		43.30	1874.89	
17		**908**	908		-21.70	470.89	
18		**905**	905		-24.70	610.09	
19		**959**	959		29.30	858.49	
20		**901**	901		-28.70	823.69	
Total		18594	18594		SUM	13052.2	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			930				
Chi Squared Value (C^2):		14.04	10.11 - 30.14	Standard Deviation:	26		
+ 20% Value:	1116	- 20% Value:	744				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2360			Instrument Serial No.	276986	
Last Calibration Date:		12/17/2014			Background Count Rate:	131	C_B
Detector Model:		43-93			Detector Serial No.:	299605	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	039401	Activity	18,279	betas/min	Efficiency:	33.9 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**1373**	1242		-50.65	2565.42	
2		**1443**	1312		19.35	374.42	
3		**1362**	1231		-61.65	3800.72	
4		**1392**	1261		-31.65	1001.72	
5		**1376**	1245		-47.65	2270.52	
6		**1412**	1281		-11.65	135.72	
7		**1400**	1269		-23.65	559.32	
8		**1430**	1299		6.35	40.32	
9		**1426**	1295		2.35	5.52	
10		**1494**	1363		70.35	4949.12	
11		**1391**	1260		-32.65	1066.02	
12		**1448**	1317		24.35	592.92	
13		**1444**	1313		20.35	414.12	
14		**1482**	1351		58.35	3404.72	
15		**1419**	1288		-4.65	21.62	
16		**1464**	1333		40.35	1628.12	
17		**1399**	1268		-24.65	607.62	
18		**1423**	1292		-0.65	0.42	
19		**1492**	1361		68.35	4671.72	
20		**1403**	1272		-20.65	426.42	
Total		28473	25853		SUM	28536.55	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			1293				
Chi Squared Value (C^2):		22.08	10.11 - 30.14	Standard Deviation:	39		
+ 20% Value:	1551	- 20% Value:	1034				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2360			Instrument Serial No.	268508	
Last Calibration Date:		7/22/2015			Background Count Rate:	2	C_B
Detector Model:		43-93			Detector Serial No.:	298435	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	039402	Activity	2,904	alphas/min	Efficiency:	36.9 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**948**	946		44.00	1936.00	
2		**905**	903		1.00	1.00	
3		**935**	933		31.00	961.00	
4		**938**	936		34.00	1156.00	
5		**941**	939		37.00	1369.00	
6		**873**	871		-31.00	961.00	
7		**863**	861		-41.00	1681.00	
8		**887**	885		-17.00	289.00	
9		**842**	840		-62.00	3844.00	
10		**922**	920		18.00	324.00	
11		**920**	918		16.00	256.00	
12		**905**	903		1.00	1.00	
13		**904**	902		0.00	0.00	
14		**918**	916		14.00	196.00	
15		**885**	883		-19.00	361.00	
16		**873**	871		-31.00	961.00	
17		**895**	893		-9.00	81.00	
18		**919**	917		15.00	225.00	
19		**902**	900		-2.00	4.00	
20		**905**	903		1.00	1.00	
Total		18080	18040		SUM	14608	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			902				
Chi Squared Value (C^2):		16.20	10.11 - 30.14	Standard Deviation:	28		
+ 20% Value:	1082	- 20% Value:	722				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2360			Instrument Serial No.	268508	
Last Calibration Date:		7/22/2015			Background Count Rate:	130	C_B
Detector Model:		43-93			Detector Serial No.:	298435	
Today's Date:		10/7/2015			Data Collected by:	William Wylie	
Source ID:	039401	Activity	18,279	betas/min	Efficiency:	28.3 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**1523**	1393		-51.00	2601.00	
2		**1623**	1493		49.00	2401.00	
3		**1549**	1419		-25.00	625.00	
4		**1623**	1493		49.00	2401.00	
5		**1576**	1446		2.00	4.00	
6		**1527**	1397		-47.00	2209.00	
7		**1533**	1403		-41.00	1681.00	
8		**1626**	1496		52.00	2704.00	
9		**1555**	1425		-19.00	361.00	
10		**1550**	1420		-24.00	576.00	
11		**1512**	1382		-62.00	3844.00	
12		**1552**	1422		-22.00	484.00	
13		**1570**	1440		-4.00	16.00	
14		**1601**	1471		27.00	729.00	
15		**1528**	1398		-46.00	2116.00	
16		**1575**	1445		1.00	1.00	
17		**1610**	1480		36.00	1296.00	
18		**1578**	1448		4.00	16.00	
19		**1661**	1531		87.00	7569.00	
20		**1608**	1478		34.00	1156.00	
Total		31480	28880		SUM	32790	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			1444				
Chi Squared Value (C^2):		22.71	10.11 - 30.14	Standard Deviation:	42		
+ 20% Value:	1733	- 20% Value:	1155				
Calculations Completed by:			William Wylie			Date:	10/7/2015
Reviewed by:			Daniel Spicuzza			Date:	10/7/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2350-1			Instrument Serial No.	126172	
Last Calibration Date:		6/19/2015			Background Count Rate:	3783	C_B
Detector Model:		44-10			Detector Serial No.:	192589	
Today's Date:		11/30/2015			Data Collected by:	William Wylie	
Source ID:	119311	Activity	6,489,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**151321**	147538		-237.15	56240.12	
2		**151234**	147451		-324.15	105073.22	
3		**151347**	147564		-211.15	44584.32	
4		**151683**	147900		124.85	15587.52	
5		**151099**	147316		-459.15	210818.72	
6		**151216**	147433		-342.15	117066.62	
7		**151561**	147778		2.85	8.12	
8		**151424**	147641		-134.15	17996.22	
9		**151289**	147506		-269.15	72441.72	
10		**151883**	148100		324.85	105527.52	
11		**151312**	147529		-246.15	60589.82	
12		**151237**	147454		-321.15	103137.32	
13		**152653**	148870		1094.85	1198696.52	
14		**151678**	147895		119.85	14364.02	
15		**151754**	147971		195.85	38357.22	
16		**151271**	147488		-287.15	82455.12	
17		**151579**	147796		20.85	434.72	
18		**152432**	148649		873.85	763613.82	
19		**151735**	147952		176.85	31275.92	
20		**151455**	147672		-103.15	10639.92	
Total		3031163	2955503		SUM	3048908.55	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			147775				
Chi Squared Value (C^2):		20.63	10.11 - 30.14	Standard Deviation:	401		
+ 20% Value:	177330	- 20% Value:	118220				
Calculations Completed by:			William Wylie			Date:	11/30/2015
Reviewed by:			Daniel Spicuzza			Date:	11/30/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2929			Instrument Serial No.	61549	
Last Calibration Date:		5/18/2015			Background Count Rate:	1.6	C_B
Detector Model:		43-10-1			Detector Serial No.:	24319	
Today's Date:		11/30/2015			Data Collected by:	William Wylie	
Source ID:	099605	Activity	9,480	alphas/min	Efficiency:	74.0 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**6264**	6262.4		-15.00	225.00	
2		**6398**	6396.4		119.00	14161.00	
3		**6142**	6140.4		-137.00	18769.00	
4		**6290**	6288.4		11.00	121.00	
5		**6091**	6089.4		-188.00	35344.00	
6		**6338**	6336.4		59.00	3481.00	
7		**6265**	6263.4		-14.00	196.00	
8		**6208**	6206.4		-71.00	5041.00	
9		**6362**	6360.4		83.00	6889.00	
10		**6281**	6279.4		2.00	4.00	
11		**6366**	6364.4		87.00	7569.00	
12		**6214**	6212.4		-65.00	4225.00	
13		**6342**	6340.4		63.00	3969.00	
14		**6238**	6236.4		-41.00	1681.00	
15		**6327**	6325.4		48.00	2304.00	
16		**6227**	6225.4		-52.00	2704.00	
17		**6388**	6386.4		109.00	11881.00	
18		**6251**	6249.4		-28.00	784.00	
19		**6315**	6313.4		36.00	1296.00	
20		**6273**	6271.4		-6.00	36.00	
Total		125580	125548		SUM	120680	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			6277				
Chi Squared Value (C^2):		19.22	10.11 - 30.14	Standard Deviation:	80		
+ 20% Value:	7533	- 20% Value:	5022				
Calculations Completed by:			William Wylie			Date:	11/30/2015
Reviewed by:			Daniel Spicuzza			Date:	11/30/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2929			Instrument Serial No.	61549	
Last Calibration Date:		5/18/2015			Background Count Rate:	51.5	C_B
Detector Model:		43-10-1			Detector Serial No.:	24319	
Today's Date:		11/30/2015			Data Collected by:	William Wylie	
Source ID:	051303	Activity	12,820	betas/min	Efficiency:	52.8 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**5215**	5163.5		-7.35	54.02	
2		**5210**	5158.5		-12.35	152.52	
3		**5292**	5240.5		69.65	4851.12	
4		**5185**	5133.5		-37.35	1395.02	
5		**5303**	5251.5		80.65	6504.42	
6		**5262**	5210.5		39.65	1572.12	
7		**5118**	5066.5		-104.35	10888.92	
8		**5130**	5078.5		-92.35	8528.52	
9		**5246**	5194.5		23.65	559.32	
10		**5279**	5227.5		56.65	3209.22	
11		**5310**	5258.5		87.65	7682.52	
12		**5156**	5104.5		-66.35	4402.32	
13		**5344**	5292.5		121.65	14798.72	
14		**5076**	5024.5		-146.35	21418.32	
15		**5151**	5099.5		-71.35	5090.82	
16		**5146**	5094.5		-76.35	5829.32	
17		**5243**	5191.5		20.65	426.42	
18		**5178**	5126.5		-44.35	1966.92	
19		**5303**	5251.5		80.65	6504.42	
20		**5300**	5248.5		77.65	6029.52	
Total		104447	103417		SUM	111864.55	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			5171				
Chi Squared Value (C^2):		21.63	10.11 - 30.14	Standard Deviation:	77		
+ 20% Value:	6205	- 20% Value:	4137				
Calculations Completed by:			William Wylie			Date:	11/30/2015
Reviewed by:			Daniel Spicuzza			Date:	11/30/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2360			Instrument Serial No.	297826	
Last Calibration Date:		1/30/2015			Background Count Rate:	0.4	C_B
Detector Model:		43-93			Detector Serial No.:	323053	
Today's Date:		11/30/2015			Data Collected by:	William Wylie	
Source ID:	039404	Activity	2,869	alphas/min	Efficiency:	34.2 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**858**	857.6		6.70	44.89	
2		**851**	850.6		-0.30	0.09	
3		**780**	779.6		-71.30	5083.69	
4		**815**	814.6		-36.30	1317.69	
5		**860**	859.6		8.70	75.69	
6		**820**	819.6		-31.30	979.69	
7		**845**	844.6		-6.30	39.69	
8		**856**	855.6		4.70	22.09	
9		**857**	856.6		5.70	32.49	
10		**839**	838.6		-12.30	151.29	
11		**890**	889.6		38.70	1497.69	
12		**848**	847.6		-3.30	10.89	
13		**850**	849.6		-1.30	1.69	
14		**893**	892.6		41.70	1738.89	
15		**855**	854.6		3.70	13.69	
16		**834**	833.6		-17.30	299.29	
17		**842**	841.6		-9.30	86.49	
18		**889**	888.6		37.70	1421.29	
19		**850**	849.6		-1.30	1.69	
20		**894**	893.6		42.70	1823.29	
Total		17026	17018		SUM	14642.2	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			851				
Chi Squared Value (C^2):		17.21	10.11 - 30.14	Standard Deviation:	28		
+ 20% Value:	1021	- 20% Value:	681				
Calculations Completed by:			William Wylie			Date:	11/30/2015
Reviewed by:			Daniel Spicuzza			Date:	11/30/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

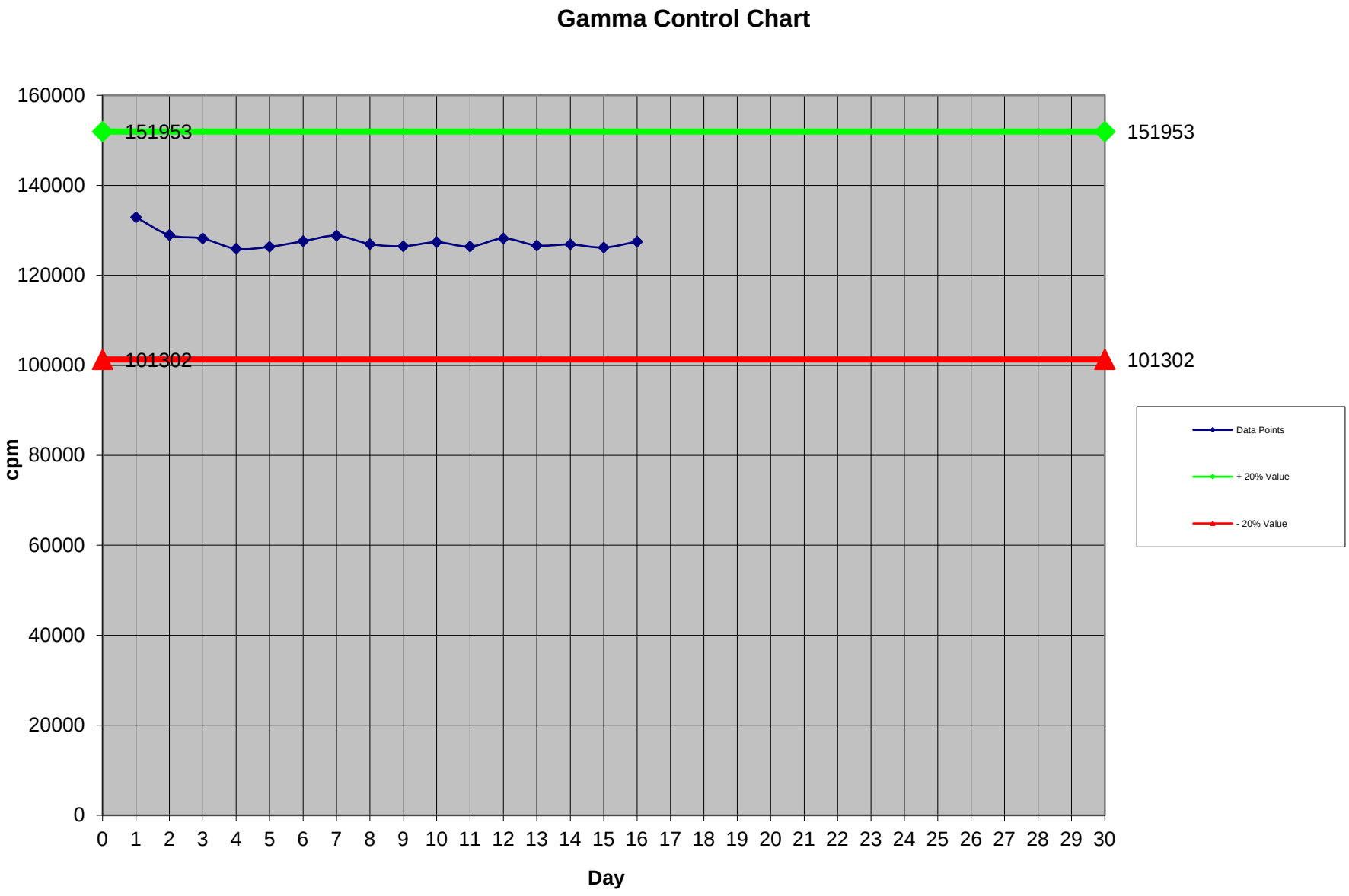
Project/Location:		NSF Indian Head Site 1					
Instrument Model:		2360			Instrument Serial No.	297826	
Last Calibration Date:		1/30/2015			Background Count Rate:	171	C_B
Detector Model:		43-93			Detector Serial No.:	323053	
Today's Date:		11/30/2015			Data Collected by:	William Wylie	
Source ID:	049410	Activity	12,132	betas/min	Efficiency:	25.5 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**3147**	2976		31.50	992.25	
2		**3087**	2916		-28.50	812.25	
3		**3141**	2970		25.50	650.25	
4		**3066**	2895		-49.50	2450.25	
5		**3134**	2963		18.50	342.25	
6		**3006**	2835		-109.50	11990.25	
7		**3132**	2961		16.50	272.25	
8		**3003**	2832		-112.50	12656.25	
9		**3167**	2996		51.50	2652.25	
10		**3204**	3033		88.50	7832.25	
11		**3140**	2969		24.50	600.25	
12		**3094**	2923		-21.50	462.25	
13		**3122**	2951		6.50	42.25	
14		**3163**	2992		47.50	2256.25	
15		**3103**	2932		-12.50	156.25	
16		**3234**	3063		118.50	14042.25	
17		**3111**	2940		-4.50	20.25	
18		**3106**	2935		-9.50	90.25	
19		**3119**	2948		3.50	12.25	
20		**3031**	2860		-84.50	7140.25	
Total		62310	58890		SUM	65473	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			2945				
Chi Squared Value (C^2):		22.24	10.11 - 30.14	Standard Deviation:	59		
+ 20% Value:	3533	- 20% Value:	2356				
Calculations Completed by:			William Wylie			Date:	11/30/2015
Reviewed by:			Daniel Spicuzza			Date:	11/30/2015

Daily Instrument Response Checks

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY dpm	BACKGROUND 4342-4725 cpm	READING cpm	Net cpm 101302-151953	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4620	137520	132900	N/A	P	WW
10/8/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4532	133469	128937	N/A	P	WW
10/9/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4612	132788	128176	N/A	P	WW
10/13/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4467	130361	125894	N/A	P	WW
10/14/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4439	130782	126343	N/A	P	WW
10/15/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4429	132000	127571	N/A	P	WW
10/16/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4490	133296	128806	N/A	P	WW
10/19/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4427	131384	126957	N/A	P	WW
10/20/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4438	130900	126462	N/A	P	WW
10/21/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4371	131733	127362	N/A	P	WW
10/22/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4388	130781	126393	N/A	P	WW
10/23/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4459	132654	128195	N/A	P	WW
10/26/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4322	130945	126623	N/A	P	WW
10/27/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4412	131276	126864	N/A	P	WW
10/28/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4478	130654	126176	N/A	P	WW
10/29/2015	2350-1/44-10	129407/196022	N	1/22/2016	019464	6,231,540	4373	131865	127492	N/A	P	WW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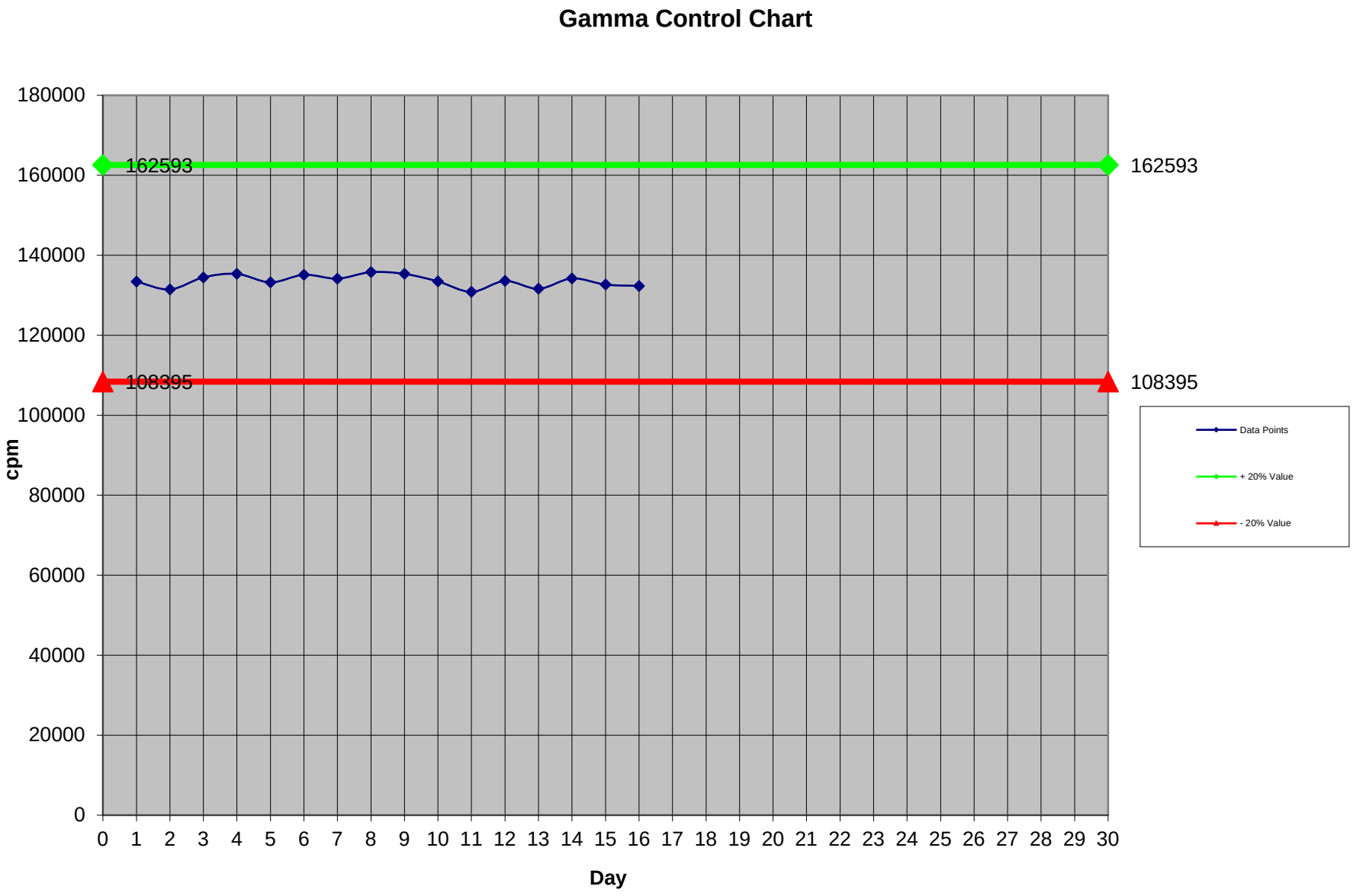
140000
120000
100000
80000
60000
40000
20000
0
cpm
151953
101302
151953
101302
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY dpm	BACKGROUND 3710-4410 cpm	READING cpm	Net cpm 108395-162593	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4107	137520	133413	N/A	P	WW
10/8/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4213	135672	131459	N/A	P	WW
10/9/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4178	138655	134477	N/A	P	WW
10/13/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4136	139480	135344	N/A	P	WW
10/14/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4072	137296	133224	N/A	P	WW
10/15/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	3975	139093	135118	N/A	P	WW
10/16/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4183	138351	134168	N/A	P	WW
10/19/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	3942	139719	135777	N/A	P	WW
10/20/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	3962	139300	135338	N/A	P	WW
10/21/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4077	137532	133455	N/A	P	WW
10/22/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	3999	134859	130860	N/A	P	WW
10/23/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4123	137690	133567	N/A	P	WW
10/26/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4065	135683	131618	N/A	P	WW
10/27/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4321	138530	134209	N/A	P	WW
10/28/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4239	136904	132665	N/A	P	WW
10/29/2015	2350-1/44-10	120588/318218	N	6/19/2016	019464	6,231,540	4327	136669	132342	N/A	P	WW


Gamma Control Chart
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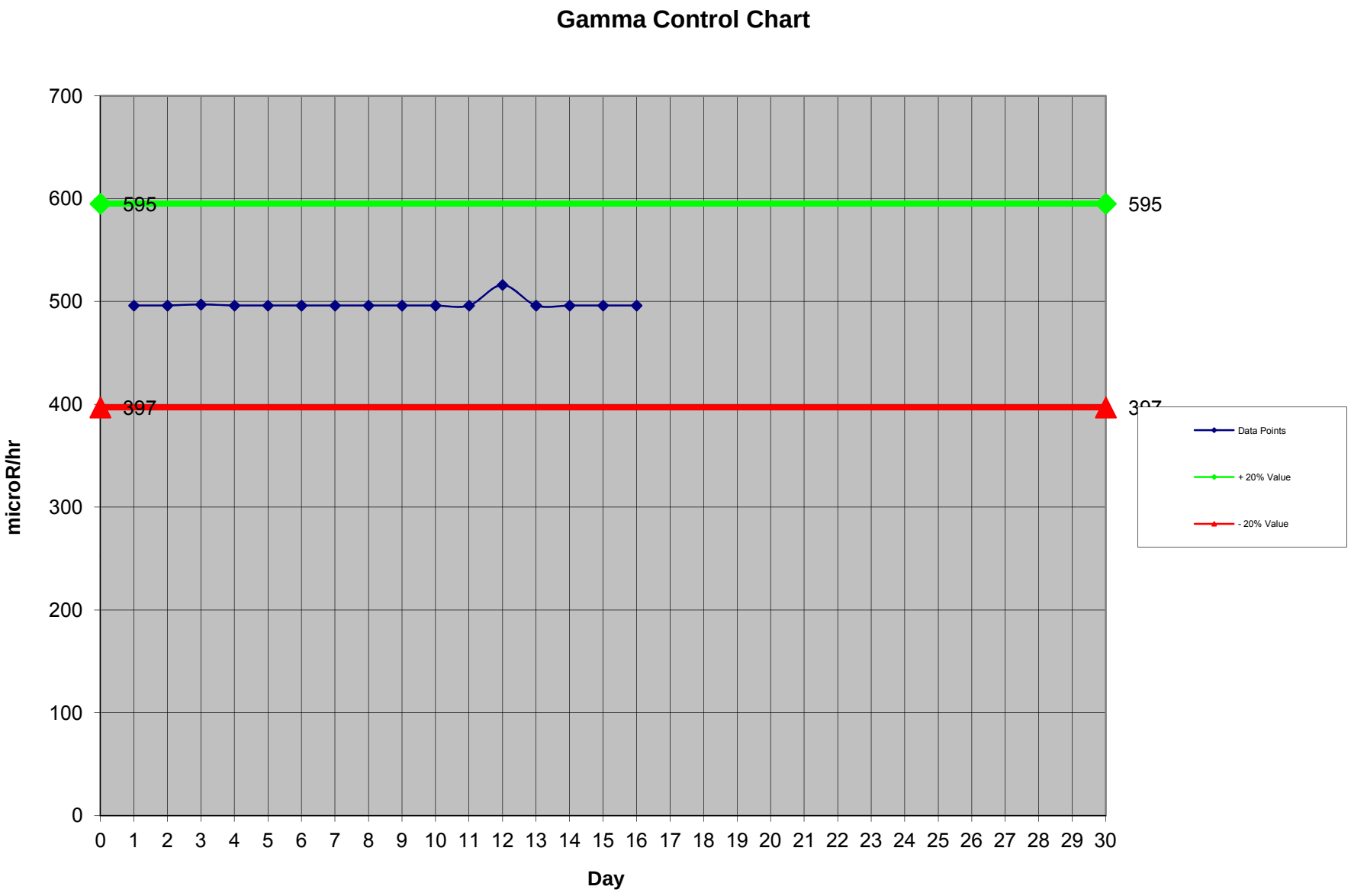
160000
140000
120000
100000
80000
60000
40000
20000
0
cpm
162593
162593
108395
108395
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Inidan head

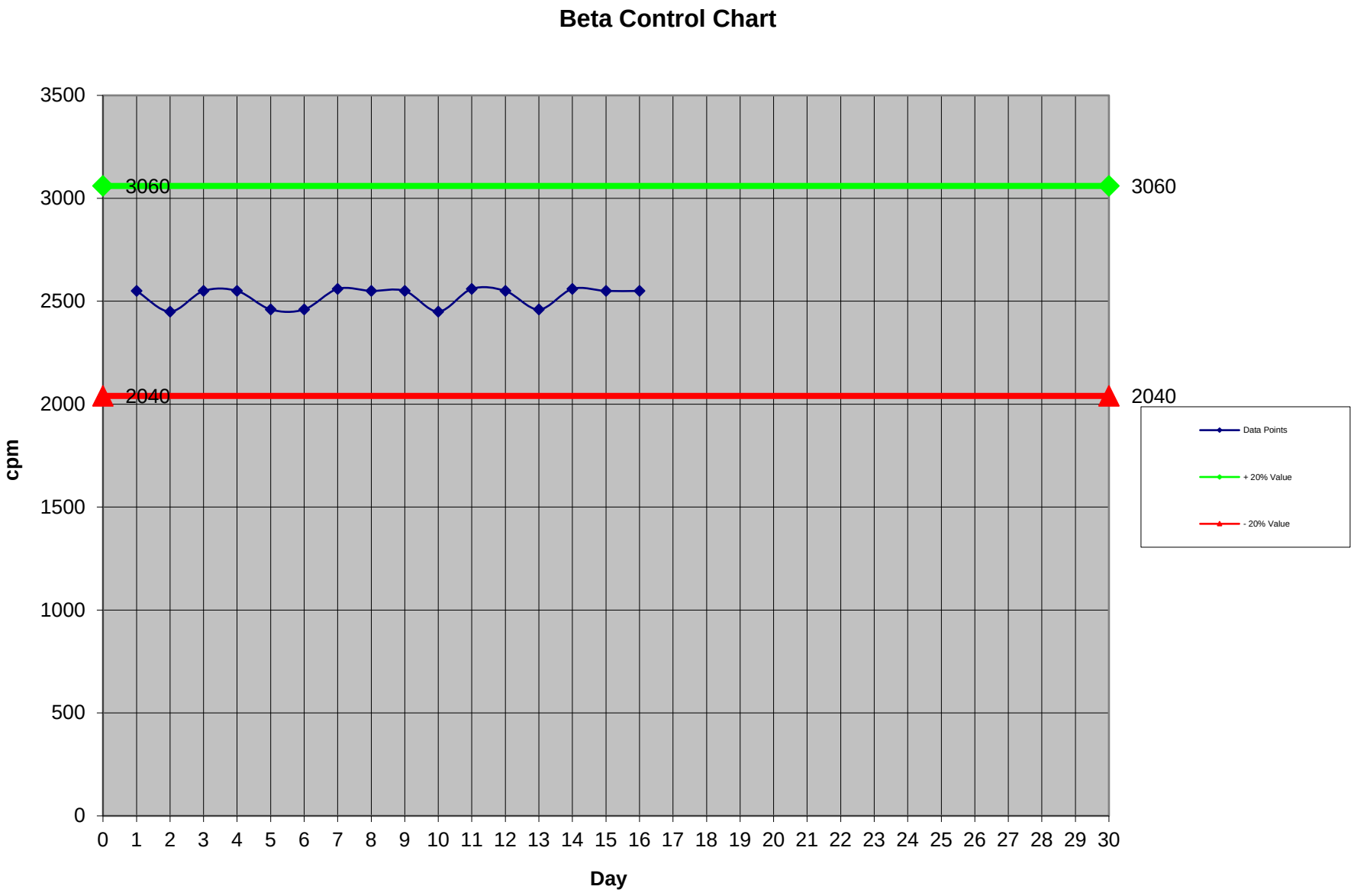
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY dpm	BACKGROUND MicroR/hr	READING MicroR/hr	Net MicroR//hr 397-595	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/8/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/9/2015	M-19	98100	N	12/22/2015	019464	6,231,540	3	500	497	N/A	P	WW
10/13/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/14/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/15/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/16/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/19/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/20/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/21/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/22/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/23/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	520	516	N/A	P	WW
10/26/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/27/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/28/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW
10/29/2015	M-19	98100	N	12/22/2015	019464	6,231,540	4	500	496	N/A	P	WW


Gamma Control Chart
700
600
500
400
300
200
100
0
microR/hr
595
595
397
397
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

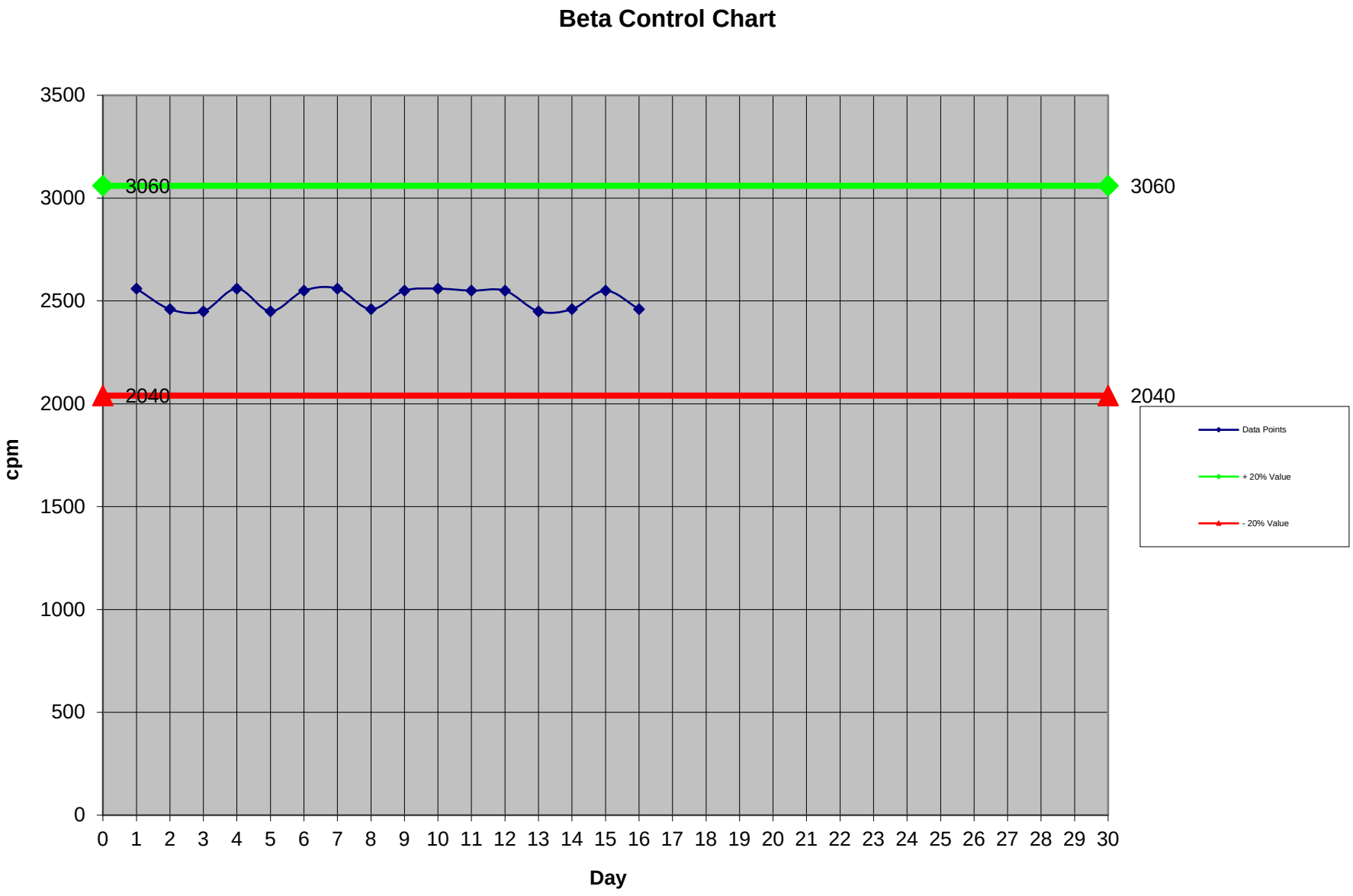
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2040-3060	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW
10/8/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2500	2450	20	P	WW
10/9/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW
10/13/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW
10/14/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	40	2500	2460	20	P	WW
10/15/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	40	2500	2460	20	P	WW
10/16/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	40	2600	2560	21	P	WW
10/19/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW
10/20/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW
10/21/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2500	2450	20	P	WW
10/22/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	40	2600	2560	21	P	WW
10/23/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW
10/26/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	40	2500	2460	20	P	WW
10/27/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	40	2600	2560	21	P	WW
10/28/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW
10/29/2015	3/44-9	294545/ES0048	N	8/17/2016	011403	12,040	50	2600	2550	21	P	WW


Beta Control Chart
3500
3000
2500
2000
1500
1000
500
0
cpm
3060
3060
2040
2040
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2040-3060	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2600	2560	21	P	WW
10/8/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2500	2460	20	P	WW
10/9/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2500	2450	20	P	WW
10/13/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2600	2560	21	P	WW
10/14/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2500	2450	20	P	WW
10/15/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2600	2550	21	P	WW
10/16/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2600	2560	21	P	WW
10/19/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2500	2460	20	P	WW
10/20/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2600	2550	21	P	WW
10/21/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2600	2560	21	P	WW
10/22/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2600	2550	21	P	WW
10/23/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2600	2550	21	P	WW
10/26/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2500	2450	20	P	WW
10/27/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2500	2460	20	P	WW
10/28/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	50	2600	2550	21	P	WW
10/29/2015	3/44-9	266272/101566	N	9/10/2016	011403	12,040	40	2500	2460	20	P	WW


Beta Control Chart
3500
3000
2500
2000
1500
1000
500
0
cpm
3060
3060
2040
2040
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

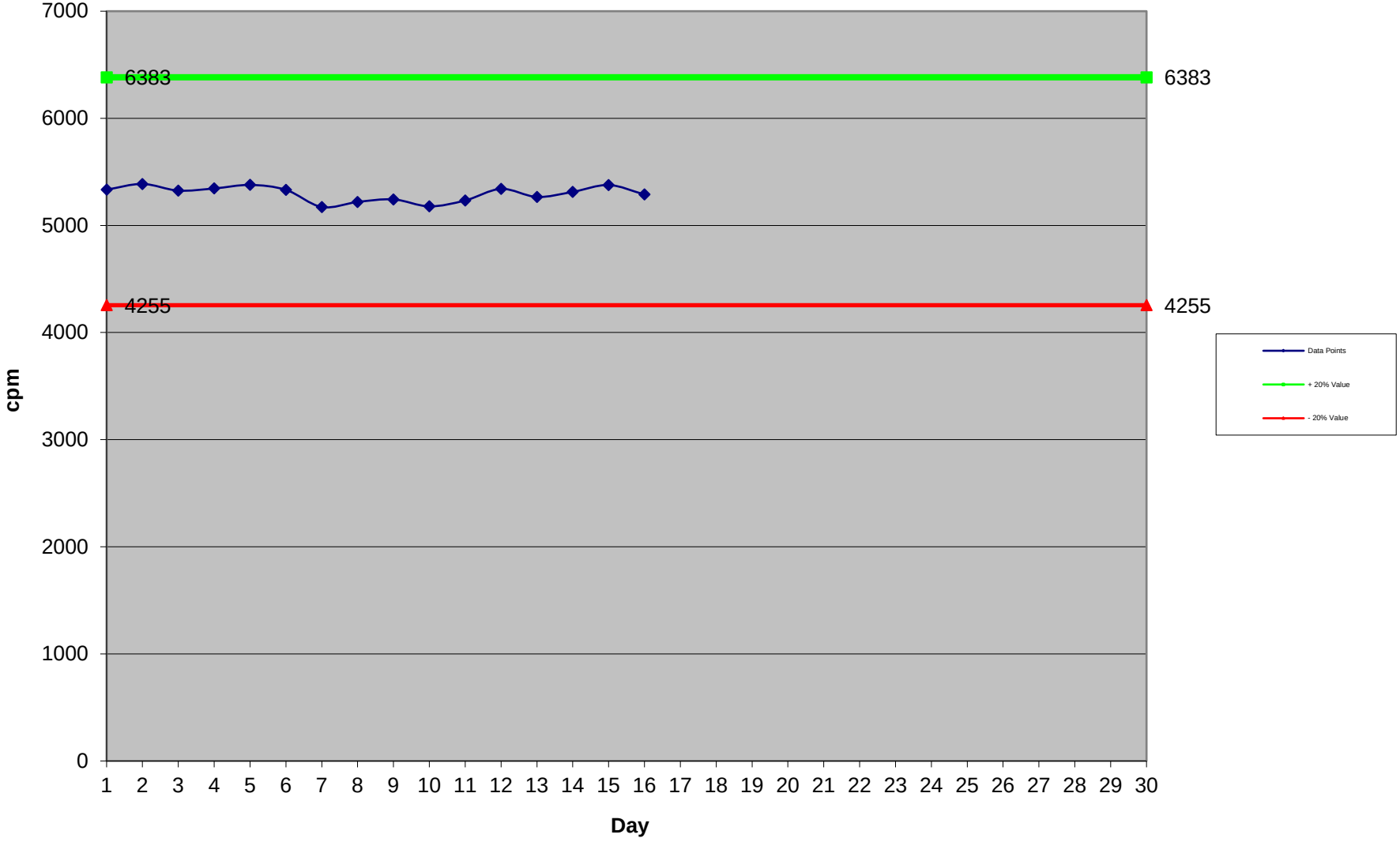
LUDLUM MODEL 2929
DAILY 30 MINUTE BACKGROUND AND EFFICIENCY

For:	October 2015, NSF Indian Head							
Instrument ID:	115563				Detector ID:	127216		
Cal Due Date:	5/19/2016							
Sources Used:			Alpha S/N:	Th-230/011404		Activity:	8,278	alphas/min
			Beta S/N:	Tc-99/011403		Activity:	12,040	betas/min
			Acceptable Range of Background:		0	CPM to	1	CPM α
Background Count Time:	30	Minutes			27	CPM to	52	CPM βγ

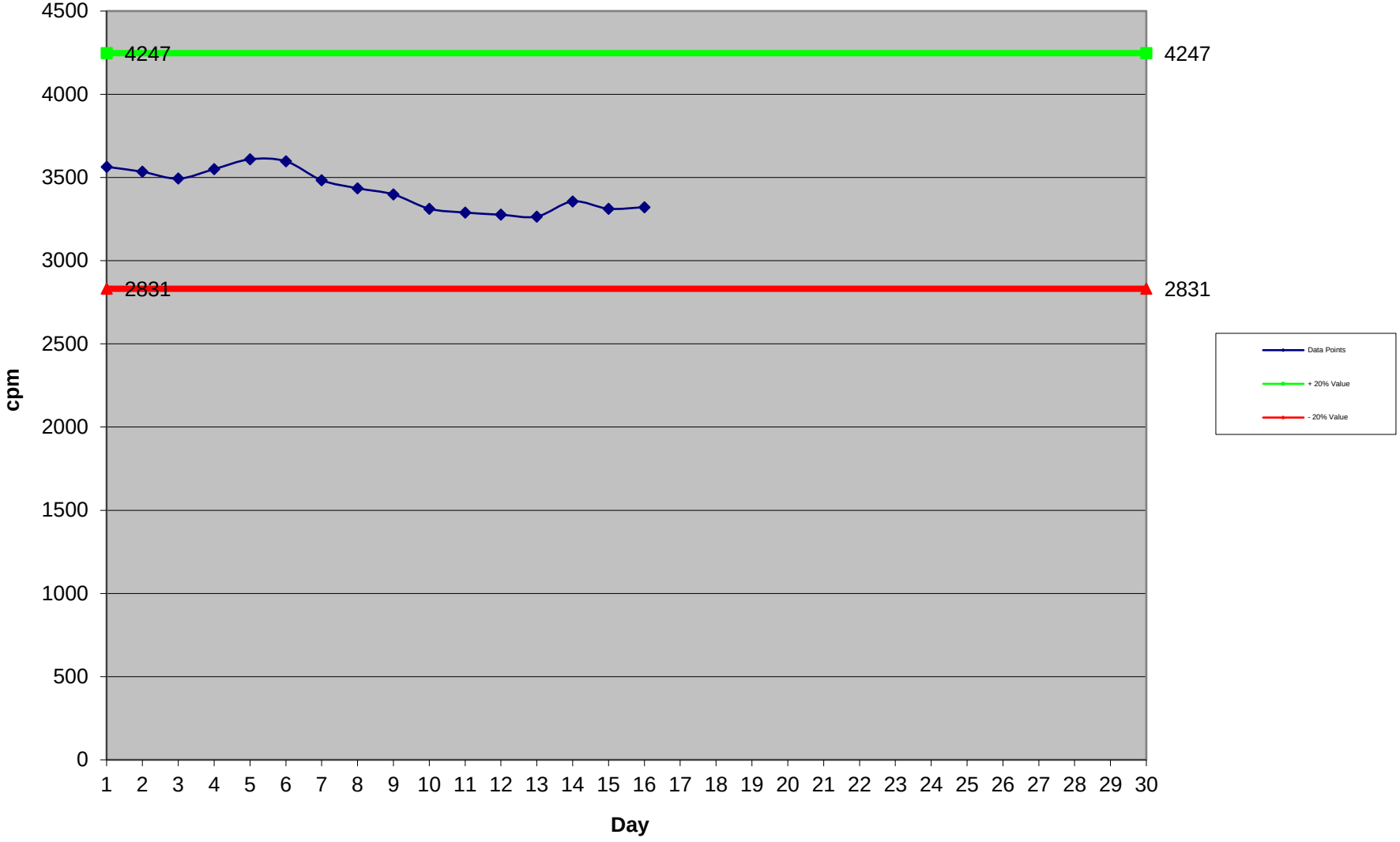
Date	Total Counts α	Total Counts βγ	30-Minute Background (CPM) α 0–1	30-Minute Background (CPM) βγ 27–52	1-min α Source Counts 4255-6383	Eff. α	1- min βγ Source Counts 2831-4247	Eff. βγ	Initials
10/7/2015	4	1221	0.1	40.7	5334	73.7	3564	36.5	WW
10/8/2015	2	1198	0.1	39.9	5387	73.7	3534	36.5	WW
10/9/2015	1	1167	0.0	38.9	5325	73.7	3493	36.5	WW
10/13/2015	4	1213	0.1	40.4	5345	73.7	3550	36.5	WW
10/14/2015	5	1267	0.2	42.2	5378	73.7	3609	36.5	WW
10/15/2015	5	1198	0.2	39.9	5332	73.7	3597	36.5	WW
10/16/2015	4	1181	0.1	39.4	5172	73.7	3483	36.5	WW
10/19/2015	6	1208	0.2	40.3	5219	73.7	3435	36.5	WW
10/20/2015	5	1271	0.2	42.4	5243	73.7	3398	36.5	WW
10/21/2015	3	1189	0.1	39.6	5178	73.7	3312	36.5	WW
10/22/2015	4	1233	0.1	41.1	5233	73.7	3289	36.5	WW
10/23/2015	6	1277	0.2	42.6	5341	73.7	3276	36.5	WW
10/26/2015	5	1245	0.2	41.5	5266	73.7	3265	36.5	WW
10/27/2015	4	1266	0.1	42.2	5313	73.7	3356	36.5	WW
10/28/2015	5	1298	0.2	43.3	5377	73.7	3312	36.5	WW
10/29/2015	7	1237	0.2	41.2	5289	73.7	3321	36.5	WW

Reviewed by: *Daniel Spicuzza* Date: 10/29/2015

Model 2929 Alpha Control Chart



Model 2929 Beta Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND 106-158 CPM	READING CPM	Net CPM 1034-1551	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	111	1314	1203	33.9	P	WW
10/8/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	117	1346	1229	33.9	P	WW
10/9/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	137	1412	1275	33.9	P	WW
10/13/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	149	1475	1326	33.9	P	WW
10/14/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	142	1465	1323	33.9	P	WW
10/15/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	141	1393	1252	33.9	P	WW
10/16/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	148	1484	1336	33.9	P	WW
10/19/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	137	1473	1336	33.9	P	WW
10/20/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	139	1437	1298	33.9	P	WW
10/21/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	144	1397	1253	33.9	P	WW
10/22/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	141	1421	1280	33.9	P	WW
10/23/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	133	1462	1329	33.9	P	WW
10/26/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	127	1403	1276	33.9	P	WW
10/27/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	129	1459	1330	33.9	P	WW
10/28/2015	2360/43-93	276986/299605	N	12/17/2015	039401	18,279	121	1359	1238	33.9	P	WW
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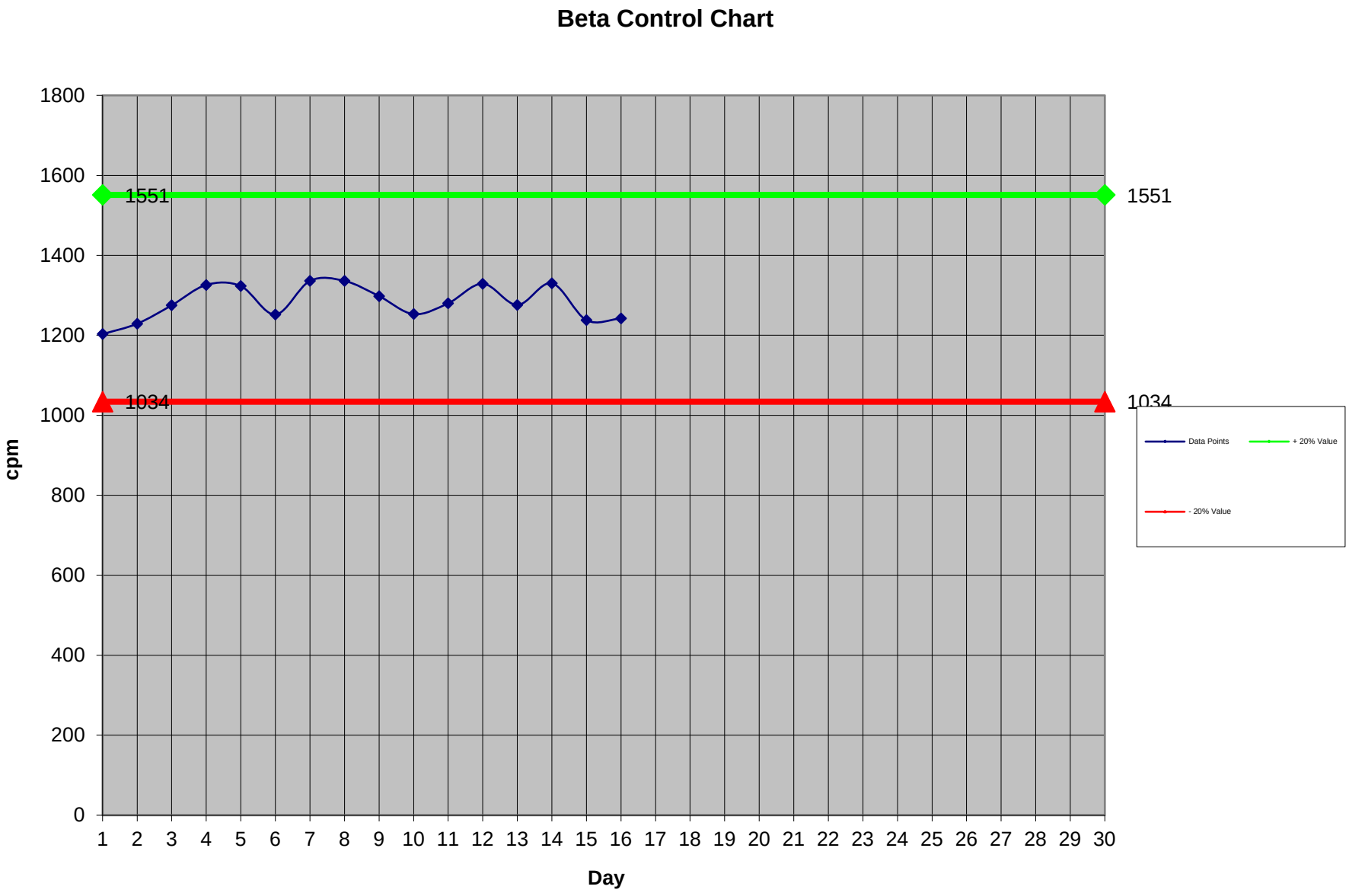
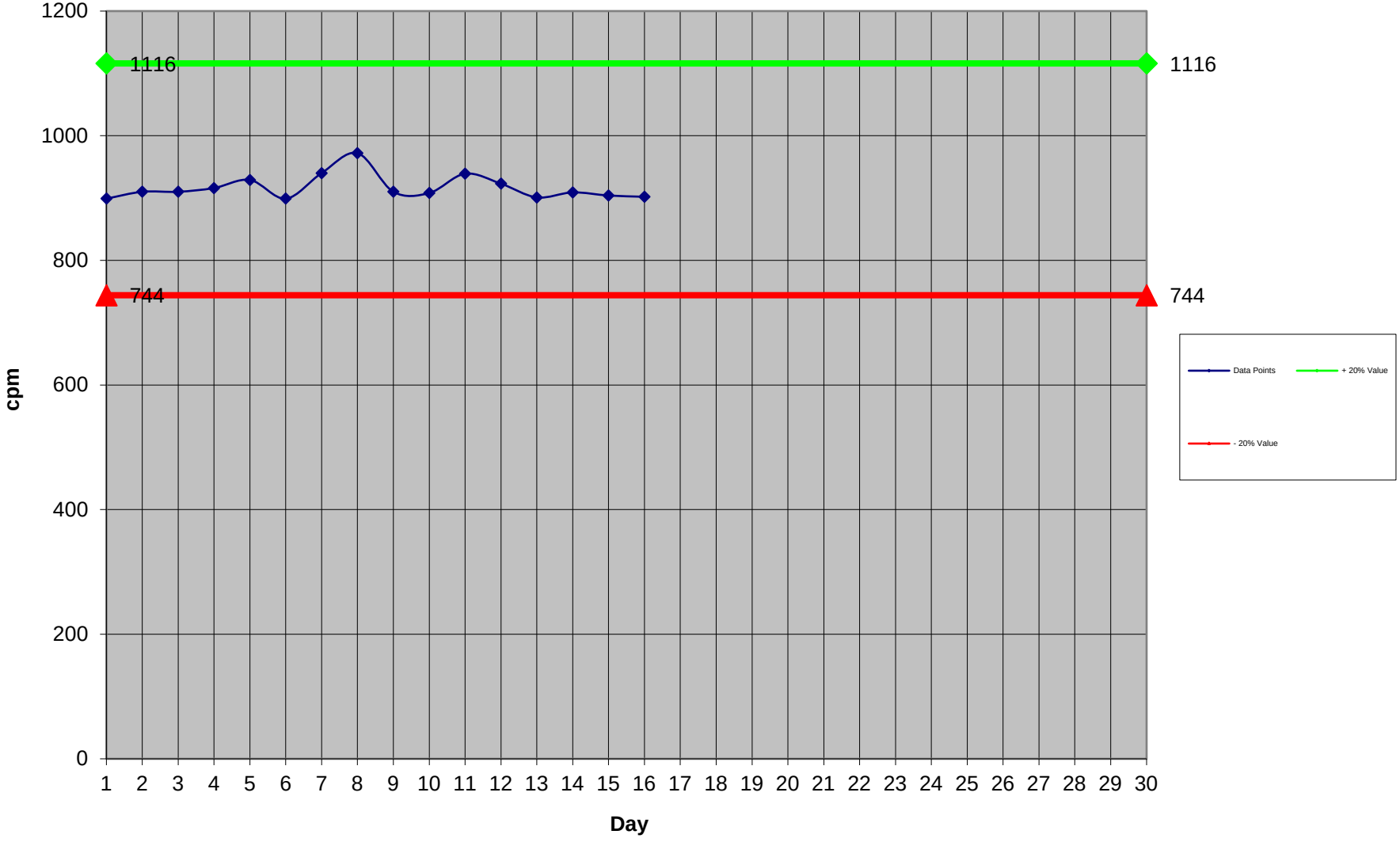

Beta Control Chart
1800
1600
1400
1200
1000
800
600
400
200
0
cpm
1551
1551
1034
1034
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND 0-6 CPM	READING CPM	Net CPM 744-1116	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	2	901	899	38.5	P	WW
10/8/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	5	915	910	38.5	P	WW
10/9/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	1	911	910	38.5	P	WW
10/13/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	2	918	916	38.5	P	WW
10/14/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	2	931	929	38.5	P	WW
10/15/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	5	904	899	38.5	P	WW
10/16/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	4	944	940	38.5	P	WW
10/19/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	5	977	972	38.5	P	WW
10/20/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	4	914	910	38.5	P	WW
10/21/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	3	911	908	38.5	P	WW
10/22/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	4	943	939	38.5	P	WW
10/23/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	3	926	923	38.5	P	WW
10/26/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	3	904	901	38.5	P	WW
10/27/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	4	913	909	38.5	P	WW
10/28/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	3	907	904	38.5	P	WW
10/29/2015	2360/43-93	276986/299605	N	12/17/2015	039402	2,904	2	904	902	38.5	P	WW

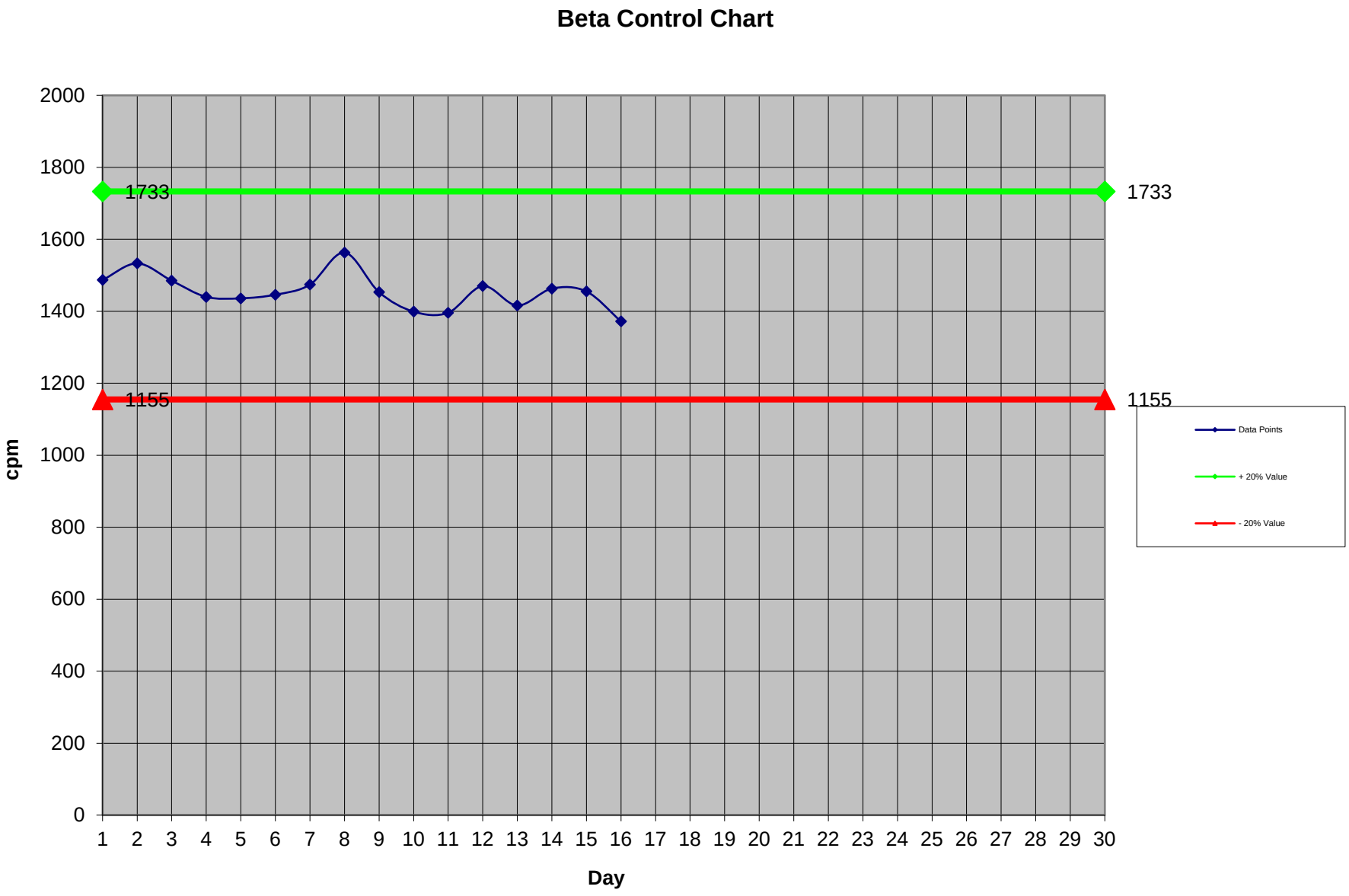
Alpha Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

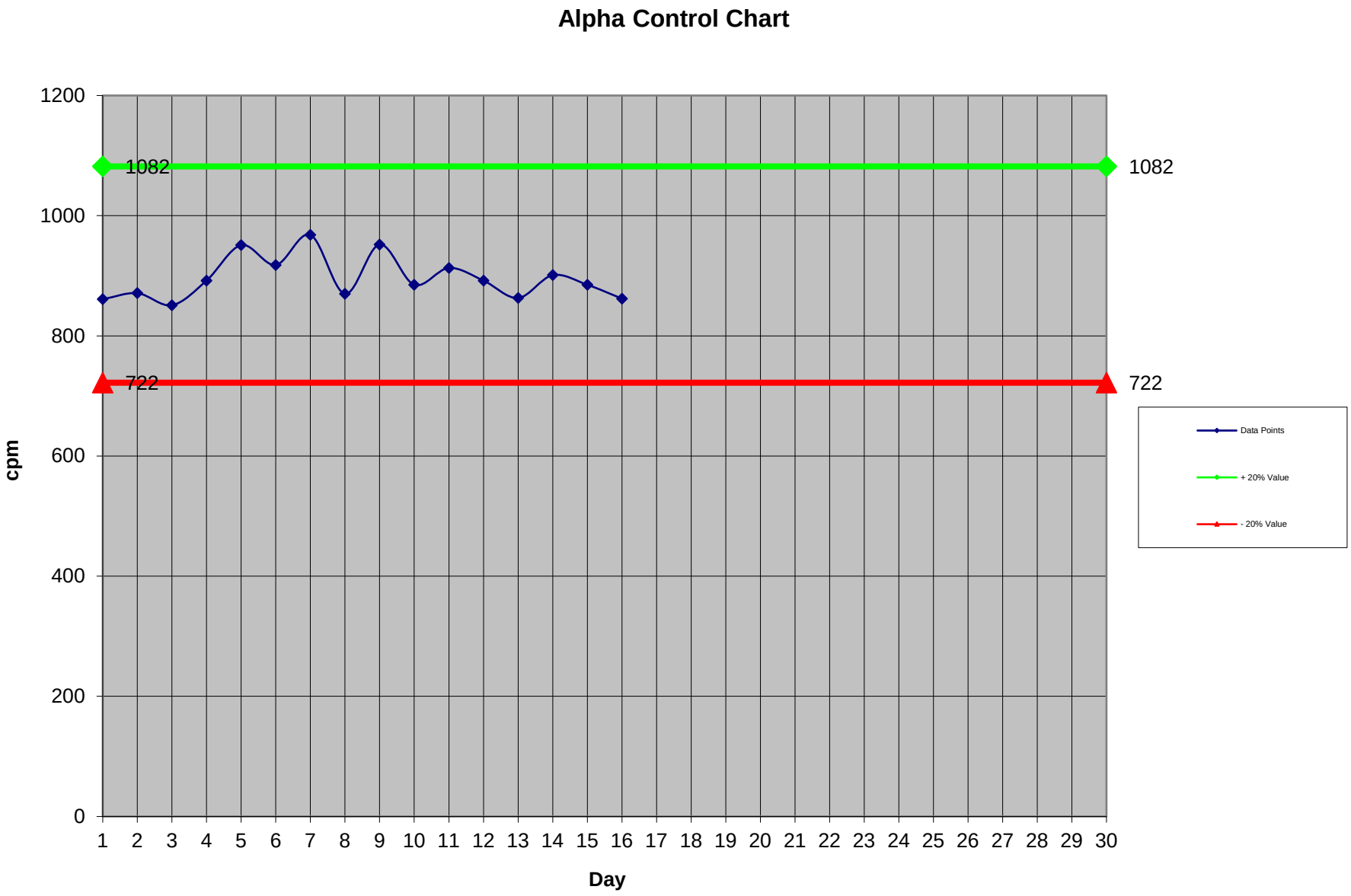
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND 104-156 CPM	READING CPM	Net CPM 1155-1733	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	129	1616	1487	28.3	P	WW
10/8/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	122	1655	1533	28.3	P	WW
10/9/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	127	1612	1485	28.3	P	WW
10/13/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	145	1585	1440	28.3	P	WW
10/14/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	144	1580	1436	28.3	P	WW
10/15/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	146	1592	1446	28.3	P	WW
10/16/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	145	1619	1474	28.3	P	WW
10/19/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	146	1709	1563	28.3	P	WW
10/20/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	144	1597	1453	28.3	P	WW
10/21/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	133	1532	1399	28.3	P	WW
10/22/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	128	1524	1396	28.3	P	WW
10/23/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	139	1609	1470	28.3	P	WW
10/26/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	133	1549	1416	28.3	P	WW
10/27/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	128	1591	1463	28.3	P	WW
10/28/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	139	1594	1455	28.3	P	WW
10/29/2015	2360/43-93	268508/298435	N	7/22/2016	039401	18,279	126	1498	1372	28.3	P	WW


Beta Control Chart
2000
1800
1600
1400
1200
1000
800
600
400
200
0
cpm
1733
1733
1155
1155
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

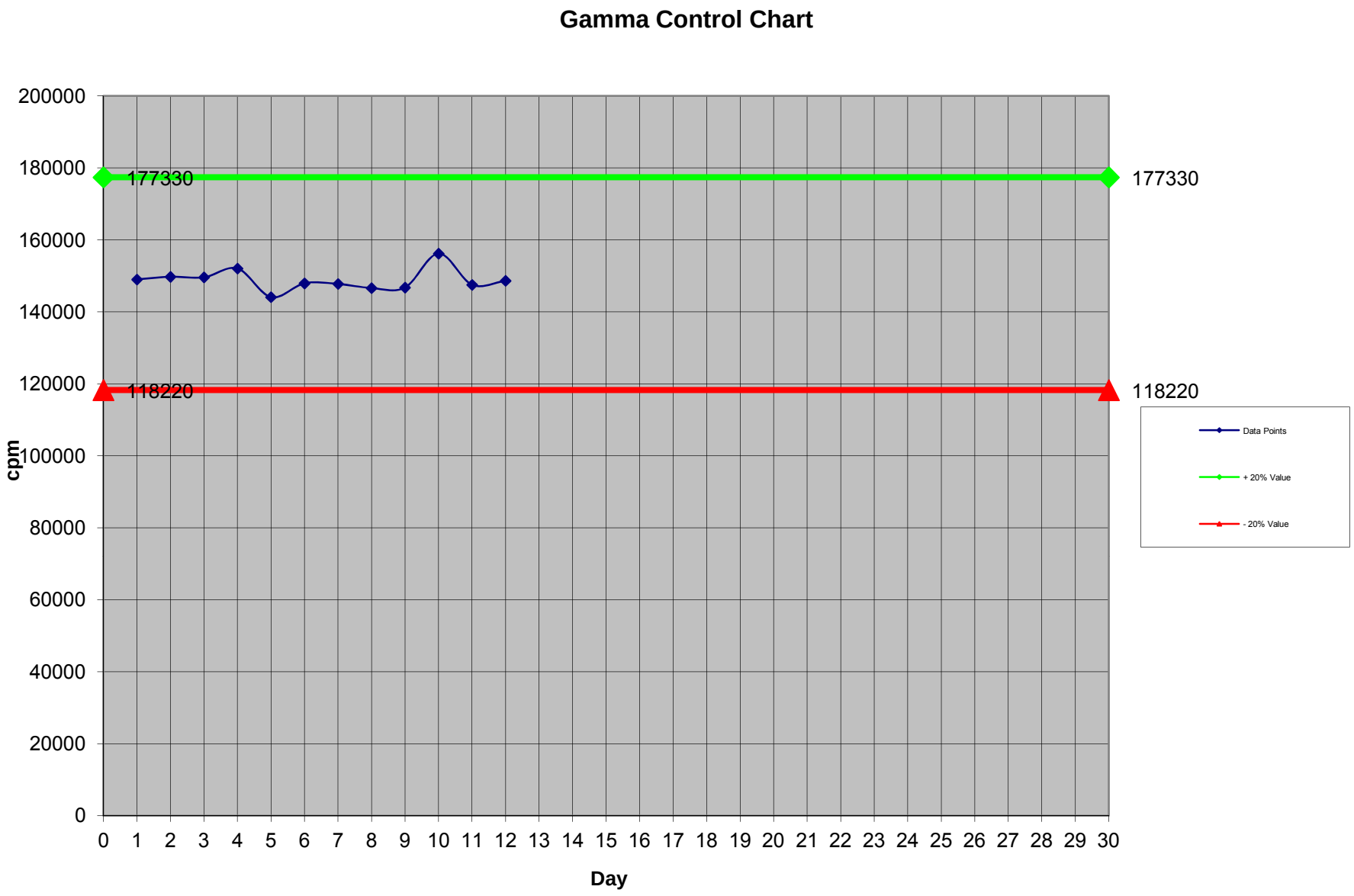
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND 0-4 CPM	READING CPM	Net CPM 722-1082	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
10/7/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	3	864	861	36.9	P	WW
10/8/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	4	875	871	36.9	P	WW
10/9/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	3	854	851	36.9	P	WW
10/13/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	4	896	892	36.9	P	WW
10/14/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	4	955	951	36.9	P	WW
10/15/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	4	922	918	36.9	P	WW
10/16/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	1	969	968	36.9	P	WW
10/19/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	3	873	870	36.9	P	WW
10/20/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	4	956	952	36.9	P	WW
10/21/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	2	887	885	36.9	P	WW
10/22/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	3	916	913	36.9	P	WW
10/23/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	4	896	892	36.9	P	WW
10/26/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	2	865	863	36.9	P	WW
10/27/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	3	904	901	36.9	P	WW
10/28/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	4	889	885	36.9	P	WW
10/29/2015	2360/43-93	268508/298435	N	7/22/2016	039402	2,904	3	865	862	36.9	P	WW


Alpha Control Chart
1200
1000
800
600
400
200
0
cpm
1082
722
1082
722
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY dpm	BACKGROUND 3710-4410 cpm	READING cpm	Net cpm 118220-177330	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
12/1/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3939	152900	148961	N/A	P	WW
12/2/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3655	153346	149691	N/A	P	WW
12/3/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3600	153145	149545	N/A	P	WW
12/4/2014	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3588	155581	151993	N/A	P	WW
12/7/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3773	147812	144039	N/A	P	WW
12/8/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3764	151652	147888	N/A	P	WW
12/9/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3711	151420	147709	N/A	P	WW
12/10/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3740	150292	146552	N/A	P	WW
12/11/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3673	150396	146723	N/A	P	WW
12/14/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3308	159462	156154	N/A	P	WW
12/15/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3574	151054	147480	N/A	P	WW
12/16/2015	2350-1/44-10	126172/192589	N	6/19/2016	119311	6,489,000	3804	152390	148586	N/A	P	WW

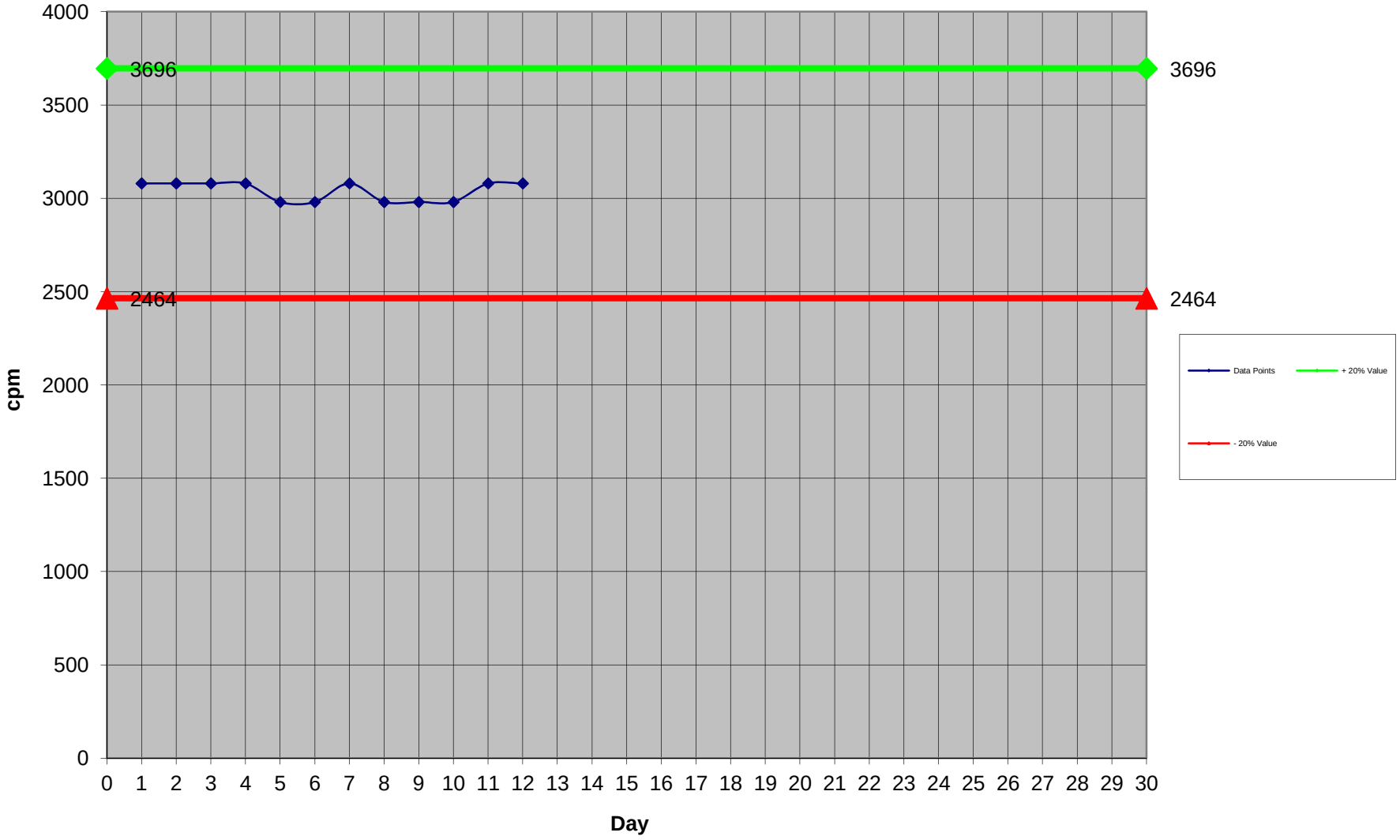

Gamma Control Chart
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
cpm
177330
118220
177330
118220
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2464-3696	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
12/1/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3100	3080	24	P	WW
12/2/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3100	3080	24	P	WW
12/3/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3100	3080	24	P	WW
12/4/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3100	3080	24	P	WW
12/7/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3000	2980	23	P	WW
12/8/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3000	2980	23	P	WW
12/9/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3100	3080	24	P	WW
12/10/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3000	2980	23	P	WW
12/11/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3000	2980	23	P	WW
12/14/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3000	2980	23	P	WW
12/15/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3100	3080	24	P	WW
12/16/2015	3/44-9	269208/150446	N	5/11/2016	051303	12,820	20	3100	3080	24	P	WW

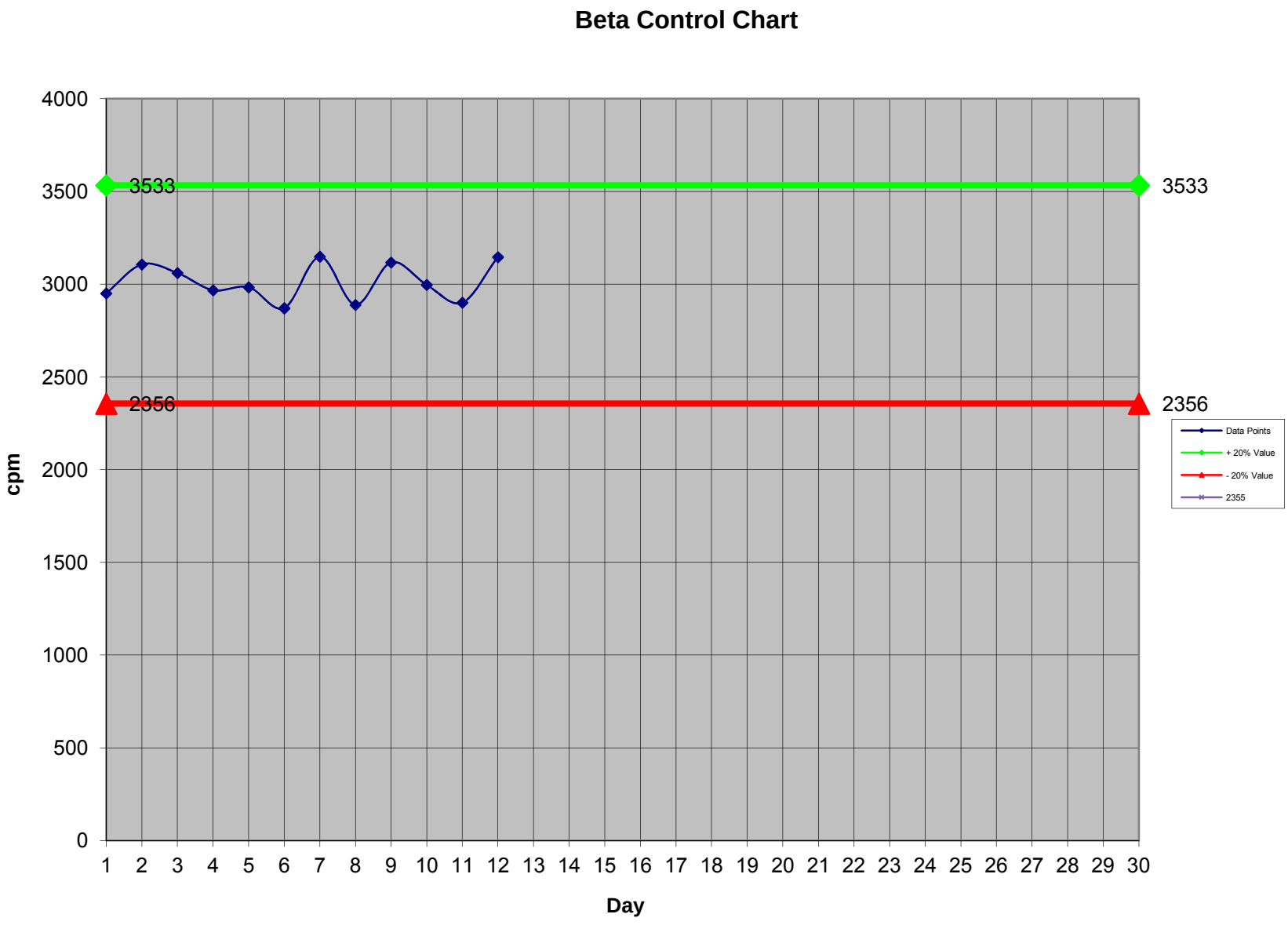
Beta Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

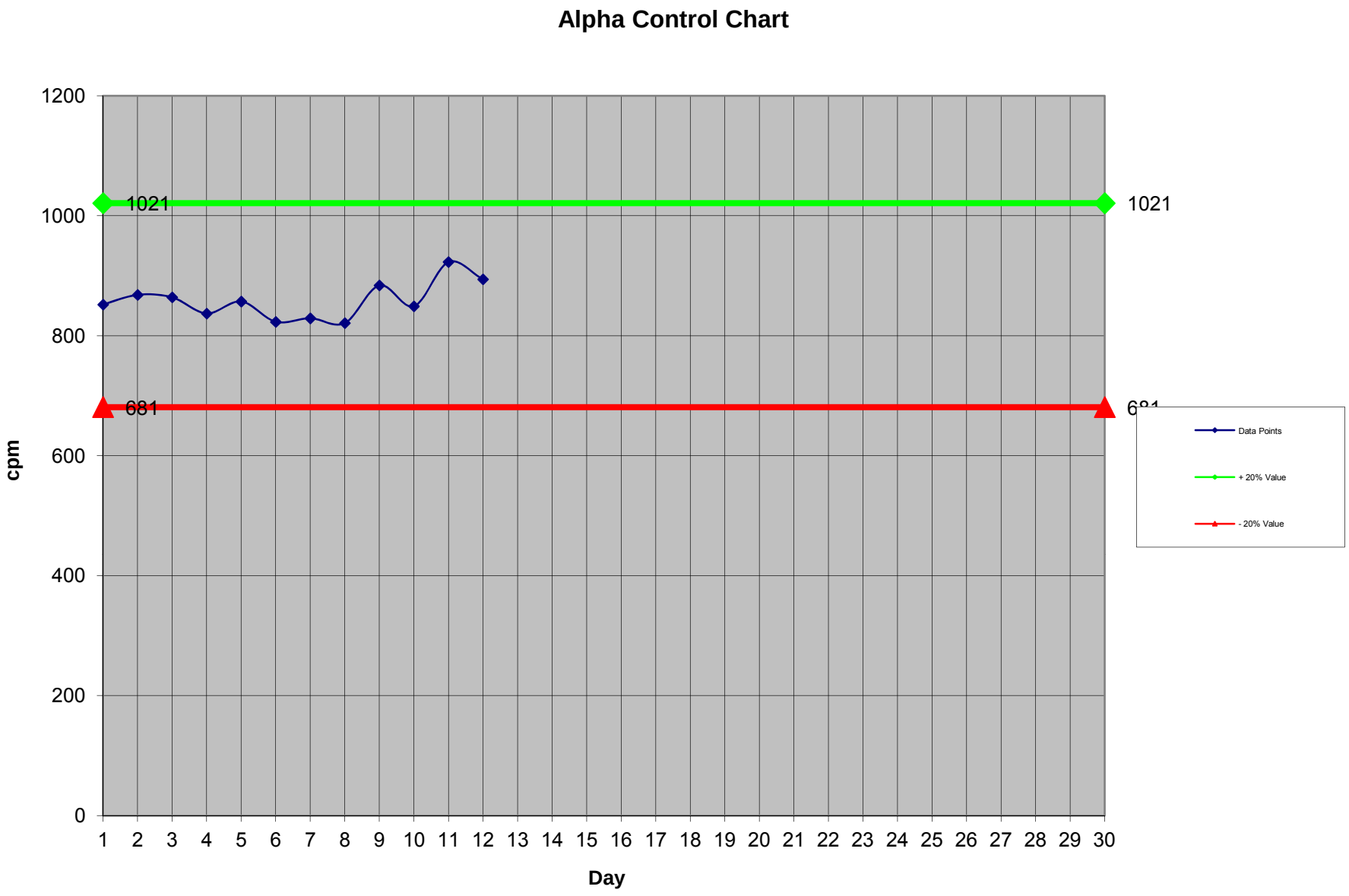
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND 104-156 CPM	READING CPM	Net CPM 2356-3533	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
12/1/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	155	3105	2950	25.5	P	WW
12/2/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	176	3282	3106	25.5	P	WW
12/3/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	189	3249	3060	25.5	P	WW
12/4/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	165	3132	2967	25.5	P	WW
12/7/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	164	3147	2983	25.5	P	WW
12/8/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	166	3036	2870	25.5	P	WW
12/9/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	147	3295	3148	25.5	P	WW
12/10/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	174	3062	2888	25.5	P	WW
12/11/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	196	3313	3117	25.5	P	WW
12/14/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	148	3144	2996	25.5	P	WW
12/15/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	174	3074	2900	25.5	P	WW
12/16/2015	2360/43-93	297826/323053	N	1/30/2016	049410	12,132	158	3304	3146	25.5	P	WW


Beta Control Chart
4000
3500
3000
2500
2000
1500
1000
500
0
cpm
3533
3533
2356
2356
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value
2355

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head Site 1

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND 0-4 CPM	READING CPM	Net CPM 681-1021	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
12/1/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	1	853	852	34.2	P	WW
12/2/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	868	868	34.2	P	WW
12/3/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	864	864	34.2	P	WW
12/4/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	837	837	34.2	P	WW
12/7/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	857	857	34.2	P	WW
12/8/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	823	823	34.2	P	WW
12/9/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	2	831	829	34.2	P	WW
12/10/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	821	821	34.2	P	WW
12/11/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	1	885	884	34.2	P	WW
12/14/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	849	849	34.2	P	WW
12/15/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	923	923	34.2	P	WW
12/16/2015	2360/43-93	297826/323053	N	1/30/2016	039404	2,869	0	894	894	34.2	P	WW


Alpha Control Chart
1200
1000
800
600
400
200
0
cpm
1021
1021
681
681
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

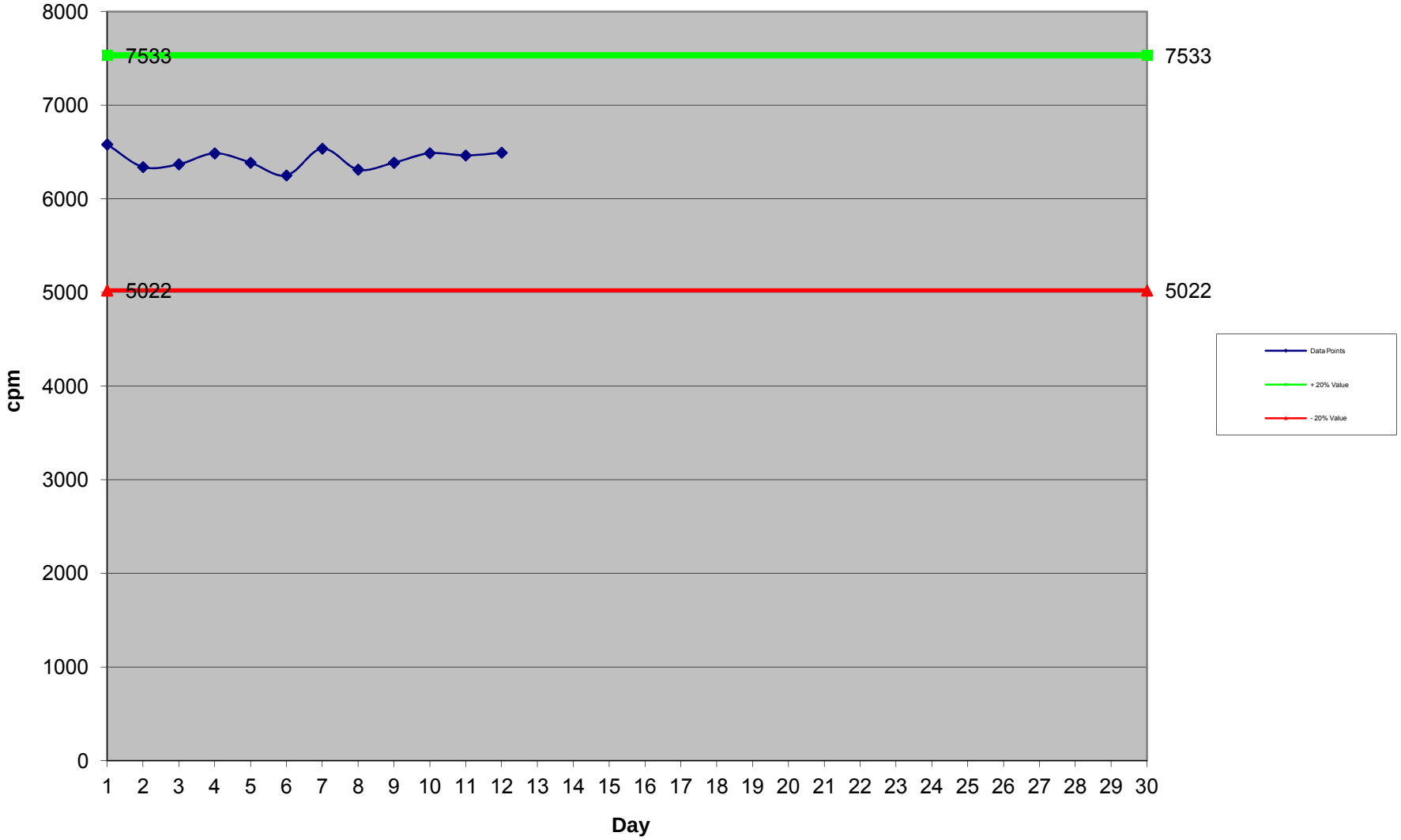
LUDLUM MODEL 2929
DAILY 30 MINUTE BACKGROUND AND EFFICIENCY

For:	December 2015, NSF Indian Head							
Instrument ID:	61549				Detector ID:	24319		
Cal Due Date:	5/18/2016							
Sources Used:			Alpha S/N:	Th-230/099605		Activity:	9,480	alphas/min
			Beta S/N:	Tc-99/051303		Activity:	12,820	betas/min
			Acceptable Range of Background:		0	CPM to	3.9	CPM α
Background Count Time:	30	Minutes			38	CPM to	65	CPM βγ

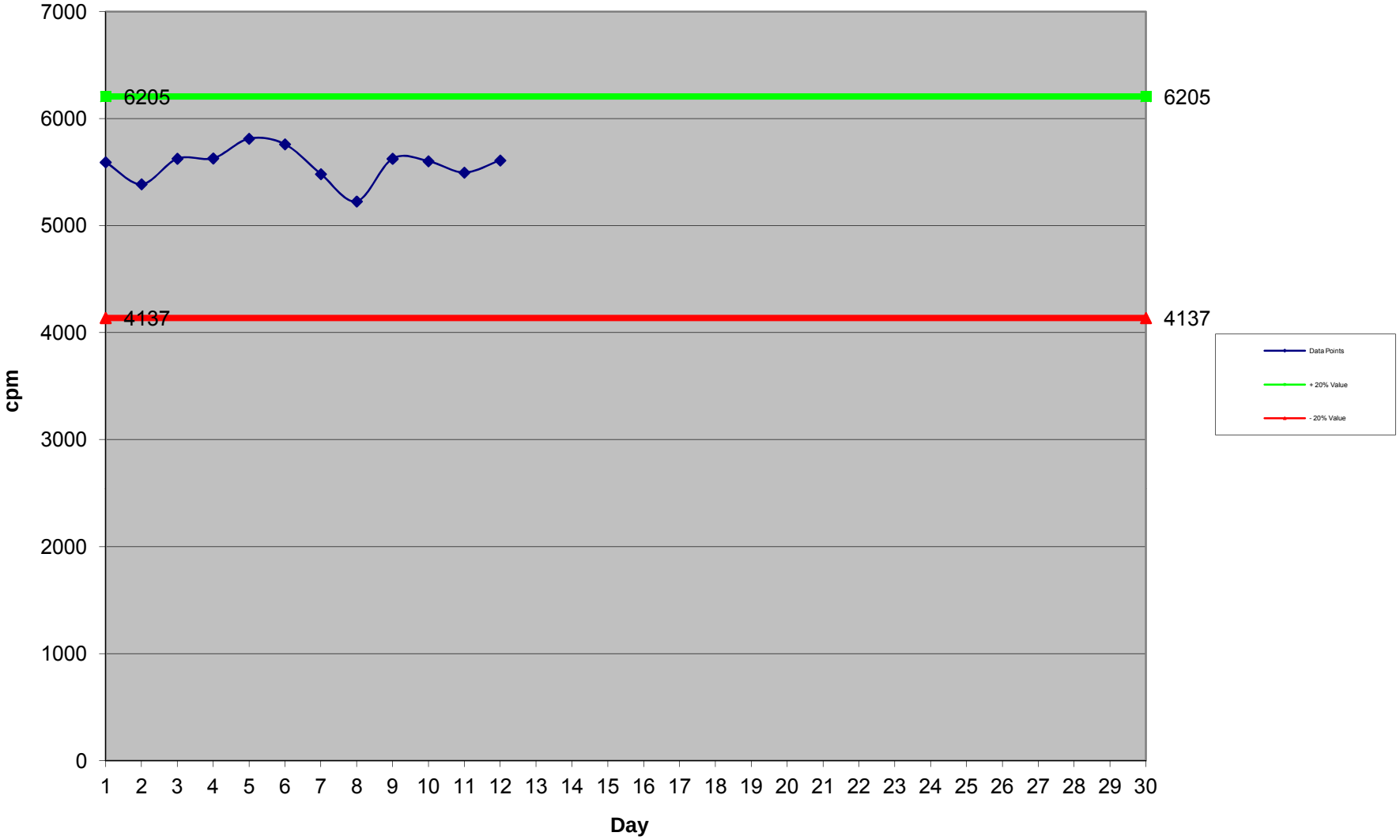
Date	Total Counts α	Total Counts βγ	30-Minute Background (CPM) α 0-3.9	30-Minute Background (CPM) βγ 38-65	1-min α Source Counts 5022-7533	Eff. α	1- min βγ Source Counts 4137-6205	Eff. βγ	Initials
12/1/2015	34	1531	1.1	51.0	6581	74.0	5591	52.8	WW
12/2/2015	38	1411	1.3	47.0	6340	74.0	5386	52.8	WW
12/3/2015	27	1896	0.9	63.2	6370	74.0	5625	52.8	WW
12/4/2015	31	1962	1.0	65.4	6486	74.0	5628	52.8	WW
12/7/2015	45	1422	1.5	47.4	6386	74.0	5811	52.8	WW
12/8/2015	34	1329	1.1	44.3	6250	74.0	5759	52.8	WW
12/9/2015	41	1357	1.4	45.2	6537	74.0	5481	52.8	WW
12/10/2015	47	1394	1.6	46.5	6312	74.0	5226	52.8	WW
12/11/2015	41	1435	1.4	47.8	6386	74.0	5624	52.8	WW
12/14/2015	29	1431	1.0	47.7	6487	74.0	5601	52.8	WW
12/15/2015	34	1340	1.1	44.7	6463	74.0	5495	52.8	WW
12/16/2015	44	1363	1.5	45.4	6492	74.0	5608	52.8	WW

Reviewed by: *Daniel Spicuzza* Date: 12/16/2015

Model 2929 Alpha Control Chart



Model 2929 Beta Control Chart

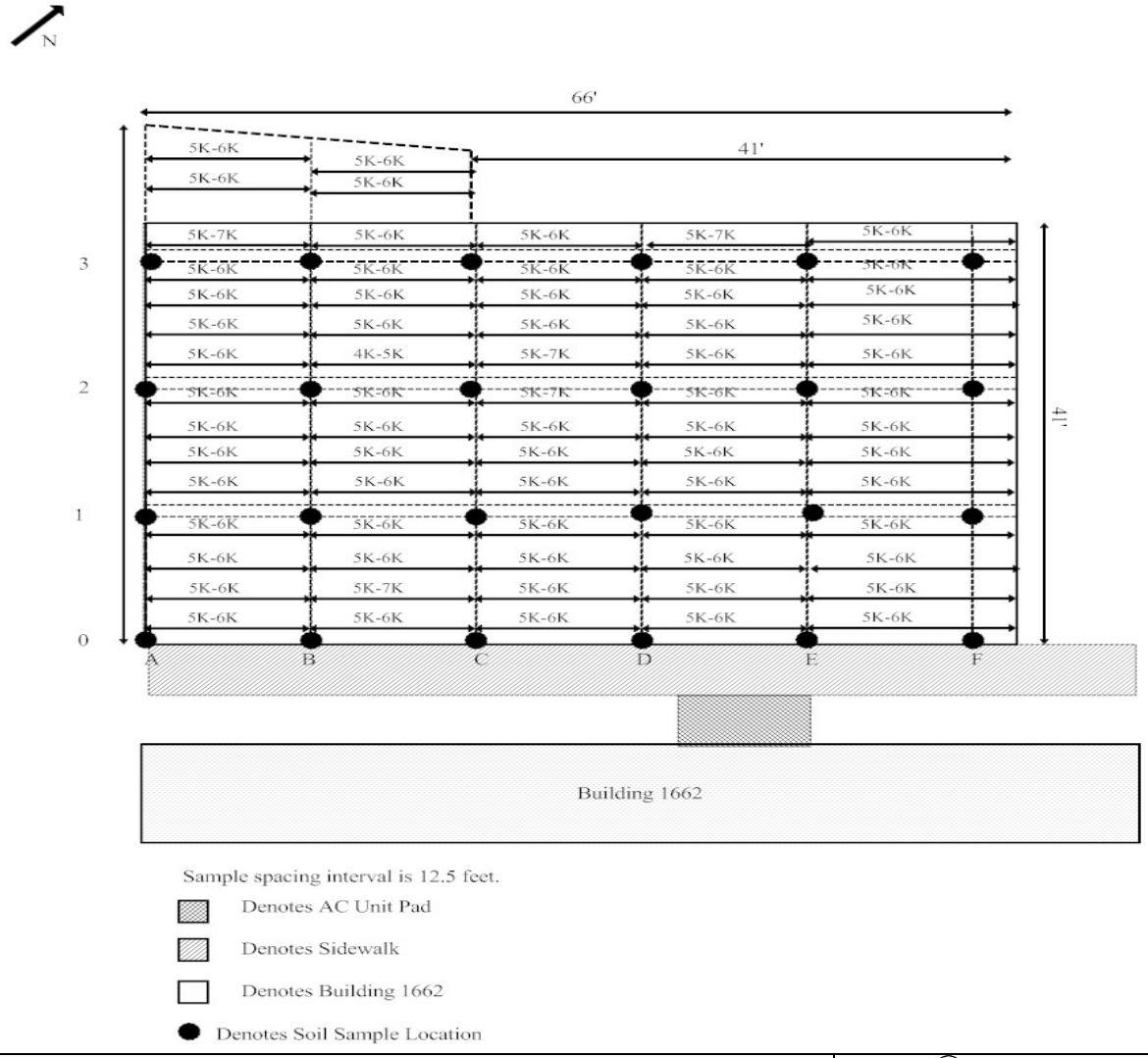


Appendix O

Excavation Bottom Survey Report

DATE:	TIME:	INSTRUMENTATION USED						
10/23/2015	09:00	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-027							
LOCATION:	NSF Indian Head Site 1							
SURVEYOR:	William Wylie							
DATE: 10/23/2015	TIME: 10:30 / Reviewed by: Daniel Spicuzza	2350-1 44-10	120588 318218	6/19/2016				5327 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Final Gamma Scan Survey of Excavation Bottom



Comments:

The area was 100% gamma scan surveyed.

Action Level: 7,110 cpm.

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-027

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								
N/A								
N/A								
N/A								

Reviewer Daniel Spicuzza	Date: 10/23/2015 Time: 10:30	

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Appendix P

Excavation Bottom Samples Laboratory Data Report

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-14502-1
Client Project/Site: NSF Indian Head Site 1

For:
Aleut World Solutions
615 E. 82nd Ave.
Suite 200
Anchorage, Alaska 99518

Attn: Daniel Spicuzza

Authorized for release by:
11/17/2015 2:01:08 PM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Cover Page 1
Table of Contents 2
Case Narrative 3
Chain of Custody 5
Receipt Checklists 10
Definitions/Glossary 11
Method Summary 12
Sample Summary 13
Client Sample Results 15
QC Sample Results 31
QC Association Summary 36
Tracer Carrier Summary 39

Job ID: 160-14502-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: NSF Indian Head Site 1

Report Number: 160-14502-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-14502-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 10/27/2015 1:40 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.1º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHS1L7-A0 (160-14502-1), IHS1L7-A1 (160-14502-2), IHS1L7-A2 (160-14502-3), IHS1L7-A3 (160-14502-4), IHS1L7-B1 (160-14502-5), IHS1L7-B2 (160-14502-6), IHS1L7-B3 (160-14502-7), IHS1L7-C1 (160-14502-8), IHS1L7-C2 (160-14502-9), IHS1L7-C3 (160-14502-10), IHS1L7-D1 (160-14502-11), IHS1L7-D2 (160-14502-12), IHS1L7-D3 (160-14502-13), IHS1L7-E1 (160-14502-14), IHS1L7-E2 (160-14502-15), IHS1L7-E3 (160-14502-16), IHS1L8-A1 (160-14502-17), IHS1L8-A2 (160-14502-18), IHS1L8-A3 (160-14502-19), IHS1L8-B1 (160-14502-20), IHS1L8-B2 (160-14502-21), IHS1L8-B3 (160-14502-22), IHS1L8-C1 (160-14502-23), IHS1L8-C2 (160-14502-24), IHS1L8-C3 (160-14502-25), IHS1L8-D1 (160-14502-26), IHS1L8-D2 (160-14502-27), IHS1L8-D3 (160-14502-28), IHS1L8-E1 (160-14502-29), IHS1L8-E2 (160-14502-30), IHS1L8-E3 (160-14502-31), IHS1L8-F2 (160-14502-32), IHS1EB-A0 (160-14502-33), IHS1EB-A1 (160-14502-34), IHS1EB-A2 (160-14502-35), IHS1EB-A3 (160-14502-36), IHS1EB-B0 (160-14502-37), IHS1EB-B1 (160-14502-38), IHS1EB-B2 (160-14502-39), IHS1EB-B3 (160-14502-40), IHS1EB-C0 (160-14502-41), IHS1EB-C1 (160-14502-42), IHS1EB-C2 (160-14502-43), IHS1EB-C3 (160-14502-44), IHS1EB-D0 (160-14502-45), IHS1EB-D1 (160-14502-46), IHS1EB-D2 (160-14502-47), IHS1EB-D3 (160-14502-48), IHS1EB-E0 (160-14502-49), IHS1EB-E1 (160-14502-50), IHS1EB-E2 (160-14502-51), IHS1EB-E3 (160-14502-52), IHS1EB-F0 (160-14502-53), IHS1EB-F1 (160-14502-54), IHS1EB-F2 (160-14502-55) and IHS1EB-F3 (160-14502-56) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 10/28/2015, prepared on 10/30/2015 and 11/03/2015 and analyzed on 11/11/2015 and 11/12/2015.

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/21/15	COC No: NSFIH-2015-5
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7488	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific N
IHS1L7- A0	10/21/2015	0753	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- A1	10/21/2015	0757	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- A2	10/21/2015	0801	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- A3	10/21/2015	0806	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- B1	10/21/2015	0809	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- B2	10/21/2015	0814	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- B3	10/21/2015	0818	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- C1	10/21/2015	0819	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- C2	10/21/2015	0822	G	Soil	1	N	Y	X	5 Day TAT
IHS1L7- C3	10/21/2015	0826	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- D1	10/21/2015	0843	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- D2	10/21/2015	0851	G	Soil	1	N	N	X	5 Day TAT

160-14502 Chain of Custody

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/21/15 1600	Received by: Jill Clark	Company: TA SR	Date/Time: 10-27-15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
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Earth City, MO 63045
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Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/21/15	COC No: NSFIH-2015-6
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1L7- D3	10/21/2015	0900	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- E1	10/21/2015	846	G	Soil	1	N	Y	X	5 Day TAT
IHS1L7- E2	10/21/2015	0854	G	Soil	1	N	N	X	5 Day TAT
IHS1L7- E3	10/21/2015	0858	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- A1	10/22/2015	1024	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- A2	10/22/2015	1027	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- A3	10/22/2015	1029	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- B1	10/22/2015	1032	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- B2	10/22/2015	1033	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- B3	10/22/2015	1035	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- C1	10/22/2015	1038	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- C2	10/22/2015	1041	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4= HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Li	AWS	10/22/15 1600	Qu Clark	TA SR	10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
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Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/22/15	COC No: NSFIH-2015-7
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	2 of 2 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1L8- C3	10/22/2015	1043	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- D1	10/22/2015	1047	G	Soil	1	N	Y	X	5 Day TAT
IHS1L8- D2	10/22/2015	1050	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- D3	10/22/2015	1052	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- E1	10/22/2015	1054	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- E2	10/22/2015	1056	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- E3	10/22/2015	1059	G	Soil	1	N	N	X	5 Day TAT
IHS1L8- F2	10/22/2015	1103	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A0	10/23/2015	0948	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A1	10/23/2015	0950	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A2	10/23/2015	0952	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- A3	10/23/2015	0953	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/23/15 1600	Received by:	Company: TA SR	Date/Time: 10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
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Earth City, MO 63045
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Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories,Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/22/15	COC No: NSFIH-2015-8
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	4 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1EB- B0	10/23/2015	0956	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- B1	10/23/2015	1000	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- B2	10/23/2015	1002	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- B3	10/23/2015	1003	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C0	10/23/2015	1007	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C1	10/23/2015	1009	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C2	10/23/2015	1010	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- C3	10/23/2015	1012	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- D0	10/23/2015	1014	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- D1	10/23/2015	1017	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- D2	10/23/2015	1019	G	Soil	1	N	Y	X	5 Day TAT
IHS1EB- D3	10/23/2015	1020	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company: AWS	Date/Time: 10/23/15 1600	Received by: Jill Clark	Company: TA SR	Date/Time: 10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories , Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/22/15	COC No: NSFIH-2015-9
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7403	Lab Contact: Erika Gish	Carrier: Fed Ex	5 of 5 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1EB- E0	10/23/2015	1022	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- E1	10/23/2015	1024	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- E2	10/23/2015	1026	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- E3	10/23/2015	1028	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F0	10/23/2015	1030	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F1	10/23/2015	1032	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F2	10/23/2015	1034	G	Soil	1	N	N	X	5 Day TAT
IHS1EB- F3	10/23/2015	1040	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/23/15 1600	Received by:	Company: TA STL	Date/Time: 10.27.15 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/022013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-14502-1

Login Number: 14502
List Number: 1
Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14502-1	IHS1L7-A0	Solid	10/21/15 07:53	10/27/15 13:40
160-14502-2	IHS1L7-A1	Solid	10/21/15 07:57	10/27/15 13:40
160-14502-3	IHS1L7-A2	Solid	10/21/15 08:01	10/27/15 13:40
160-14502-4	IHS1L7-A3	Solid	10/21/15 08:06	10/27/15 13:40
160-14502-5	IHS1L7-B1	Solid	10/21/15 08:09	10/27/15 13:40
160-14502-6	IHS1L7-B2	Solid	10/21/15 08:14	10/27/15 13:40
160-14502-7	IHS1L7-B3	Solid	10/21/15 08:18	10/27/15 13:40
160-14502-8	IHS1L7-C1	Solid	10/21/15 08:19	10/27/15 13:40
160-14502-9	IHS1L7-C2	Solid	10/21/15 08:22	10/27/15 13:40
160-14502-10	IHS1L7-C3	Solid	10/21/15 08:26	10/27/15 13:40
160-14502-11	IHS1L7-D1	Solid	10/21/15 08:43	10/27/15 13:40
160-14502-12	IHS1L7-D2	Solid	10/21/15 08:51	10/27/15 13:40
160-14502-13	IHS1L7-D3	Solid	10/21/15 09:00	10/27/15 13:40
160-14502-14	IHS1L7-E1	Solid	10/21/15 08:46	10/27/15 13:40
160-14502-15	IHS1L7-E2	Solid	10/21/15 08:54	10/27/15 13:40
160-14502-16	IHS1L7-E3	Solid	10/21/15 08:58	10/27/15 13:40
160-14502-17	IHS1L8-A1	Solid	10/22/15 10:24	10/27/15 13:40
160-14502-18	IHS1L8-A2	Solid	10/22/15 10:27	10/27/15 13:40
160-14502-19	IHS1L8-A3	Solid	10/22/15 10:29	10/27/15 13:40
160-14502-20	IHS1L8-B1	Solid	10/22/15 10:32	10/27/15 13:40
160-14502-21	IHS1L8-B2	Solid	10/22/15 10:33	10/27/15 13:40
160-14502-22	IHS1L8-B3	Solid	10/22/15 10:35	10/27/15 13:40
160-14502-23	IHS1L8-C1	Solid	10/22/15 10:38	10/27/15 13:40
160-14502-24	IHS1L8-C2	Solid	10/22/15 10:41	10/27/15 13:40
160-14502-25	IHS1L8-C3	Solid	10/22/15 10:43	10/27/15 13:40
160-14502-26	IHS1L8-D1	Solid	10/22/15 10:47	10/27/15 13:40
160-14502-27	IHS1L8-D2	Solid	10/22/15 10:50	10/27/15 13:40
160-14502-28	IHS1L8-D3	Solid	10/22/15 10:52	10/27/15 13:40
160-14502-29	IHS1L8-E1	Solid	10/22/15 10:54	10/27/15 13:40
160-14502-30	IHS1L8-E2	Solid	10/22/15 10:56	10/27/15 13:40
160-14502-31	IHS1L8-E3	Solid	10/22/15 10:59	10/27/15 13:40
160-14502-32	IHS1L8-F2	Solid	10/22/15 11:03	10/27/15 13:40
160-14502-33	IHS1EB-A0	Solid	10/23/15 09:48	10/27/15 13:40
160-14502-34	IHS1EB-A1	Solid	10/23/15 09:50	10/27/15 13:40
160-14502-35	IHS1EB-A2	Solid	10/23/15 09:52	10/27/15 13:40
160-14502-36	IHS1EB-A3	Solid	10/23/15 09:53	10/27/15 13:40
160-14502-37	IHS1EB-B0	Solid	10/23/15 09:56	10/27/15 13:40
160-14502-38	IHS1EB-B1	Solid	10/23/15 10:00	10/27/15 13:40
160-14502-39	IHS1EB-B2	Solid	10/23/15 10:02	10/27/15 13:40
160-14502-40	IHS1EB-B3	Solid	10/23/15 10:03	10/27/15 13:40
160-14502-41	IHS1EB-C0	Solid	10/23/15 10:07	10/27/15 13:40
160-14502-42	IHS1EB-C1	Solid	10/23/15 10:09	10/27/15 13:40
160-14502-43	IHS1EB-C2	Solid	10/23/15 10:10	10/27/15 13:40
160-14502-44	IHS1EB-C3	Solid	10/23/15 10:12	10/27/15 13:40
160-14502-45	IHS1EB-D0	Solid	10/23/15 10:14	10/27/15 13:40
160-14502-46	IHS1EB-D1	Solid	10/23/15 10:17	10/27/15 13:40
160-14502-47	IHS1EB-D2	Solid	10/23/15 10:19	10/27/15 13:40
160-14502-48	IHS1EB-D3	Solid	10/23/15 10:20	10/27/15 13:40
160-14502-49	IHS1EB-E0	Solid	10/23/15 10:22	10/27/15 13:40
160-14502-50	IHS1EB-E1	Solid	10/23/15 10:24	10/27/15 13:40
160-14502-51	IHS1EB-E2	Solid	10/23/15 10:26	10/27/15 13:40
160-14502-52	IHS1EB-E3	Solid	10/23/15 10:28	10/27/15 13:40
160-14502-53	IHS1EB-F0	Solid	10/23/15 10:30	10/27/15 13:40

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14502-54	IHS1EB-F1	Solid	10/23/15 10:32	10/27/15 13:40
160-14502-55	IHS1EB-F2	Solid	10/23/15 10:34	10/27/15 13:40
160-14502-56	IHS1EB-F3	Solid	10/23/15 10:40	10/27/15 13:40

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-A0

Lab Sample ID: 160-14502-1
Date Collected: 10/21/15 07:53
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.552		0.137	0.145	1.00	0.0738	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.536		0.133	0.140	1.00	0.0500	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.596		0.138	0.147	1.00	0.0241	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.1*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-A1

Lab Sample ID: 160-14502-2
Date Collected: 10/21/15 07:57
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.676		0.147	0.157	1.00	0.0695	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.404		0.113	0.118	1.00	0.0545	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.486		0.122	0.129	1.00	0.0369	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.7*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-A2

Lab Sample ID: 160-14502-3
Date Collected: 10/21/15 08:01
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.538		0.136	0.143	1.00	0.0777	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.564		0.135	0.143	1.00	0.0242	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.536		0.132	0.139	1.00	0.0389	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.8*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-A3

Lab Sample ID: 160-14502-4
Date Collected: 10/21/15 08:06
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.13		0.191	0.213	1.00	0.0824	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.538		0.131	0.138	1.00	0.0520	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	1.09		0.185	0.206	1.00	0.0518	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-A3

Lab Sample ID: 160-14502-4
Matrix: Solid
Date Collected: 10/21/15 08:06
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.5		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-B1

Lab Sample ID: 160-14502-5
Matrix: Solid
Date Collected: 10/21/15 08:09
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.622		0.133	0.143	1.00	0.0438	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.506		0.123	0.130	1.00	0.0679	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.630		0.133	0.143	1.00	0.0340	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-B2

Lab Sample ID: 160-14502-6
Matrix: Solid
Date Collected: 10/21/15 08:14
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.693		0.149	0.160	1.00	0.0663	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.574		0.136	0.144	1.00	0.0586	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.548		0.131	0.139	1.00	0.0435	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.9		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-B3

Lab Sample ID: 160-14502-7
Matrix: Solid
Date Collected: 10/21/15 08:18
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.620		0.139	0.149	1.00	0.0733	pCi/g	10/30/15 10:05	11/11/15 21:49	1
Thorium-230	0.879		0.163	0.179	1.00	0.0557	pCi/g	10/30/15 10:05	11/11/15 21:49	1
Thorium-232	0.687		0.143	0.155	1.00	0.0493	pCi/g	10/30/15 10:05	11/11/15 21:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	10/30/15 10:05	11/11/15 21:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-C1

Lab Sample ID: 160-14502-8
Date Collected: 10/21/15 08:19
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.708		0.148	0.159	1.00	0.0568	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.669		0.146	0.156	1.00	0.0766	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.590		0.134	0.143	1.00	0.0466	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.3*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-C2

Lab Sample ID: 160-14502-9
Date Collected: 10/21/15 08:22
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.665		0.148	0.158	1.00	0.0719	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.687		0.148	0.159	1.00	0.0516	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.629		0.142	0.151	1.00	0.0525	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.7*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-C3

Lab Sample ID: 160-14502-10
Date Collected: 10/21/15 08:26
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.593		0.131	0.140	1.00	0.0655	pCi/g	10/30/15 10:05	11/12/15 16:23	1
Thorium-230	0.577		0.128	0.137	1.00	0.0496	pCi/g	10/30/15 10:05	11/12/15 16:23	1
Thorium-232	0.598		0.130	0.139	1.00	0.0429	pCi/g	10/30/15 10:05	11/12/15 16:23	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*102*		*30 - 110*	*10/30/15 10:05*	*11/12/15 16:23*	*1*

Client Sample ID: IHS1L7-D1

Lab Sample ID: 160-14502-11
Date Collected: 10/21/15 08:43
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.409		0.115	0.120	1.00	0.0823	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.522		0.125	0.133	1.00	0.0635	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.394		0.108	0.112	1.00	0.0479	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-D1
Date Collected: 10/21/15 08:43
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-11
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	98.3		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-D2
Date Collected: 10/21/15 08:51
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-12
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.630		0.141	0.151	1.00	0.0777	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.549		0.129	0.137	1.00	0.0464	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.403		0.110	0.115	1.00	0.0418	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	96.3		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-D3
Date Collected: 10/21/15 09:00
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-13
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.525		0.125	0.133	1.00	0.0613	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.552		0.127	0.135	1.00	0.0404	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.614		0.133	0.143	1.00	0.0402	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	103		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample ID: IHS1L7-E1
Date Collected: 10/21/15 08:46
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-14
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.647		0.145	0.155	1.00	0.0596	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.798		0.160	0.173	1.00	0.0445	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.569		0.134	0.142	1.00	0.0237	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110	10/30/15 10:05	11/11/15 10:49	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L7-E2

Lab Sample ID: 160-14502-15
Date Collected: 10/21/15 08:54
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.433		0.112	0.118	1.00	0.0674	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.432		0.109	0.115	1.00	0.0422	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.477		0.115	0.121	1.00	0.0420	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*110*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L7-E3

Lab Sample ID: 160-14502-16
Date Collected: 10/21/15 08:58
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.781		0.159	0.172	1.00	0.0749	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-230	0.669		0.146	0.156	1.00	0.0611	pCi/g	10/30/15 10:05	11/11/15 10:49	1
Thorium-232	0.960		0.173	0.191	1.00	0.0473	pCi/g	10/30/15 10:05	11/11/15 10:49	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.9*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:49*	*1*

Client Sample ID: IHS1L8-A1

Lab Sample ID: 160-14502-17
Date Collected: 10/22/15 10:24
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.601		0.141	0.150	1.00	0.0716	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.568		0.136	0.144	1.00	0.0647	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.653		0.146	0.156	1.00	0.0669	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.8*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:56*	*1*

Client Sample ID: IHS1L8-A2

Lab Sample ID: 160-14502-18
Date Collected: 10/22/15 10:27
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.958		0.177	0.194	1.00	0.0630	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.740		0.154	0.166	1.00	0.0241	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.696		0.149	0.160	1.00	0.0240	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-A2

Lab Sample ID: 160-14502-18
Date Collected: 10/22/15 10:27
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.0		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample ID: IHS1L8-A3

Lab Sample ID: 160-14502-19
Date Collected: 10/22/15 10:29
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.881		0.170	0.185	1.00	0.0703	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.859		0.166	0.181	1.00	0.0386	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.845		0.164	0.179	1.00	0.0444	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.0		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample ID: IHS1L8-B1

Lab Sample ID: 160-14502-20
Date Collected: 10/22/15 10:32
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.25		0.201	0.226	1.00	0.0793	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.605		0.139	0.148	1.00	0.0485	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	1.10		0.186	0.208	1.00	0.0482	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.2		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample ID: IHS1L8-B2

Lab Sample ID: 160-14502-21
Date Collected: 10/22/15 10:33
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.688		0.141	0.152	1.00	0.0594	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-230	0.691		0.141	0.152	1.00	0.0572	pCi/g	10/30/15 13:17	11/11/15 10:56	1
Thorium-232	0.567		0.126	0.134	1.00	0.0336	pCi/g	10/30/15 13:17	11/11/15 10:56	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	10/30/15 13:17	11/11/15 10:56	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-B3

Lab Sample ID: 160-14502-22
Date Collected: 10/22/15 10:35
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.544		0.133	0.140	1.00	0.0782	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-230	0.537		0.130	0.137	1.00	0.0620	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-232	0.633		0.139	0.149	1.00	0.0465	pCi/g	10/30/15 13:17	11/11/15 10:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.2*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:57*	*1*

Client Sample ID: IHS1L8-C1

Lab Sample ID: 160-14502-23
Date Collected: 10/22/15 10:38
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.484		0.122	0.128	1.00	0.0626	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-230	0.525		0.126	0.134	1.00	0.0579	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-232	0.377		0.106	0.110	1.00	0.0410	pCi/g	10/30/15 13:17	11/11/15 10:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*98.4*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:57*	*1*

Client Sample ID: IHS1L8-C2

Lab Sample ID: 160-14502-24
Date Collected: 10/22/15 10:41
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.799		0.162	0.175	1.00	0.0743	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.766		0.157	0.170	1.00	0.0563	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.825		0.162	0.176	1.00	0.0487	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.1*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-C3

Lab Sample ID: 160-14502-25
Date Collected: 10/22/15 10:43
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.716		0.150	0.161	1.00	0.0783	pCi/g	10/30/15 13:17	11/12/15 16:21	1
Thorium-230	0.659		0.141	0.151	1.00	0.0495	pCi/g	10/30/15 13:17	11/12/15 16:21	1
Thorium-232	0.781		0.153	0.166	1.00	0.0492	pCi/g	10/30/15 13:17	11/12/15 16:21	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-C3
Date Collected: 10/22/15 10:43
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-25
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	103		30 - 110	10/30/15 13:17	11/12/15 16:21	1

Client Sample ID: IHS1L8-D1
Date Collected: 10/22/15 10:47
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-26
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.30		0.213	0.239	1.00	0.0772	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.849		0.171	0.186	1.00	0.0605	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.870		0.172	0.187	1.00	0.0410	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.3		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample ID: IHS1L8-D2
Date Collected: 10/22/15 10:50
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-27
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.544		0.131	0.139	1.00	0.0482	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.518		0.131	0.138	1.00	0.0747	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.461		0.120	0.126	1.00	0.0373	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.5		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample ID: IHS1L8-D3
Date Collected: 10/22/15 10:52
Date Received: 10/27/15 13:40

Lab Sample ID: 160-14502-28
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.823		0.165	0.179	1.00	0.0680	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.629		0.144	0.153	1.00	0.0601	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.801		0.160	0.174	1.00	0.0447	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.8		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-E1

Lab Sample ID: 160-14502-29
Date Collected: 10/22/15 10:54
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.806		0.163	0.176	1.00	0.0777	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.706		0.151	0.163	1.00	0.0670	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.692		0.150	0.161	1.00	0.0702	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.9*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-E2

Lab Sample ID: 160-14502-30
Date Collected: 10/22/15 10:56
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.534		0.127	0.135	1.00	0.0552	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.584		0.135	0.144	1.00	0.0745	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.507		0.123	0.130	1.00	0.0453	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*100*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-E3

Lab Sample ID: 160-14502-31
Date Collected: 10/22/15 10:59
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.615		0.140	0.149	1.00	0.0696	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.858		0.163	0.178	1.00	0.0511	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.701		0.147	0.158	1.00	0.0509	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.3*		*30 - 110*	*10/30/15 13:17*	*11/11/15 21:50*	*1*

Client Sample ID: IHS1L8-F2

Lab Sample ID: 160-14502-32
Date Collected: 10/22/15 11:03
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.771		0.159	0.172	1.00	0.0807	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-230	0.662		0.145	0.155	1.00	0.0520	pCi/g	10/30/15 13:17	11/11/15 21:50	1
Thorium-232	0.461		0.120	0.126	1.00	0.0434	pCi/g	10/30/15 13:17	11/11/15 21:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1L8-F2

Lab Sample ID: 160-14502-32
Date Collected: 10/22/15 11:03
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.8		30 - 110	10/30/15 13:17	11/11/15 21:50	1

Client Sample ID: IHS1EB-A0

Lab Sample ID: 160-14502-33
Date Collected: 10/23/15 09:48
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.537		0.137	0.144	1.00	0.0822	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-230	0.680		0.150	0.160	1.00	0.0578	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-232	0.636		0.145	0.154	1.00	0.0574	pCi/g	10/30/15 13:19	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.4		30 - 110	10/30/15 13:19	11/11/15 21:50	1

Client Sample ID: IHS1EB-A1

Lab Sample ID: 160-14502-34
Date Collected: 10/23/15 09:50
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.05		0.186	0.206	1.00	0.0806	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-230	0.700		0.151	0.162	1.00	0.0567	pCi/g	10/30/15 13:19	11/11/15 21:50	1
Thorium-232	0.871		0.166	0.182	1.00	0.0384	pCi/g	10/30/15 13:19	11/11/15 21:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	96.3		30 - 110	10/30/15 13:19	11/11/15 21:50	1

Client Sample ID: IHS1EB-A2

Lab Sample ID: 160-14502-35
Date Collected: 10/23/15 09:52
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.923		0.173	0.190	1.00	0.0879	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.927		0.171	0.188	1.00	0.0678	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.972		0.173	0.192	1.00	0.0511	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.7		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-A3

Lab Sample ID: 160-14502-36
Date Collected: 10/23/15 09:53
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.779		0.156	0.169	1.00	0.0777	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.684		0.144	0.155	1.00	0.0463	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.801		0.155	0.169	1.00	0.0418	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.9*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-B0

Lab Sample ID: 160-14502-37
Date Collected: 10/23/15 09:56
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.663		0.142	0.153	1.00	0.0627	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.595		0.133	0.142	1.00	0.0414	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.717		0.146	0.158	1.00	0.0412	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*102*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-B1

Lab Sample ID: 160-14502-38
Date Collected: 10/23/15 10:00
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.585		0.136	0.145	1.00	0.0582	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.532		0.129	0.137	1.00	0.0435	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.468		0.120	0.126	1.00	0.0232	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.3*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-B2

Lab Sample ID: 160-14502-39
Date Collected: 10/23/15 10:02
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.764		0.163	0.175	1.00	0.0933	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.624		0.143	0.153	1.00	0.0455	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.751		0.157	0.169	1.00	0.0455	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-B2

Lab Sample ID: 160-14502-39
Date Collected: 10/23/15 10:02
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.1		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-B3

Lab Sample ID: 160-14502-40
Date Collected: 10/23/15 10:03
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.743		0.158	0.169	1.00	0.0771	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.763		0.158	0.171	1.00	0.0630	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.753		0.156	0.169	1.00	0.0598	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.9		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-C0

Lab Sample ID: 160-14502-41
Date Collected: 10/23/15 10:07
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.612		0.141	0.150	1.00	0.0761	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.444		0.118	0.123	1.00	0.0433	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.439		0.117	0.123	1.00	0.0474	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.8		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-C1

Lab Sample ID: 160-14502-42
Date Collected: 10/23/15 10:09
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.791		0.160	0.173	1.00	0.0751	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.704		0.150	0.161	1.00	0.0584	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	1.22		0.195	0.220	1.00	0.0474	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.4		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-C2

Lab Sample ID: 160-14502-43
Date Collected: 10/23/15 10:10
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.712		0.154	0.166	1.00	0.0732	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.718		0.154	0.166	1.00	0.0662	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.560		0.137	0.145	1.00	0.0684	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.8*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-C3

Lab Sample ID: 160-14502-44
Date Collected: 10/23/15 10:12
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.710		0.146	0.158	1.00	0.0578	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.731		0.147	0.159	1.00	0.0222	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.647		0.138	0.148	1.00	0.0220	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.6*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-D0

Lab Sample ID: 160-14502-45
Date Collected: 10/23/15 10:14
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.781		0.157	0.170	1.00	0.0672	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.615		0.137	0.147	1.00	0.0369	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.857		0.162	0.177	1.00	0.0425	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*98.2*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:52*	*1*

Client Sample ID: IHS1EB-D1

Lab Sample ID: 160-14502-46
Date Collected: 10/23/15 10:17
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.788		0.163	0.176	1.00	0.0812	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-230	0.757		0.157	0.169	1.00	0.0496	pCi/g	10/30/15 15:00	11/11/15 21:52	1
Thorium-232	0.689		0.149	0.160	1.00	0.0494	pCi/g	10/30/15 15:00	11/11/15 21:52	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-D1

Lab Sample ID: 160-14502-46
Date Collected: 10/23/15 10:17
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110	10/30/15 15:00	11/11/15 21:52	1

Client Sample ID: IHS1EB-D2

Lab Sample ID: 160-14502-47
Date Collected: 10/23/15 10:19
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	2.24		0.261	0.322	1.00	0.0687	pCi/g	10/30/15 15:00	11/12/15 16:23	1
Thorium-230	0.830		0.159	0.173	1.00	0.0466	pCi/g	10/30/15 15:00	11/12/15 16:23	1
Thorium-232	2.33		0.264	0.329	1.00	0.0225	pCi/g	10/30/15 15:00	11/12/15 16:23	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	99.2		30 - 110	10/30/15 15:00	11/12/15 16:23	1

Client Sample ID: IHS1EB-D3

Lab Sample ID: 160-14502-48
Date Collected: 10/23/15 10:20
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.767		0.164	0.176	1.00	0.0643	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.692		0.154	0.165	1.00	0.0257	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.725		0.157	0.169	1.00	0.0256	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.6		30 - 110	10/30/15 15:00	11/11/15 21:53	1

Client Sample ID: IHS1EB-E0

Lab Sample ID: 160-14502-49
Date Collected: 10/23/15 10:22
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.29		0.197	0.225	1.00	0.0728	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.575		0.131	0.140	1.00	0.0482	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	1.00		0.172	0.191	1.00	0.0390	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.2		30 - 110	10/30/15 15:00	11/11/15 21:53	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-E1

Lab Sample ID: 160-14502-50
Date Collected: 10/23/15 10:24
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.811		0.167	0.180	1.00	0.0631	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.715		0.156	0.167	1.00	0.0562	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.694		0.152	0.163	1.00	0.0351	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.3*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:53*	*1*

Client Sample ID: IHS1EB-E2

Lab Sample ID: 160-14502-51
Date Collected: 10/23/15 10:26
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.561		0.136	0.144	1.00	0.0816	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.756		0.154	0.166	1.00	0.0515	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.597		0.136	0.145	1.00	0.0372	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.9*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:53*	*1*

Client Sample ID: IHS1EB-E3

Lab Sample ID: 160-14502-52
Date Collected: 10/23/15 10:28
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.744		0.156	0.168	1.00	0.0823	pCi/g	10/30/15 15:00	11/11/15 21:51	1
Thorium-230	0.669		0.145	0.156	1.00	0.0519	pCi/g	10/30/15 15:00	11/11/15 21:51	1
Thorium-232	0.724		0.150	0.162	1.00	0.0433	pCi/g	10/30/15 15:00	11/11/15 21:51	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.1*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:51*	*1*

Client Sample ID: IHS1EB-F0

Lab Sample ID: 160-14502-53
Date Collected: 10/23/15 10:30
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.658		0.144	0.154	1.00	0.0809	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-230	0.733		0.148	0.161	1.00	0.0553	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-232	0.723		0.146	0.159	1.00	0.0474	pCi/g	11/03/15 10:56	11/11/15 21:54	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Client Sample ID: IHS1EB-F0

Lab Sample ID: 160-14502-53
Date Collected: 10/23/15 10:30
Matrix: Solid
Date Received: 10/27/15 13:40

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	104		30 - 110	11/03/15 10:56	11/11/15 21:54	1

Client Sample ID: IHS1EB-F1

Lab Sample ID: 160-14502-54
Date Collected: 10/23/15 10:32
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.701		0.154	0.165	1.00	0.0696	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-230	0.822		0.164	0.178	1.00	0.0458	pCi/g	11/03/15 10:56	11/11/15 21:54	1
Thorium-232	0.688		0.150	0.161	1.00	0.0456	pCi/g	11/03/15 10:56	11/11/15 21:54	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.9		30 - 110	11/03/15 10:56	11/11/15 21:54	1

Client Sample ID: IHS1EB-F2

Lab Sample ID: 160-14502-55
Date Collected: 10/23/15 10:34
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.347		0.104	0.108	1.00	0.0476	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-230	0.542		0.133	0.140	1.00	0.0738	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-232	0.349		0.104	0.108	1.00	0.0369	pCi/g	11/03/15 10:56	11/12/15 16:20	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.7		30 - 110	11/03/15 10:56	11/12/15 16:20	1

Client Sample ID: IHS1EB-F3

Lab Sample ID: 160-14502-56
Date Collected: 10/23/15 10:40
Matrix: Solid
Date Received: 10/27/15 13:40

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.549		0.131	0.139	1.00	0.0641	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-230	0.493		0.124	0.131	1.00	0.0594	pCi/g	11/03/15 10:56	11/12/15 16:20	1
Thorium-232	0.613		0.136	0.146	1.00	0.0421	pCi/g	11/03/15 10:56	11/12/15 16:20	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	11/03/15 10:56	11/12/15 16:20	1

QC Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-219235/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221399 — **Prep Batch: 219235**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.004228	U	0.0179	0.0179	1.00	0.0474	pCi/g	10/30/15 10:05	11/11/15 10:48	1
Thorium-230	0.05447		0.0450	0.0452	1.00	0.0474	pCi/g	10/30/15 10:05	11/11/15 10:48	1
Thorium-232	-0.001210	U	0.00319	0.00319	1.00	0.0370	pCi/g	10/30/15 10:05	11/11/15 10:48	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.4*		*30 - 110*	*10/30/15 10:05*	*11/11/15 10:48*	*1*

Lab Sample ID: LCS 160-219235/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221400 — **Prep Batch: 219235**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.55		2.50	1.00	0.0482	pCi/g	104	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*94.2*		*30 - 110*

Lab Sample ID: 160-14502-9 MS — **Client Sample ID: IHS1L7-C2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221444 — **Prep Batch: 219235**

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.687		3.98	4.870		0.574	1.00	0.0553	pCi/g	105	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*86.2*		*30 - 110*

Lab Sample ID: 160-14502-9 MSD — **Client Sample ID: IHS1L7-C2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 221486 — **Prep Batch: 219235**

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.687		3.98	5.023		0.586	1.00	0.0546	pCi/g	109	76 - 115	0.13	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*87.1*		*30 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14502-14 MS
Matrix: Solid
Analysis Batch: 221453

Client Sample ID: IHS1L7-E1
Prep Type: Total/NA
Prep Batch: 219235

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.798		4.01	4.714		0.557	1.00	0.0456	pCi/g	98	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*87.3*		*30 - 110*

Lab Sample ID: 160-14502-14 MSD
Matrix: Solid
Analysis Batch: 221454

Client Sample ID: IHS1L7-E1
Prep Type: Total/NA
Prep Batch: 219235

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.798		3.98	5.082		0.574	1.00	0.0593	pCi/g	108	76 - 115	0.33	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*99.3*		*30 - 110*

Lab Sample ID: MB 160-219364/1-A
Matrix: Solid
Analysis Batch: 221397

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 219364

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.02489	U	0.0347	0.0348	1.00	0.0566	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-230	0.07423		0.0511	0.0515	1.00	0.0411	pCi/g	10/30/15 13:17	11/11/15 10:57	1
Thorium-232	0.007228	U	0.0172	0.0172	1.00	0.0371	pCi/g	10/30/15 13:17	11/11/15 10:57	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*87.2*		*30 - 110*	*10/30/15 13:17*	*11/11/15 10:57*	*1*

Lab Sample ID: LCS 160-219364/2-A
Matrix: Solid
Analysis Batch: 221398

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 219364

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.01		2.44	1.00	0.0740	pCi/g	102	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*98.5*		*30 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14502-26 MS
Matrix: Solid
Analysis Batch: 221437

Client Sample ID: IHS1L8-D1
Prep Type: Total/NA
Prep Batch: 219364

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.849		3.99	5.142		0.592	1.00	0.0240	pCi/g	108	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*89.4*		*30 - 110*

Lab Sample ID: 160-14502-26 MSD
Matrix: Solid
Analysis Batch: 221438

Client Sample ID: IHS1L8-D1
Prep Type: Total/NA
Prep Batch: 219364

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.849		3.99	4.748		0.548	1.00	0.0497	pCi/g	98	76 - 115	0.35	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*102*		*30 - 110*

Lab Sample ID: MB 160-219392/1-A
Matrix: Solid
Analysis Batch: 221403

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 219392

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.0002712	U	0.00152	0.00152	1.00	0.0310	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-230	0.1295		0.0683	0.0692	1.00	0.0525	pCi/g	10/30/15 15:00	11/11/15 21:53	1
Thorium-232	0.006335	U	0.0174	0.0174	1.00	0.0409	pCi/g	10/30/15 15:00	11/11/15 21:53	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*81.6*		*30 - 110*	*10/30/15 15:00*	*11/11/15 21:53*	*1*

Lab Sample ID: LCS 160-219392/2-A
Matrix: Solid
Analysis Batch: 221404

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 219392

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.81		2.52	1.00	0.105	pCi/g	105	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*95.2*		*30 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14502-47 MS
Matrix: Solid
Analysis Batch: 221765

Client Sample ID: IHS1EB-D2
Prep Type: Total/NA
Prep Batch: 219392

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.830		4.00	4.423		0.523	1.00	0.0543	pCi/g	90	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*98.4*		*30 - 110*

Lab Sample ID: 160-14502-47 MSD
Matrix: Solid
Analysis Batch: 221766

Client Sample ID: IHS1EB-D2
Prep Type: Total/NA
Prep Batch: 219392

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.830		3.98	5.040		0.584	1.00	0.0241	pCi/g	106	76 - 115	0.56	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*88.8*		*30 - 110*

Lab Sample ID: MB 160-219803/1-A
Matrix: Solid
Analysis Batch: 221400

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 219803

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.008109	U	0.0243	0.0243	1.00	0.0542	pCi/g	11/03/15 10:56	11/11/15 21:55	1
Thorium-230	0.07302		0.0487	0.0491	1.00	0.0243	pCi/g	11/03/15 10:56	11/11/15 21:55	1
Thorium-232	0.0000	U	0.00404	0.00404	1.00	0.0242	pCi/g	11/03/15 10:56	11/11/15 21:55	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.8*		*30 - 110*	*11/03/15 10:56*	*11/11/15 21:55*	*1*

Lab Sample ID: LCS 160-219803/2-A
Matrix: Solid
Analysis Batch: 221401

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 219803

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	26.47		2.58	1.00	0.0904	pCi/g	108	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*88.9*		*30 - 110*

QC Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: 160-14374-A-1-H DU
Matrix: Solid
Analysis Batch: 221473

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 219803

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	1.81			1.845		0.295	1.00	0.0844	pCi/g			0.05	1
Thorium-230	1.33			1.492		0.256	1.00	0.0404	pCi/g			0.32	1
Thorium-232	1.50			1.744		0.282	1.00	0.0249	pCi/g			0.46	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*86.5*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Rad

Leach Batch: 218756

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-1	IHS1L7-A0	Total/NA	Solid	Dry and Grind	
160-14502-2	IHS1L7-A1	Total/NA	Solid	Dry and Grind	
160-14502-3	IHS1L7-A2	Total/NA	Solid	Dry and Grind	
160-14502-4	IHS1L7-A3	Total/NA	Solid	Dry and Grind	
160-14502-5	IHS1L7-B1	Total/NA	Solid	Dry and Grind	
160-14502-6	IHS1L7-B2	Total/NA	Solid	Dry and Grind	
160-14502-7	IHS1L7-B3	Total/NA	Solid	Dry and Grind	
160-14502-8	IHS1L7-C1	Total/NA	Solid	Dry and Grind	
160-14502-9	IHS1L7-C2	Total/NA	Solid	Dry and Grind	
160-14502-9 MS	IHS1L7-C2	Total/NA	Solid	Dry and Grind	
160-14502-9 MSD	IHS1L7-C2	Total/NA	Solid	Dry and Grind	
160-14502-10	IHS1L7-C3	Total/NA	Solid	Dry and Grind	
160-14502-11	IHS1L7-D1	Total/NA	Solid	Dry and Grind	
160-14502-12	IHS1L7-D2	Total/NA	Solid	Dry and Grind	
160-14502-13	IHS1L7-D3	Total/NA	Solid	Dry and Grind	
160-14502-14	IHS1L7-E1	Total/NA	Solid	Dry and Grind	
160-14502-14 MS	IHS1L7-E1	Total/NA	Solid	Dry and Grind	
160-14502-14 MSD	IHS1L7-E1	Total/NA	Solid	Dry and Grind	
160-14502-15	IHS1L7-E2	Total/NA	Solid	Dry and Grind	
160-14502-16	IHS1L7-E3	Total/NA	Solid	Dry and Grind	
160-14502-17	IHS1L8-A1	Total/NA	Solid	Dry and Grind	
160-14502-18	IHS1L8-A2	Total/NA	Solid	Dry and Grind	
160-14502-19	IHS1L8-A3	Total/NA	Solid	Dry and Grind	
160-14502-20	IHS1L8-B1	Total/NA	Solid	Dry and Grind	
160-14502-21	IHS1L8-B2	Total/NA	Solid	Dry and Grind	
160-14502-22	IHS1L8-B3	Total/NA	Solid	Dry and Grind	
160-14502-23	IHS1L8-C1	Total/NA	Solid	Dry and Grind	
160-14502-24	IHS1L8-C2	Total/NA	Solid	Dry and Grind	
160-14502-25	IHS1L8-C3	Total/NA	Solid	Dry and Grind	
160-14502-26	IHS1L8-D1	Total/NA	Solid	Dry and Grind	
160-14502-26 MS	IHS1L8-D1	Total/NA	Solid	Dry and Grind	
160-14502-26 MSD	IHS1L8-D1	Total/NA	Solid	Dry and Grind	
160-14502-27	IHS1L8-D2	Total/NA	Solid	Dry and Grind	
160-14502-28	IHS1L8-D3	Total/NA	Solid	Dry and Grind	
160-14502-29	IHS1L8-E1	Total/NA	Solid	Dry and Grind	
160-14502-30	IHS1L8-E2	Total/NA	Solid	Dry and Grind	
160-14502-31	IHS1L8-E3	Total/NA	Solid	Dry and Grind	
160-14502-32	IHS1L8-F2	Total/NA	Solid	Dry and Grind	
160-14502-33	IHS1EB-A0	Total/NA	Solid	Dry and Grind	
160-14502-34	IHS1EB-A1	Total/NA	Solid	Dry and Grind	
160-14502-35	IHS1EB-A2	Total/NA	Solid	Dry and Grind	
160-14502-36	IHS1EB-A3	Total/NA	Solid	Dry and Grind	
160-14502-37	IHS1EB-B0	Total/NA	Solid	Dry and Grind	
160-14502-38	IHS1EB-B1	Total/NA	Solid	Dry and Grind	
160-14502-39	IHS1EB-B2	Total/NA	Solid	Dry and Grind	
160-14502-40	IHS1EB-B3	Total/NA	Solid	Dry and Grind	
160-14502-41	IHS1EB-C0	Total/NA	Solid	Dry and Grind	
160-14502-42	IHS1EB-C1	Total/NA	Solid	Dry and Grind	
160-14502-43	IHS1EB-C2	Total/NA	Solid	Dry and Grind	
160-14502-44	IHS1EB-C3	Total/NA	Solid	Dry and Grind	
160-14502-45	IHS1EB-D0	Total/NA	Solid	Dry and Grind	

Rad (Continued)

Leach Batch: 218756 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-46	IHS1EB-D1	Total/NA	Solid	Dry and Grind	
160-14502-47	IHS1EB-D2	Total/NA	Solid	Dry and Grind	
160-14502-47 MS	IHS1EB-D2	Total/NA	Solid	Dry and Grind	
160-14502-47 MSD	IHS1EB-D2	Total/NA	Solid	Dry and Grind	
160-14502-48	IHS1EB-D3	Total/NA	Solid	Dry and Grind	
160-14502-49	IHS1EB-E0	Total/NA	Solid	Dry and Grind	
160-14502-50	IHS1EB-E1	Total/NA	Solid	Dry and Grind	
160-14502-51	IHS1EB-E2	Total/NA	Solid	Dry and Grind	
160-14502-52	IHS1EB-E3	Total/NA	Solid	Dry and Grind	
160-14502-53	IHS1EB-F0	Total/NA	Solid	Dry and Grind	
160-14502-54	IHS1EB-F1	Total/NA	Solid	Dry and Grind	
160-14502-55	IHS1EB-F2	Total/NA	Solid	Dry and Grind	
160-14502-56	IHS1EB-F3	Total/NA	Solid	Dry and Grind	

Prep Batch: 219235

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-1	IHS1L7-A0	Total/NA	Solid	ExtChrom	218756
160-14502-2	IHS1L7-A1	Total/NA	Solid	ExtChrom	218756
160-14502-3	IHS1L7-A2	Total/NA	Solid	ExtChrom	218756
160-14502-4	IHS1L7-A3	Total/NA	Solid	ExtChrom	218756
160-14502-5	IHS1L7-B1	Total/NA	Solid	ExtChrom	218756
160-14502-6	IHS1L7-B2	Total/NA	Solid	ExtChrom	218756
160-14502-7	IHS1L7-B3	Total/NA	Solid	ExtChrom	218756
160-14502-8	IHS1L7-C1	Total/NA	Solid	ExtChrom	218756
160-14502-9	IHS1L7-C2	Total/NA	Solid	ExtChrom	218756
160-14502-9 MS	IHS1L7-C2	Total/NA	Solid	ExtChrom	218756
160-14502-9 MSD	IHS1L7-C2	Total/NA	Solid	ExtChrom	218756
160-14502-10	IHS1L7-C3	Total/NA	Solid	ExtChrom	218756
160-14502-11	IHS1L7-D1	Total/NA	Solid	ExtChrom	218756
160-14502-12	IHS1L7-D2	Total/NA	Solid	ExtChrom	218756
160-14502-13	IHS1L7-D3	Total/NA	Solid	ExtChrom	218756
160-14502-14	IHS1L7-E1	Total/NA	Solid	ExtChrom	218756
160-14502-14 MS	IHS1L7-E1	Total/NA	Solid	ExtChrom	218756
160-14502-14 MSD	IHS1L7-E1	Total/NA	Solid	ExtChrom	218756
160-14502-15	IHS1L7-E2	Total/NA	Solid	ExtChrom	218756
160-14502-16	IHS1L7-E3	Total/NA	Solid	ExtChrom	218756
LCS 160-219235/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219235/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 219364

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-17	IHS1L8-A1	Total/NA	Solid	ExtChrom	218756
160-14502-18	IHS1L8-A2	Total/NA	Solid	ExtChrom	218756
160-14502-19	IHS1L8-A3	Total/NA	Solid	ExtChrom	218756
160-14502-20	IHS1L8-B1	Total/NA	Solid	ExtChrom	218756
160-14502-21	IHS1L8-B2	Total/NA	Solid	ExtChrom	218756
160-14502-22	IHS1L8-B3	Total/NA	Solid	ExtChrom	218756
160-14502-23	IHS1L8-C1	Total/NA	Solid	ExtChrom	218756
160-14502-24	IHS1L8-C2	Total/NA	Solid	ExtChrom	218756
160-14502-25	IHS1L8-C3	Total/NA	Solid	ExtChrom	218756
160-14502-26	IHS1L8-D1	Total/NA	Solid	ExtChrom	218756

Rad (Continued)

Prep Batch: 219364 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-26 MS	IHS1L8-D1	Total/NA	Solid	ExtChrom	218756
160-14502-26 MSD	IHS1L8-D1	Total/NA	Solid	ExtChrom	218756
160-14502-27	IHS1L8-D2	Total/NA	Solid	ExtChrom	218756
160-14502-28	IHS1L8-D3	Total/NA	Solid	ExtChrom	218756
160-14502-29	IHS1L8-E1	Total/NA	Solid	ExtChrom	218756
160-14502-30	IHS1L8-E2	Total/NA	Solid	ExtChrom	218756
160-14502-31	IHS1L8-E3	Total/NA	Solid	ExtChrom	218756
160-14502-32	IHS1L8-F2	Total/NA	Solid	ExtChrom	218756
160-14502-33	IHS1EB-A0	Total/NA	Solid	ExtChrom	218756
160-14502-34	IHS1EB-A1	Total/NA	Solid	ExtChrom	218756
LCS 160-219364/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219364/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 219392

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14502-35	IHS1EB-A2	Total/NA	Solid	ExtChrom	218756
160-14502-36	IHS1EB-A3	Total/NA	Solid	ExtChrom	218756
160-14502-37	IHS1EB-B0	Total/NA	Solid	ExtChrom	218756
160-14502-38	IHS1EB-B1	Total/NA	Solid	ExtChrom	218756
160-14502-39	IHS1EB-B2	Total/NA	Solid	ExtChrom	218756
160-14502-40	IHS1EB-B3	Total/NA	Solid	ExtChrom	218756
160-14502-41	IHS1EB-C0	Total/NA	Solid	ExtChrom	218756
160-14502-42	IHS1EB-C1	Total/NA	Solid	ExtChrom	218756
160-14502-43	IHS1EB-C2	Total/NA	Solid	ExtChrom	218756
160-14502-44	IHS1EB-C3	Total/NA	Solid	ExtChrom	218756
160-14502-45	IHS1EB-D0	Total/NA	Solid	ExtChrom	218756
160-14502-46	IHS1EB-D1	Total/NA	Solid	ExtChrom	218756
160-14502-47	IHS1EB-D2	Total/NA	Solid	ExtChrom	218756
160-14502-47 MS	IHS1EB-D2	Total/NA	Solid	ExtChrom	218756
160-14502-47 MSD	IHS1EB-D2	Total/NA	Solid	ExtChrom	218756
160-14502-48	IHS1EB-D3	Total/NA	Solid	ExtChrom	218756
160-14502-49	IHS1EB-E0	Total/NA	Solid	ExtChrom	218756
160-14502-50	IHS1EB-E1	Total/NA	Solid	ExtChrom	218756
160-14502-51	IHS1EB-E2	Total/NA	Solid	ExtChrom	218756
160-14502-52	IHS1EB-E3	Total/NA	Solid	ExtChrom	218756
LCS 160-219392/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219392/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 219803

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14374-A-1-H DU	Duplicate	Total/NA	Solid	ExtChrom	
160-14502-53	IHS1EB-F0	Total/NA	Solid	ExtChrom	218756
160-14502-54	IHS1EB-F1	Total/NA	Solid	ExtChrom	218756
160-14502-55	IHS1EB-F2	Total/NA	Solid	ExtChrom	218756
160-14502-56	IHS1EB-F3	Total/NA	Solid	ExtChrom	218756
LCS 160-219803/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-219803/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	Client Sample ID	Th-229 (30-110)						
160-14374-A-1-H DU	Duplicate	86.5						
160-14502-1	IHS1L7-A0	92.1						
160-14502-2	IHS1L7-A1	97.7						
160-14502-3	IHS1L7-A2	88.8						
160-14502-4	IHS1L7-A3	97.5						
160-14502-5	IHS1L7-B1	101						
160-14502-6	IHS1L7-B2	97.9						
160-14502-7	IHS1L7-B3	101						
160-14502-8	IHS1L7-C1	97.3						
160-14502-9	IHS1L7-C2	93.7						
160-14502-9 MS	IHS1L7-C2	86.2						
160-14502-9 MSD	IHS1L7-C2	87.1						
160-14502-10	IHS1L7-C3	102						
160-14502-11	IHS1L7-D1	98.3						
160-14502-12	IHS1L7-D2	96.3						
160-14502-13	IHS1L7-D3	103						
160-14502-14	IHS1L7-E1	88.0						
160-14502-14 MS	IHS1L7-E1	87.3						
160-14502-14 MSD	IHS1L7-E1	99.3						
160-14502-15	IHS1L7-E2	110						
160-14502-16	IHS1L7-E3	93.9						
160-14502-17	IHS1L8-A1	88.8						
160-14502-18	IHS1L8-A2	89.0						
160-14502-19	IHS1L8-A3	94.0						
160-14502-20	IHS1L8-B1	90.2						
160-14502-21	IHS1L8-B2	101						
160-14502-22	IHS1L8-B3	96.2						
160-14502-23	IHS1L8-C1	98.4						
160-14502-24	IHS1L8-C2	90.1						
160-14502-25	IHS1L8-C3	103						
160-14502-26	IHS1L8-D1	88.3						
160-14502-26 MS	IHS1L8-D1	89.4						
160-14502-26 MSD	IHS1L8-D1	102						
160-14502-27	IHS1L8-D2	92.5						
160-14502-28	IHS1L8-D3	94.8						
160-14502-29	IHS1L8-E1	94.9						
160-14502-30	IHS1L8-E2	100						
160-14502-31	IHS1L8-E3	96.3						
160-14502-32	IHS1L8-F2	91.8						
160-14502-33	IHS1EB-A0	89.4						
160-14502-34	IHS1EB-A1	96.3						
160-14502-35	IHS1EB-A2	91.7						
160-14502-36	IHS1EB-A3	95.9						
160-14502-37	IHS1EB-B0	102						
160-14502-38	IHS1EB-B1	90.3						
160-14502-39	IHS1EB-B2	87.1						
160-14502-40	IHS1EB-B3	89.9						
160-14502-41	IHS1EB-C0	97.8						
160-14502-42	IHS1EB-C1	93.4						

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14502-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	**Client Sample ID**	**Th-229 (30-110)**						
160-14502-43	IHS1EB-C2	86.8						
160-14502-44	IHS1EB-C3	96.6						
160-14502-45	IHS1EB-D0	98.2						
160-14502-46	IHS1EB-D1	88.0						
160-14502-47	IHS1EB-D2	99.2						
160-14502-47 MS	IHS1EB-D2	98.4						
160-14502-47 MSD	IHS1EB-D2	88.8						
160-14502-48	IHS1EB-D3	83.6						
160-14502-49	IHS1EB-E0	97.2						
160-14502-50	IHS1EB-E1	92.3						
160-14502-51	IHS1EB-E2	96.9						
160-14502-52	IHS1EB-E3	96.1						
160-14502-53	IHS1EB-F0	104						
160-14502-54	IHS1EB-F1	90.9						
160-14502-55	IHS1EB-F2	93.7						
160-14502-56	IHS1EB-F3	101						
LCS 160-219235/2-A	Lab Control Sample	94.2						
LCS 160-219364/2-A	Lab Control Sample	98.5						
LCS 160-219392/2-A	Lab Control Sample	95.2						
LCS 160-219803/2-A	Lab Control Sample	88.9						
MB 160-219235/1-A	Method Blank	89.4						
MB 160-219364/1-A	Method Blank	87.2						
MB 160-219392/1-A	Method Blank	81.6						
MB 160-219803/1-A	Method Blank	93.8						

Tracer/Carrier Legend

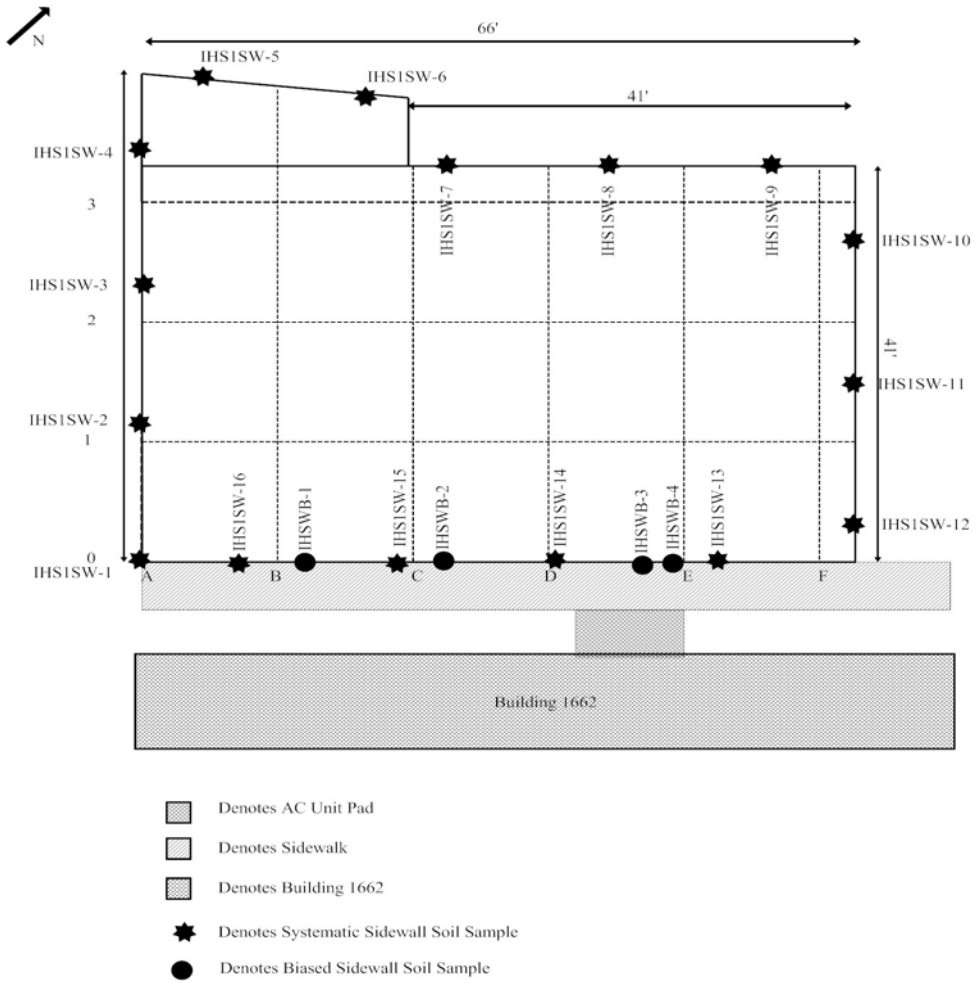
Th-229 = Thorium-229

Appendix Q

Excavation Sidewalls Survey Report

DATE:	TIME:	INSTRUMENTATION USED						
10/26/2015	15:55	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER:	NSFIH-032							
LOCATION:	NSF Indian Head Site 1							
SURVEYOR:	William Wylie							
DATE: 10/26/2015	TIME: 16:00 / Reviewed by: Daniel Spicuzza	2350-1 44-10	120588 318218	6/19/2016				5327 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey of Excavation Sidewalls



Comments:

The sidewalls were was 100% gamma scan surveyed.

Action Level: 7,110 cpm.

Results were between 5K and 7.5K cpm.

#	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000 cpm

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

Rev 2 03/13/2006

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-032

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								
N/A								
N/A								

Reviewer	Date: 10/26/2015
Daniel Spicuzza	Time: 16:00

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Appendix R

Excavation Sidewalls Samples Laboratory Data Report

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-14561-1
Client Project/Site: NSF Indian Head Site 1

For:
Aleut World Solutions
615 E. 82nd Ave.
Suite 200
Anchorage, Alaska 99518

Attn: Daniel Spicuzza

Authorized for release by:
11/19/2015 4:59:59 PM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Tracer Carrier Summary 19

Job ID: 160-14561-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: NSF Indian Head Site 1

Report Number: 160-14561-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-14561-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 10/29/2015 1:15 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.0º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHSWB-1 (160-14561-1), IHSWB-2 (160-14561-2), IHSWB-3 (160-14561-3), IHSWB-4 (160-14561-4), IHS1SW-1 (160-14561-5), IHS1SW-2 (160-14561-6), IHS1SW-3 (160-14561-7), IHS1SW-4 (160-14561-8), IHS1SW-5 (160-14561-9), IHS1SW-6 (160-14561-10), IHS1SW-7 (160-14561-11), IHS1SW-8 (160-14561-12), IHS1SW-9 (160-14561-13), IHS1SW-10 (160-14561-14), IHS1SW-11 (160-14561-15), IHS1SW-12 (160-14561-16), IHS1SW-13 (160-14561-17), IHS1SW-14 (160-14561-18), IHS1SW-15 (160-14561-19) and IHS1SW-16 (160-14561-20) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 10/30/2015, prepared on 11/05/2015 and analyzed on 11/12/2015 and 11/13/2015.

The following samples could not be thoroughly homogenized before sub-sampling was performed due to sample matrix: IHSWB-1 (160-14561-1), IHSWB-2 (160-14561-2), IHSWB-3 (160-14561-3), IHSWB-4 (160-14561-4), IHS1SW-1 (160-14561-5), IHS1SW-2 (160-14561-6), IHS1SW-3 (160-14561-7), IHS1SW-4 (160-14561-8), IHS1SW-5 (160-14561-9), IHS1SW-6 (160-14561-10), IHS1SW-7 (160-14561-11), IHS1SW-8 (160-14561-12), IHS1SW-9 (160-14561-13), IHS1SW-10 (160-14561-14), IHS1SW-11 (160-14561-15), IHS1SW-12 (160-14561-16), IHS1SW-13 (160-14561-17), IHS1SW-14 (160-14561-18), IHS1SW-15 (160-14561-19), IHS1SW-16 (160-14561-20) and (160-14561-A-1-A DU). The samples contain rocks.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 10/28/15	COC No: NSFIH-2015-10
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 1 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.: USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHSWB- 1	10/26/2015	1326	G	Soil	1	N	N	X	5 Day TAT
IHSWB- 2	10/26/2015	1340	G	Soil	1	N	N	X	5 Day TAT
IHSWB- 3	10/26/2015	1520	G	Soil	1	N	N	X	5 Day TAT
IHSWB- 4	10/26/2015	1526	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 1	10/27/2015	0748	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 2	10/27/2015	0750	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 3	10/27/2015	0753	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 4	10/27/2015	0755	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 5	10/27/2015	0757	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 6	10/27/2015	0800	G	Soil	1	N	Y	X	5 Day TAT
IHS1SW- 7	10/27/2015	0802	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 8	10/27/2015	0805	G	Soil	1	N	N	X	5 Day TAT

160-14561 Chain of Custody

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company: AWS	Date/Time: 10/27/15 1600	Received by:	Company: TA STL	Date/Time: 10-29-15 1315
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time: 10/29/15
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:10/26/15	COC No: NSFIH-2015-11
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7468	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 1 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 5			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1SW- 9	10/27/2015	0807	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 10	10/27/2015	0810	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 11	10/27/2015	0811	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 12	10/27/2015	0813	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 13	10/27/2015	0815	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 14	10/27/2015	0818	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 15	10/27/2015	0822	G	Soil	1	N	N	X	5 Day TAT
IHS1SW- 16	10/27/2015	0826	G	Soil	1	N	N	X	5 Day TAT

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 10/27/15 1600	Received by:	Company: TA STL	Date/Time: 10-29-15 1315
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-14561-1

Login Number: 14561
List Number: 1
Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-14561-1	IHSWB-1	Solid	10/26/15 13:26	10/29/15 13:15
160-14561-2	IHSWB-2	Solid	10/26/15 13:40	10/29/15 13:15
160-14561-3	IHSWB-3	Solid	10/26/15 15:20	10/29/15 13:15
160-14561-4	IHSWB-4	Solid	10/26/15 15:26	10/29/15 13:15
160-14561-5	IHS1SW-1	Solid	10/27/15 07:48	10/29/15 13:15
160-14561-6	IHS1SW-2	Solid	10/27/15 07:50	10/29/15 13:15
160-14561-7	IHS1SW-3	Solid	10/27/15 07:53	10/29/15 13:15
160-14561-8	IHS1SW-4	Solid	10/27/15 07:55	10/29/15 13:15
160-14561-9	IHS1SW-5	Solid	10/27/15 07:57	10/29/15 13:15
160-14561-10	IHS1SW-6	Solid	10/27/15 08:00	10/29/15 13:15
160-14561-11	IHS1SW-7	Solid	10/27/15 08:02	10/29/15 13:15
160-14561-12	IHS1SW-8	Solid	10/27/15 08:05	10/29/15 13:15
160-14561-13	IHS1SW-9	Solid	10/27/15 08:07	10/29/15 13:15
160-14561-14	IHS1SW-10	Solid	10/27/15 08:10	10/29/15 13:15
160-14561-15	IHS1SW-11	Solid	10/27/15 08:11	10/29/15 13:15
160-14561-16	IHS1SW-12	Solid	10/27/15 08:13	10/29/15 13:15
160-14561-17	IHS1SW-13	Solid	10/27/15 08:15	10/29/15 13:15
160-14561-18	IHS1SW-14	Solid	10/27/15 08:16	10/29/15 13:15
160-14561-19	IHS1SW-15	Solid	10/27/15 08:22	10/29/15 13:15
160-14561-20	IHS1SW-16	Solid	10/27/15 08:26	10/29/15 13:15

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Client Sample ID: IHSWB-1

Lab Sample ID: 160-14561-1
Date Collected: 10/26/15 13:26
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.657		0.145	0.155	1.00	0.0583	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	0.671		0.148	0.159	1.00	0.0787	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	0.575		0.134	0.143	1.00	0.0479	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.7*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHSWB-2

Lab Sample ID: 160-14561-2
Date Collected: 10/26/15 13:40
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.550		0.140	0.148	1.00	0.0863	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	0.609		0.144	0.153	1.00	0.0557	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	0.826		0.166	0.180	1.00	0.0465	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.1*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHSWB-3

Lab Sample ID: 160-14561-3
Date Collected: 10/26/15 15:20
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.565		0.138	0.146	1.00	0.0805	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	0.734		0.154	0.166	1.00	0.0596	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	0.618		0.141	0.150	1.00	0.0562	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.6*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHSWB-4

Lab Sample ID: 160-14561-4
Date Collected: 10/26/15 15:26
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.666		0.149	0.159	1.00	0.0800	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	0.544		0.133	0.140	1.00	0.0563	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	0.580		0.135	0.144	1.00	0.0381	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Client Sample ID: IHSWB-4
Date Collected: 10/26/15 15:26
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-4
Matrix: Solid

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.1*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHS1SW-1
Date Collected: 10/27/15 07:48
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-5
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	**0.693**		0.154	0.165	1.00	0.0913	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	**0.740**		0.156	0.168	1.00	0.0705	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	**0.748**		0.155	0.168	1.00	0.0531	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.4*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHS1SW-2
Date Collected: 10/27/15 07:50
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-6
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	**0.886**		0.174	0.189	1.00	0.0808	pCi/g	11/05/15 10:01	11/13/15 14:57	1
Thorium-230	**0.834**		0.166	0.180	1.00	0.0546	pCi/g	11/05/15 10:01	11/13/15 14:57	1
Thorium-232	**0.827**		0.164	0.179	1.00	0.0432	pCi/g	11/05/15 10:01	11/13/15 14:57	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*87.6*		*30 - 110*	*11/05/15 10:01*	*11/13/15 14:57*	*1*

Client Sample ID: IHS1SW-3
Date Collected: 10/27/15 07:53
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-7
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	**0.845**		0.164	0.179	1.00	0.0790	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	**0.625**		0.139	0.149	1.00	0.0509	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	**0.819**		0.158	0.172	1.00	0.0425	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.4*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Client Sample ID: IHS1SW-4

Lab Sample ID: 160-14561-8
Date Collected: 10/27/15 07:55
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.633		0.142	0.152	1.00	0.0658	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	0.647		0.142	0.152	1.00	0.0434	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	0.643		0.141	0.151	1.00	0.0432	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.6*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHS1SW-5

Lab Sample ID: 160-14561-9
Date Collected: 10/27/15 07:57
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.654		0.139	0.149	1.00	0.0543	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	0.524		0.124	0.131	1.00	0.0405	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	0.576		0.129	0.138	1.00	0.0216	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.1*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHS1SW-6

Lab Sample ID: 160-14561-10
Date Collected: 10/27/15 08:00
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.650		0.155	0.164	1.00	0.0969	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-230	0.818		0.167	0.181	1.00	0.0475	pCi/g	11/05/15 10:01	11/12/15 16:17	1
Thorium-232	0.860		0.171	0.185	1.00	0.0472	pCi/g	11/05/15 10:01	11/12/15 16:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*83.4*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:17*	*1*

Client Sample ID: IHS1SW-7

Lab Sample ID: 160-14561-11
Date Collected: 10/27/15 08:02
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.960		0.173	0.191	1.00	0.0729	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.752		0.153	0.165	1.00	0.0596	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.984		0.173	0.192	1.00	0.0566	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Client Sample ID: IHS1SW-7
Date Collected: 10/27/15 08:02
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-11
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.8		30 - 110	11/05/15 10:01	11/12/15 16:18	1

Client Sample ID: IHS1SW-8
Date Collected: 10/27/15 08:05
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-12
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.829		0.166	0.180	1.00	0.0792	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.630		0.143	0.152	1.00	0.0451	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.856		0.166	0.181	1.00	0.0493	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.9		30 - 110	11/05/15 10:01	11/12/15 16:18	1

Client Sample ID: IHS1SW-9
Date Collected: 10/27/15 08:07
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-13
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.666		0.152	0.162	1.00	0.0797	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.820		0.166	0.180	1.00	0.0650	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.672		0.149	0.160	1.00	0.0503	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.7		30 - 110	11/05/15 10:01	11/12/15 16:18	1

Client Sample ID: IHS1SW-10
Date Collected: 10/27/15 08:10
Date Received: 10/29/15 13:15

Lab Sample ID: 160-14561-14
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.47		0.216	0.249	1.00	0.0707	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.756		0.155	0.168	1.00	0.0639	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	1.31		0.203	0.231	1.00	0.0660	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.7		30 - 110	11/05/15 10:01	11/12/15 16:18	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Client Sample ID: IHS1SW-11

Lab Sample ID: 160-14561-15
Matrix: Solid
Date Collected: 10/27/15 08:11
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.886		0.170	0.186	1.00	0.0630	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.756		0.156	0.168	1.00	0.0241	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.848		0.165	0.180	1.00	0.0240	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.9*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:18*	*1*

Client Sample ID: IHS1SW-12

Lab Sample ID: 160-14561-16
Matrix: Solid
Date Collected: 10/27/15 08:13
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.944		0.174	0.191	1.00	0.0691	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.766		0.155	0.168	1.00	0.0379	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.831		0.161	0.176	1.00	0.0437	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.3*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:18*	*1*

Client Sample ID: IHS1SW-13

Lab Sample ID: 160-14561-17
Matrix: Solid
Date Collected: 10/27/15 08:15
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.702		0.159	0.170	1.00	0.0864	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.634		0.148	0.157	1.00	0.0528	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.628		0.147	0.156	1.00	0.0526	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*82.9*		*30 - 110*	*11/05/15 10:01*	*11/12/15 16:18*	*1*

Client Sample ID: IHS1SW-14

Lab Sample ID: 160-14561-18
Matrix: Solid
Date Collected: 10/27/15 08:16
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.886		0.168	0.184	1.00	0.0663	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.685		0.148	0.159	1.00	0.0639	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.866		0.164	0.179	1.00	0.0375	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Client Sample ID: IHS1SW-14

Lab Sample ID: 160-14561-18
Date Collected: 10/27/15 08:16
Matrix: Solid
Date Received: 10/29/15 13:15

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.1		30 - 110	11/05/15 10:01	11/12/15 16:18	1

Client Sample ID: IHS1SW-15

Lab Sample ID: 160-14561-19
Date Collected: 10/27/15 08:22
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	2.30		0.257	0.321	1.00	0.0731	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.593		0.131	0.140	1.00	0.0579	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	1.84		0.228	0.276	1.00	0.0393	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	103		30 - 110	11/05/15 10:01	11/12/15 16:18	1

Client Sample ID: IHS1SW-16

Lab Sample ID: 160-14561-20
Date Collected: 10/27/15 08:26
Matrix: Solid
Date Received: 10/29/15 13:15

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.755		0.157	0.169	1.00	0.0671	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-230	0.499		0.128	0.134	1.00	0.0620	pCi/g	11/05/15 10:01	11/12/15 16:18	1
Thorium-232	0.640		0.142	0.152	1.00	0.0440	pCi/g	11/05/15 10:01	11/12/15 16:18	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.0		30 - 110	11/05/15 10:01	11/12/15 16:18	1

QC Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-220290/1-A
Matrix: Solid
Analysis Batch: 221951

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 220290

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.03521	U	0.0395	0.0396	1.00	0.0587	pCi/g	11/05/15 10:01	11/13/15 14:57	1
Thorium-230	0.07119		0.0472	0.0476	1.00	0.0235	pCi/g	11/05/15 10:01	11/13/15 14:57	1
Thorium-232	0.007790	U	0.0156	0.0156	1.00	0.0234	pCi/g	11/05/15 10:01	11/13/15 14:57	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.9*		*30 - 110*	*11/05/15 10:01*	*11/13/15 14:57*	*1*

Lab Sample ID: LCS 160-220290/2-A
Matrix: Solid
Analysis Batch: 221729

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 220290

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	12.3	12.27		1.20	1.00	0.0363	pCi/g	100	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*101*		*30 - 110*

Lab Sample ID: 160-14561-1 DU
Matrix: Solid
Analysis Batch: 221772

Client Sample ID: IHSWB-1
Prep Type: Total/NA
Prep Batch: 220290

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Thorium-228	0.657		0.7248		0.167	1.00	0.0731	pCi/g	0.21	1
Thorium-230	0.671		0.7265		0.165	1.00	0.0525	pCi/g	0.17	1
Thorium-232	0.575		0.5037		0.135	1.00	0.0534	pCi/g	0.26	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*92.2*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Rad

Leach Batch: 219227

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14561-1	IHSWB-1	Total/NA	Solid	Dry and Grind	
160-14561-1 DU	IHSWB-1	Total/NA	Solid	Dry and Grind	
160-14561-2	IHSWB-2	Total/NA	Solid	Dry and Grind	
160-14561-3	IHSWB-3	Total/NA	Solid	Dry and Grind	
160-14561-4	IHSWB-4	Total/NA	Solid	Dry and Grind	
160-14561-5	IHS1SW-1	Total/NA	Solid	Dry and Grind	
160-14561-6	IHS1SW-2	Total/NA	Solid	Dry and Grind	
160-14561-7	IHS1SW-3	Total/NA	Solid	Dry and Grind	
160-14561-8	IHS1SW-4	Total/NA	Solid	Dry and Grind	
160-14561-9	IHS1SW-5	Total/NA	Solid	Dry and Grind	
160-14561-10	IHS1SW-6	Total/NA	Solid	Dry and Grind	
160-14561-11	IHS1SW-7	Total/NA	Solid	Dry and Grind	
160-14561-12	IHS1SW-8	Total/NA	Solid	Dry and Grind	
160-14561-13	IHS1SW-9	Total/NA	Solid	Dry and Grind	
160-14561-14	IHS1SW-10	Total/NA	Solid	Dry and Grind	
160-14561-15	IHS1SW-11	Total/NA	Solid	Dry and Grind	
160-14561-16	IHS1SW-12	Total/NA	Solid	Dry and Grind	
160-14561-17	IHS1SW-13	Total/NA	Solid	Dry and Grind	
160-14561-18	IHS1SW-14	Total/NA	Solid	Dry and Grind	
160-14561-19	IHS1SW-15	Total/NA	Solid	Dry and Grind	
160-14561-20	IHS1SW-16	Total/NA	Solid	Dry and Grind	

Prep Batch: 220290

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-14561-1	IHSWB-1	Total/NA	Solid	ExtChrom	219227
160-14561-1 DU	IHSWB-1	Total/NA	Solid	ExtChrom	219227
160-14561-2	IHSWB-2	Total/NA	Solid	ExtChrom	219227
160-14561-3	IHSWB-3	Total/NA	Solid	ExtChrom	219227
160-14561-4	IHSWB-4	Total/NA	Solid	ExtChrom	219227
160-14561-5	IHS1SW-1	Total/NA	Solid	ExtChrom	219227
160-14561-6	IHS1SW-2	Total/NA	Solid	ExtChrom	219227
160-14561-7	IHS1SW-3	Total/NA	Solid	ExtChrom	219227
160-14561-8	IHS1SW-4	Total/NA	Solid	ExtChrom	219227
160-14561-9	IHS1SW-5	Total/NA	Solid	ExtChrom	219227
160-14561-10	IHS1SW-6	Total/NA	Solid	ExtChrom	219227
160-14561-11	IHS1SW-7	Total/NA	Solid	ExtChrom	219227
160-14561-12	IHS1SW-8	Total/NA	Solid	ExtChrom	219227
160-14561-13	IHS1SW-9	Total/NA	Solid	ExtChrom	219227
160-14561-14	IHS1SW-10	Total/NA	Solid	ExtChrom	219227
160-14561-15	IHS1SW-11	Total/NA	Solid	ExtChrom	219227
160-14561-16	IHS1SW-12	Total/NA	Solid	ExtChrom	219227
160-14561-17	IHS1SW-13	Total/NA	Solid	ExtChrom	219227
160-14561-18	IHS1SW-14	Total/NA	Solid	ExtChrom	219227
160-14561-19	IHS1SW-15	Total/NA	Solid	ExtChrom	219227
160-14561-20	IHS1SW-16	Total/NA	Solid	ExtChrom	219227
LCS 160-220290/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-220290/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-14561-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	**Client Sample ID**	**Th-229 (30-110)**						
160-14561-1	IHSWB-1	94.7						
160-14561-1 DU	IHSWB-1	92.2						
160-14561-2	IHSWB-2	86.1						
160-14561-3	IHSWB-3	91.6						
160-14561-4	IHSWB-4	97.1						
160-14561-5	IHS1SW-1	88.4						
160-14561-6	IHS1SW-2	87.6						
160-14561-7	IHS1SW-3	94.4						
160-14561-8	IHS1SW-4	96.6						
160-14561-9	IHS1SW-5	97.1						
160-14561-10	IHS1SW-6	83.4						
160-14561-11	IHS1SW-7	94.8						
160-14561-12	IHS1SW-8	93.9						
160-14561-13	IHS1SW-9	87.7						
160-14561-14	IHS1SW-10	89.7						
160-14561-15	IHS1SW-11	88.9						
160-14561-16	IHS1SW-12	95.3						
160-14561-17	IHS1SW-13	82.9						
160-14561-18	IHS1SW-14	90.1						
160-14561-19	IHS1SW-15	103						
160-14561-20	IHS1SW-16	92.0						
LCS 160-220290/2-A	Lab Control Sample	101						
MB 160-220290/1-A	Method Blank	91.9						

Tracer/Carrier Legend

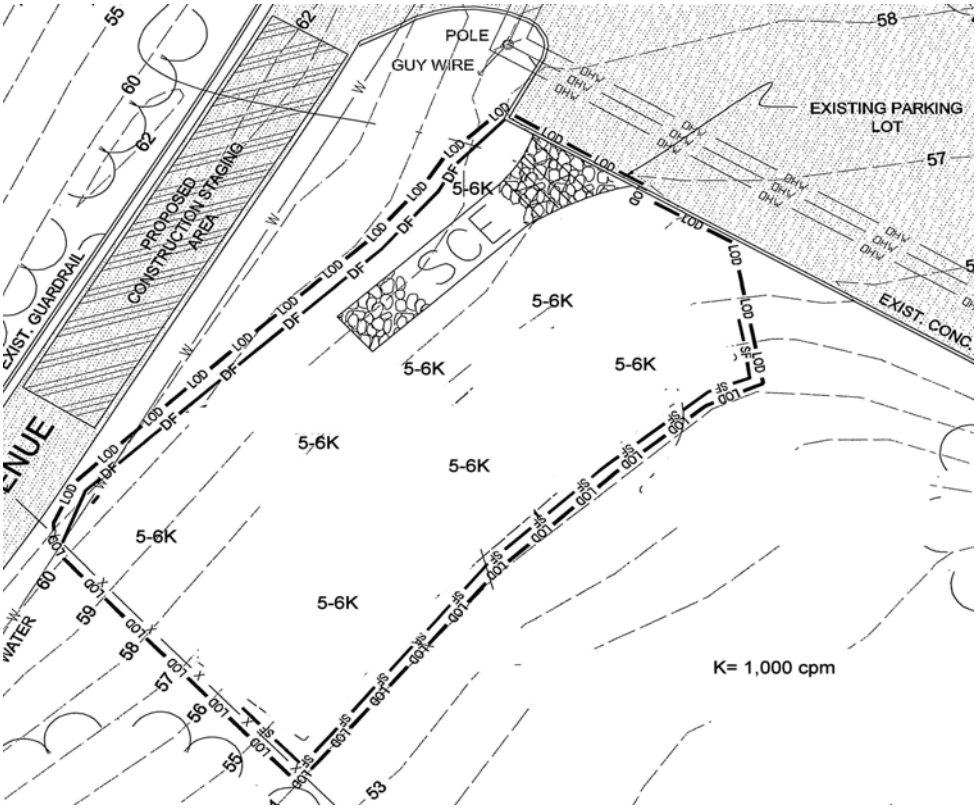
Th-229 = Thorium-229

Appendix S

Soil Laydown Area Survey Report

DATE:	TIME:	INSTRUMENTATION USED						
12/14/2015	11:25	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-041							
LOCATION:	NSF Indian Head IR Site 1 Soil Laydown Area							
SURVEYOR:	William Wylie							
DATE: 12/15/2015	TIME: 12:30 / Reviewed by: Daniel Spicuzza	2350-1 44-10	126172 192589	6/19/2016				5246 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Soil Laydown Area Post Job Gamma Scan Survey



Comments:

The area was 50% gamma scan surveyed.

Action Level: 6,216 cpm.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-041

SURVEYOR: William Wylie | LOCATION: NSF Indian Head IR Site 1 Soil Laydown Area

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								
N/A								
N/A								

Reviewer Daniel Spicuzza	Date: 12/15/2015 Time: 12:30	

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Appendix T

Soil Laydown Samples Laboratory Data Report

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-15442-1
Client Project/Site: NSF Indian Head Site 1

For:
Aleut World Solutions
615 E. 82nd Ave.
Suite 200
Anchorage, Alaska 99518

Attn: Mary Ann Tapia

Authorized for release by:
1/27/2016 10:07:22 AM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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QC Association Summary 18
Tracer Carrier Summary 19

Job ID: 160-15442-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: NSF Indian Head Site 1

Report Number: 160-15442-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 12/17/2015 12:45 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 20.1º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHS1SLD-1 (160-15442-1), IHS1SLD-2 (160-15442-2), IHS1SLD-3 (160-15442-3), IHS1SLD-4 (160-15442-4), IHS1SLD-5 (160-15442-5), IHS1SLD-6 (160-15442-6), IHS1SLD-7 (160-15442-7), IHS1SLD-8 (160-15442-8), IHS1SLD-9 (160-15442-9), IHS1SLD-10 (160-15442-10), IHS1SLD-11 (160-15442-11), IHS1SLD-12 (160-15442-12), IHS1SLD-13 (160-15442-13), IHS1SLD-14 (160-15442-14), IHS1SLD-15 (160-15442-15) and IHS1SLD-16 (160-15442-16) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 12/18/2015, prepared on 01/20/2016 and 12/31/2015 and analyzed on 01/14/2016, 01/18/2016 and 01/25/2016.

The resolution (FWHM) for the thorium-229 tracer peak for the following samples is greater than the 100 keV limit (107.7 keV and 102.4 keV respectively). The resolution of the tracer peak in all other samples associated with the batch are well within the 100 keV limit indicating an anomaly isolated to these two samples. The laboratory does not believe this excursion adversely affects the data.

Job ID: 160-15442-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

IHS1SLD-1 (160-15442-1) and IHS1SLD-12 (160-15442-12)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐DW ☐NPDES ☐RCRA ☑Other:

TestAmerica Laboratories,Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:12/16/2015	COC No: NSFIH-2015-12
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 2 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐CALENDAR DAYS ☑WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1SLD- 1	12/15/2015	815	G	Soil	1	N	N	X	
IHS1SLD- 2	12/15/2015	820	G	Soil	1	N	N	X	
IHS1SLD- 3	12/15/2015	825	G	Soil	1	N	N	X	
IHS1SLD- 4	12/15/2015	830	G	Soil	1	N	N	X	
IHS1SLD- 5	12/15/2015	835	G	Soil	1	N	N	X	
IHS1SLD- 6	12/15/2015	842	G	Soil	1	N	N	X	
IHS1SLD- 7	12/15/2015	847	G	Soil	1	N	N	X	
IHS1SLD- 8	12/15/2015	855	G	Soil	1	N	N	X	
IHS1SLD- 9	12/15/2015	900	G	Soil	1	N	Y	X	
IHS1SLD- 10	12/15/2015	905	G	Soil	1	N	N	X	
IHS1SLD- 11	12/15/2015	910	G	Soil	1	N	N	X	
IHS1SLD- 12	12/15/2015	918	G	Soil	1	N	N	X	

160-15442 Chain of Custody

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐Non-Hazard ☐Flammable ☐Skin Irritant ☐Poison B ☑Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐Return to Client ☑Disposal by Lab ☐Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	AWS	1200 12-15-2015	[signature]	TA STL	12.17.15 1245
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐DW ☐NPDES ☐RCRA ☑Other:

TestAmerica Laboratories,Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	12/15/2015	COC No: NSFIH-2015-13
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	2 of 2 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐CALENDAR DAYS ☑WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indiand Head Site 1 Removal Action	☐ 1 week			
Site: NSF Indian Head Site 1	☐ 2 days			Job / SDG No.:USN 2015-011
Quote # 16004474-0	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium- Alpha Spec	Sample Specific Notes:
IHS1SLD- 13	12/15/2015	923	G	Soil	1	N	N	X	
IHS1SLD- 14	12/15/2015	929	G	Soil	1	N	N	X	
IHS1SLD- 15	12/15/2015	937	G	Soil	1	N	N	X	
IHS1SLD- 16	12/15/2015	944	G	Soil	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐Non-Hazard ☐Flammable ☐Skin Irritant ☐Poison B ☑Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐Return to Client ☑Disposal by Lab ☐Archive for_____ Months

Special Instructions/QC Requirements & Comments: Email results to:radconpro@verizon.net

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	AWS	12-15-2015/1200	[signature]	TA STL	12-17-15 1245
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-15442-1

Login Number: 15442
List Number: 1
Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Result is less than the sample detection limit.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-15442-1	IHS1SLD-1	Solid	12/15/15 08:15	12/17/15 12:45
160-15442-2	IHS1SLD-2	Solid	12/15/15 08:20	12/17/15 12:45
160-15442-3	IHS1SLD-3	Solid	12/15/15 08:25	12/17/15 12:45
160-15442-4	IHS1SLD-4	Solid	12/15/15 08:30	12/17/15 12:45
160-15442-5	IHS1SLD-5	Solid	12/15/15 08:35	12/17/15 12:45
160-15442-6	IHS1SLD-6	Solid	12/15/15 08:42	12/17/15 12:45
160-15442-7	IHS1SLD-7	Solid	12/15/15 08:47	12/17/15 12:45
160-15442-8	IHS1SLD-8	Solid	12/15/15 08:55	12/17/15 12:45
160-15442-9	IHS1SLD-9	Solid	12/15/15 09:00	12/17/15 12:45
160-15442-10	IHS1SLD-10	Solid	12/15/15 09:05	12/17/15 12:45
160-15442-11	IHS1SLD-11	Solid	12/15/15 09:10	12/17/15 12:45
160-15442-12	IHS1SLD-12	Solid	12/15/15 09:18	12/17/15 12:45
160-15442-13	IHS1SLD-13	Solid	12/15/15 09:23	12/17/15 12:45
160-15442-14	IHS1SLD-14	Solid	12/15/15 09:29	12/17/15 12:45
160-15442-15	IHS1SLD-15	Solid	12/15/15 09:37	12/17/15 12:45
160-15442-16	IHS1SLD-16	Solid	12/15/15 09:44	12/17/15 12:45

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Client Sample ID: IHS1SLD-1

Lab Sample ID: 160-15442-1
Date Collected: 12/15/15 08:15
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.587		0.136	0.145	1.00	0.0693	pCi/g	12/31/15 10:28	01/18/16 13:01	1
Thorium-230	0.808		0.158	0.172	1.00	0.0571	pCi/g	12/31/15 10:28	01/18/16 13:01	1
Thorium-232	0.608		0.136	0.145	1.00	0.0423	pCi/g	12/31/15 10:28	01/18/16 13:01	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.2*		*30 - 110*	*12/31/15 10:28*	*01/18/16 13:01*	*1*

Client Sample ID: IHS1SLD-2

Lab Sample ID: 160-15442-2
Date Collected: 12/15/15 08:20
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.642		0.153	0.162	1.00	0.0897	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.694		0.153	0.164	1.00	0.0282	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.589		0.141	0.150	1.00	0.0371	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.1*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

Client Sample ID: IHS1SLD-3

Lab Sample ID: 160-15442-3
Date Collected: 12/15/15 08:25
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.629		0.147	0.156	1.00	0.0836	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.807		0.161	0.175	1.00	0.0242	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.462		0.123	0.129	1.00	0.0450	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*97.1*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

Client Sample ID: IHS1SLD-4

Lab Sample ID: 160-15442-4
Date Collected: 12/15/15 08:30
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.458		0.124	0.130	1.00	0.0812	pCi/g	01/20/16 13:45	01/25/16 12:54	1
Thorium-230	0.739		0.151	0.164	1.00	0.0475	pCi/g	01/20/16 13:45	01/25/16 12:54	1
Thorium-232	0.594		0.135	0.144	1.00	0.0370	pCi/g	01/20/16 13:45	01/25/16 12:54	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Client Sample ID: IHS1SLD-4
Date Collected: 12/15/15 08:30
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-4
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	97.1		30 - 110	01/20/16 13:45	01/25/16 12:54	1

Client Sample ID: IHS1SLD-5
Date Collected: 12/15/15 08:35
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-5
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.708		0.146	0.158	1.00	0.0605	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.625		0.136	0.146	1.00	0.0357	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.585		0.131	0.140	1.00	0.0355	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	99.0		30 - 110	12/31/15 10:28	01/14/16 15:53	1

Client Sample ID: IHS1SLD-6
Date Collected: 12/15/15 08:42
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-6
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.597		0.130	0.140	1.00	0.0712	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.479		0.114	0.121	1.00	0.0440	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.569		0.123	0.132	1.00	0.0201	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	110		30 - 110	12/31/15 10:28	01/14/16 15:53	1

Client Sample ID: IHS1SLD-7
Date Collected: 12/15/15 08:47
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-7
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.652		0.151	0.161	1.00	0.0866	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.729		0.155	0.166	1.00	0.0399	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.552		0.134	0.142	1.00	0.0394	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.4		30 - 110	12/31/15 10:28	01/14/16 15:53	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Client Sample ID: IHS1SLD-8

Lab Sample ID: 160-15442-8
Date Collected: 12/15/15 08:55
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.691		0.156	0.166	1.00	0.0765	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.647		0.148	0.157	1.00	0.0252	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.776		0.161	0.174	1.00	0.0405	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*85.9*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

Client Sample ID: IHS1SLD-9

Lab Sample ID: 160-15442-9
Date Collected: 12/15/15 09:00
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.883		0.164	0.180	1.00	0.0762	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.662		0.140	0.150	1.00	0.0221	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.759		0.149	0.162	1.00	0.0382	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*104*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

Client Sample ID: IHS1SLD-10

Lab Sample ID: 160-15442-10
Date Collected: 12/15/15 09:05
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.768		0.161	0.173	1.00	0.0757	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.610		0.141	0.150	1.00	0.0468	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.664		0.147	0.157	1.00	0.0537	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.6*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

Client Sample ID: IHS1SLD-11

Lab Sample ID: 160-15442-11
Date Collected: 12/15/15 09:10
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.716		0.152	0.164	1.00	0.0726	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.931		0.171	0.188	1.00	0.0436	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.690		0.146	0.157	1.00	0.0232	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Client Sample ID: IHS1SLD-11
Date Collected: 12/15/15 09:10
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-11
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	99.2		30 - 110	12/31/15 10:28	01/14/16 15:53	1

Client Sample ID: IHS1SLD-12
Date Collected: 12/15/15 09:18
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-12
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.962		0.181	0.198	1.00	0.0656	pCi/g	12/31/15 10:28	01/18/16 13:01	1
Thorium-230	1.26		0.206	0.232	1.00	0.0594	pCi/g	12/31/15 10:28	01/18/16 13:01	1
Thorium-232	0.783		0.162	0.175	1.00	0.0514	pCi/g	12/31/15 10:28	01/18/16 13:01	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.6		30 - 110	12/31/15 10:28	01/18/16 13:01	1

Client Sample ID: IHS1SLD-13
Date Collected: 12/15/15 09:23
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-13
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.773		0.166	0.178	1.00	0.0892	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.789		0.164	0.177	1.00	0.0472	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.713		0.156	0.167	1.00	0.0560	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	84.6		30 - 110	12/31/15 10:28	01/14/16 15:53	1

Client Sample ID: IHS1SLD-14
Date Collected: 12/15/15 09:29
Date Received: 12/17/15 12:45

Lab Sample ID: 160-15442-14
Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.564		0.135	0.143	1.00	0.0660	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.603		0.137	0.146	1.00	0.0375	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.605		0.137	0.146	1.00	0.0232	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	99.8		30 - 110	12/31/15 10:28	01/14/16 15:53	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Client Sample ID: IHS1SLD-15

Lab Sample ID: 160-15442-15
Date Collected: 12/15/15 09:37
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.643		0.143	0.153	1.00	0.0812	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.840		0.159	0.174	1.00	0.0364	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.584		0.132	0.141	1.00	0.0224	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*102*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

Client Sample ID: IHS1SLD-16

Lab Sample ID: 160-15442-16
Date Collected: 12/15/15 09:44
Matrix: Solid
Date Received: 12/17/15 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.661		0.150	0.160	1.00	0.0873	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.729		0.152	0.164	1.00	0.0384	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.899		0.169	0.185	1.00	0.0382	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.4*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-230242/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 232336 — **Prep Batch: 230242**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.03749	U	0.0442	0.0443	1.00	0.0680	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-230	0.2943		0.101	0.104	1.00	0.0419	pCi/g	12/31/15 10:28	01/14/16 15:53	1
Thorium-232	0.006455	U	0.0177	0.0178	1.00	0.0417	pCi/g	12/31/15 10:28	01/14/16 15:53	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.4*		*30 - 110*	*12/31/15 10:28*	*01/14/16 15:53*	*1*

Lab Sample ID: LCS 160-230242/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 232337 — **Prep Batch: 230242**

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	26.14		2.56	1.00	0.101	pCi/g	107	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*90.1*		*30 - 110*

Lab Sample ID: 160-15442-1 DU — **Client Sample ID: IHS1SLD-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 232340 — **Prep Batch: 230242**

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.479			0.6449		0.149	1.00	0.0716	pCi/g			0.59	1
Thorium-230	0.643			0.6985		0.153	1.00	0.0343	pCi/g			0.18	1
Thorium-232	0.572			0.4384		0.118	1.00	0.0436	pCi/g			0.52	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*100*		*30 - 110*

Lab Sample ID: MB 160-233359/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 234002 — **Prep Batch: 233359**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.008536	U	0.00764	0.00767	1.00	0.0486	pCi/g	01/20/16 13:45	01/25/16 12:54	1
Thorium-230	0.03950		0.0337	0.0339	1.00	0.0331	pCi/g	01/20/16 13:45	01/25/16 12:54	1
Thorium-232	0.0000	U	0.00340	0.00340	1.00	0.0204	pCi/g	01/20/16 13:45	01/25/16 12:54	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*105*		*30 - 110*	*01/20/16 13:45*	*01/25/16 12:54*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-233359/2-A
Matrix: Solid
Analysis Batch: 234003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 233359

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	22.81		2.23	1.00	0.101	pCi/g	93	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*101*		*30 - 110*

Lab Sample ID: 160-15587-F-1-J DU
Matrix: Solid
Analysis Batch: 234005

Client Sample ID: Duplicate
Prep Type: Total/NA
Prep Batch: 233359

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.368			0.3500		0.108	1.00	0.0636	pCi/g			0.08	1
Thorium-230	0.441			0.4362		0.119	1.00	0.0403	pCi/g			0.02	1
Thorium-232	0.469			0.3179		0.100	1.00	0.0444	pCi/g			0.66	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*104*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Rad

Leach Batch: 228179

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-15442-1	IHS1SLD-1	Total/NA	Solid	Dry and Grind	
160-15442-1 DU	IHS1SLD-1	Total/NA	Solid	Dry and Grind	
160-15442-2	IHS1SLD-2	Total/NA	Solid	Dry and Grind	
160-15442-3	IHS1SLD-3	Total/NA	Solid	Dry and Grind	
160-15442-4	IHS1SLD-4	Total/NA	Solid	Dry and Grind	
160-15442-5	IHS1SLD-5	Total/NA	Solid	Dry and Grind	
160-15442-6	IHS1SLD-6	Total/NA	Solid	Dry and Grind	
160-15442-7	IHS1SLD-7	Total/NA	Solid	Dry and Grind	
160-15442-8	IHS1SLD-8	Total/NA	Solid	Dry and Grind	
160-15442-9	IHS1SLD-9	Total/NA	Solid	Dry and Grind	
160-15442-10	IHS1SLD-10	Total/NA	Solid	Dry and Grind	
160-15442-11	IHS1SLD-11	Total/NA	Solid	Dry and Grind	
160-15442-12	IHS1SLD-12	Total/NA	Solid	Dry and Grind	
160-15442-13	IHS1SLD-13	Total/NA	Solid	Dry and Grind	
160-15442-14	IHS1SLD-14	Total/NA	Solid	Dry and Grind	
160-15442-15	IHS1SLD-15	Total/NA	Solid	Dry and Grind	
160-15442-16	IHS1SLD-16	Total/NA	Solid	Dry and Grind	

Prep Batch: 230242

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-15442-1	IHS1SLD-1	Total/NA	Solid	ExtChrom	228179
160-15442-1 DU	IHS1SLD-1	Total/NA	Solid	ExtChrom	228179
160-15442-2	IHS1SLD-2	Total/NA	Solid	ExtChrom	228179
160-15442-3	IHS1SLD-3	Total/NA	Solid	ExtChrom	228179
160-15442-5	IHS1SLD-5	Total/NA	Solid	ExtChrom	228179
160-15442-6	IHS1SLD-6	Total/NA	Solid	ExtChrom	228179
160-15442-7	IHS1SLD-7	Total/NA	Solid	ExtChrom	228179
160-15442-8	IHS1SLD-8	Total/NA	Solid	ExtChrom	228179
160-15442-9	IHS1SLD-9	Total/NA	Solid	ExtChrom	228179
160-15442-10	IHS1SLD-10	Total/NA	Solid	ExtChrom	228179
160-15442-11	IHS1SLD-11	Total/NA	Solid	ExtChrom	228179
160-15442-12	IHS1SLD-12	Total/NA	Solid	ExtChrom	228179
160-15442-13	IHS1SLD-13	Total/NA	Solid	ExtChrom	228179
160-15442-14	IHS1SLD-14	Total/NA	Solid	ExtChrom	228179
160-15442-15	IHS1SLD-15	Total/NA	Solid	ExtChrom	228179
160-15442-16	IHS1SLD-16	Total/NA	Solid	ExtChrom	228179
LCS 160-230242/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-230242/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Leach Batch: 230692

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-15587-F-1-J DU	Duplicate	Total/NA	Solid	Dry and Grind	

Prep Batch: 233359

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-15442-4	IHS1SLD-4	Total/NA	Solid	ExtChrom	228179
160-15587-F-1-J DU	Duplicate	Total/NA	Solid	ExtChrom	230692
LCS 160-233359/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-233359/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head Site 1

TestAmerica Job ID: 160-15442-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)							
Lab Sample ID	**Client Sample ID**	**Th-229 (30-110)**							
160-15442-1	IHS1SLD-1	94.2							
160-15442-1 DU	IHS1SLD-1	100							
160-15442-2	IHS1SLD-2	91.1							
160-15442-3	IHS1SLD-3	97.1							
160-15442-4	IHS1SLD-4	97.1							
160-15442-5	IHS1SLD-5	99.0							
160-15442-6	IHS1SLD-6	110							
160-15442-7	IHS1SLD-7	93.4							
160-15442-8	IHS1SLD-8	85.9							
160-15442-9	IHS1SLD-9	104							
160-15442-10	IHS1SLD-10	95.6							
160-15442-11	IHS1SLD-11	99.2							
160-15442-12	IHS1SLD-12	91.6							
160-15442-13	IHS1SLD-13	84.6							
160-15442-14	IHS1SLD-14	99.8							
160-15442-15	IHS1SLD-15	102							
160-15442-16	IHS1SLD-16	96.4							
160-15587-F-1-J DU	Duplicate	104							
LCS 160-230242/2-A	Lab Control Sample	90.1							
LCS 160-233359/2-A	Lab Control Sample	101							
MB 160-230242/1-A	Method Blank	91.4							
MB 160-233359/1-A	Method Blank	105							

Tracer/Carrier Legend

Th-229 = Thorium-229

Appendix U

Waste Profile Samples Laboratory Data Report

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-1688-1
Client Project/Site: Waste Characterizations

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Mary Ann Tapia

Authorized for release by:
4/9/2013 3:59:55 PM

Erika Starman
Project Manager I
erika.starman@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-1688-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Waste Characterizations

Report Number: 160-1688-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 3/6/2013 1:40 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 6.0º C.

General Chemistry

Citrix server went down 3/19/13, rework samples were started for TCLP extraction using the fluid determination from the initial extraction.

TCLP VOLATILE ORGANIC COMPOUNDS (GC-MS)

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP volatile organic compounds (GC-MS) in accordance with EPA SW846 Method 1311/8260C. The samples were leached on 03/12/2013 and analyzed on 03/12/2013.

No difficulties were encountered during the VOCs analysis.

All quality control parameters were within the acceptance limits.

TCLP SEMIVOLATILE ORGANIC COMPOUNDS (GC-MS)

Job ID: 160-1688-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP semivolatile organic compounds (GC-MS) in accordance with EPA SW-846 Methods 1311 / 8270D. The samples were leached on 03/12/2013, prepared on 03/13/2013 and analyzed on 03/15/2013.

Terphenyl-d14 (Surr) failed the surrogate recovery criteria low for 1H-WP1MS (160-1688-1MS). The laboratory's SOP allows one acid surrogate and/or one base surrogate to be outside acceptance limits; therefore, re-extraction/re-analysis was not performed. These results have been reported and qualified. Refer to the QC report for details.

No other difficulties were encountered during the SVOCs analysis.

All other quality control parameters were within the acceptance limits.

TCLP CHLORINATED PESTICIDES

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP chlorinated pesticides in accordance with EPA SW-846 Methods 1311/ 8081B. The samples were leached on 03/12/2013, prepared on 03/18/2013 and analyzed on 03/19/2013.

Tetrachloro-m-xylene failed the surrogate recovery criteria low for LB 160-39306/1-B, 1H-WP1MS (160-1688-1MS), and 1H-WP1MSD (160-1688-1MSD). However the spike recovery for the LSC, MS, and MSD is within QC limits, thus showing a good extraction. Also the surrogate recovery for the sample was within QC limits. Refer to the QC report for details.

No other difficulties were encountered during the pesticides analysis.

All other quality control parameters were within the acceptance limits.

TCLP CHLORINATED HERBICIDES

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP chlorinated herbicides in accordance with EPA SW-846 Methods 1311/ 8151A. The samples were leached on 03/19/2013, and prepared and analyzed on 03/20/2013.

Surrogates are added during the extraction process prior to dilution. When the sample dilution is 5X or greater, surrogate recoveries are diluted out and no corrective action is required.

2,4-Dichlorophenylacetic acid failed the surrogate recovery criteria high for 1H-WP1MSD (160-1688-1MSD). This sample did not contain any target analytes above the RL; therefore, re-extraction and/or re-analysis was not performed. Refer to the QC report for details.

The MSD recovery for 2,4-D, and 2,4,5-TP is outside the upper QC limit and the RPD was poor, indicating a potential positive bias for these analytes. These analytes were not observed above the reporting limit in the associated samples; therefore the sample data was not adversely affected by this excursion.

No other difficulties were encountered during the herbicides analysis.

All other quality control parameters were within the acceptance limits.

TCLP METALS (ICP)

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP metals (ICP) in accordance with EPA SW-846 Method 1311/6010C. The samples were leached on 03/12/2013, prepared on 03/12/2013 and analyzed on 03/19/2013.

Barium, Chromium and Selenium were detected in method blank LB 160-39311/1-B at levels that were above the method detection limit but below the reporting limit. Refer to the QC report for details.

The serial dilution performed for the following sample(s) associated with batch 39344 was outside control limits for lead indicating a possible matrix interference: (160-1688-1 SD)

No other difficulties were encountered during the metals analysis.

All other quality control parameters were within the acceptance limits.

Job ID: 160-1688-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

TCLP MERCURY

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP mercury in accordance with EPA SW-846 Methods 1311/7470A. The samples were leached on 03/12/2013, prepared on 04/02/2013 and analyzed on 04/04/2013.

The MS\MSD were spiked after preservation. Due to instrument related issues the batch needed to be re-extracted.

No difficulties were encountered during the mercury analysis.

All quality control parameters were within the acceptance limits.

IGNITABILITY,PENSKY-MARTENS CLOSED CUP METHOD

Sample 1H-WP2 (160-1688-2) was analyzed for Ignitability,Pensky-Martens Closed Cup Method in accordance with EPA SW-846 Method 1010. The samples were analyzed on 03/29/2013.

No other difficulties were encountered during the Ignitability, CCM analysis.

All other quality control parameters were within the acceptance limits.

REACTIVE CYANIDE

Sample 1H-WP2 (160-1688-2) was analyzed for reactive cyanide in accordance with EPA SW-846 Method 7.3.3. The samples were prepared and analyzed on 03/20/2013.

Cyanide, Reactive failed the recovery criteria low for LCS 160-41005/2-A and MS of sample 1H-WP2MS (160-1688-2). Since this test is semi-qualitative no further action is required. Refer to the QC report for details.

For the associated samples in Reactive CN Batch 41105, the samples were distilled and analyzed one day out of hold due to TALS being down for most of the day, prior to the prep analyst leaving. (160-1688-2 DU), (160-1688-2 MS), 1H-WP2 (160-1688-2)

No other difficulties were encountered during the Reactive cynide analysis.

All other quality control parameters were within the acceptance limits.

REACTIVE SULFIDE

Sample 1H-WP2 (160-1688-2) was analyzed for reactive sulfide in accordance with EPA SW-846 Method 7.3.4. The samples were prepared on 03/20/2013 and analyzed on 03/21/2013.

Sulfide, Reactive failed the recovery criteria high for LCS 160-41006/2-A. Refer to the QC report for details.

For Reactive Sulfide batch # 41093, the LCS was outside the upper QC limit, resulting in a potential positive bias for the samples associated with this batch. The analyte was not detected in the associated samples, therefore the results were not adversely affected.1H-WP2 (160-1688-2)

For Reactive Sulfide batch 41093, the sample was prepped and analyzed outside of holding time. Samples were prepped and analyzed within two times hold.1H-WP2 (160-1688-2)

No other difficulties were encountered during the sulfide analysis.

All other quality control parameters were within the acceptance limits.

PH

Sample 1H-WP2 (160-1688-2) was analyzed for pH in accordance with EPA SW-846 Method 9045D. The samples were leached on 03/13/2013 and analyzed on 03/13/2013.

No difficulties were encountered during the pH analysis.

Job ID: 160-1688-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

All quality control parameters were within the acceptance limits.

PERCENT SOLIDS

Sample 1H-WP2 (160-1688-2) was analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 03/13/2013.

No difficulties were encountered during the % solids analysis.

All quality control parameters were within the acceptance limits.

CVR 4 34

St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

4/9/2013

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 3/5/2013	COC No: IH-4
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	___ of ___ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample (Perform MS/MSD)	TCLP Volatiles, Semivolatiles, Metals, Herbicides, Pesticides	pH, Ignitibility, Reactive Sulfide, Reactive Cyanide	Sample Specific Notes:
IH-WP1	3/5/2013	0800	Composite	S	1		X		
IH-WP2	3/5/2013	0805	Composite	S	1			X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ___

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* ___ *Months*

Special Instructions/QC Requirements & Comments: QC Level IV.

Relinquished by:	Company: AWS	Date/Time: 3/5/2013/1500	Received by:	Company: Ta	Date/Time: 3/6/13 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-1688-1

Login Number: 1688

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

GC/MS Semi VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

GC Semi VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

Metals

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
J	Estimated: The analyte was positively identified; the quantitation is an estimation

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
Q	One or more quality control criteria failed.
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	TAL SL
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL SL
8081B	Organochlorine Pesticides (GC)	SW846	TAL SL
8151A	Herbicides (GC)	SW846	TAL SL
6010C	Metals (ICP)	SW846	TAL SL
7470A	Mercury (CVAA)	SW846	TAL SL
1010A	Ignitability,Pensky-Martens Closed Cup Method	SW846	TAL SL
9012	Cyanide, Reactive	SW846	TAL SL
9034	Sulfide, Reactive	SW846	TAL SL
9045D	pH	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-1688-1	1H-WP1	Solid	03/05/13 08:00	03/06/13 13:40
160-1688-2	1H-WP2	Solid	03/05/13 08:05	03/06/13 13:40

Detection Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Client Sample ID: 1H-WP1 — Lab Sample ID: 160-1688-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	647		125	9.88	ug/L	1		6010C	TCLP
Cadmium	4.25	J	12.5	2.28	ug/L	1		6010C	TCLP
Lead	288		250	3.18	ug/L	1		6010C	TCLP
Selenium	7.00	J	500	6.65	ug/L	1		6010C	TCLP

Client Sample ID: 1H-WP2 — Lab Sample ID: 160-1688-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Flashpoint	>60		23.0	23.0	Degrees F	1		1010A	Total/NA
pH	6.70		0.100	0.100	SU	1		9045D	Soluble

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Client Sample ID: 1H-WP1

Date Collected: 03/05/13 08:00
Date Received: 03/06/13 13:40

Lab Sample ID: 160-1688-1

Matrix: Solid

Method: 8260C - Volatile Organic Compounds by GC/MS - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane	3.72	U	50.0	3.72	ug/L			03/12/13 19:52	1
1,4-Dichlorobenzene	2.60	U	50.0	2.60	ug/L			03/12/13 19:52	1
2-Butanone (MEK)	3.89	U	50.0	3.89	ug/L			03/12/13 19:52	1
Benzene	2.53	U	50.0	2.53	ug/L			03/12/13 19:52	1
Carbon tetrachloride	3.60	U	50.0	3.60	ug/L			03/12/13 19:52	1
Chlorobenzene	3.82	U	50.0	3.82	ug/L			03/12/13 19:52	1
Chloroform	0.920	U	50.0	0.920	ug/L			03/12/13 19:52	1
Tetrachloroethene	2.80	U	50.0	2.80	ug/L			03/12/13 19:52	1
Trichloroethene	2.90	U	50.0	2.90	ug/L			03/12/13 19:52	1
Vinyl chloride	4.28	U	100	4.28	ug/L			03/12/13 19:52	1
1,1-Dichloroethene	3.65	U	50.0	3.65	ug/L			03/12/13 19:52	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*101*		*85 - 115*		*03/12/13 19:52*	*1*
Dibromofluoromethane (Surr)	*101*		*85 - 115*		*03/12/13 19:52*	*1*
4-Bromofluorobenzene (Surr)	*95*		*84 - 120*		*03/12/13 19:52*	*1*
1,2-Dichloroethane-d4 (Surr)	*95*		*83 - 117*		*03/12/13 19:52*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
2,4-Dinitrotoluene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Hexachlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Hexachlorobutadiene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Hexachloroethane	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
2-Methylphenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
3 & 4 Methylphenol	5.00	U	100	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Nitrobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Pentachlorophenol	10.0	U	250	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
Pyridine	25.0	U	100	25.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
2,4,5-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
2,4,6-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*75*		*50 - 101*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
Nitrobenzene-d5 (Surr)	*78*		*45 - 102*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
Phenol-d5 (Surr)	*75*		*40 - 95*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
Terphenyl-d14 (Surr)	*56*		*56 - 118*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
2-Fluorobiphenyl (Surr)	*71*		*42 - 95*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
2-Fluorophenol (Surr)	*82*		*38 - 98*	*03/13/13 12:00*	*03/15/13 01:49*	*1*

Method: 8081B - Organochlorine Pesticides (GC) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
gamma-BHC (Lindane)	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 18:39	1
Endrin	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Heptachlor	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 18:39	1
Heptachlor epoxide	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Methoxychlor	0.0500	U	1.00	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Toxaphene	0.0500	U	20.0	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Technical Chlordane	0.200	U	5.00	0.200	ug/L		03/18/13 10:00	03/19/13 18:39	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Client Sample ID: 1H-WP1

Lab Sample ID: 160-1688-1

Date Collected: 03/05/13 08:00
Matrix: Solid
Date Received: 03/06/13 13:40

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*101*		*70 - 130*	*03/18/13 10:00*	*03/19/13 18:39*	*1*
Tetrachloro-m-xylene	*70*		*70 - 130*	*03/18/13 10:00*	*03/19/13 18:39*	*1*

Method: 8151A - Herbicides (GC) - TCLP - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	19.8	U J	40.0	19.8	ug/L		03/20/13 09:29	03/20/13 15:02	1
Silvex (2,4,5-TP)	2.98	U J	10.0	2.98	ug/L		03/20/13 09:29	03/20/13 15:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*127*		*56 - 147*	*03/20/13 09:29*	*03/20/13 15:02*	*1*

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.93	U	500	4.93	ug/L		03/12/13 12:42	03/19/13 17:29	1
Barium	**647**		125	9.88	ug/L		03/12/13 12:42	03/19/13 17:29	1
Cadmium	**4.25**	**J**	12.5	2.28	ug/L		03/12/13 12:42	03/19/13 17:29	1
Chromium	7.85	U	25.0	7.85	ug/L		03/12/13 12:42	03/19/13 17:29	1
Lead	**288**		250	3.18	ug/L		03/12/13 12:42	03/19/13 17:29	1
Selenium	**7.00**	**J**	500	6.65	ug/L		03/12/13 12:42	03/19/13 17:29	1
Silver	14.9	U	25.0	14.9	ug/L		03/12/13 12:42	03/19/13 17:29	1

Method: 7470A - Mercury (CVAA) - TCLP - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0790	U	1.00	0.0790	ug/L		04/02/13 11:05	04/04/13 16:06	1

Client Sample ID: 1H-WP2

Lab Sample ID: 160-1688-2

Date Collected: 03/05/13 08:05
Matrix: Solid
Date Received: 03/06/13 13:40

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Flashpoint	**>60**		23.0	23.0	Degrees F			03/29/13 16:04	1
Cyanide, Reactive	0.251	U H Q J	0.251	0.251	mg/Kg		03/20/13 15:29	03/20/13 19:43	1
Sulfide, Reactive	22.2	U H Q	22.2	22.2	mg/Kg		03/20/13 15:29	03/21/13 10:12	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.70**		0.100	0.100	SU			03/13/13 14:15	1

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: LCS 160-39507/9-A
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dichloroethane	500	452		ug/L		90	80 - 115
1,4-Dichlorobenzene	500	510		ug/L		102	85 - 115
2-Butanone (MEK)	500	454		ug/L		91	64 - 117
Benzene	500	467		ug/L		93	85 - 115
Carbon tetrachloride	500	494		ug/L		99	79 - 119
Chlorobenzene	500	441		ug/L		88	85 - 115
Chloroform	500	492		ug/L		98	85 - 115
Tetrachloroethene	500	527		ug/L		105	79 - 116
Trichloroethene	500	451		ug/L		90	85 - 115
Vinyl chloride	500	456		ug/L		91	72 - 136
1,1-Dichloroethene	500	465		ug/L		93	79 - 117

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*107*		*85 - 115*
Dibromofluoromethane (Surr)	*101*		*85 - 115*
4-Bromofluorobenzene (Surr)	*93*		*84 - 120*
1,2-Dichloroethane-d4 (Surr)	*95*		*83 - 117*

Lab Sample ID: LB 160-39297/1-A LB
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: Method Blank
Prep Type: TCLP

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane	3.72	U	50.0	3.72	ug/L			03/12/13 19:27	1
1,4-Dichlorobenzene	2.60	U	50.0	2.60	ug/L			03/12/13 19:27	1
2-Butanone (MEK)	3.89	U	50.0	3.89	ug/L			03/12/13 19:27	1
Benzene	2.53	U	50.0	2.53	ug/L			03/12/13 19:27	1
Carbon tetrachloride	3.60	U	50.0	3.60	ug/L			03/12/13 19:27	1
Chlorobenzene	3.82	U	50.0	3.82	ug/L			03/12/13 19:27	1
Chloroform	0.920	U	50.0	0.920	ug/L			03/12/13 19:27	1
Tetrachloroethene	2.80	U	50.0	2.80	ug/L			03/12/13 19:27	1
Trichloroethene	2.90	U	50.0	2.90	ug/L			03/12/13 19:27	1
Vinyl chloride	4.28	U	100	4.28	ug/L			03/12/13 19:27	1
1,1-Dichloroethene	3.65	U	50.0	3.65	ug/L			03/12/13 19:27	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*101*		*85 - 115*		*03/12/13 19:27*	*1*
Dibromofluoromethane (Surr)	*100*		*85 - 115*		*03/12/13 19:27*	*1*
4-Bromofluorobenzene (Surr)	*97*		*84 - 120*		*03/12/13 19:27*	*1*
1,2-Dichloroethane-d4 (Surr)	*100*		*83 - 117*		*03/12/13 19:27*	*1*

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: 1H-WP1
Prep Type: TCLP

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dichloroethane	3.72	U	500	470		ug/L		94	85 - 115

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: 1H-WP1
Prep Type: TCLP

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,4-Dichlorobenzene	2.60	U	500	497		ug/L		99	85 - 115
2-Butanone (MEK)	3.89	U	500	456		ug/L		91	67 - 117
Benzene	2.53	U	500	467		ug/L		93	85 - 115
Carbon tetrachloride	3.60	U	500	449		ug/L		90	79 - 117
Chlorobenzene	3.82	U	500	447		ug/L		89	85 - 115
Chloroform	0.920	U	500	480		ug/L		96	85 - 115
Tetrachloroethene	2.80	U	500	516		ug/L		103	82 - 115
Trichloroethene	2.90	U	500	470		ug/L		94	84 - 115
Vinyl chloride	4.28	U	500	396		ug/L		79	75 - 132
1,1-Dichloroethene	3.65	U	500	421		ug/L		84	80 - 115

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Toluene-d8 (Surr)	*102*		*85 - 115*
Dibromofluoromethane (Surr)	*100*		*85 - 115*
4-Bromofluorobenzene (Surr)	*91*		*84 - 120*
1,2-Dichloroethane-d4 (Surr)	*96*		*83 - 117*

Lab Sample ID: 160-1688-1 MSD
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: 1H-WP1
Prep Type: TCLP

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2-Dichloroethane	3.72	U	500	478		ug/L		96	85 - 115	2	20
1,4-Dichlorobenzene	2.60	U	500	512		ug/L		102	85 - 115	3	20
2-Butanone (MEK)	3.89	U	500	467		ug/L		93	67 - 117	2	20
Benzene	2.53	U	500	468		ug/L		94	85 - 115	0	20
Carbon tetrachloride	3.60	U	500	467		ug/L		93	79 - 117	4	20
Chlorobenzene	3.82	U	500	447		ug/L		89	85 - 115	0	20
Chloroform	0.920	U	500	469		ug/L		94	85 - 115	2	20
Tetrachloroethene	2.80	U	500	516		ug/L		103	82 - 115	0	20
Trichloroethene	2.90	U	500	458		ug/L		92	84 - 115	3	20
Vinyl chloride	4.28	U	500	410		ug/L		82	75 - 132	4	20
1,1-Dichloroethene	3.65	U	500	427		ug/L		85	80 - 115	2	20

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*102*		*85 - 115*
Dibromofluoromethane (Surr)	*99*		*85 - 115*
4-Bromofluorobenzene (Surr)	*93*		*84 - 120*
1,2-Dichloroethane-d4 (Surr)	*96*		*83 - 117*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: LCS 160-39484/2-A
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 39484

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,4-Dichlorobenzene	500	376		ug/L		75	40 - 93
2,4-Dinitrotoluene	500	374		ug/L		75	49 - 95
Hexachlorobenzene	500	369		ug/L		74	46 - 87
Hexachlorobutadiene	500	342		ug/L		68	30 - 95
Hexachloroethane	500	383		ug/L		77	25 - 97
2-Methylphenol	500	419		ug/L		84	51 - 99
3 & 4 Methylphenol	1000	830		ug/L		83	53 - 96
Nitrobenzene	500	361		ug/L		72	45 - 95
Pentachlorophenol	500	343		ug/L		69	35 - 98
Pyridine	500	256		ug/L		51	10 - 72
2,4,5-Trichlorophenol	500	378		ug/L		76	47 - 92
2,4,6-Trichlorophenol	500	358		ug/L		72	47 - 88

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*81*		*50 - 101*
Nitrobenzene-d5 (Surr)	*75*		*45 - 102*
Phenol-d5 (Surr)	*79*		*40 - 95*
Terphenyl-d14 (Surr)	*56*		*56 - 118*
2-Fluorobiphenyl (Surr)	*71*		*42 - 95*
2-Fluorophenol (Surr)	*82*		*38 - 98*

Lab Sample ID: LB 160-39296/1-B LB
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 39484

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
2,4-Dinitrotoluene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Hexachlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Hexachlorobutadiene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Hexachloroethane	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
2-Methylphenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
3 & 4 Methylphenol	5.00	U	100	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Nitrobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Pentachlorophenol	10.0	U	250	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
Pyridine	25.0	U	100	25.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
2,4,5-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
2,4,6-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*77*		*50 - 101*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
Nitrobenzene-d5 (Surr)	*71*		*45 - 102*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
Phenol-d5 (Surr)	*73*		*40 - 95*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
Terphenyl-d14 (Surr)	*57*		*56 - 118*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
2-Fluorobiphenyl (Surr)	*67*		*42 - 95*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
2-Fluorophenol (Surr)	*79*		*38 - 98*	*03/13/13 12:00*	*03/14/13 20:09*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 39484

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,4-Dichlorobenzene	5.00	U	500	319		ug/L		64	35 - 93
2,4-Dinitrotoluene	5.00	U	500	344		ug/L		69	52 - 100
Hexachlorobenzene	5.00	U	500	335		ug/L		67	46 - 90
Hexachlorobutadiene	5.00	U	500	290		ug/L		58	29 - 96
Hexachloroethane	5.00	U	500	329		ug/L		66	23 - 104
2-Methylphenol	10.0	U	500	358		ug/L		72	44 - 106
3 & 4 Methylphenol	5.00	U	1000	710		ug/L		71	49 - 100
Nitrobenzene	5.00	U	500	318		ug/L		64	44 - 102
Pentachlorophenol	10.0	U	500	327		ug/L		65	35 - 108
Pyridine	25.0	U	500	252		ug/L		50	10 - 80
2,4,5-Trichlorophenol	10.0	U	500	331		ug/L		66	47 - 96
2,4,6-Trichlorophenol	10.0	U	500	316		ug/L		63	48 - 96

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*71*		*50 - 101*
Nitrobenzene-d5 (Surr)	*65*		*45 - 102*
Phenol-d5 (Surr)	*67*		*40 - 95*
Terphenyl-d14 (Surr)	*52*	*J*	*56 - 118*
2-Fluorobiphenyl (Surr)	*56*		*42 - 95*
2-Fluorophenol (Surr)	*71*		*38 - 98*

Lab Sample ID: 160-1688-1 MSD
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 39484

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,4-Dichlorobenzene	5.00	U	500	375		ug/L		75	35 - 93	16	20
2,4-Dinitrotoluene	5.00	U	500	404		ug/L		81	52 - 100	16	20
Hexachlorobenzene	5.00	U	500	382		ug/L		76	46 - 90	13	20
Hexachlorobutadiene	5.00	U	500	341		ug/L		68	29 - 96	16	20
Hexachloroethane	5.00	U	500	383		ug/L		77	23 - 104	15	20
2-Methylphenol	10.0	U	500	415		ug/L		83	44 - 106	15	20
3 & 4 Methylphenol	5.00	U	1000	824		ug/L		82	49 - 100	15	20
Nitrobenzene	5.00	U	500	375		ug/L		75	44 - 102	16	20
Pentachlorophenol	10.0	U	500	358		ug/L		72	35 - 108	9	20
Pyridine	25.0	U	500	288		ug/L		58	10 - 80	13	20
2,4,5-Trichlorophenol	10.0	U	500	389		ug/L		78	47 - 96	16	20
2,4,6-Trichlorophenol	10.0	U	500	371		ug/L		74	48 - 96	16	20

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*83*		*50 - 101*
Nitrobenzene-d5 (Surr)	*77*		*45 - 102*
Phenol-d5 (Surr)	*78*		*40 - 95*
Terphenyl-d14 (Surr)	*58*		*56 - 118*
2-Fluorobiphenyl (Surr)	*71*		*42 - 95*
2-Fluorophenol (Surr)	*84*		*38 - 98*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8081B - Organochlorine Pesticides (GC)

Lab Sample ID: LCS 160-40486/2-A
Matrix: Solid
Analysis Batch: 40930

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 40486

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
gamma-BHC (Lindane)	5.00	4.39		ug/L		88	70 - 130
Endrin	5.00	4.53		ug/L		91	70 - 130
Heptachlor	5.00	4.06		ug/L		81	70 - 130
Heptachlor epoxide	5.00	4.34		ug/L		87	70 - 130
Methoxychlor	5.00	5.00		ug/L		100	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*103*		*70 - 130*
Tetrachloro-m-xylene	*68*	*J*	*70 - 130*

Lab Sample ID: LB 160-39306/1-B LB
Matrix: Solid
Analysis Batch: 40930

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 40486

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
gamma-BHC (Lindane)	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 17:58	1
Endrin	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Heptachlor	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 17:58	1
Heptachlor epoxide	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Methoxychlor	0.0500	U	1.00	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Toxaphene	0.0500	U	20.0	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Technical Chlordane	0.200	U	5.00	0.200	ug/L		03/18/13 10:00	03/19/13 17:58	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*112*		*70 - 130*	*03/18/13 10:00*	*03/19/13 17:58*	*1*
Tetrachloro-m-xylene	*69*	*J*	*70 - 130*	*03/18/13 10:00*	*03/19/13 17:58*	*1*

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 40930

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 40486

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
gamma-BHC (Lindane)	0.0150	U	5.00	4.58		ug/L		92	70 - 130
Endrin	0.0500	U	5.00	4.65		ug/L		93	70 - 130
Heptachlor	0.0150	U	5.00	4.32		ug/L		86	70 - 130
Heptachlor epoxide	0.0500	U	5.00	4.48		ug/L		90	70 - 130
Methoxychlor	0.0500	U	5.00	4.88		ug/L		98	70 - 130

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*95*		*70 - 130*
Tetrachloro-m-xylene	*69*	*J*	*70 - 130*

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: 160-1688-1 MSD — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 40930 — **Prep Batch: 40486**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
gamma-BHC (Lindane)	0.0150	U	5.00	4.55		ug/L		91	70 - 130	1	20
Endrin	0.0500	U	5.00	4.65		ug/L		93	70 - 130	0	20
Heptachlor	0.0150	U	5.00	4.16		ug/L		83	70 - 130	4	20
Heptachlor epoxide	0.0500	U	5.00	4.46		ug/L		89	70 - 130	0	20
Methoxychlor	0.0500	U	5.00	5.11		ug/L		102	70 - 130	5	20

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*102*		*70 - 130*
Tetrachloro-m-xylene	*67*	*J*	*70 - 130*

Method: 8151A - Herbicides (GC)

Lab Sample ID: LCS 160-40921/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41055 — **Prep Batch: 40921**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4-D	250	257		ug/L		103	46 - 140
Silvex (2,4,5-TP)	25.0	28.2		ug/L		113	42 - 140

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*106*		*56 - 147*

Lab Sample ID: LB 160-40693/1-B LB — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 41055 — **Prep Batch: 40921**

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	19.8	U	40.0	19.8	ug/L		03/20/13 09:29	03/20/13 14:02	1
Silvex (2,4,5-TP)	2.98	U	10.0	2.98	ug/L		03/20/13 09:29	03/20/13 14:02	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*131*		*56 - 147*	*03/20/13 09:29*	*03/20/13 14:02*	*1*

Method: 8151A - Herbicides (GC) - RE

Lab Sample ID: 160-1688-1 MS — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 41055 — **Prep Batch: 40921**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4-D - RE	19.8	U J	250	292		ug/L		117	52 - 150
Silvex (2,4,5-TP) - RE	2.98	U J	25.0	31.6		ug/L		126	45 - 150

Method: 8151A - Herbicides (GC) - RE (Continued)

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 41055

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 40921

Surrogate	MS %Recovery	MS Qualifier	Limits
2,4-Dichlorophenylacetic acid - RE	*124*		*56 - 147*

Lab Sample ID: 160-1688-1 MSD
Matrix: Solid
Analysis Batch: 41055

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 40921

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2,4-D - RE	19.8	U J	250	394	J	ug/L		158	52 - 150	30	20
Silvex (2,4,5-TP) - RE	2.98	U J	25.0	45.0	J	ug/L		180	45 - 150	35	20

Surrogate	MSD %Recovery	MSD Qualifier	Limits
2,4-Dichlorophenylacetic acid - RE	*174*	*J*	*56 - 147*

Method: 6010C - Metals (ICP)

Lab Sample ID: LCS 160-39344/2-A
Matrix: Solid
Analysis Batch: 40682

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 39344

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	2500	2610		ug/L		105	80 - 120
Barium	2500	2580		ug/L		103	80 - 120
Cadmium	2500	2560		ug/L		102	80 - 120
Chromium	2500	2530		ug/L		101	80 - 120
Lead	2500	2500		ug/L		100	80 - 120
Selenium	2500	2720		ug/L		109	80 - 120
Silver	250	234		ug/L		93	80 - 120

Lab Sample ID: LB 160-39311/1-B LB
Matrix: Solid
Analysis Batch: 40682

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 39344

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.93	U	500	4.93	ug/L		03/12/13 12:42	03/19/13 17:22	1
Barium	12.0	J	125	9.88	ug/L		03/12/13 12:42	03/19/13 17:22	1
Cadmium	2.28	U	12.5	2.28	ug/L		03/12/13 12:42	03/19/13 17:22	1
Chromium	8.75	J	25.0	7.85	ug/L		03/12/13 12:42	03/19/13 17:22	1
Lead	3.18	U	250	3.18	ug/L		03/12/13 12:42	03/19/13 17:22	1
Selenium	9.00	J	500	6.65	ug/L		03/12/13 12:42	03/19/13 17:22	1
Silver	14.9	U	25.0	14.9	ug/L		03/12/13 12:42	03/19/13 17:22	1

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: 160-1688-1 MS — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 40682 — **Prep Batch: 39344**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.93	U	2500	2550		ug/L		102	75 - 125
Barium	647		2500	3260		ug/L		104	75 - 125
Cadmium	4.25	J	2500	2550		ug/L		102	75 - 125
Chromium	7.85	U	2500	2490		ug/L		100	75 - 125
Lead	288		2500	2720		ug/L		97	75 - 125
Selenium	7.00	J	2500	2630		ug/L		105	75 - 125
Silver	14.9	U	250	230		ug/L		92	75 - 125

Lab Sample ID: 160-1688-1 MSD — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 40682 — **Prep Batch: 39344**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.93	U	2500	2520		ug/L		101	75 - 125	1	20
Barium	647		2500	3210		ug/L		103	75 - 125	1	20
Cadmium	4.25	J	2500	2530		ug/L		101	75 - 125	1	20
Chromium	7.85	U	2500	2480		ug/L		99	75 - 125	0	20
Lead	288		2500	2700		ug/L		97	75 - 125	1	20
Selenium	7.00	J	2500	2590		ug/L		103	75 - 125	1	20
Silver	14.9	U	250	230		ug/L		92	75 - 125	0	20

Method: 7470A - Mercury (CVAA) - RE

Lab Sample ID: LCS 160-43574/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury - RE	25.0	26.5		ug/L		106	80 - 120

Lab Sample ID: LB 160-39312/1-B LB — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury - RE	0.0790	U	1.00	0.0790	ug/L		04/02/13 11:05	04/04/13 16:03	1

Lab Sample ID: 160-1688-1 MS — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury - RE	0.0790	U	25.0	27.0		ug/L		108	70 - 130

Method: 7470A - Mercury (CVAA) - RE (Continued)

Lab Sample ID: 160-1688-1 MSD — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury - RE	0.0790	U	25.0	26.1		ug/L		104	70 - 130	3	20

Method: 1010A - Ignitability,Pensky-Martens Closed Cup Method

Lab Sample ID: MB 160-43126/3 — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43126

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Flashpoint	>60		23.0	23.0	Degrees F			03/29/13 16:04	1

Lab Sample ID: LCS 160-43126/2 — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43126

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Flashpoint	77.0	77.0		Degrees F		100	95.9 - 104

Lab Sample ID: 160-1688-2 DU — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43126

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Flashpoint	>60		>60		Degrees F		NC	20

Method: 9012 - Cyanide, Reactive

Lab Sample ID: MB 160-41005/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cyanide, Reactive	0.250	U	0.250	0.250	mg/Kg		03/20/13 15:29	03/20/13 19:36	1

Lab Sample ID: LCS 160-41005/2-A ^2 — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cyanide, Reactive	6.25	0.500	U Q	mg/Kg		5	10 - 75

Lab Sample ID: 160-1688-2 MS — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Cyanide, Reactive	0.251	U H Q J	6.24	0.516	H J	mg/Kg		8	10 - 45

Method: 9012 - Cyanide, Reactive (Continued)

Lab Sample ID: 160-1688-2 DU — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Cyanide, Reactive	0.251	U H Q J	0.248	U H Q	mg/Kg		NC	30

Method: 9034 - Sulfide, Reactive

Lab Sample ID: MB 160-41006/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide, Reactive	22.2	U	22.2	22.2	mg/Kg		03/20/13 15:29	03/21/13 10:12	1

Lab Sample ID: LCS 160-41006/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide, Reactive	201	291	Q	mg/Kg		144	10 - 128

Lab Sample ID: 160-1688-2 MS — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide, Reactive	22.2	U H Q	199	218		mg/Kg		109	10 - 121

Lab Sample ID: 160-1688-2 DU — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Sulfide, Reactive	22.2	U H Q	22.0	U Q	mg/Kg		NC	20

Method: 9045D - pH

Lab Sample ID: LCS 160-39480/5 — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 39480

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	6.95		SU		99	99.0 - 101.0

Lab Sample ID: 160-1698-B-1-K DU — **Client Sample ID: Duplicate**
Matrix: Solid — **Prep Type: Soluble**
Analysis Batch: 39480

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
pH	6.46		6.42		SU		0.6	5

QC Association Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

GC/MS VOA

Leach Batch: 39297

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39297/1-A LB	Method Blank	TCLP	Solid	1311	

Analysis Batch: 39507

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	8260C	39297
160-1688-1 MS	1H-WP1	TCLP	Solid	8260C	39297
160-1688-1 MSD	1H-WP1	TCLP	Solid	8260C	39297
LB 160-39297/1-A LB	Method Blank	TCLP	Solid	8260C	39297
LCS 160-39507/9-A	Lab Control Sample	Total/NA	Solid	8260C	

GC/MS Semi VOA

Leach Batch: 39296

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39296/1-B LB	Method Blank	TCLP	Solid	1311	

Prep Batch: 39484

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	3510C	39296
160-1688-1 MS	1H-WP1	TCLP	Solid	3510C	39296
160-1688-1 MSD	1H-WP1	TCLP	Solid	3510C	39296
LB 160-39296/1-B LB	Method Blank	TCLP	Solid	3510C	39296
LCS 160-39484/2-A	Lab Control Sample	Total/NA	Solid	3510C	

Analysis Batch: 40220

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	8270D	39484
160-1688-1 MS	1H-WP1	TCLP	Solid	8270D	39484
160-1688-1 MSD	1H-WP1	TCLP	Solid	8270D	39484
LB 160-39296/1-B LB	Method Blank	TCLP	Solid	8270D	39484
LCS 160-39484/2-A	Lab Control Sample	Total/NA	Solid	8270D	39484

GC Semi VOA

Leach Batch: 39306

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39306/1-B LB	Method Blank	TCLP	Solid	1311	

Prep Batch: 40486

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	3510C	39306

GC Semi VOA (Continued)

Prep Batch: 40486 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 MS	1H-WP1	TCLP	Solid	3510C	39306
160-1688-1 MSD	1H-WP1	TCLP	Solid	3510C	39306
LB 160-39306/1-B LB	Method Blank	TCLP	Solid	3510C	39306
LCS 160-40486/2-A	Lab Control Sample	Total/NA	Solid	3510C	

Leach Batch: 40693

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	1311	
LB 160-40693/1-B LB	Method Blank	TCLP	Solid	1311	

Prep Batch: 40921

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	8151A	40693
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	8151A	40693
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	8151A	40693
LB 160-40693/1-B LB	Method Blank	TCLP	Solid	8151A	40693
LCS 160-40921/2-A	Lab Control Sample	Total/NA	Solid	8151A	

Analysis Batch: 40930

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	8081B	40486
160-1688-1 MS	1H-WP1	TCLP	Solid	8081B	40486
160-1688-1 MSD	1H-WP1	TCLP	Solid	8081B	40486
LB 160-39306/1-B LB	Method Blank	TCLP	Solid	8081B	40486
LCS 160-40486/2-A	Lab Control Sample	Total/NA	Solid	8081B	40486

Analysis Batch: 41055

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	8151A	40921
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	8151A	40921
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	8151A	40921
LB 160-40693/1-B LB	Method Blank	TCLP	Solid	8151A	40921
LCS 160-40921/2-A	Lab Control Sample	Total/NA	Solid	8151A	40921

Metals

Leach Batch: 39311

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39311/1-B LB	Method Blank	TCLP	Solid	1311	

Leach Batch: 39312

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	1311	

Metals (Continued)

Leach Batch: 39312 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LB 160-39312/1-B LB - RE	Method Blank	TCLP	Solid	1311	

Prep Batch: 39344

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	3010A	39311
160-1688-1 MS	1H-WP1	TCLP	Solid	3010A	39311
160-1688-1 MSD	1H-WP1	TCLP	Solid	3010A	39311
LB 160-39311/1-B LB	Method Blank	TCLP	Solid	3010A	39311
LCS 160-39344/2-A	Lab Control Sample	Total/NA	Solid	3010A	

Analysis Batch: 40682

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	6010C	39344
160-1688-1 MS	1H-WP1	TCLP	Solid	6010C	39344
160-1688-1 MSD	1H-WP1	TCLP	Solid	6010C	39344
LB 160-39311/1-B LB	Method Blank	TCLP	Solid	6010C	39344
LCS 160-39344/2-A	Lab Control Sample	Total/NA	Solid	6010C	39344

Prep Batch: 43574

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	7470A	39312
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	7470A	39312
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	7470A	39312
LB 160-39312/1-B LB - RE	Method Blank	TCLP	Solid	7470A	39312
LCS 160-43574/2-A - RE	Lab Control Sample	Total/NA	Solid	7470A	

Analysis Batch: 44437

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	7470A	43574
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	7470A	43574
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	7470A	43574
LB 160-39312/1-B LB - RE	Method Blank	TCLP	Solid	7470A	43574
LCS 160-43574/2-A - RE	Lab Control Sample	Total/NA	Solid	7470A	43574

General Chemistry

Analysis Batch: 39412

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	Moisture	
160-1688-2 DU	1H-WP2	Total/NA	Solid	Moisture	

Leach Batch: 39462

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Soluble	Solid	DI Leach	
160-1698-B-1-K DU	Duplicate	Soluble	Solid	DI Leach	

Analysis Batch: 39480

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Soluble	Solid	9045D	39462
160-1698-B-1-K DU	Duplicate	Soluble	Solid	9045D	39462

General Chemistry (Continued)

Analysis Batch: 39480 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 160-39480/5	Lab Control Sample	Total/NA	Solid	9045D	

Prep Batch: 41005

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	7.3.3	
160-1688-2 DU	1H-WP2	Total/NA	Solid	7.3.3	
160-1688-2 MS	1H-WP2	Total/NA	Solid	7.3.3	
LCS 160-41005/2-A ^2	Lab Control Sample	Total/NA	Solid	7.3.3	
MB 160-41005/1-A	Method Blank	Total/NA	Solid	7.3.3	

Prep Batch: 41006

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	7.3.4	
160-1688-2 DU	1H-WP2	Total/NA	Solid	7.3.4	
160-1688-2 MS	1H-WP2	Total/NA	Solid	7.3.4	
LCS 160-41006/2-A	Lab Control Sample	Total/NA	Solid	7.3.4	
MB 160-41006/1-A	Method Blank	Total/NA	Solid	7.3.4	

Analysis Batch: 41093

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	9034	41006
160-1688-2 DU	1H-WP2	Total/NA	Solid	9034	41006
160-1688-2 MS	1H-WP2	Total/NA	Solid	9034	41006
LCS 160-41006/2-A	Lab Control Sample	Total/NA	Solid	9034	41006
MB 160-41006/1-A	Method Blank	Total/NA	Solid	9034	41006

Analysis Batch: 41105

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	9012	41005
160-1688-2 DU	1H-WP2	Total/NA	Solid	9012	41005
160-1688-2 MS	1H-WP2	Total/NA	Solid	9012	41005
LCS 160-41005/2-A ^2	Lab Control Sample	Total/NA	Solid	9012	41005
MB 160-41005/1-A	Method Blank	Total/NA	Solid	9012	41005

Analysis Batch: 43126

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	1010A	
160-1688-2 DU	1H-WP2	Total/NA	Solid	1010A	
LCS 160-43126/2	Lab Control Sample	Total/NA	Solid	1010A	
MB 160-43126/3	Method Blank	Total/NA	Solid	1010A	

Surrogate Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	12DCE
Lab Sample ID	Client Sample ID	(85-115)	(85-115)	(84-120)	(83-117)
LCS 160-39507/9-A	Lab Control Sample	107	101	93	95

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	12DCE
Lab Sample ID	Client Sample ID	(85-115)	(85-115)	(84-120)	(83-117)
160-1688-1	1H-WP1	101	101	95	95
160-1688-1 MS	1H-WP1	102	100	91	96
160-1688-1 MSD	1H-WP1	102	99	93	96
LB 160-39297/1-A LB	Method Blank	101	100	97	100

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)					
		TBP	NBZ	PHL	TPH	FBP	2FP
Lab Sample ID	Client Sample ID	(50-101)	(45-102)	(40-95)	(56-118)	(42-95)	(38-98)
LCS 160-39484/2-A	Lab Control Sample	81	75	79	56	71	82

Surrogate Legend

TBP = 2,4,6-Tribromophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPH = Terphenyl-d14 (Surr)
FBP = 2-Fluorobiphenyl (Surr)
2FP = 2-Fluorophenol (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)					
		TBP	NBZ	PHL	TPH	FBP	2FP
Lab Sample ID	Client Sample ID	(50-101)	(45-102)	(40-95)	(56-118)	(42-95)	(38-98)
160-1688-1	1H-WP1	75	78	75	56	71	82
160-1688-1 MS	1H-WP1	71	65	67	52 J	56	71
160-1688-1 MSD	1H-WP1	83	77	78	58	71	84

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)					
		TBP	NBZ	PHL	TPH	FBP	2FP
Lab Sample ID	Client Sample ID	(50-101)	(45-102)	(40-95)	(56-118)	(42-95)	(38-98)
LB 160-39296/1-B LB	Method Blank	77	71	73	57	67	79

Surrogate Legend

TBP = 2,4,6-Tribromophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPH = Terphenyl-d14 (Surr)
FBP = 2-Fluorobiphenyl (Surr)
2FP = 2-Fluorophenol (Surr)

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)	
		DCB2	TCX2
Lab Sample ID	Client Sample ID	(70-130)	(70-130)
LCS 160-40486/2-A	Lab Control Sample	103	68 J

Surrogate Legend

DCB = DCB Decachlorobiphenyl (Surr)
TCX = Tetrachloro-m-xylene

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)	
		DCB2	TCX2
Lab Sample ID	Client Sample ID	(70-130)	(70-130)
160-1688-1	1H-WP1	101	70
160-1688-1 MS	1H-WP1	95	69 J
160-1688-1 MSD	1H-WP1	102	67 J
LB 160-39306/1-B LB	Method Blank	112	69 J

Surrogate Legend

DCB = DCB Decachlorobiphenyl (Surr)
TCX = Tetrachloro-m-xylene

Method: 8151A - Herbicides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		DCPA2
Lab Sample ID	Client Sample ID	(56-147)
LCS 160-40921/2-A	Lab Control Sample	106

Surrogate Legend

DCPA = 2,4-Dichlorophenylacetic acid

Surrogate Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8151A - Herbicides (GC)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)						
		DCPA2						
Lab Sample ID	**Client Sample ID**	**(56-147)**						
160-1688-1 - RE	1H-WP1	127						
160-1688-1 MS - RE	1H-WP1	124						
160-1688-1 MSD - RE	1H-WP1	174 J						
LB 160-40693/1-B LB	Method Blank	131						

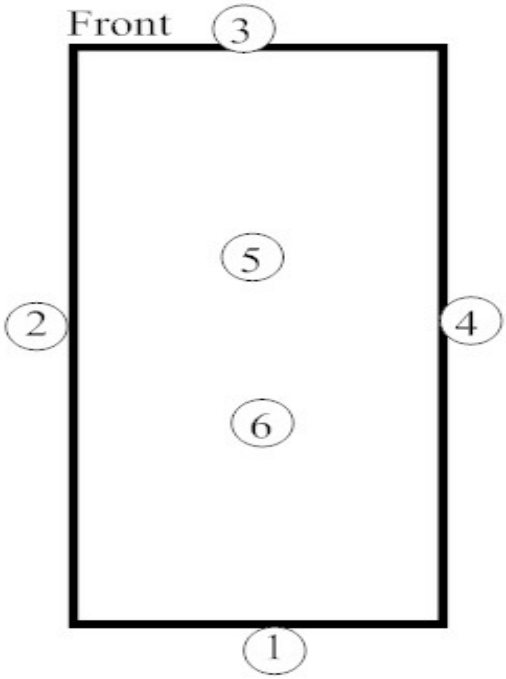
Surrogate Legend

DCPA = 2,4-Dichlorophenylacetic acid

Appendix V

Container Outgoing Surveys

DATE: 10/9/2015	TIME: 12:30	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-05							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 8.1 βγ 180.7	α 0.0 βγ 426.3
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/9/2015	TIME: 13:55 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000018						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 46,223 lbs.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-05

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	3	3				2.7	165.5	Rear
2	5	5				0.0	-9.9	Left Side
3	4	4				0.0	-53.7	Front
4	4	4				0.0	110.7	Right Side
5	4	4				0.0	1.1	Top
6	4	4				0.0	55.9	Bottom
6D						0.0	66.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 10/9/2015
Daniel Spicuzza	Time: 13:55

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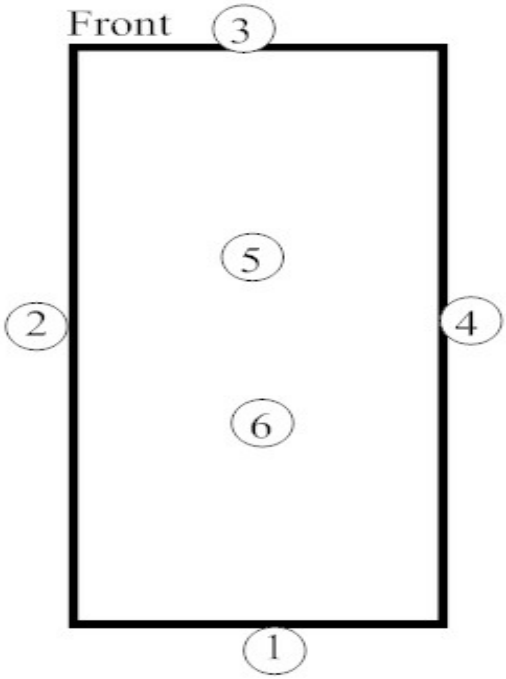
DATE: 10/13/2015	TIME: 13:15	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-07							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 183.8	α 0.5 βγ 442.7
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 µR/hr
DATE: 10/13/2015	TIME: 13:50 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000003						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-07

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	5	4				10.3	77.8	Rear
2	10	8				2.2	83.3	Left Side
3	7	5				2.2	94.2	Front
4	11	9				4.9	105.2	Right Side
5	11	9				2.2	50.4	Top
6	12	8				2.2	-15.3	Bottom
3D						2.2	83.3	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/13/2015 Time: 13:50	

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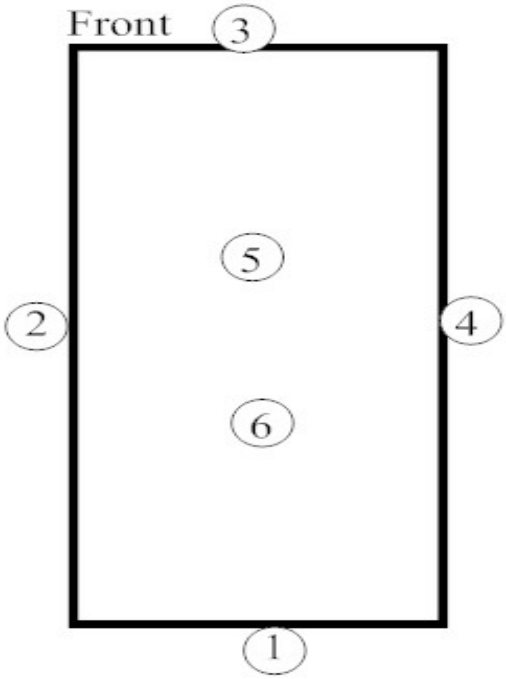
DATE: 10/14/2015	TIME: 15:12	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-09							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 183.8	α 0.5 βγ 442.7
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/14/2015	TIME: 15:50 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000009						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-09

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	5	4				2.2	77.8	Rear
2	5	4				-0.5	6.6	Left Side
3	9	6				4.9	-37.3	Front
4	7	5				2.2	99.7	Right Side
5	6	5				4.9	12.1	Top
6	7	5				-0.5	-64.7	Bottom
4D						2.2	88.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 10/14/2015
Daniel Spicuzza	Time: 15:50

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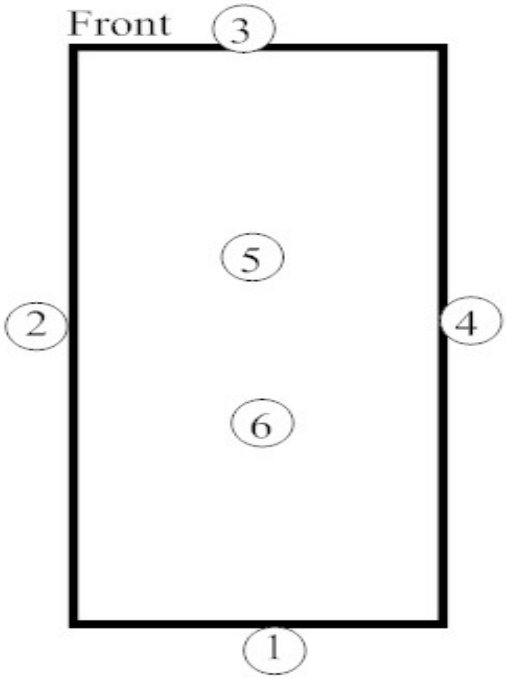
DATE: 10/15/2015	TIME: 14:15	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-011							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 183.8	α 0.5 βγ 442.7
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 µR/hr
DATE: 10/15/2015	TIME: 14:50 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000020						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-011

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	5	4				-0.5	-15.3	Rear
2	5	4				4.9	-9.9	Left Side
3	7	5				13.0	28.5	Front
4	7	5				4.9	17.5	Right Side
5	7	5				-0.5	6.6	Top
6	8	6				7.6	72.3	Bottom
1D						-0.5	-31.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 10/15/2015
Daniel Spicuzza	Time: 14:50

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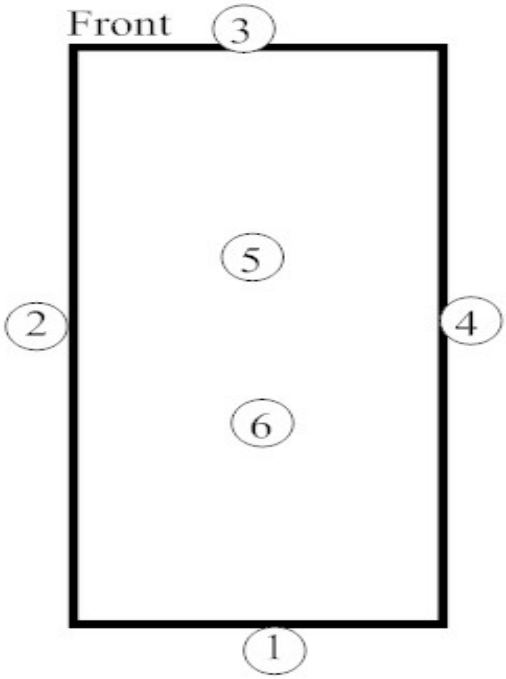
DATE: 10/16/2015	TIME: 13:45	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-015							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 181.7	α 0.5 βγ 431.8
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/16/2015	TIME: 14:20 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000035						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-015

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	4	3				-0.5	50.4	Rear
2	5	4				4.9	99.7	Left Side
3	20	9				-0.5	77.8	Front
4	4	3				7.6	1.1	Right Side
5	20	9				-0.5	99.7	Top
6	8	6				2.2	39.5	Bottom
2D						4.9	88.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 10/16/2015

Time: 14:20

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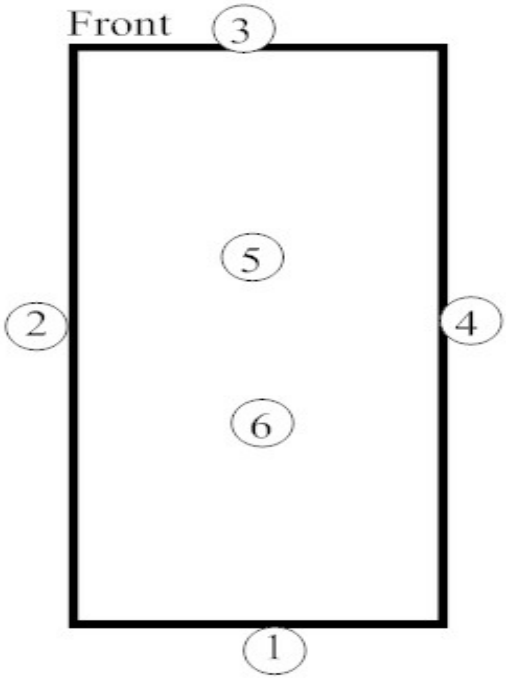
DATE: 10/19/2015	TIME: 14:20	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-017							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 14.0 βγ 183.6	α 1.1 βγ 441.6
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/19/2015	TIME: 15:30 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000019						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-017

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	5	3				-1.1	7.7	Rear
2	5	4				1.6	24.1	Left Side
3	5	7				4.3	35.1	Front
4	7	5				7.1	-30.7	Right Side
5	7	5				7.1	7.7	Top
6	6	5				4.3	-30.7	Bottom
2D						1.6	40.5	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								
N/A								
N/A								

Reviewer	Date: 10/19/2015
Daniel Spicuzza	Time: 15:30

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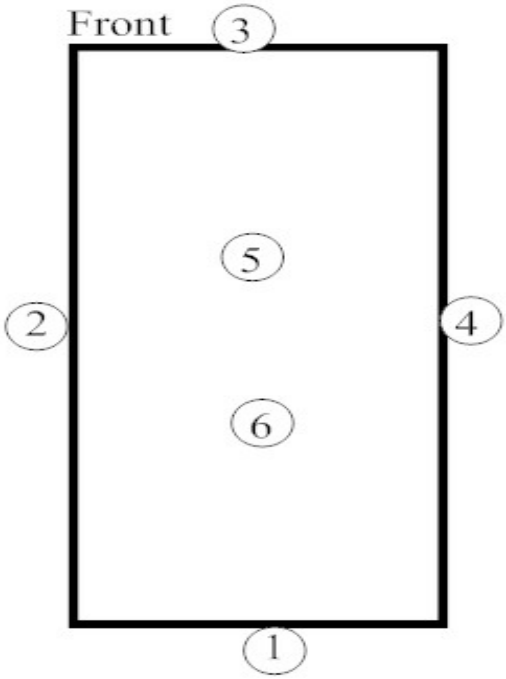
DATE: 10/20/2015	TIME: 15:20	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-020							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 14.0 βγ 187.9	α 1.1 βγ 464.7
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/20/2015	TIME: 15:32 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000031						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-020

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	5	3				4.3	50.4	Rear
2	7	4				4.3	66.8	Left Side
3	4	3				4.3	-37.3	Front
4	5	3				4.3	34.0	Right Side
5	7	3				1.6	23.0	Top
6	5	3				1.6	-37.3	Bottom
3D						4.3	-42.7	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 10/20/2015
Daniel Spicuzza	Time: 15:32

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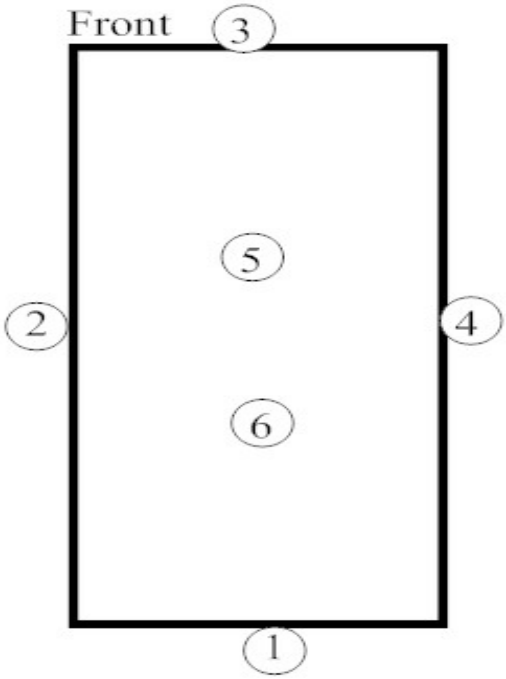
DATE: 10/21/2015	TIME: 15:20	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-23							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 182.1	α 0.5 βγ 434.0
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/21/2015	TIME: 15:42 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000025						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-23

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	4	4				2.2	-12.1	Rear
2	4	4				7.6	20.8	Left Side
3	4	3				-0.5	-23.0	Front
4	5	4				2.2	-17.5	Right Side
5	5	4				7.6	15.3	Top
6	5	4				2.2	-34.0	Bottom
1D						2.2	-23.0	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/21/2015 Time: 15:42	

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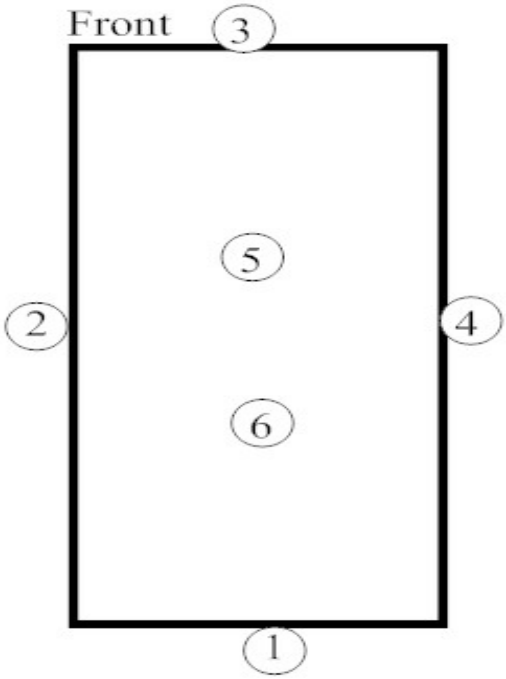
DATE: 10/22/2015	TIME: 14:55	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-026							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 185.2	α 0.5 βγ 450.4
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/22/2015	TIME: 15:35 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000023						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-026

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	4	4				7.6	31.8	Rear
2	7	4				4.9	75.6	Left Side
3	4	4				10.3	-1.1	Front
4	4	4				2.2	-17.5	Right Side
5	4	4				4.9	9.9	Top
6	7	4				4.9	-12.1	Bottom
5D						4.9	-1.1	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 10/22/2015

Time: 15:35

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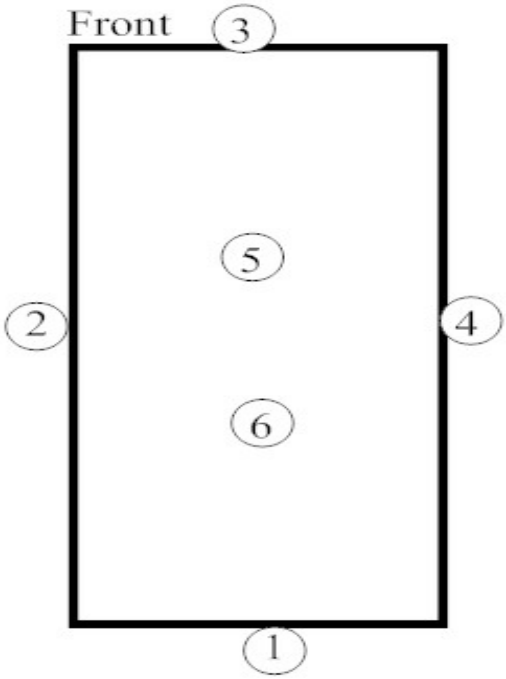
DATE: 10/23/2015	TIME: 14:55	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-029							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 14.0 βγ 188.3	α 1.1 βγ 466.8
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/23/2015	TIME: 15:30 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Container Outgoing Survey: ISEU-000022



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-029

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	4	4				1.6	4.4	Rear
2	13	4				-1.1	-23.0	Left Side
3	4	4				4.3	-55.9	Front
4	40	6				4.3	-77.8	Right Side
5	12	4				-1.1	-66.8	Top
6	4	4				-1.1	42.7	Bottom
5D						-1.1	-77.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 10/23/2015

Time: 15:30

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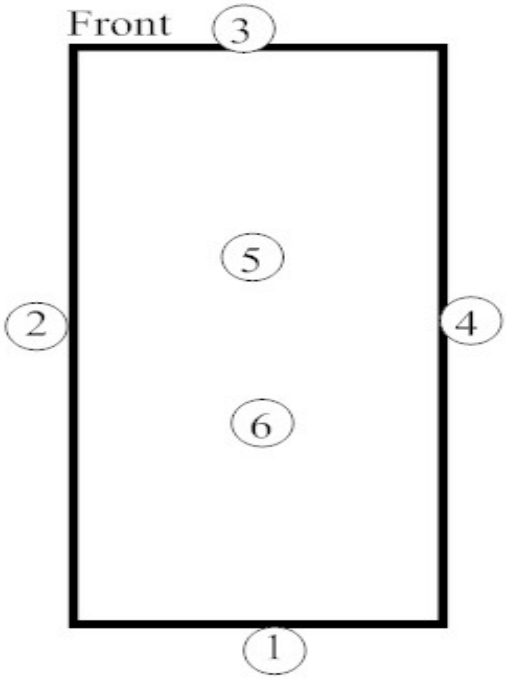
DATE: 10/26/2015	TIME: 15:45	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-031							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 14.0 βγ 186.1	α 1.1 βγ 454.8
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/26/2015	TIME: 15:55 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000040						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-031

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	4	4				-1.1	27.4	Rear
2	4	4				-1.1	32.9	Left Side
3	4	4				9.8	-5.5	Front
4	4	4				4.3	-54.8	Right Side
5	4	4				1.6	-60.3	Top
6	4	4				1.6	-82.2	Bottom
3D						7.1	-16.4	Duplicate Swipe
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 10/26/2015

Time: 15:55

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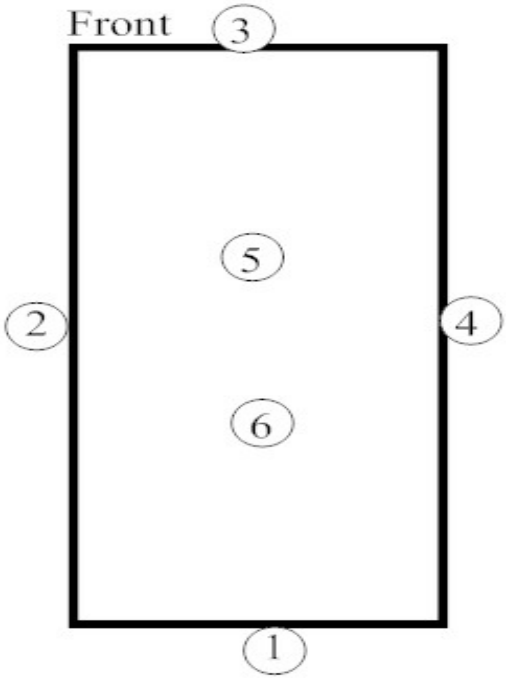
DATE: 10/27/2015	TIME: 14:45	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-034							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 187.5	α 0.5 βγ 462.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/27/2015	TIME: 15:15 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000027						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-034

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	4	4				-0.5	3.3	Rear
2	4	4				18.5	14.2	Left Side
3	4	4				10.3	-7.7	Front
4	4	4				4.9	-29.6	Right Side
5	4	4				7.6	36.2	Top
6	4	4				4.9	25.2	Bottom
2D						15.7	3.3	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 10/27/2015
Daniel Spicuzza	Time: 15:15

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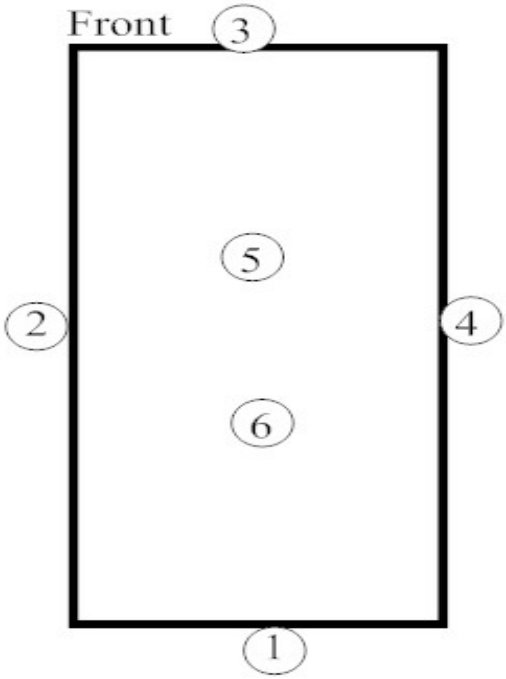
DATE: 10/28/2015	TIME: 14:45	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-036							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 14.0 βγ 189.7	α 1.1 βγ 474.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/28/2015	TIME: 15:55 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						
		Container Outgoing Survey: ISEU-000013						



Comments:

Tare Weight:7630 lbs.

Gross Weight: 42,840 lbs.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-036

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1	4	4				-1.1	-14.2	Rear
2	4	4				1.6	-47.1	Left Side
3	4	4				1.6	-47.1	Front
4	4	4				4.3	-74.5	Right Side
5	4	4				1.6	-41.6	Top
6	4	4				7.1	-85.5	Bottom
4D						4.3	-91.0	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 10/28/2015

Time: 15:55

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Appendix W

Waste Disposal Documents

25,750
12,946T
14yds

1511241011 7

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-12
DATE: 10/28/2015
WSID No.: 31422-0

NAME OF CARRIER No. 1: Visionary Solutions
NAME OF CARRIER No. 2: Norfolk Southern Railroad
NAME OF CARRIER No. 3: Union Pacific Railroad
NAME OF CARRIER No. 4: Steve Forler Trucking
NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1616	ZIP CODE:	20640	PHONE:	803-507-1629

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000027

Truck No. 312

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	14.38	46450	38820
Metal Intermodal					
		Th-232 0.09 uCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding
$ 0.00 per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Richard Whited
Signature

Freight C.O.D. to:
C.O.D. Amt $
Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not demand payment of freight and all other lawful charges.

C.O.D. Fee:
Prepaid
Collect $
Extra charges $
Freight Charges
Freight Prepaid
Check box if charges are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of the Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF-Indian Head	Received By:	Eric Miller
Signature:	Richard Whited	Signature:	Antonio Rodriguez
Title:	Broker, Agent for US Army JBBC	Title:	Receiving Clerk
Date:	10/28/2015	Date:	11/24/15

Carrier No. 1:	Visionary Solutions		
Signature:		Date:	10/28/2015
Carrier No. 2:	Norfolk Southern Railroad		
Signature:		Date:	
Carrier No. 3:	Union Pacific Railroad		
Signature:		Date:	
Carrier No. 4:	Steve Forler Trucking		
Signature:		Date:	11-23-15
Carrier No. 5:			
Signature:		Date:	

WSID should be 31442-0
per customer service
USEI weight OK per
Richard Shatchu via Wilson
11/24/15 ar

12yds

1571021 10130 21489p

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-06
DATE: 10/20/2015
WBID No.: 31442-0

NAME OF CARRIER No. 1. Visionary Solutions
NAME OF CARRIER No 2: Norfolk Southern Railroad
NAME OF CARRIER No 3: Union Pacific Railroad
NAME OF CARRIER No. 4. Steve Forter Trucking
NAME OF CARRIER No. 5.

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	903-507-1629

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000019

Truck No. 305

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	11.91	39800	32170
Metal Intermodal					
		Th-232 0.88 ci/G			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ 0.00 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Rated C.O.D. to:
C.O.D. Amt $
Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee
Prepaid
Collect $
Total Charges $
Freight Charges
Freight Prepaid Check not if charges

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to the usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF-Indian Head	Received By:	US Ecology
Signature:	Richard Thatcher	Signature:	Jennifer Little
Title:	Broker, Agent for US Army JMC	Title:	Receiving
Date:	10/20/2015	Date:	11-24-15

Carrier No. 1:	Visionary Solutions		
Signature:		Date:	10/20/2015
Carrier No. 2:	Norfolk Southern Railroad		
Signature:		Date:	
Carrier No. 3:	Union Pacific Railroad		
Signature:		Date:	
Carrier No. 4:	Steve Forter Trucking		
Signature:		Date:	11/24/15
Carrier No. 5:			
Signature:		Date:	

WBS should be 31442-0

USEI weight ok per Richard Thatcher

1511241 0138

24,100p 12 YRDS

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-03

DATE: 10/15/15

WSID No: 31442-0

NAME OF CARRIER No. 1: Visionary Solutions

NAME OF CARRIER No. 2: Norfolk Southern Railroad

NAME OF CARRIER No. 3: Union Pacific Railroad

NAME OF CARRIER No. 4: Steve Forler Trucking

NAME OF CARRIER No 5:

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1616	ZIP CODE:	20640	PHONE:	803-607-1628

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000009

Truck No. 305

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	13.32	43600	35970
Metal Intermodal					
		Th-232 0.06 mCi			

PLACARDS TENDERED: NO

Note Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ 0.00 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked marked and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Rate C.O.D. to

C.O.D. Amt $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee: Prepaid / Collect $

Total Charges $

Freight Charges: Freight Prepaid / Check box if charges are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of the Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy NSF Indian Head	Received By:	US Idaho
Signature:		Signature:	Jessica Leonard
Title:	Broker, Agent for US Army JBCC	Title:	
Date	10/15/15	Date:	11/24/2015

Carrier No. 1.	Visionary Solutions
Signature:	Date 10/15/15
Carrier No. 2.	Norfolk Southern Railroad
Signature	Date.
Carrier No. 3.	Union Pacific Railroad
Signature:	Date:
Carrier No. 4.	Steve Forler Trucking
Signature	Date 11/24/15
Carrier No. 5:	
Signature:	Date:

USEI will pay ok per Richard Shatchu 11/24/15 CR

1511241014 5 23280p 12YRDS

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-04

NAME OF CARRIER No. 1: Visionary Solutions

NAME OF CARRIER No. 2: Norfolk Southern Railroad

NAME OF CARRIER No. 3: Union Pacific Railroad

NAME OF CARRIER No 4: Steve Forler Trucking

NAME OF CARRIER No. 5:

DATE: 10/16/2015

WSID No.: 31442-0

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000020

Truck No. 306

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	12.97	42650	35020
Metal Intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.48 per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked, name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Name C.O.D. to:

C.O.D. Amt $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges

C.O.D. Fee: Prepaid Collect $

Total Charges $

Freight Charges: Freight Prepaid Check box if charges are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy NSF Indian Head	Received By:	USE Idaho
Signature:		Signature:	
Title:	Broker, Agent for US Army IMO	Title:	
Date:	10/16/15	Date:	11/24/2015

Carrier No. 1:	Visionary Solutions	
Signature:		Date: 10/16/15
Carrier No.2	Norfolk Southern Railroad	
Signature:		Date:
Carrier No. 3	Union Pacific Railroad	
Signature:		Date:
Carrier No. 4:	Steve Forler Trucking	
Signature:		Date: 11/24/15
Carrier No. 5:		
Signature:		Date:

WSID should be 31442

USEI weight ok per Richard Shatelin 11/24/15 CK

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]

EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. NO: TSE4000027 **SHIPPING DOCUMENT NUMBER:** USN2015-011-USE1-12-1-1

Step 1: Is container *"Visibly Clean?"*[2] Yes ☑ No ☐. RJ

If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent...
Serial Number: PR156746 Calibration Due: 9/5/16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent...
Serial Number: 162435 Calibration Due: 9/5/16

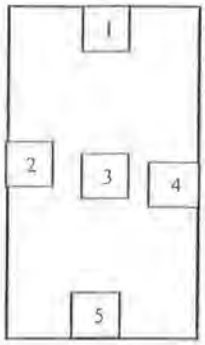
d. Bicron MicroRem or equivalent.....Serial Number: model 19 Calibration Due: 12/15/15

A. ALPHA
Background: 0 cpm
Efficiency: 7.95 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	2	2	11
2	4	4	22
3	0	0	0
4	16	6	33
5	0	0	0

Front



Rear

B. BETA
Background: 36 cpm
Efficiency: 25.89 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	43	7	27
2	55	19	73
3	34	0	0
4	45	9	35
5	28	0	0

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 38 dpm, 2 95 dpm, 3 0 dpm, 4 68 dpm, 5 0 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☑ RJ

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☑ No ☐

B. Approved for Returned to Service by: Date: 11-24-15

Printed name of Radiation Technician Dawna Harlow Start Time: 9:14

C. Signed: Dawna S Harlow End Time: 9:19
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

Indian Head
1571241030

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]
EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. No: USEU0000019 SHIPPING DOCUMENT NUMBER: USN 2015-011-USEI-06-1-1

Step 1: Is container *Visibly Clean?*[2] Yes ☒ No ☐ RJ

If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent... Serial Number: PR328262 Calibration Due: 7-30-16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent... Serial Number: 316200 Calibration Due: 7-30-16

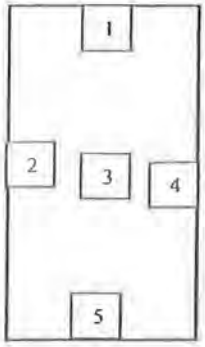
d. Bicron MicroRem or equivalent.....Serial Number: Model 19 Calibration Due: 12-5-15

A. ALPHA
Background: 0 cpm
Efficiency: 37.30 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	0	0	0
2	0	0	0
3	2	2	5
4	0	0	0
5	1	1	3

Front



Rear

B. BETA
Background: 39 cpm
Efficiency: 49.70 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	35	0	0
2	31	0	0
3	38	0	0
4	35	0	0
5	36	0	0

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 0 dpm, 2 0 dpm, 3 5 dpm, 4 0 dpm, 5 3 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☒ RJ

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☑ No ☐

B. Approved for Returned to Service by: Date: 11-24-15

Printed name of Radiation Technician Danna Harlow Start Time: 10:55

C. Signed: Danna Harlow End Time: PH 11:00
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

Dr drum Head
1571371010138

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]
EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. No: ISEU000009 SHIPPING DOCUMENT NUMBER: USN2015-011-USEI-03

Step 1: Is container "*Visibly Clean*?"[2] Yes ☒ No ☐ RS

If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent...
Serial Number: PR328262 Calibration Due: 7-30-16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent...
Serial Number: 316200 Calibration Due: 7-30-16

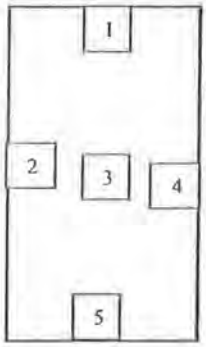
d. Bicron MicroRem or equivalent.....Serial Number: Model 19 Calibration Due: 12-5-5

A. ALPHA
Background: 0 cpm
Efficiency: 37.30 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0

Front



Rear

B. BETA
Background: 36 cpm
Efficiency: 49.70 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	32	0	0
2	41	5	19
3	38	2	8
4	33	0	0
5	36	0	0

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 0 dpm, 2 19 dpm, 3 8 dpm, 4 0 dpm, 5 0 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☒ RS

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☒ No ☐ DL

B. Approved for Returned to Service by: Date: 11/24/15
Printed name of Radiation Technician Dylane Lawson Start Time: 16:00

C. Signed: Dylane Lawson End Time: 16:06
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

Ludlum Head
1571711014-5

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]

EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. NO: ISEU000020 SHIPPING DOCUMENT NUMBER: USN 20150011-USEI-04

Step 1: Is container *"Visibly Clean?"*?[2] Yes ☒ No ☐. RS

If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent...
Serial Number: PR156946 Calibration Due: 9/5/16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent...
Serial Number: 162435 Calibration Due: 9/5/16

d. Bicron MicroRem or equivalent.....Serial Number: Model 19 Calibration Due: 12/15/15

A. ALPHA

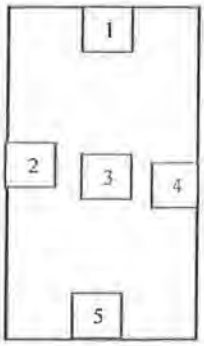
Background: 0 cpm

Efficiency: 17.95 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0

Front



Rear

B. BETA

Background: 36 cpm

Efficiency: 25.89 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	37	1	4
2	34	0	0
3	43	7	27
4	38	2	8
5	31	0	0

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 4 dpm, 2 0 dpm, 3 27 dpm, 4 8 dpm, 5 0 dpm

Is Fixed Contamination <500 μrem (Class 7 Only)? Yes ☐ No ☐ N/A ☒ RS

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☑ No ☐ RL

B. Approved for Returned to Service by: Date: 11/24/15

Printed name of Radiation Technician Devani Lawson Start Time: 16:06

C. Signed: Devani Lawson End Time: 16:12
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.

[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

1511251016 0

21,980p

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No USN 2015-011-USEI-05
DATE 10/19/2015
WSID No.: 31443-0

NAME OF CARRIER No 1 Visionary Solutions
NAME OF CARRIER No 2. Norfolk Southern Railroad
NAME OF CARRIER No. 3 Union Pacific Railroad
NAME OF CARRIER No. 4: Steve Forler Trucking
NAME OF CARRIER No 5

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1618	ZIP CODE.	20640	PHONE:	603-507-1628

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000035

Truck No. 305

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	12.66	41800	34170
Metal Intermodal					
		Th-232 6.68 mCi			

PLACARDS TENDERED: NO

Rate Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ value per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked, named and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation.

Signature

Rate C.O.D. to:

C.O.D. Amt $

Subject to Section 7 of the conditions, if any shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee

Prepaid

Collect $

Total Charges $

Freight Charges

Freight Prepaid

Check box if charges are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy,NSF-Indian Head	Received By:	USE Idaho
Signature	Richard Thatcher	Signature.	Jessica Leonard
Title:	Broker, Agent for US Army JMC	Title	
Date	10/19/15	Date:	11/25/2015

Carrier No. 1:	Visionary Solutions	
Signature:		Date 10/19/15
Carrier No. 2:	Norfolk Southern Railroad	
Signature		Date:
Carrier No. 3:	Union Pacific Railroad	
Signature:		Date:
Carrier No. 4:	Steve Forler Trucking	
Signature:		Date. 11/25/15
Carrier No. 5:		
Signature		Date:

USEI Weight OK per Richard Thatcher

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]
EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. NO: ISEU000035 **SHIPPING DOCUMENT NUMBER:** USN2015-011 USEI-05-1-1

Step 1: Is container *"Visibly Clean?"*[2] Yes ☒ No ☐. KJ
If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent...
Serial Number: PR156946 Calibration Due: 9/5/16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent...
Serial Number: 162435 Calibration Due: 9/5/16

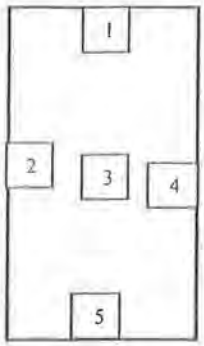
d. Bicron MicroRem or equivalent.....Serial Number: Model 19 Calibration Due: 12/15/15

A. ALPHA
Background: 0 cpm
Efficiency: 17.95 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	0	0	0
2	1	1	6
3	1	1	6
4	0	0	0
5	0	0	0

Front



Rear

B. BETA
Background: 33 cpm
Efficiency: 25.89 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	37	4	15
2	37	4	15
3	28	0	0
4	32	0	0
5	39	6	23

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 15 dpm, 2 21 dpm, 3 6 dpm, 4 0 dpm, 5 23 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☒ RJ

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☐ No ☐

B. Approved for Returned to Service by: Date: 11-25-15
Printed name of Radiation Technician Donna Harlow Start Time: 11:37
C. Signed: Donna J Harlow End Time: 11:42
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure*

1511251017O 25800p

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-01

DATE: 10/13/2015

WSID No.: 31442-0

NAME OF CARRIER No. 1: Visionary Solutions

NAME OF CARRIER No. 2: Norfolk Southern Railroad

NAME OF CARRIER No. 3: Union Pacific Railroad

NAME OF CARRIER No. 4: Steve Forler Trucking

NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF- Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1616	ZIP CODE:	20640	PHONE:	603-507-1619

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISE000018

Truck No. 305

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	14.29	46223	38593
Metal Intermodal					
		Th-232 0.09 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.01 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Rated C.O.D. to

C.O.D. Amt $

Subject to Section 7 of the conditions, if the shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following guarantee:
The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee

Prepaid

Collect $

Total Charges $

Freight Charges

Freight Prepaid Check box if charges are to be collected except when box is not right checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy NSF Indian Head	Received By:	USE Idaho
Signature:	Richard Thatcher	Signature:	Debbie Leonard
Title:	Broker, Agent for US Army JMC	Title:	
Date:	10/13/15	Date:	11/25/2015

Carrier No. 1:	Visionary Solutions
Signature:	Date: 10/13/15
Carrier No.2:	Norfolk Southern Railroad
Signature:	Date:
Carrier No. 3:	Union Pacific Railroad
Signature:	Date:
Carrier No. 4:	Steve Forler Trucking
Signature:	Date: 11/25/15
Carrier No. 5:	
Signature:	Date:

USEI Weight OK
per Richard Thatcher

Indian Head 151125101700

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]
EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. NO: Bin 018 **SHIPPING DOCUMENT NUMBER:** USN2015-011-125 USEI-01-1-1

Step 1: Is container *Visibly Clean*?[2] Yes ☑ No ☐
If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent... Serial Number: PR328262 Calibration Due: 7-30-16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent... Serial Number: 316200 Calibration Due: 7-30-16

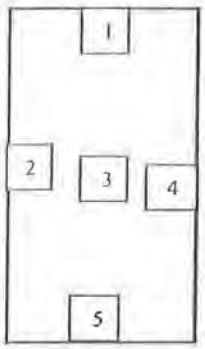
d. Bicron MicroRem or equivalent.....Serial Number: model 19 Calibration Due: 12-5-15

A. ALPHA
Background: 0 cpm
Efficiency: 37.30 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	0	0	0
2	5	5	28
3	1	1	6
4	0	0	0
5	0	0	0

Front



Rear

B. BETA
Background: 33 cpm
Efficiency: 49.70 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	42	9	35
2	38	5	19
3	40	7	27
4	38	5	19
5	34	1	4

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION – DPM/WIPE (ALPHA+BETA):

A. 1 35 dpm, 2 47 dpm, 3 33 dpm, 4 19 dpm, 5 4 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☑ RS

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☑ No ☐

B. Approved for Returned to Service by: Date: 11-25-15

Printed name of Radiation Technician Donna Harlow Start Time: 11:30

C. Signed: Donna Harlow End Time: 11:35
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

15112510178

23340p 12yd3

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-02
DATE: 10/14/15
WSID No.: 31442-0

NAME OF CARRIER No. 1: Visionary Solutions
NAME OF CARRIER No. 2: Norfolk Southern Railroad
NAME OF CARRIER No. 3: Union Pacific Railroad
NAME OF CARRIER No. 4: Steve Forler Trucking
NAME OF CARRIER No. 5:

TO:		FROM:	
CONSIGNEE:	USE Ecology Idaho, Inc.	CONSIGNOR:	AWS for US Navy @ NSF- Indian Head
STREET:	20400 Lemley Road	STREET:	3767 Strauss Ave.
CITY:	Grand View STATE: ID	CITY:	Indian Head STATE: MD
ZIP CODE:	83624 PHONE: 800-274-1616	ZIP CODE:	20640 PHONE: 603-507-1629

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000003

Truck No. 305

NO OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172 202, 172 203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	13.04	42840	35210
Metal intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.49 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked, name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Remit C.O.D. to:
C.O.D. Amt$
Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee
Prepaid
Collect $
Total Charges $
Freight Charges
Freight Prepaid Check box if charges are to be collected
except when box is checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of the Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper	AWS for US Navy, NSF Indian Head	Received By:	USE Idaho
Signature:	Richard Thatcher	Signature:	Jennifer Lutt
Title:	Broker, Agent for US Army JMC	Title:	
Date:	10/14/15	Date:	11-25-15

Carrier No. 1:	Visionary Solutions
Signature:	Date: 10/14/15
Carrier No. 2:	Norfolk Southern Railroad
Signature:	Date:
Carrier No. 3:	Union Pacific Railroad
Signature:	Date:
Carrier No. 4:	Steve Forler Trucking
Signature:	Date: 11/25/15
Carrier No. 5:	
Signature:	Date:

USEI weight ok per Richard Thatcher

Indian Head 151125101178

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]
EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. NO: ISEU000003 SHIPPING DOCUMENT NUMBER: USN 2015[illegible]-USEI-02

Step 1: Is container *"Visibly Clean?"*[2] Yes ☑ No ☐
If Step 1 is answered "yes", then proceed to Step 2. DS

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent...
Serial Number: PR151046 Calibration Due: 9/5/16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent...
Serial Number: 162435 Calibration Due: 9/5/16

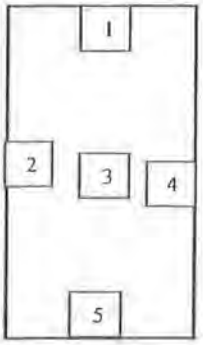
d. Bicron MicroRem or equivalent.....Serial Number: Model 19 Calibration Due: 12/15/15

A. ALPHA
Background: 0 cpm
Efficiency: 17.95 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	0	0	0
2	2	2	11
3	2	2	11
4	1	1	6
5	0	0	0

Front



Rear

B. BETA
Background: 33 cpm
Efficiency: 25.89 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	30	0	0
2	37	4	15
3	25	0	0
4	36	3	12
5	32	0	6

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 0 dpm, 2 26 dpm, 3 11 dpm, 4 18 dpm, 5 0 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☑ DS

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☑ DL No ☐

B. Approved for Returned to Service by: Date: 11/25/15
Printed name of Radiation Technician Dwyane Causer Start Time: 13:12

C. Signed: Dwyane Causer End Time: 13:18
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and/or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

15112018057

12yds

23980P

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-10

DATE: 10/26/2015

WSID No: 31442-0

NAME OF CARRIER No 1: Visionary Solutions

NAME OF CARRIER No 2: Norfolk Southern Railroad

NAME OF CARRIER No. 3: Union Pacific Railroad

NAME OF CARRIER No. 4: Steve Forler Trucking

NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1616	ZIP CODE:	20640	PHONE:	603-607-1629

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000022

Truck No. 312

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	13.23	43360	35730
Metal Intermodal					
		Th-232 0.08 mCi			

PLACARDS REQUIRED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ 0.00 per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked, name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Rated C.O.D. to:

C.O.D. Amt $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee:

Prepaid $

Collect $

Total Charges $

Freight Charges: Check box if charges are to be collected

Freight Prepaid

except when box of fight checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper	AWS for US Navy, NSF-Indian Head	Received By:	USE Idaho
Signature:	Richard Thatcher	Signature:	Jennifer Little
Title	Broker, Agent for US Army JMC	Title:	Receiving
Date	10/26/2015	Date:	11-20-15

Carrier No 1:	Visionary Solutions	
Signature:		Date: 10/26/2015
Carrier No 2:	Norfolk Southern Railroad	
Signature:		Date:
Carrier No. 3:	Union Pacific Railroad	
Signature:		Date:
Carrier No 4:	Steve Forler Trucking	
Signature:		Date: 11/20/15
Carrier No 5		
Signature		Date:

Driver released pending resolution

Actual received 23980*, not ok per Richard Thatcher via email 12/1/15

15718010057

24540 ~~25450~~

12yds

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: **USN 2015-011-USEI-09**

DATE: 10/23/2015

WSID No.: 31432-0

NAME OF CARRIER No. 1: Visionary Solutions

NAME OF CARRIER No. 2: Norfolk Southern Railroad

NAME OF CARRIER No. 3. Union Pacific Railroad

NAME OF CARRIER No 4. Steve Foster Trucking

NAME OF CARRIER No 5:

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET:	20400 Lemley Road			STREET:	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	600-274-1516	ZIP CODE:	20640	PHONE:	803-507-1629

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000023

Truck No. 312

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203)	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	13.76	44780	37160
Metal Intermodal					
		Tn-232 0.00 eaCS			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <Ad per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation.

Signature

Remit C.O.D. to:

C.O.D. Amt $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee

Prepaid $

Collect $

Total Charges $

Freight Charges

Freight Prepaid — Check box if charges are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF-Indian Head	Received By:	Unit Name
Signature:	Richard Thatcher	Signature:	Gilbert Dilligan
Title:	Broker, Agent for US Army JMC	Title:	Receiving Clerk
Date:	10/23/2015	Date:	11/20/15

Carrier No. 1:	Visionary Solutions	
Signature:		Date: 10/23/2015
Carrier No.2:	Norfolk Southern Railroad	
Signature:		Date:
Carrier No. 3:	Union Pacific Railroad	
Signature:		Date:
Carrier No. 4:	Steve Foster Trucking	
Signature:		Date: 11/20/15
Carrier No 5:		
Signature:		Date:

WSIS 37442 per AS 11/20/15

Driver released pending resolution

Actual received 24,540#, wt ok per Richard Thatcher via email 12/1/15

151178010044

22,500#

12 YRDS

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-07
DATE: 10/21/2015
WSID No.: 31442-0

NAME OF CARRIER No. 1. Visionary Solutions
NAME OF CARRIER No. 2 Norfolk Southern Railroad
NAME OF CARRIER No. 3. Union Pacific Railroad
NAME OF CARRIER No 4 Steve Forler Trucking
NAME OF CARRIER No. 5:

TO:		FROM:	
CONSIGNEE:	US Ecology Idaho, Inc.	CONSIGNOR:	AWS for US Navy @ NSF-Indian Head
STREET	20400 Lemley Road	STREET	3767 Strauss Ave.
CITY	Grand View STATE ID	CITY	Indian Head STATE MD
ZIP CODE	83624 PHONE: 800-274-1516	ZIP CODE:	20640 PHONE: 603-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000031

Truck No. 312

NO OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	12.45	41250	33620
Metal Intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note: Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding
$ <$0.40 per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked, labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation.

Signature

Rate C.O.D. as

C.O.D. Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee: Prepaid $ Collect $ Type of Charge: $

Freight Charges: Freight Prepaid Check box if charges are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its own, or some other carrier on the route to said destination, it is mutually agreed as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF-Indian Head	Received by	USE Idaho
Signature:		Signature:	
Title:	Broker, Agent for US Army JMO	Title	
Date:	10/21/2015	Date:	

Carrier No. 1.	Visionary Solutions	
Signature:		Date 10/21/2015
Carrier No.2.	Norfolk Southern Railroad	
Signature:		Date:
Carrier No. 3	Union Pacific Railroad	
Signature:		Date:
Carrier No. 4	Steve Forler Trucking	
Signature:		Date 11/26/15
Carrier No. 5:		
Signature:		Date:

W87D 31442-0 AR CS
11/20/15

Driver released, pending resolution 11/20/15

Actual received 22500#, wt ok
per Richard Thatcher via email 12/1/15

12YRDS

1511201002 8 24640p

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No. USN 2015-011-USEI-13
DATE: 10/29/2015
WSID No.: 31422-0

NAME OF CARRIER No. 1. Visionary Solutions
NAME OF CARRIER No. 2. Norfolk Southern Railroad
NAME OF CARRIER No. 3. Union Pacific Railroad
NAME OF CARRIER No. 4. Steve Forler Trucking
NAME OF CARRIER No. 5.

TO:				FROM:			
CONSIGNEE:	US Ecology Idaho, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET	20400 Lemley Road			STREET	3757 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1616	ZIP CODE:	20640	PHONE:	803-507-1528

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000013

Truck No. 312

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	13.86	45060	37430
Metal Intermodal					
		Th-232 0.68 mCi			

PLACARDS PROVIDED: no

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding
$ value per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked, name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation
Richard Thatcher Signature

Send C.O.D. to
C.O.D. amt $
Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without payment of the consignee the carrier shall sign the following statement: The carrier shall not deliver the shipment without payment of freight and all other lawful charges.

C.O.D. Fee:
Prepaid
Collect $
Total Charges $
Freight Charges
Freight Prepaid
Check box if charges are to be collected
amount when box at right is checked

RECEIVED, subject to the classifications and lawful tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF Indian Head		Received By:	USE Idaho
Signature:	Richard Thatcher	10/29/2015	Signature:	Jeffrey Leonard
Title:	Broker, Agent for US Army JMC		Title:	
Date:	10/29/15		Date:	11/20/2015

Carrier No. 1:	Visionary Solutions	
Signature:		Date: 10/29/2015
Carrier No. 2:	Norfolk Southern Railroad	
Signature:		Date:
Carrier No. 3:	Union Pacific Railroad	
Signature:		Date:
Carrier No. 4:	Steve Forler Trucking	
Signature:		Date: 11/20/15
Carrier No. 5:		
Signature:		Date:

WSIS 31442 per CS 11/20/15
Driver released pending resolution
Actual received 24640#, wt ok
Per Richard Thatcher via email 12/1/15

Indian Head 1571231008 7

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]
EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. No: ISEU000040 SHIPPING DOCUMENT NUMBER: USN2015-011-USEI-11-1-1

Step 1: Is container *Visibly Clean?*[2] Yes ☒ No ☐ RJ

If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent...
Serial Number: PR328262 Calibration Due: 7-30-16 7-30-16

b. Ludlum Sample Holder (Model 180-1) or equivalent

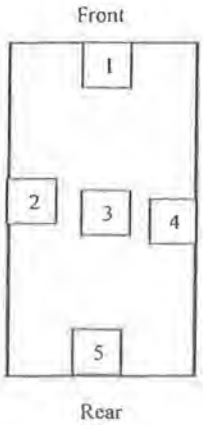
c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent...
Serial Number: 316200 Calibration Due: ~~7-30-16~~ DH

d. Bicron MicroRem or equivalent.....Serial Number: Model 19 Calibration Due: ~~12-5-15~~ 12-15-15

A. ALPHA
Background: 0 cpm
Efficiency: 37.30 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	2	2	5
2	2	2	5
3	0	0	0
4	1	1	3
5	0	0	0



B. BETA
Background: 39 cpm
Efficiency: 49.70 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	39	0	0
2	37	0	0
3	37	0	0
4	36	0	0
5	39	0	0

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 5 dpm, 2 5 dpm, 3 0 dpm, 4 3 dpm, 5 0 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☒ RJ

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☒ No ☐

B. Approved for Returned to Service by: Date: 11-23-15

Printed name of Radiation Technician Donna Harlow Start Time: 11:54

C. Signed: Donna J Harlow End Time: 11:59
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

1511231008 7

27580 #
15 yds

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-11
DATE: 10/27/2015
WSID No.: 31422-0

NAME OF CARRIER No. 1: Visionary Solutions
NAME OF CARRIER No. 2: Norfolk Southern Railroad
NAME OF CARRIER No. 3: Union Pacific Railroad
NAME OF CARRIER No. 4: Steve Forler Trucking
NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	US Ecology, Inc.			CONSIGNOR:	AWS for US Navy @ NSF-Indian Head		
STREET	20400 Lemley Road			STREET	3767 Strauss Ave.		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1618	ZIP CODE:	20640	PHONE:	803-607-1629

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-5063

Container No. ISEU000040

Truck No. 312

NO OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172-203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	14.96	46020	40390
Metal Intermodal					
		Th-232 0.09 mCi			

PLACARDS TENDERED: No

Note: Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

( ) Lb. per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Send C.O.D. to

C.O.D. Amt $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee

Prepaid $
Collect $
Total Charges $

Freight Charges: Check box if charges are to be collected

Freight Prepaid

accept when box of right checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to the usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF-Indian Head	Received By:	USE Mobile
Signature:	Richard W. Breber	Signature:	Arthur Rodriguez
Title:	Breber, Agent for US Army JMC	Title:	Receiving Clerk
Date:	10/27/2015	Date:	11/23/15

Carrier No. 1:	Visionary Solutions	
Signature:		Date: 10/27/2015
Carrier No. 2:	Norfolk Southern Railroad	
Signature:		Date:
Carrier No. 3:	Union Pacific Railroad	
Signature:		Date:
Carrier No. 4:	Steve Forler Trucking	
Signature:		Date: 11-23-15
Carrier No. 5:		
Signature:		Date:

Profile 31422-0 per CS 11/23/15

USEI weight OK per Richard Thatcher via telecom 11/23/15

Indian Head 15712 370088

Figure 2-1

EMPTY CONTAINER DECONTAMINATION / RETURNED TO SERVICE FORM[1]
EXEMPT MATERIAL CONTAINER WIPE SAMPLES (300 SQ. CM.)

CONTAINER NUMBER (IMC)/ID. NO: ISEU00025 SHIPPING DOCUMENT NUMBER: USN2015-[redacted]-USEI-08

Step 1: Is container "*Visibly Clean*?"?[2] Yes ☒ No ☐. RS

If Step 1 is answered "yes", then proceed to Step 2.

Step 2: Equipment Required:

a. Ludlum alpha/beta scintillator – *Phoswich detector* (Model 43-2-2) or equivalent...
Serial Number: PR156946 Calibration Due: 9/5/16

b. Ludlum Sample Holder (Model 180-1) or equivalent

c. Ludlum Scaler/Ratemeter (Model 2224-1) or equivalent...
Serial Number: 162435 Calibration Due: 9/5/16

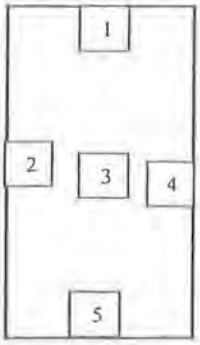
d. Bicron MicroRem or equivalent.....Serial Number: Model 19 Calibration Due: 12/15/15

A. ALPHA
Background: 0 cpm
Efficiency: 17.95 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	alpha DPM* (Net CPM / Efficiency)
1	0	0	0
2	1	1	6
3	0	0	0
4	3	3	17
5	0	0	0

Front



Rear

B. BETA
Background: 31 cpm
Efficiency: 25.89 % (cpm/dpm)

Inside Readings:

Sample #	Gross CPM	Net CPM (Gross CPM – Bkg)	beta DPM* (Net CPM / Efficiency)
1	33	2	8
2	45	14	54
3	29	0	0
4	37	6	23
5	26	0	0

*Enter the total alpha and beta DPM for each sample into Step 3.A. For example, add the alpha DPM results of sample 1 to the beta DPM results of sample 1 and enter the total in Step 3.A.

Step 3. Survey Results Evaluation

TOTAL CONTAMINATION - DPM/WIPE (ALPHA+BETA):

A. 1 8 dpm, 2 60 dpm, 3 0 dpm, 4 40 dpm, 5 0 dpm

Is Fixed Contamination <500 µrem (Class 7 Only)? Yes ☐ No ☐ N/A ☒ RS

Can the container be Returned to Service (≤6600 dpm/wipe sample)? Yes ☑ No ☐

B. Approved for Returned to Service by: Date: 11/23/13

Printed name of Radiation Technician Dejani Lawson Start Time: 13:12

C. Signed: Dejani Lawson End Time: 13:18
Radiation Technician

[1] This survey form does not provide or constitute the "unrestricted (free) release" of the package or conveyance.
[2] *"Visibly clean" means: Potentially contaminated material on the interior of each EXEMPT MATERIAL container, which can practically be removed with a broom, shovel or other similar hand tool is removed. Material that is practical to remove with a broom and or shovel implies that there will be some "non-fixed" residue remaining. The amount of residue left on the container surface could include streaks and clumped particles left by the broom or shoveling activity. However, a representative wipe sample of this residue will be obtained and analyzed utilizing this Returned to Service procedure.*

134205

15112310088

23640p

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2015-011-USEI-08
DATE: 10/22/15
WSID No.: 31442-0

NAME OF CARRIER No. 1: Visionary Solutions
NAME OF CARRIER No. 2: Norfolk Southern Railroad
NAME OF CARRIER No. 3: Union Pacific Railroad
NAME OF CARRIER No. 4: Steve Forler Trucking
NAME OF CARRIER No. 5:

TO:		FROM:	
CONSIGNEE:	US Ecology Idaho, Inc.	CONSIGNOR:	AWS for US Navy @ NSF-Indian Head
STREET:	20400 Lemley Road	STREET	3767 Strauss Ave.
CITY:	Grand View	STATE: ID	CITY: Indian Head	STATE: MD
ZIP CODE:	83624	PHONE: 208-274-1516	ZIP CODE: 20640	PHONE: 803-607-1528

24 HOUR EMERGENCY RESPONSE TELEPHONE No:

Call INFOTRAC 1-800-535-5053

Container No. ISEU000025

Truck No. 312

NO OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	13.17	43200	35570
Metal Intermodal					
		Th-232 0.00 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.00 per lb.

I hereby certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation.

Signature

Prepaid C.O.D. to:

C.O.D. Amt $

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor will sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee

Prepaid
Collect $
Total Charges $

Freight Charges

Freight Prepaid — Check box if charges are to be collected

RECEIVED, subject to the classifications and lawful tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF-Indian Head	Received By:	USE Idaho
Signature:		Signature:	
Title:	Broker, Agent for US Navy JMC	Title:	
Date:	10/22/15	Date:	11/23/2015

Carrier No. 1:	Visionary Solutions	
Signature:		Date: 10/22/15
Carrier No 2:	Norfolk Southern Railroad	
Signature:		Date:
Carrier No. 3:	Union Pacific Railroad	
Signature:		Date:
Carrier No. 4:	Steve Forler Trucking	
Signature:		Date: 11-23-15
Carrier No. 5:		
Signature:		Date:

Profile 31442-0 per CS 11/23/15 cc

USEI weight OK per Richard Thatcher via telecom CR 11/23/15

CERTIFICATE OF DISPOSAL

December 02,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-13/** was received by U.S. Ecology, Inc., on **11/20/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/20/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112010028-USN 2015-011-USEI-13-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

December 02,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-07/** was received by U.S. Ecology, Inc., on **11/20/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/20/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112010044-USN 2015-011-USEI-07-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

December 02,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-11-USEI-09/** was received by U.S. Ecology, Inc., on **11/20/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/20/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112010051-USN 2015-11-USEI-09-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

December 02,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USE--10/** was received by U.S. Ecology, Inc., on **11/20/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/20/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112010057-USN 2015-011-USE--10-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN2015-011-USEI-11/** was received by U.S. Ecology, Inc., on **11/23/2015**.The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/23/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112310087-USN2015-011-USEI-11-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN2015-011-USEI-08/** was received by U.S. Ecology, Inc., on **11/23/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/23/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112310088-USN2015-011-USEI-08-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN2015-011-USEI-12/** was received by U.S. Ecology, Inc., on **11/24/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/24/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112410117-USN2015-011-USEI-12-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-03/** was received by U.S. Ecology, Inc., on **11/24/2015**. The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/24/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112410138-USN 2015-011-USEI-03-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-04/** was received by U.S. Ecology, Inc., on **11/24/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/24/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112410145-USN 2015-011-USEI-04-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-05/** was received by U.S. Ecology, Inc., on **11/25/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/25/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112510160-USN 2015-011-USEI-05-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-01/** was received by U.S. Ecology, Inc., on **11/25/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/25/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112510170-USN 2015-011-USEI-01-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-02/** was received by U.S. Ecology, Inc., on **11/25/2015**. The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/25/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112510178-USN 2015-011-USEI-02-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

November 30,2015

AWS FOR US NAVY @ INDIAN HEAD NSWC
3787 STRATUS AVE.
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2015-011-USEI-06/** was received by U.S. Ecology, Inc., on **11/24/2015** .The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of on **11/24/2015** in accordance with permits and laws regulating this facility.

Reference Number: 15112410130-USN 2015-011-USEI-06-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Stream #: 31442-0
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

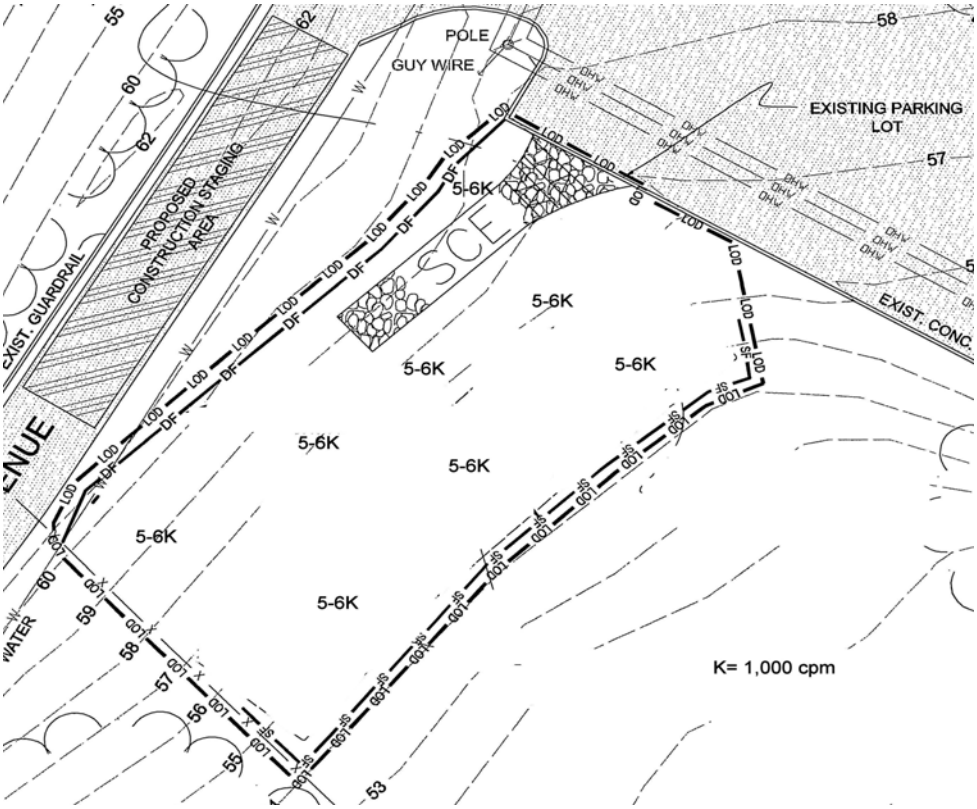
Title: RECEIVING SUPERVISOR

Appendix X

Soil Laydown Area Survey Reports

DATE:	TIME:	INSTRUMENTATION USED						
10/7/2015	10:10	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-01							
LOCATION:	NSF Indian Head IR Site 1 Soil Laydown Area							
SURVEYOR:	William Wylie							
DATE: 10/7/2015	TIME: 11:30 / Reviewed by: Daniel Spicuzza	2350-1 44-10	120588 318218	6/19/2016				5327 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Soil Laydown Area Pre Job Gamma Scan Survey



Comments:

The area was 50% gamma scan surveyed.

Action Level: 7,110 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-01

SURVEYOR: William Wylie

LOCATION: NSF Indian Head IR Site 1 Soil Laydown Area

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha $dpm/100cm^2$	Beta/Gamma $dpm/100cm^2$	Alpha $dpm/100cm^2$	Beta/Gamma $dpm/100cm^2$	
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/7/2015	
	Time: 11:30	

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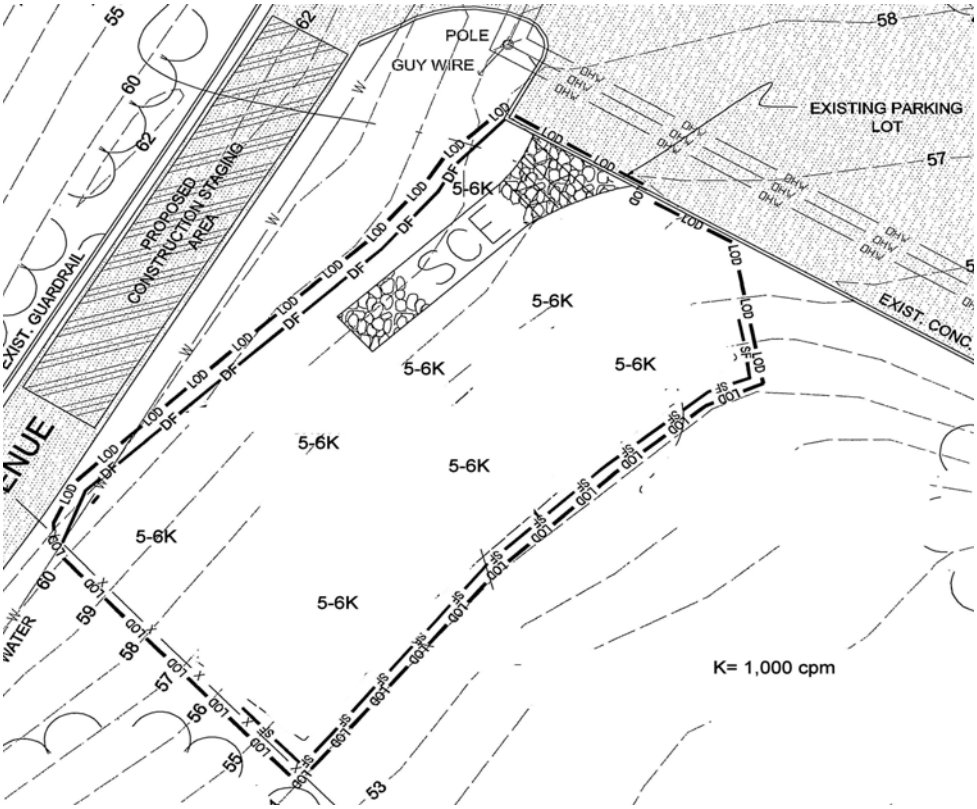
DATE:	TIME:	INSTRUMENTATION USED						
12/14/2015	11:25	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-041							
LOCATION:	NSF Indian Head IR Site 1 Soil Laydown Area							
SURVEYOR:	William Wylie							
DATE: 12/15/2015	TIME: 12:30 / Reviewed by: Daniel Spicuzza	2350-1 44-10	126172 192589	6/19/2016				5246 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Soil Laydown Area Post Job Gamma Scan Survey



Comments:

The area was 50% gamma scan surveyed.

Action Level: 6,216 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-041								
SURVEYOR: William Wylie				LOCATION: NSF Indian Head IR Site 1 Soil Laydown Area				
Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza			Date: 12/15/2015 Time: 12:30					

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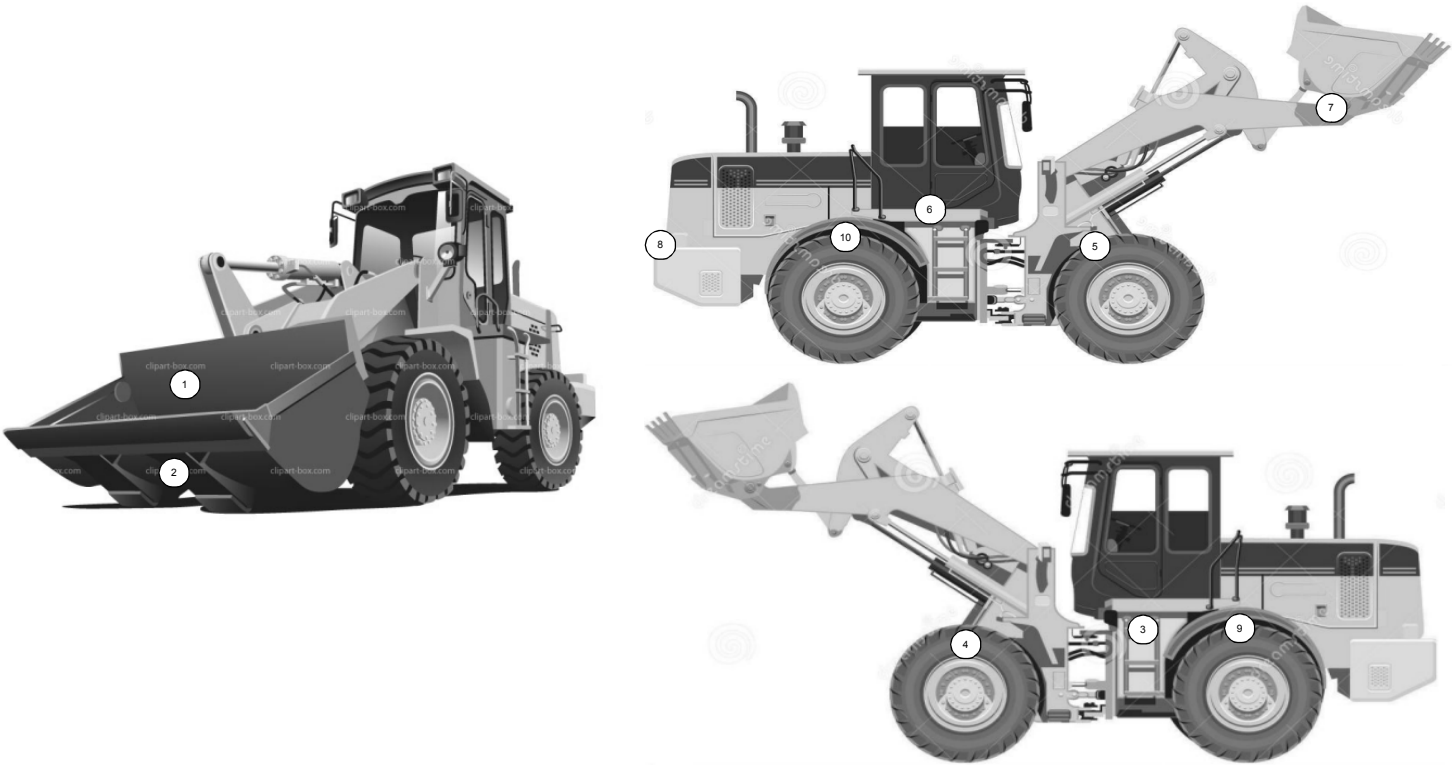
Appendix Y

Miscellaneous Survey Reports

RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/9/2015	TIME: 10:00	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-03	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 8.1	α 0.0
					βγ 36.5%	βγ 9.1%	βγ 180.7	βγ 426.3
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/9/2015	TIME: 10:55	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Incoming Survey of Front End Loader



Comments:

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-03

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-7.3	64.9	2.7	1.1	Inside Bucket
2				-7.3	-29.5	2.7	28.5	Outside Bucket
3				-2.1	64.9	2.7	-9.9	Steps
4				-12.5	123.9	0.0	44.9	Left Tires
5				-2.1	-47.2	2.7	-9.9	Right Tires
6				-2.1	106.2	2.7	39.5	Floor Boards
7				-17.7	35.4	5.4	55.9	Under Bucket
8				-12.5	0.0	5.4	6.6	Rear Bumper
9				-22.9	112.1	2.7	44.9	Left Mud Flaps
10				-28.1	182.9	2.7	50.4	Right Mud Flaps
4D						0.0	39.5	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/9/2015 Time: 10:55	

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-03	Date : 10/9/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Incoming Survey of Front End Loader	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	115563	5/19/2016	α	18.43%	α	0.00
			β	9.13%	β	426.30
2360 43-93	276986	12/17/2015	α	9.63%	α	33.25
			β	8.48%	β	1321.53

Contamination Levels:

-2.1	dpm / 100cm^2	α	**Maximum Fixed**
182.9	dpm / 100cm^2	β	
5.4	dpm / 100cm^2	α	**Maximum Removable**
55.9	dpm / 100cm^2	β	

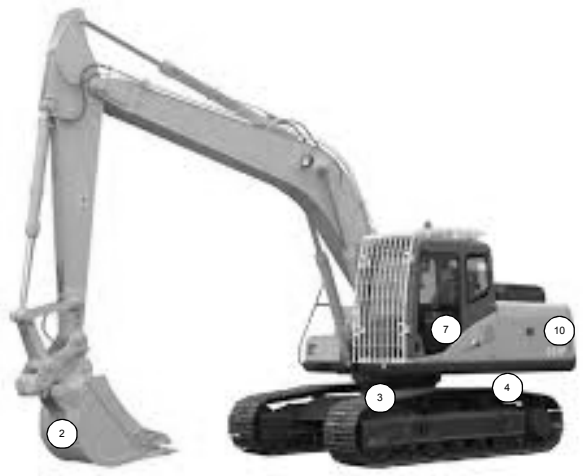
THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

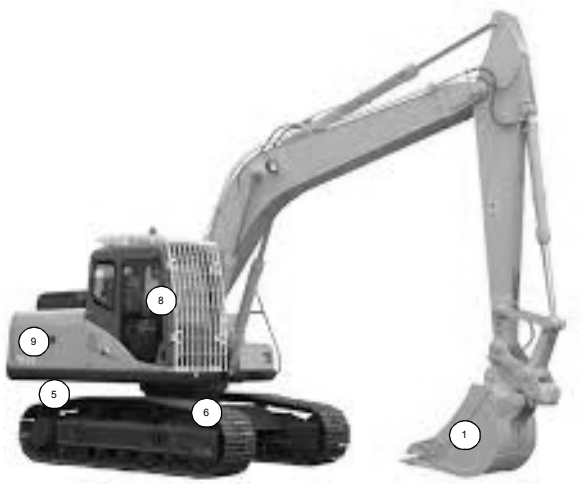
Radiological Control Technician: William Wylie	Date: 10/9/2015
	Time: 1000
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 10/9/2015 10:55:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/9/2015	TIME: 10:55	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-04	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 8.1	α 0.0
					βγ 36.5%	βγ 9.1%	βγ 180.7	βγ 426.3
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/9/2015	TIME: 11:35	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Incoming Survey of Excavator





Comments:

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-04

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-7.3	76.7	5.4	55.9	Inside Bucket
2				-17.7	23.6	5.4	12.1	Outside Bucket
3				-12.5	59.0	2.7	6.6	Left Tracks
4				-7.3	100.3	0.0	28.5	Left Tracks
5				-12.5	53.1	5.4	44.9	Right Tracks
6				-12.5	47.2	2.7	34.0	Right Tracks
7				-12.5	23.6	5.4	-4.4	Cab Floor
8				-17.7	165.2	5.4	6.6	Cab Controls
9				-22.9	135.7	5.4	28.5	Right Back
10				-22.9	123.9	2.7	17.5	Left Back
2D						5.4	1.1	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 10/9/2015

Time: 11:35

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-04	Date : 10/9/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Incoming Survey of Excavator	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	115563	5/19/2016	α	18.43%	α	0.00
			β	9.13%	β	426.30
2360 43-93	276986	12/17/2015	α	9.63%	α	33.25
			β	8.48%	β	1321.53

Contamination Levels:

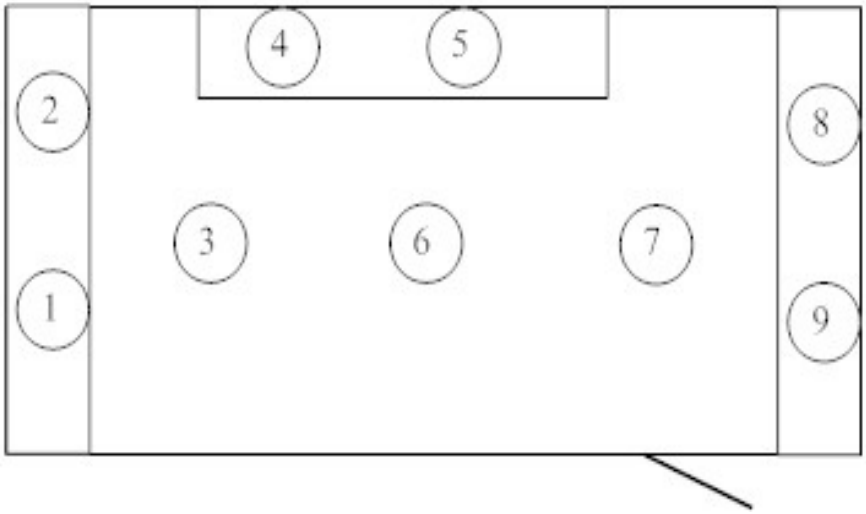
-7.3	dpm / 100cm^2	α	**Maximum Fixed**
165.2	dpm / 100cm^2	β	
5.4	dpm / 100cm^2	α	**Maximum Removable**
55.9	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 10/9/2015
	Time: 1055
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 10/9/2015 11:35:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/16/2015	TIME: 11:45	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-014							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 12.3 βγ 181.7	α 0.5 βγ 431.8
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 µR/hr
DATE: 10/16/2015	TIME: 12:55 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Ra-226		Static Count Time: 2 Minutes						
		Weekly Trailer Survey						



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-014

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1						2.2	39.5	Table
2						4.9	50.4	Table
3						-0.5	61.4	Floor
4						4.9	-26.3	Table
5						4.9	-48.2	Table
6						4.9	17.5	Floor
7						2.2	28.5	Floor
8						-0.5	-4.4	Table
9						2.2	-20.8	Table
5D						4.9	-42.7	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/16/2015 Time: 12:55	

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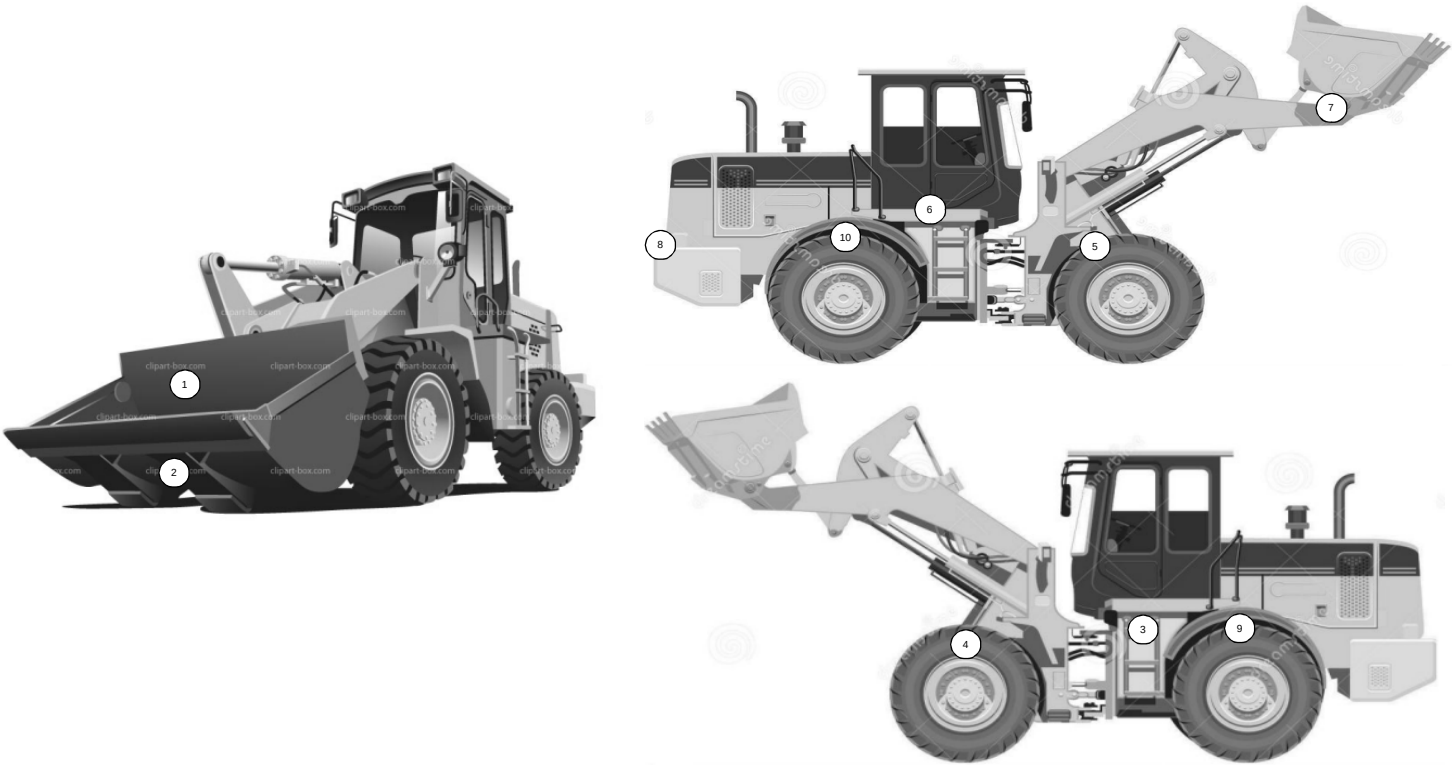
RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/29/2015	TIME: 08:45	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-037	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 185.4	βγ 451.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 µR/hr
DATE: 10/29/2015	TIME: 10:00	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Outgoing Survey of Front End Loader



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-037

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-12.5	35.4	1.6	30.7	Inside Bucket
2				-12.5	112.1	1.6	36.2	Outside Bucket
3				-12.5	64.9	4.3	19.7	Steps
4				-17.7	100.3	4.3	8.8	Left Tires
5				-7.3	88.5	1.6	-2.2	Right Tires
6				-7.3	118.0	4.3	30.7	Floor Boards
7				-17.7	70.8	-1.1	-18.6	Under Bucket
8				-17.7	53.1	-1.1	19.7	Rear Bumper
9				-22.9	159.3	1.6	8.8	Left Mud Flaps
10				-28.1	118.0	1.6	41.6	Right Mud Flaps
3D						4.3	14.2	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 10/29/2015
Daniel Spicuzza	Time: 10:00

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-037	Date : 10/29/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Outgoing Survey of Front End Loader	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	115563	5/19/2016	α	18.43%	α	1.09
			β	9.13%	β	451.51
2360 43-93	276986	12/17/2015	α	9.63%	α	33.25
			β	8.48%	β	1321.53

Contamination Levels:

-7.3	dpm / 100cm^2 α	**Maximum Fixed**
159.3	dpm / 100cm^2 β	
4.3	dpm / 100cm^2 α	**Maximum Removable**
41.6	dpm / 100cm^2 β	

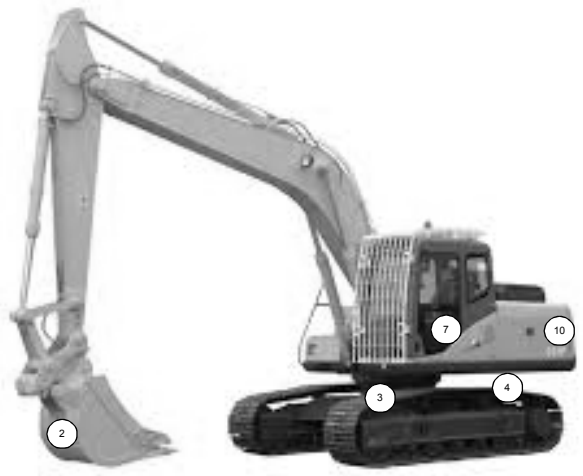
THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

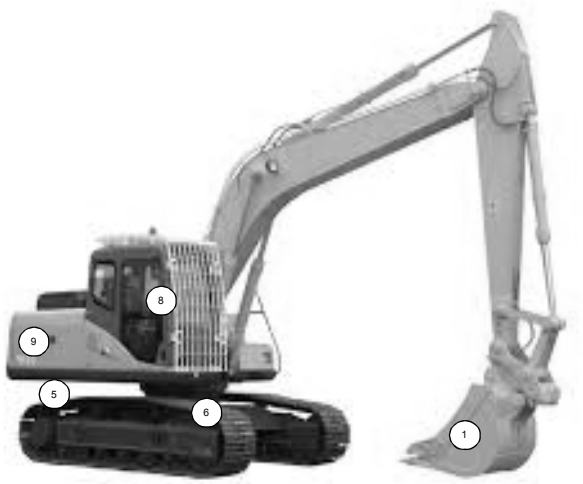
Radiological Control Technician: William Wylie	Date: 10/29/2015
	Time: 0845
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 10/29/2015 10:00:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/29/2015	TIME: 09:45	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-038	2360	276986	12/17/2015	α 38.5%	α 9.6%	α 76.7	α 33.2
		43-93	299605		βγ 33.9%	βγ 8.5%	βγ 428.5	βγ 1321.5
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7%	α 18.4%	α 14.0	α 1.1
					βγ 36.5%	βγ 9.1%	βγ 185.4	βγ 451.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/29/2015	TIME: 11:25	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Outgoing Survey of Excavator





Comments:

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-038

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-12.5	135.7	4.3	36.2	Inside Bucket
2				-17.7	53.1	4.3	8.8	Outside Bucket
3				-12.5	88.5	7.1	-13.2	Left Tracks
4				-17.7	94.4	7.1	-35.1	Left Tracks
5				-12.5	82.6	4.3	36.2	Right Tracks
6				-12.5	106.2	4.3	52.6	Right Tracks
7				-12.5	53.1	1.6	47.1	Cab Floor
8				-12.5	106.2	7.1	3.3	Cab Controls
9				-22.9	41.3	4.3	-24.1	Right Back
10				-22.9	147.5	4.3	19.7	Left Back
6D						4.3	41.6	Duplicate Swipe
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/29/2015 Time: 11:25	

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-038	Date : 10/29/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Outgoing Survey of Excavator	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	115563	5/19/2016	α	18.43%	α	1.09
			β	9.13%	β	451.51
2360 43-93	276986	12/17/2015	α	9.63%	α	33.25
			β	8.48%	β	1321.53

Contamination Levels:

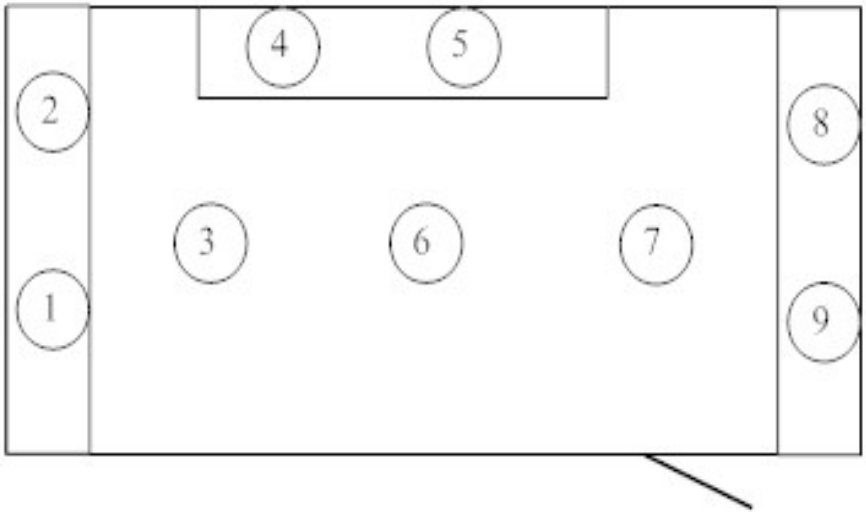
-12.5	dpm / 100cm^2	α	**Maximum Fixed**
147.5	dpm / 100cm^2	β	
7.1	dpm / 100cm^2	α	**Maximum Removable**
52.6	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 10/29/2015
	Time: 0945
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 10/29/2015 11:25:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE: 10/29/2015	TIME: 12:30	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-039							
LOCATION:	NSF Indian Head Site 1	2929	115563	5/19/2016	α 73.7% βγ 36.5%	α 18.4% βγ 9.1%	α 14.0 βγ 185.4	α 1.1 βγ 451.5
SURVEYOR:	William Wylie	Model 19	98100	12/22/2015				3 μR/hr
DATE: 10/29/2015	TIME: 13:55 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						
q		Weekly Trailer Survey						



Comments:

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-039

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1						4.3	-7.7	Table
2						4.3	-13.2	Table
3						1.6	8.8	Floor
4						-1.1	-24.1	Table
5						4.3	-13.2	Table
6						1.6	25.2	Floor
7						1.6	-18.6	Floor
8						-1.1	-51.5	Table
9						1.6	30.7	Table
3D						1.6	-2.2	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 10/29/2015 Time: 13:55	

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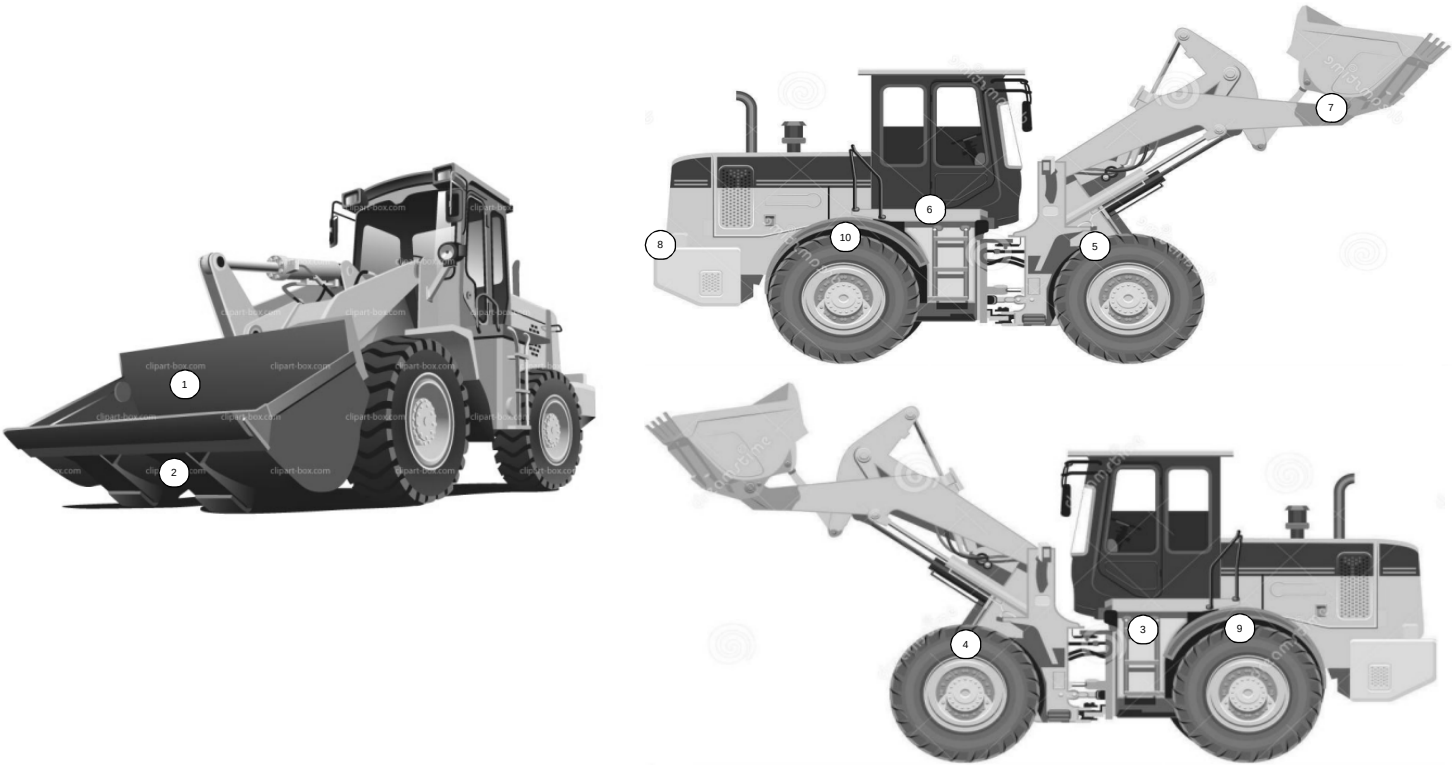
RADIATION/CONTAMINATION SURVEY FORM

DATE: 12/14/2015	TIME: 12:30	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-042	2360	297826	1/30/2016	α 34.2%	α 8.6%	α 74.6	α 25.7
		43-93	323053		βγ 25.5%	βγ 6.4%	βγ 598.2	βγ 1945.1
LOCATION:	NSF Indian Head Site 1	2929	61549	5/18/2016	α 74.0%	α 18.5%	α 16.2	α 5.4
					βγ 52.8%	βγ 13.2%	βγ 111.8	βγ 361.4
SURVEYOR:	William Wylie							
DATE: 12/15/2015	TIME: 08:05	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Outgoing Survey of Front End Loader



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-042

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-2.3	54.9	5.4	25.0	Inside Bucket
2				-2.3	-117.6	3.6	14.9	Outside Bucket
3				-2.3	-47.1	1.8	30.1	Steps
4				-8.2	-54.9	5.4	37.6	Left Tires
5				-2.3	0.0	7.2	2.3	Right Tires
6				-14.0	-31.4	9.0	17.4	Floor Boards
7				-8.2	23.5	1.8	22.5	Under Bucket
8				-8.2	-117.6	0.0	14.9	Rear Bumper
9				-14.0	-31.4	1.8	19.9	Left Mud Flaps
10				-19.9	31.4	3.6	32.6	Right Mud Flaps
6D						7.2	12.4	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 12/15/2015

Time: 8:05

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-042	Date : 12/14/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Outgoing Survey of Front End Loader	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	61549	5/18/2016	α	18.50%	α	5.41
			β	13.20%	β	361.36
2360 43-93	297826	1/30/2016	α	8.55%	α	25.73
			β	6.38%	β	1945.10

Contamination Levels:

-2.3	dpm / 100cm^2 α	**Maximum Fixed**
54.9	dpm / 100cm^2 β	
9.0	dpm / 100cm^2 α	**Maximum Removable**
37.6	dpm / 100cm^2 β	

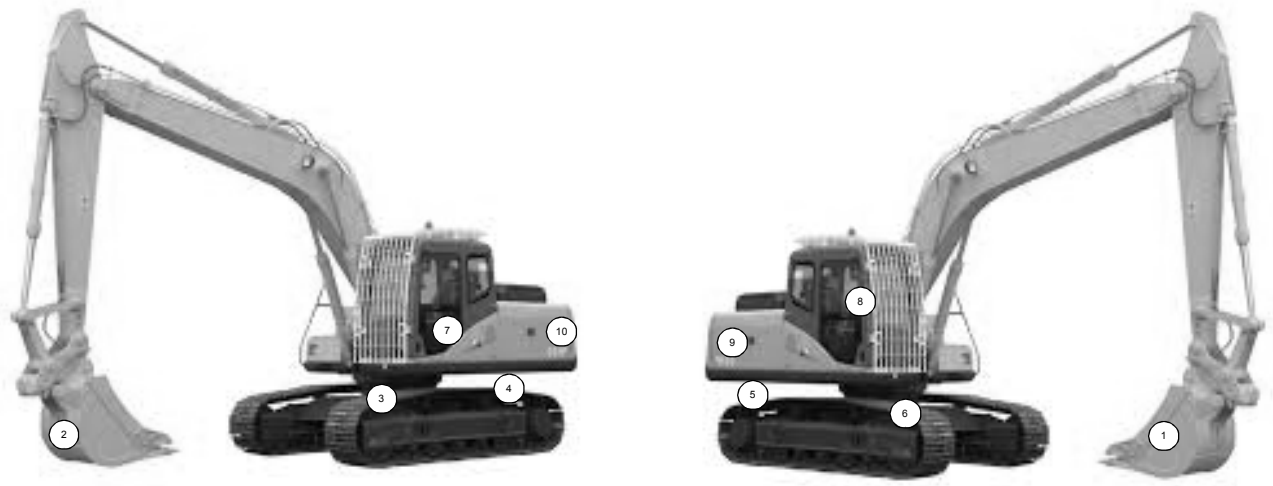
THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 12/14/2015
	Time: 1230
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 12/15/2015 08:05:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE: 12/14/2015	TIME: 13:15	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-043	2360	297826	1/30/2016	α 34.2%	α 8.6%	α 74.6	α 25.7
		43-93	323053		βγ 25.5%	βγ 6.4%	βγ 598.2	βγ 1945.1
LOCATION:	NSF Indian Head Site 1	2929	61549	5/18/2016	α 74.0%	α 18.5%	α 16.2	α 5.4
					βγ 52.8%	βγ 13.2%	βγ 111.8	βγ 361.4
SURVEYOR:	William Wylie							
DATE: 12/15/2015	TIME: 08:10	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Outgoing Survey of Excavator



Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings
# denotes G/A radiation readings
/ # denotes contact / 1 meter radiation readings.
* denotes highest radiation reading on contact
LAW denotes large area masslinn wipe
Δ denotes static location.
+ Unless Otherwise Noted
All readings in mr/hr unless otherwise noted
K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-043

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-2.3	54.9	0.0	4.8	Inside Bucket
2				3.5	39.2	-1.8	19.9	Outside Bucket
3				3.5	7.8	0.0	14.9	Left Tracks
4				-8.2	15.7	5.4	37.6	Left Tracks
5				-2.3	-23.5	5.4	9.8	Right Tracks
6				-2.3	47.1	3.6	22.5	Right Tracks
7				3.5	-31.4	5.4	30.1	Cab Floor
8				-2.3	86.3	5.4	37.6	Cab Controls
9				-14.0	-62.7	7.2	45.2	Right Back
10				-8.2	86.3	5.4	32.6	Left Back
3D						5.4	12.4	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 12/15/2015
Daniel Spicuzza	Time: 8:10

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-043	Date : 12/14/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Outgoing Survey of Excavator	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	61549	5/18/2016	α	18.50%	α	5.41
			β	13.20%	β	361.36
2360 43-93	297826	1/30/2016	α	8.55%	α	25.73
			β	6.38%	β	1945.10

Contamination Levels:

3.5	dpm / 100cm^2	α	**Maximum Fixed**
86.3	dpm / 100cm^2	β	
7.2	dpm / 100cm^2	α	**Maximum Removable**
45.2	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 12/14/2015
	Time: 1315
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 12/15/2015 08:10:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE: 12/14/2015	TIME: 13:55	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-044	2360	297826	1/30/2016	α 34.2%	α 8.6%	α 74.6	α 25.7
		43-93	323053		βγ 25.5%	βγ 6.4%	βγ 598.2	βγ 1945.1
LOCATION:	NSF Indian Head Site 1	2929	61549	5/18/2016	α 74.0%	α 18.5%	α 16.2	α 5.4
					βγ 52.8%	βγ 13.2%	βγ 111.8	βγ 361.4
SURVEYOR:	William Wylie							
DATE: 12/15/2015	TIME: 08:55	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Outgoing Survey of Bobcat

Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-044

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				9.4	-23.5	5.4	2.3	Inside Bucket
2				3.5	-70.6	3.6	27.5	Outside Bucket
3				3.5	70.6	3.6	-10.4	Left Tracks
4				-2.3	54.9	1.8	9.8	Left Tracks
5				-8.2	0.0	5.4	35.1	Right Tracks
6				-2.3	78.4	3.6	12.4	Right Tracks
7				3.5	47.1	5.4	22.5	Cab Floor
8				-2.3	39.2	5.4	22.5	Cab Controls
9				-14.0	7.8	7.2	9.8	Right Back
10				-2.3	62.7	5.4	22.5	Left Back
4D						1.8	4.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 12/15/2015

Time: 8:55

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-044	Date : 12/14/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Outgoing Survey of Bobcat	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	61549	5/18/2016	α	18.50%	α	5.41
			β	13.20%	β	361.36
2360 43-93	297826	1/30/2016	α	8.55%	α	25.73
			β	6.38%	β	1945.10

Contamination Levels:

9.4	dpm / 100cm^2 α	**Maximum Fixed**
78.4	dpm / 100cm^2 β	
7.2	dpm / 100cm^2 α	**Maximum Removable**
35.1	dpm / 100cm^2 β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 12/14/2015
	Time: 1355
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 12/15/2015 08:55:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE: 12/14/2015	TIME: 14:30	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	NSFIH-045	2360	297826	1/30/2016	α 34.2%	α 8.6%	α 74.6	α 25.7
		43-93	323053		βγ 25.5%	βγ 6.4%	βγ 598.2	βγ 1945.1
LOCATION:	NSF Indian Head Site 1	2929	61549	5/18/2016	α 74.0%	α 18.5%	α 16.2	α 5.4
					βγ 52.8%	βγ 13.2%	βγ 111.8	βγ 361.4
SURVEYOR:	William Wylie							
DATE: 12/15/2015	TIME: 09:10	Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Outgoing Survey of Hand Tools

Comments:

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

/ # denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

+ Unless Otherwise Noted

All readings in mr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: NSFIH-045

SURVEYOR: William Wylie

LOCATION: NSF Indian Head Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				3.5	23.5	0.0	-2.8	Spade Shovel #1
2				-2.3	-7.8	0.0	19.9	Spade Shovel #1
3				3.5	23.5	0.0	2.3	Spade Shovel #2
4				-2.3	-7.8	1.8	12.4	Spade Shovel #2
5				-2.3	-23.5	1.8	25.0	Flat Shovel #1
6				-2.3	0.0	0.0	27.5	Flat Shovel #1
7				-2.3	15.7	1.8	40.2	Flat Shovel #2
8				-8.2	-15.7	0.0	12.4	Flat Shovel #2
9				-14.0	-31.4	1.8	30.1	Rake #1
10				-2.3	0.0	1.8	-0.3	Rake #2
3D						0.0	4.8	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
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N/A								
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N/A								
N/A								
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Reviewer
Daniel Spicuzza

Date: 12/15/2015

Time: 9:10

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # NSFIH-045	Date : 12/14/2015
Project Location : NSF Indian Head Site 1	
Description of Equipment or Materials: Outgoing Survey of Hand Tools	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	61549	5/18/2016	α	18.50%	α	5.41
			β	13.20%	β	361.36
2360 43-93	297826	1/30/2016	α	8.55%	α	25.73
			β	6.38%	β	1945.10

Contamination Levels:

3.5	dpm / 100cm^2	α	**Maximum Fixed**
23.5	dpm / 100cm^2	β	
1.8	dpm / 100cm^2	α	**Maximum Removable**
40.2	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 12/14/2015
	Time: 1430
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 12/15/2015 09:10:00 AM

Appendix Z

Aleut World Solutions, LLC (AWS), 2013. Draft Survey Report Site 1 Removal Action, Naval Support Facility Indian Head, Indian Head, MD, Rev. 0 December 20, 2013.

Appendix Z

Aleut World Solutions, LLC (AWS), 2013. Final Survey Report Site 1 Removal Action, Naval Support Facility Indian Head, Indian Head, MD, Rev. 0 December 20, 2013.

ALEUT WORLD SOLUTIONS

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FINAL SURVEY REPORT
IR SITE 1 REMOVAL ACTION

NAVAL SUPPORT FACILITY INDIAN HEAD

INDIAN HEAD, MD

For the:

U.S. ARMY JOINT MUNITIONS COMMAND

ROCK ISLAND, IL

Project No. USN 2011-008

Contract No. W52P1J-08-D-0034/DO:0054

December 20, 2013
Rev. 0

Prepared by:

Aleut World Solutions, LLC
615 E. 82nd Ave. Suite 200
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FINAL SURVEY REPORT

SITE 1 REMOVAL ACTION

NAVAL SUPPORT FACILITY INDIAN HEAD

INDIAN HEAD, MD

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December 20, 2013
Rev. 0

Prepared by:

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Approvals Page

FINAL STATUS SURVEY REPORT

Written by: Daniel M. Spicuzza Date: 12/20/2013
Daniel Spicuzza, AWS Project Manager

Approved by: WG Haney Digitally signed by WG Haney DN: cn=WG Haney, o=US, o=AWS, LLC, ou=Field Operations, email=bhaney@aleutworldsolutions.com Date: 2016.06.23 10:18:18 -04'00' Date: 12/20/2013
William Haney, AWS Field Projects Manager

Approved by: WHITAKER.FRANK.C.JR.1270398916 Digitally signed by WHITAKER.FRANK.C.JR.1270398916 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=WHITAKER.FRANK.C.JR.1270398916 Date: 2016.06.07 15:54:55 -05'00' Date: 12/20/2013
Mr. Frank Whitaker, U.S. Army JMC Representative

Approved by: Allen Ray Stambaugh Jr. Date: 12/20/2013
Mr. Allen Stambaugh, RASO Representative

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ABBREVIATIONS AND ACRONYMS

ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOC	Areas of Concern
AWS	Aleut World Solutions, LLC
Bgs	Below grade surface
BLDG	Building
CDE	Committed Dose Equivalent
CFR	Code of Federal Regulations
Cm	Centimeter
Cpm	Counts per minute
DCGLs	Derived Concentration Guideline Limits
DDE	Deep Dose Equivalent
DOD	Department of Defense
DOT	Department of Transportation
dpm/100 cm^2	disintegrations per 100 square centimeters
DQO	Data Quality Objectives
ε_i	Instrument Efficiency
ε_s	Surface Efficiency Factor
Ft	Feet
ft^2	square feet
FSS	Final Status Survey
HASL-300	Environmental Laboratory Procedures Manual, 28th Edition 1997
HASP	Health and Safety Plan
IOP	Instrument Operating Procedure

ISO	International Organization for Standardization
LDE	Lens Dose Equivalent
LLRW	Low Level Radioactive Waste
M	Meter
m^2	square meter
MARSSIM	Multi Agency Radiation Survey & Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimal Detectable Count Rate
MDE	Maryland Department of the Environment
MSDS	Material Safety Data Sheets
mrem/y	milliRem per year
N/A	Not Applicable
NaI	sodium iodide
NIST	National Institute of Standards and Technology
NSF	Naval Support Facility
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PM	Project Manager
PPE	personal protective equipment
QA	Quality Assurance
QC	Quality Control
RI	Remedial Investigation
RASO	Naval Sea Systems Command Detachment, Radiological Affairs Support Office
RSO	Radiation Safety Officer
RWP	Radiation Work Permit
SDE	Shallow Dose Equivalent
σ	standard deviation

SOPs	Standard Operating Procedures
TEDE	Total Effective Dose Equivalent
Th-228	thorium-228
Th-230	thorium-230
Th-232	thorium-232
TLD	thermoluminescent dosimeter
µR/h	micro roentgens per hour
WRS	Wilcoxon Rank Sum Test
y	Year

RECORD OF REVISIONS

Revision Number	Description	Date
0	Final Survey Report	12/20/2013

1.0 EXECUTIVE SUMMARY

Bering Sea Environmental LLC dba Aleut World Solutions (AWS) was contracted by the U.S. Army Joint Munitions Command (JMC) to perform a soil removal action and Final Status Survey in accordance with MARSSIM guidelines at the IR Site 1 located at the Naval Support Facility Indian Head (NSF-IH) in Indian Head, MD. Experiments with radioactive materials (Thorium-232) were conducted in the past in this area. The work was performed from 11 February 2013 to 8 March 2013 and from 19 August 2013 to 6 September 2013. A map showing the location of the Naval Support Facility Indian Head is provided in Figure 1 below. Figure 2 presents an overview map of the site.

Figure 1 Naval Support Facility Indian Head Location Map

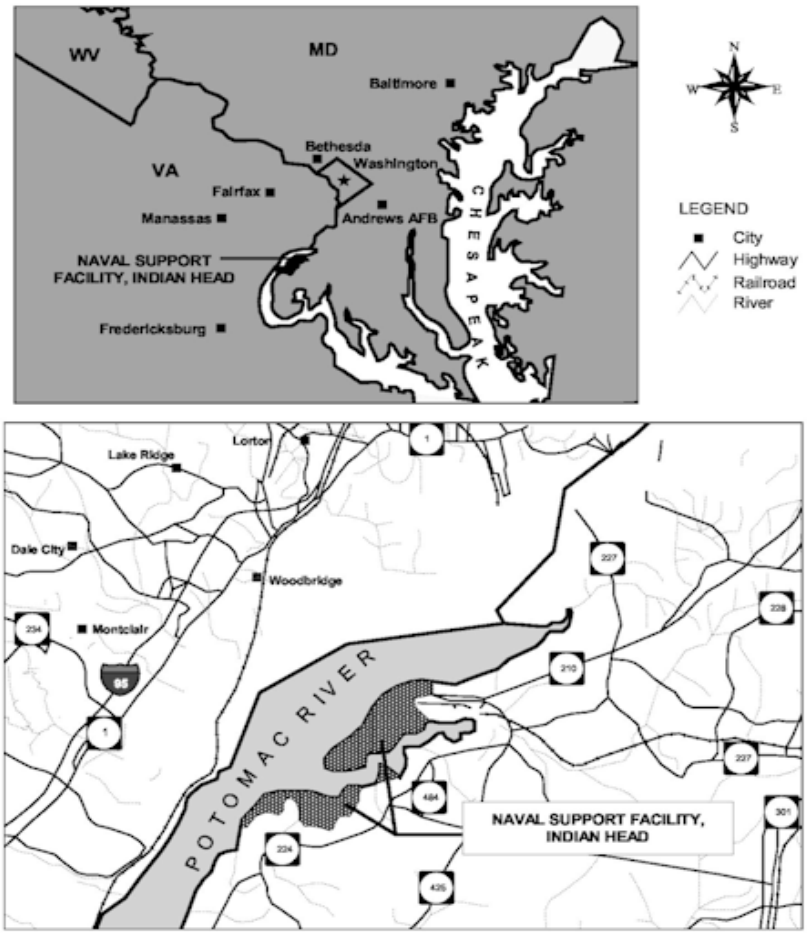
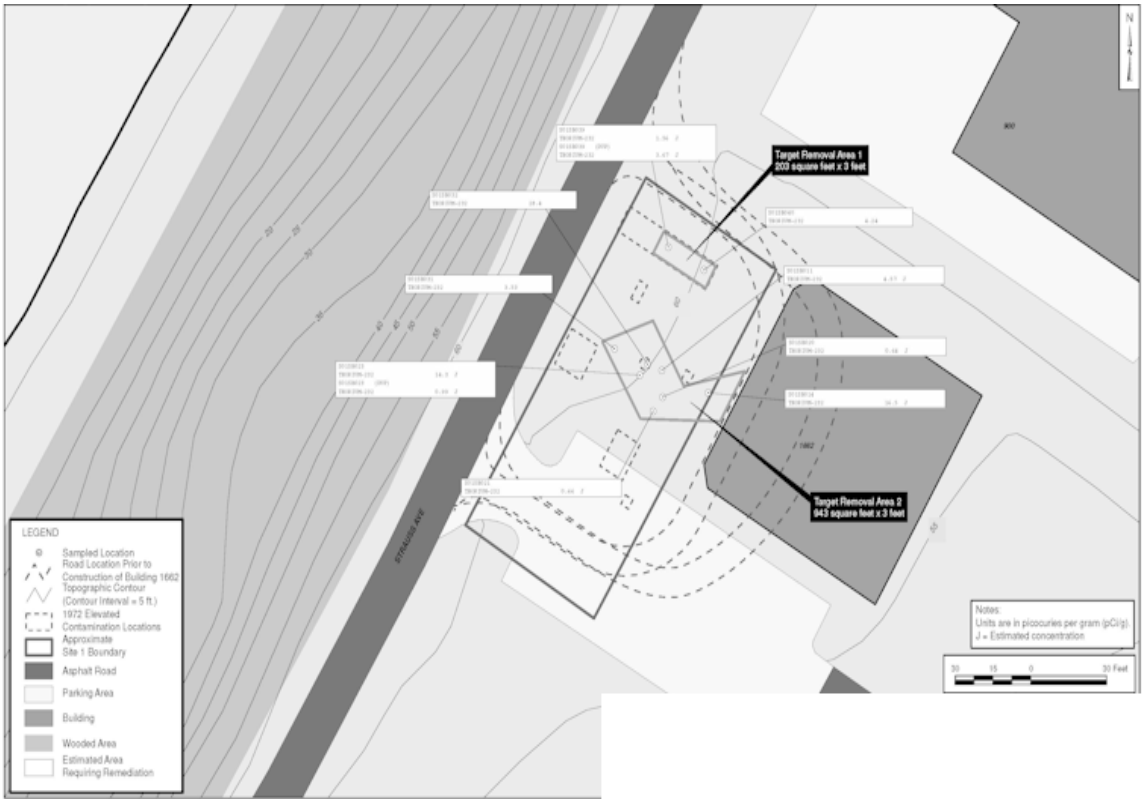


Figure 2 Site Overview Map



The original plan was to remove soils in the excavation area to a depth of 4’ below grade surface (bgs). However, due to the unexpected amount of radiologically impacted soils discovered in the first 2 feet of the excavation and also the discovery of potential unexploded ordnance in the area, a stop work order was issued by the Navy.

At approximately 0835 hours on 1 March 2013 while walking down the excavation area prior to soil removal, potential unexploded ordinance was discovered in the area. A phone call was placed to NSF security and the area was evacuated.

A Navy unexploded ordnance (UXO) team was dispatched to the site from the Naval Surface Warfare Center Dahlgren. The UXO team entered the area and proceeded to find what appeared to be a submunition, two land mines, and a grenade in the area. All of the items were determined to be training/practice items and inert.

As a precautionary measure, the items were removed from the excavation area and taken to a remote location in the ‘Restricted Area” at NSF Indian Head to be destroyed. Prior to removal to that area the items were surveyed for radiological contamination. No detectable activity above background was found on any of the items. At this time a stop work order was issued by the Navy and no further excavation was performed in the area. The area was secured and the work crew was demobilized from the site in the following days.

On 19 August 2013 the crew was mobilized back to the site under a modified work scope. At this time the Navy directed AWS to perform a limited characterization survey in the excavation area, package and transport removed contaminated soils off site for disposal, and backfill and restore the excavation area. No further excavation was to be done in the area.

In addition, the removed radiologically impacted and non impacted soils were to be screened for UXO by UXO personnel during loading into roll off bins for disposal, and into the excavation area for backfill.

During the two site visits, work that was completed included:

- Providing a radiation safety briefing to staff assigned to the project who have not previously received a radiation safety briefing.
- Performing incoming equipment and material surveys.
- Excavation of former burial areas down to 2’ below grade surface in 6” lifts.
- Surveying and surface soil sampling of over burden soils as Class 1 areas (6” lifts) in accordance with MARSSIM guidelines.
- Surveying and surface soil sampling of former burial areas as a Class 1 area following excavation down to 2’ below grade surface in accordance with MARSSIM guidelines.
- Loaded seven 25 cubic yard intermodal roll off bins with contaminated soils for disposal following screening for UXO by UXO personnel.
- Providing radiological monitoring during the collection of samples.
- Performing personnel surveys while the work is being performed, if necessary.
- Performing radiological release surveys on outgoing equipment and material.
- Performed a limited characterization survey effort in the excavation area to determine the remaining volume of radiologically impacted soils that would require removal in the future.
- Backfilled and restored the excavation area following screening for UXO by UXO personnel. Restoration included backfilling, compaction, and reseeding of the area.

2.0 PROJECT BACKGROUND INFORMATION

2.1 Facility Location

NSF-IH is located in northwestern Charles County, Maryland, as shown on Figure 1. NSF-IH is approximately 25 miles southwest of Washington, D.C. NSF-IH is a military facility consisting of the Main Area on the Cornwallis Neck Peninsula and the Annex on Stump Neck. As shown on Figure 1, the Main Area is bounded by the Potomac River on the northwest, west, and south, the Mattawoman Creek to the south and east, and the Town of Indian Head to the northeast. Stump Neck Annex is located across the Mattawoman Creek and is not contiguous with the Main Area. The location of Site 1 is shown on Figure 2.

2.2 Facility History/Background

The Indian Head peninsula is located in the Atlantic Coastal Plain Physiographic Province, approximately 8 to 10 miles east of the Fall Line that marks the western extent of the physiographic province. Indian Head has gently rolling to undulating topography with elevations ranging from sea level to more than 100 feet (ft) above mean sea level (msl). The higher elevations are on the eastern portion of the facility, and the land surface generally slopes to the southwest and southeast. The portion of NSF-IH along the Potomac River is characterized by 20- to 100-ft bluffs. The portion along Mattawoman Creek is more gently sloping.

The primary mission of NSF-IH consists of the following:

- To provide services in energetics for all warfare centers through engineering, fleet and operation support, manufacturing technology, limited production, and industrial base support.

- To provide research, development, testing, and evaluation of energetic materials, ordnance devices and components, and other related ordnance engineering standards including chemicals, propellants and their propulsion systems, explosives, pyrotechnics, warheads, and simulators.

- To provide support to all warfare centers, military departments, and the ordnance industry for special weapons, explosive safety, and ordnance environmental issues.

In 1951, the Navy was assigned the joint-service explosive ordnance disposal (EOD) responsibilities for basic training and research and development. In 1953, the research and

development tasks were established as a separate organization, and re-designated the Naval EOD Technical Center. The training function was renamed the Naval School, EOD (NAVSCOLEOD). From 1955 on, all joint service EOD training was provided at NSF-IH until the school moved to Eglin Air Force Base (AFB). In 1958, the NAVSCOLEOD moved from its Jackson Road location to Strauss Avenue. The NAVSCOLEOD command moved to Eglin AFB in 1993, and the NAVSCOLEOD at NSF-IH was designated as a detachment.

The Commanding Officer and the NAVSCOLEOD Headquarters returned to NSF-IH in 1994 while a construction project was being completed at Eglin AFB. In January 1999, the NAVSCOLEOD was consolidated at Eglin AFB. A detachment of EOD personnel remains at NSF-IH.

2.3 Site Information

2.3.1 Site Description

Site 1 is an area of approximately 60 by 135 feet located between Building 1662 and Strauss Avenue (Figure 2). The area is currently covered by a parking lot and maintained lawn. Building 1662 is used for electrical and satellite communications.

Future land use is expected to be any military, industrial, or commercial use needed to support the NSF-IH mission. It is unlikely that the site area would be developed for residential use while under government control. (TTNUS, 2010).

2.3.2 Site Background

The Naval Sea Systems Command Detachment (NAVSEADET) Radiological Affairs Support Office (RASO) provided the historical information that served as the basis for site background information.

The construction of Building 1662 was completed in 1983. Building 900, located northeast of Building 1662, was in place prior to 1962.

Thorium was first placed on the ground at Site 1 in 1962 in connection with radiation training exercises conducted by the NAVSCOLEOD. Thorium ore from approximately five drums of 30 to 50-gallon capacity was spread over the site. No U.S. Atomic Energy Commission (USAEC) license was issued at the time the ore was purchased.

Thorium is a soft, silvery white metal that dissolves slowly in water. Thorium-232 has a half-life of 14 billion years and decays by alpha emission with accompanying gamma radiation. Thorium-232 is at the top of a long decay series

that contains key radionuclides such as radium-228, its direct decay product, and radon-220. Two other isotopes of thorium are thorium-230 and thorium-228, both of which also belong to other decay series. They decay by alpha emission with accompanying gamma radiation, and have half-lives of 75,400 years and 1.9 years, respectively.

As mentioned above, thorite ore was first placed on Site 1 in 1962. Early in 1967, some of the thorite ore was removed from the site, placed into barrels, and transferred to an unknown destination. The remaining soil on the site was then disked and harrowed several times to uniformly incorporate any residual thorite ore into the soil. It was reported that the soil was affected to a depth of 8 to 12 inches.

In 1971, a sample of the thorite ore was assayed for thorium content by the Engineering Division, U.S. Army Engineer Power Group, Fort Belvoir,Virginia. The results were reported as, "Thorium content 2.5 w/o thorium with a specific activity of 100 disintegrations per second (dps) per gram." A radiological survey conducted at Site 1 on March 28, 1972, determined that the affected areas included seven locations covering a total of approximately 600 square feet. The depths of the affected soil ranged from 12 to 18 inches below ground surface (bgs).

In July 1972, the radioactive soil was excavated, placed into fifty 55-gallon drums, and staged at the facility's radiation training area. The drums were shipped in October for disposal at the Nuclear Engineering Company, Inc., in Morehead, Kentucky.

Two subsequent radiological surveys, each followed by the removal of radioactive material, occurred on November 1972. The excavated area was backfilled with 18 to 24 inches of clean soil to reestablish original grade.

A final radiological survey of the area was performed by RASO personnel in February 1976. In a March 1976 memorandum, RASO indicated that based on the survey, "the subject area has been returned to background and may be released for unrestricted use."

However, in 1983, two buried drums containing thorium material, dirt, and gravel were discovered near the site during construction of Building 1662. The drums were shipped off-site for disposal as low-level radioactive waste.

Prior to constructing an addition to Building 900, a radiological survey was performed in October 2001 along the southeastern side of the building where the site was initially thought to be located.

Ten subsurface soil (0.5 to 2 ft bgs) samples were collected. The associated survey report concluded that "based on the laboratory results, no further actions regarding thorium are required at this time. Soil remediation will not be required as part of Building 900 Joint Interoperability Project."

In November 2004, RASO indicated that it considered all known drums of thorium ore to have been accounted for and properly disposed. However, RASO indicated in the same communication that "radiation measurements made in 1972 are not definitive as to the thorium concentrations remaining after the cleanup. Characterization surveys are still necessary."

Following a search of historical files, RASO provided a description of the location of Site 1:

Clean soil covers the 60-ft by 90-ft area to a depth of 12 to 18 inches as a result of the 1972 removal of contaminated soil and its replacement with clean soil. No drums currently exist at the site. If contamination exists at the site, it will be found below the 12 to 18 inches of clean soil and within the next12 inches of depth (i.e., the bottom of the interval in question is 24 to 30 inches bgs). (TTNUS, 2010).

2.3.3 Previous Investigations and Activities

The investigation at Site 1 began in 2005 to determine whether historical practices resulted in the release of thorium at concentrations of potential environmental concern. During the investigation, soil samples were collected from the RASO-approved Reference Area and from the onsite study area. Samples were collected from variable depth intervals (18 to 24, 24 to 30, or 30 to36 inches bgs) from a 3-inch diameter borehole and sent to a laboratory for thorium-232 analysis using alpha spectroscopy. The appropriate depth interval for laboratory sample selection was based on the highest gross gamma radiation reading in the field from a gamma probe scintillator lowered down each borehole.

The presence or absence of residual contamination at Site 1 was determined by evaluating analytical results between the site and the Reference Area (uncontaminated background conditions). Background conditions, or a derived concentration guideline level (DCGL), were/was established by adding 1 picoCurie per gram (pCi/g) to each of the Reference Area data (determined by RASO to be an appropriate incremental concentration by which the site could not exceed the Reference Area). The site and background data sets were compared using the Wilcoxon Rank Sum (WRS) test.

The results of the 2005 effort, along with additional research on historical activities, indicated an expanded study area was required.

Subsequently, a larger study area was established and additional soil samples were collected in 2007 and analyzed for thorium-232 [a subset of samples also were analyzed for naturally occurring radioactive material (NORM) by gamma spectroscopy].

After evaluating both the 2005 and the expanded 2007 data sets, it was determined that nine sample locations (S01SB011, S01SB014, S01SB020, S01SB021, S01SB023, S01SB031, S01SB032, S01SB039, and S01SB040) exhibited elevated activity considering the DCGL and field measurements. Figure 3 shows these areas.

Based on exceedances of the DCGL and elevated field readings, there were nine sampling locations within two areas that were candidates for excavation and removal to depths ranging from 24 to 36 inches bgs.

The first area was defined by sample locations S01SB039 and S01SB40 in the northern portion of the site. The estimated area of contamination is 300 square feet, and the depth of contamination is 30 inches (2.5 feet).

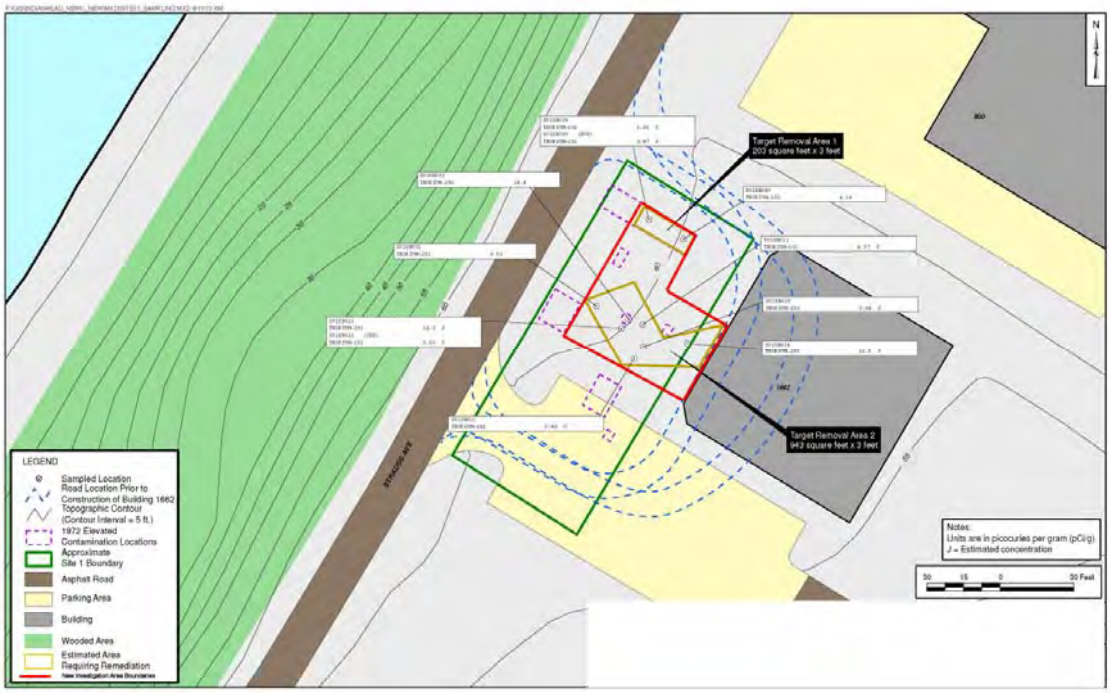
The second area was defined by the remaining sample locations in the central portion of the site. The estimated area of contamination is 775 square feet, and the average depth of contamination is 30 inches (2.5 feet). (TTNUS, 2010).

In order to reduce the number of survey units, individual soil stockpile areas, and soil samples. Target Removal Area 1 and Target Removal Area 2 were combined into one contiguous area.

The Removal Area is estimated to be 35’ wide by 56.5’ long, and 26’ wide by 26’ long. The area is ~2,653 ft^2 in size. The estimated amount of soil to be removed was 393 cubic yards.

Figure 3 presents a map of the consolidated soil removal area. The area is outlined in red.

Figure 3 Site 1 Soil Removal Areas



2.4 License Number, Status, and Authorized Activities

All work detailed in this report was performed under the AWS Nuclear Regulatory Commission (NRC) Broad Scope Radioactive Materials License 50-29273-01.

A Memorandum of Understanding (MOU) was completed between the Navy and AWS prior to the start of the remediation and survey activities defining the license responsibilities between the two organizations.

The signed Memorandum of Understanding is in this report in Appendix A.

3.0 RADIOLOGICAL CONTROL REQUIREMENTS

3.1 Radiation Work Permit

Radiation Work Permits (RWPs) were prepared that specified the field activities to be performed and all radiological safety requirements for the work. All personnel assigned to site work were required to read and sign the RWP, acknowledging that they understood the requirements of the RWP, prior to beginning work.

The RWPs were also used as an information document for industrial safety. Site hazards other than radiological were included in the RWPs so proper protective actions could be taken for all potential hazards. The RWPs clearly specified the need for a briefing on the radiological conditions present in the work environment.

The RWPs listed tasks and specific levels of protection for each worker covered by the RWPs. The RWPs also detailed the dosimetry requirements, the protective clothing requirements, and the expected radiation and contamination levels to be encountered during the remediation and field survey activities.

Copies of the RWPs are presented in this report in Appendix B.

3.2 Personnel Monitoring and Dosimetry

Even though the planned work consists of excavation, equipment and area surveys and potential minor decontamination efforts, and the likelihood that personnel would receive any external or internal exposure was considered minimal. Aleut World Solutions administrative policies require the use of external dosimetry on any field project that has the potential for exposure to radioactive material.

The Project Manager (or designee) was responsible for ensuring that all AWS personnel assigned to perform the work (employees, vendors, contractors, and visitors) are appropriately monitored for exposure to ionizing radiation. Each individual working at the site wore the dosimetry devices specified in the RWPs. Personnel were issued a thermoluminescent dosimeter (TLD). The issuance of the monitoring devices was documented on a Badge Issue Log and furnished to the vendor that processes the TLD's

The TLDs were worn by personnel on the front of the body between the neck and the waist.

Due to the low exposure rates at the sites, perimeter environmental TLD's were not required.

3.3 Official Exposure Determination and Project Dose Estimate

The official and permanent record of accumulated external dose received by individuals was obtained from the processing of the personnel monitoring devices. The vendor TLD processing report showed that no personnel received any detectable whole body exposure greater than 10 millirem, which is the detection threshold of the TLDs.

A copy of the vendor TLD report can be furnished upon request.

4.0 SITE PREPARATION, EQUIPMENT AND PERSONNEL

4.1 Accessibility

Access to the active work areas was radiologically controlled using temporary fencing, barricades, and/or boundary rope/tape. The appropriate postings were displayed. This limited access to only those personnel performing work in the areas.

4.2 Office Space and Restroom Facilities

Temporary office space and restroom facilities were utilized during the task.

4.3 Erosion and Sediment Control Plan

Maryland Department of the Environment (MDE) regulations required an approved Erosion and Sediment Control Plan (E & SC) since the amount of soil to be excavated was greater than 100 cubic yards for this removal action. All the requirements of this plan were implemented prior to excavation activities starting in the work area. The E & SC Plan was prepared by Colbert, Matz, Rosenfelt, Inc. A copy of the approved E & SC Plan is provided in this report in Appendix C.

4.4 Bin Storage Area

A fenced area located in the “Restricted Area” near Water Works Way Rd. was used to store the empty and loaded 25 cubic yard roll off bins prior to shipment off site for disposal. The area was covered with large gravel. Additional temporary fencing was setup around the northern end of the area to provide radiological controls. A vehicle gate with a chain and padlock was used to gain access to the area.

4.5 Bin Storage Area Pre Job Surveys

The area underwent a 100% gamma scan survey prior to the start of work to identify areas of elevated activity. No areas of elevated activity above background were found during the gamma scan survey. Gamma scan results were between 3,000 to 4,000 gross cpm gamma.

Post job surveys of this area were also performed following completion of the project yielding the same results.

4.6 Electrical Power**

Portable generators were used to provide electrical power in the work areas where it is needed.

4.7 Temporary Fencing

Temporary fencing was used to restrict access to work areas where it was needed.

4.8 Area Posting and Access Control

In order to minimize unauthorized access to, and/or removal from the site of radioactive material(s), application of appropriate security protective measures were exercised (i.e., temporary fencing with locked gates, boundary ropes with warning signs). Identification of locations where radioactive materials were present was accomplished with the use of conspicuous postings compliant with Title 10 Code of Federal Regulations (CFR) Part 20.

Only pre-authorized areas were used to store radioactive materials at NSF Indian Head. These areas were selected with concurrence of RASO and the appropriate NSF Indian Head personnel.

Radioactive material handling activities was performed in a manner to ensure:

- Access to areas was restricted where radioactive materials was known to be present.
- Surveys of radioactive materials storage areas were completed periodically as warranted.

4.9 Import Backfill Soil

Farm Service Inc. located in Accokeek, MD was selected as the source of import backfill soils. Grab samples were collected from the stockpiles of the provider. The samples were sent to Test America, Inc. for analysis. The analysis included:

- Total Volatile Organic Compounds
- Total Semi-volatile Organic Compounds
- Total Mercury
- Total RCRA Metals
- Total Herbicides
- Total Pesticides
- Total Gasoline Range Organics
- Total Diesel Range Organics
- Radionuclide’s (Gamma Spectroscopy, to include Ra-226)

The results of the sample analysis were compared to the Maryland Department of the Environment (MDE) cleanup standards for soil and groundwater. All sample results were found acceptable.

The off-site laboratory's information is as follows:

Test America Laboratories, Inc.

13715 Rider Trail North

Earth City, MO 63045

The laboratory data for the sample results are in this report in Appendix D.

The total amount of select backfill soil used for restoration of Site1 was approximately 145 tons and the total amount of screened topsoil used was approximately 51 tons.

4.10 Training

Prior to the start of work, all site personnel, including subcontractors, attended a briefing that discussed radiological conditions and radiological controls that were implemented at the site.

4.11 Underground Utility Location

A licensed subcontractor (Line Locator's Inc.) visited the site prior to the start of excavation activities to locate and mark underground utilities in the excavation area. No interferences in the excavation area were found. All underground utilities were located outside of the excavation area.

4.12 IR Work Approval Permits

Installation Restoration (IR) work approval permits were issued by NSF Indian Head prior to the start of onsite work activities. Copies of these work approval permits are in this report in Appendix E.

4.13 Incoming Bin Surveys/Inspection

Upon arrival at the site, the 25 cubic yard intermodal roll-off bins underwent incoming radiological surveys. The external and internal surfaces of the bin were surveyed. The surveys consisted of loose surface contamination surveys for gross alpha-beta activity and gamma scan surveys. The results of the surveys were compared to the applicable DOT limits set forth in 49 CFR Parts 173.441 and 173.443. None of the results of the surveys were above the applicable DOT limits.

The roll-off bin incoming surveys are in this report in Appendix F. After loading, the bins external surfaces were also surveyed (see Section 12.1).

The bins were also inspected prior to use, the inspection included, but was not limited to the following:

4.13.1 Container Outer Surface Condition

Inspect the outer surface of the container (lid included) for conditions that could compromise the integrity of the container (for example, holes, cracks, bulges, deformations, dents, and evidence of severe corrosion).

If present, inspect the lid lifting rings and attachment points for damage and signs of fatigue.

4.13.2 Container Inner Surface Condition

Inspect the inner surface of the container (lid included). Inspect for holes, cracks, bulges, deformations/dents, and evidence of severe corrosion, which could compromise the integrity of the container.

Note: For both outer and inner surface conditions, minor corrosion and paint flaking was acceptable.

4.13.3 Container Closure

Inspect the lid gasket for deformations, cracks, bulges, and other conditions which could compromise the sealing of the container.

Inspect the gasket-seating surface of the container for cleanliness and debris. Remove any foreign debris and clean the seating surface (as necessary) to ensure proper sealing of the lid.

If present, inspect lid closure bolts and devices for damage and/or signs of fatigue.

4.14 Personnel

Task personnel consisted of the following:

Project Manager – Was the point of contact responsible for the overall operations and safety of the project team. The Project Manager also acted as the onsite Radiation Safety Officer (RSO) for the project.

Health Physics Technicians - Performed surveys, sampling operations and supervised any decontamination efforts that were required.

Equipment Operator - Operated heavy equipment used to support excavation and remediation activities.

Decontamination Technicians - Performed decontamination efforts as required and provided general labor support.

Truck Drivers- Operated trucks for the movement of waste containers between the storage/staging area and excavation areas, and also between the storage area and the rail loading facility.

U.S. Army JMC Certified Senior Waste Broker - Employed by AWS. Prepared and completed all waste manifests and applicable DOT shipping documentation for the waste shipments.

Bering Sea Environmental UXO II Tech- Was responsible for the screening of soils for the presence of UXO.

Bering Sea Environmental Senior UXO Supervisor- Was responsible for the supervision of the screening of soils for the presence of UXO.

Greenfield Logistics personnel were responsible for scheduling logistics of the waste that was packaged and transported to the disposal facility. They provided truck support for bin movement and support functions at the rail loading facility.

All personnel were trained and experienced at the tasks that they performed.

5.0 SOIL REMOVAL AND EXCAVATION ACTIVITIES

Figure 3 presents a map of the excavation area.

5.1 Gamma Scan Surveys

Prior to each 6" lift in the excavation area, a 100% walkover gamma scan survey was performed in the area with 2" by 2" NaI detectors. The following is a summary of the ranges found during the gamma scan surveys (background levels were ~ 5,500 cpm):

1st 6" Lift: 6,000-70,000 cpm

2nd 6" Lift: 6,000-105,000 cpm

3rd 6" Lift: 6,000-200,000 cpm

4th 6" Lift: 6,000-300,000 cpm

5th 6" Lift (Not Performed): 7,000-900,000 cpm

Copies of the surveys are in this report in Appendix G.

5.2 Soil Samples

Following each gamma scan survey of each 6" lift in the excavation area, systematic soil samples were collected in the area. The samples were sent to the offsite laboratory for gamma spectroscopy analysis. Figures 4, 5, 6, 7, and 8 present maps of the soil sample locations.

The laboratory data for the soil samples are in this report in Appendix H.

Figure 4 1st 6" Lift Soil Sample Location Map

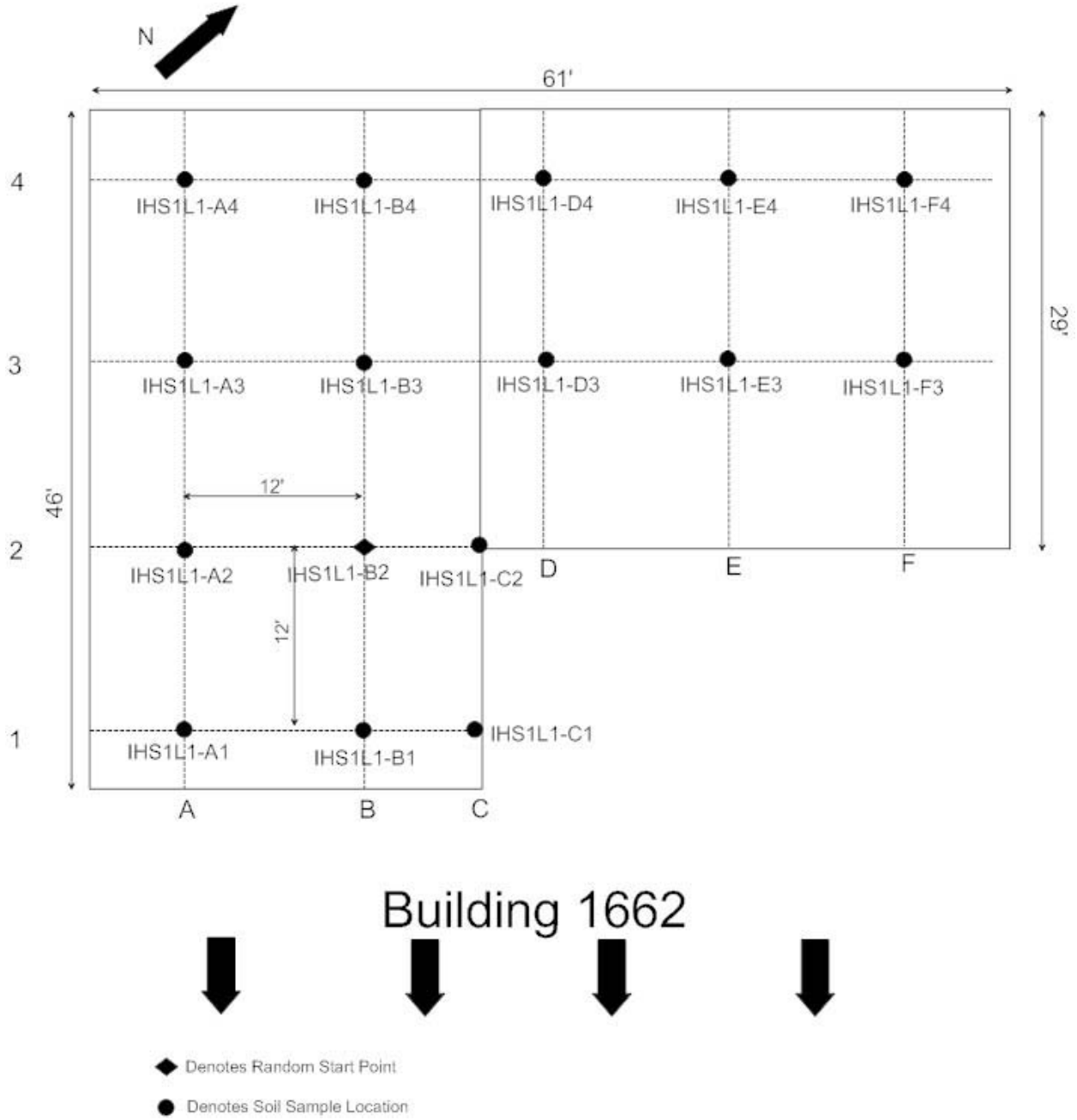


Figure 5 2nd 6" Lift Soil Sample Map

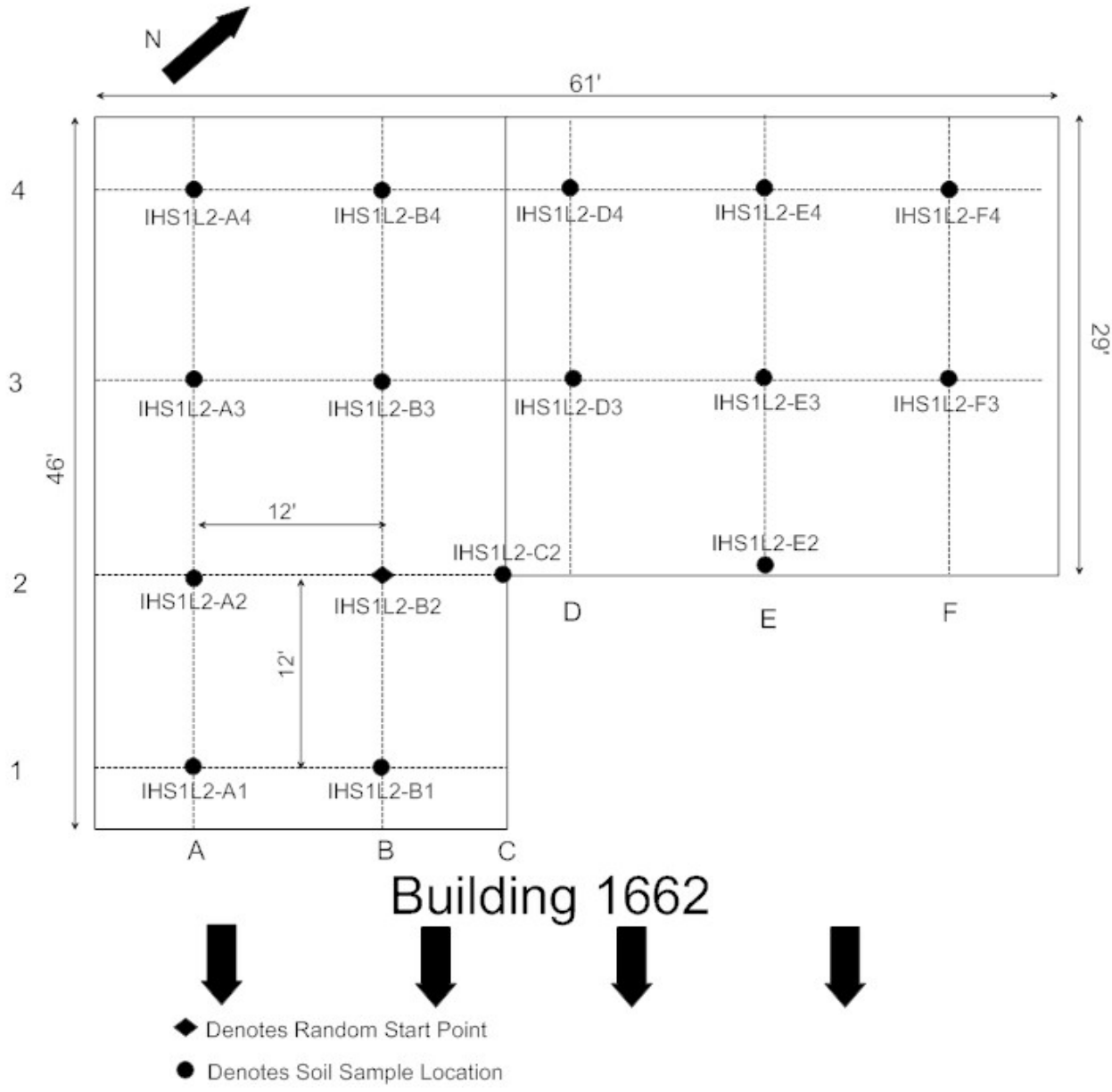


Figure 6 3rd 6" Lift Soil Sample Map

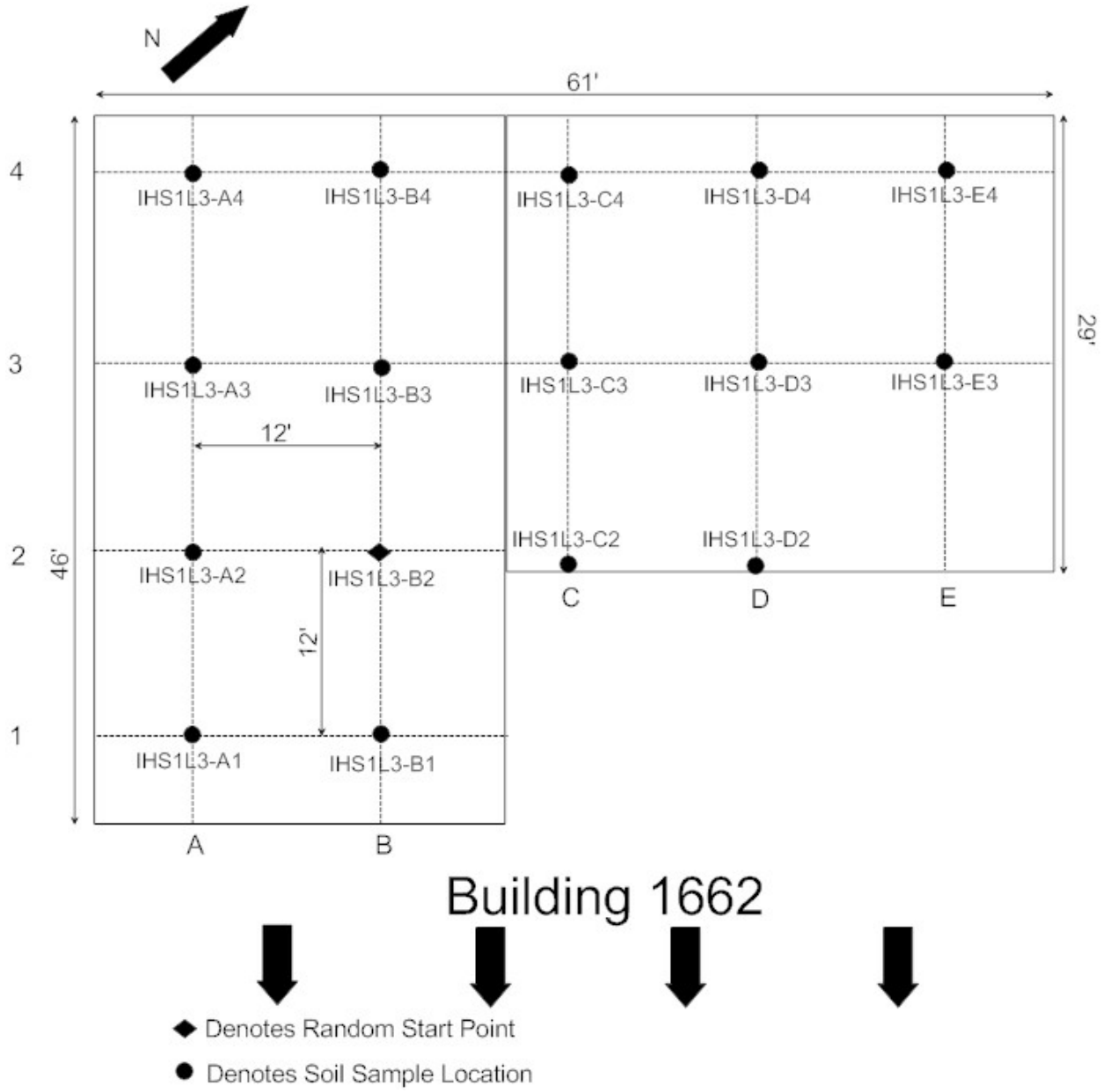


Figure 7 4th 6" Lift Soil Sample Map

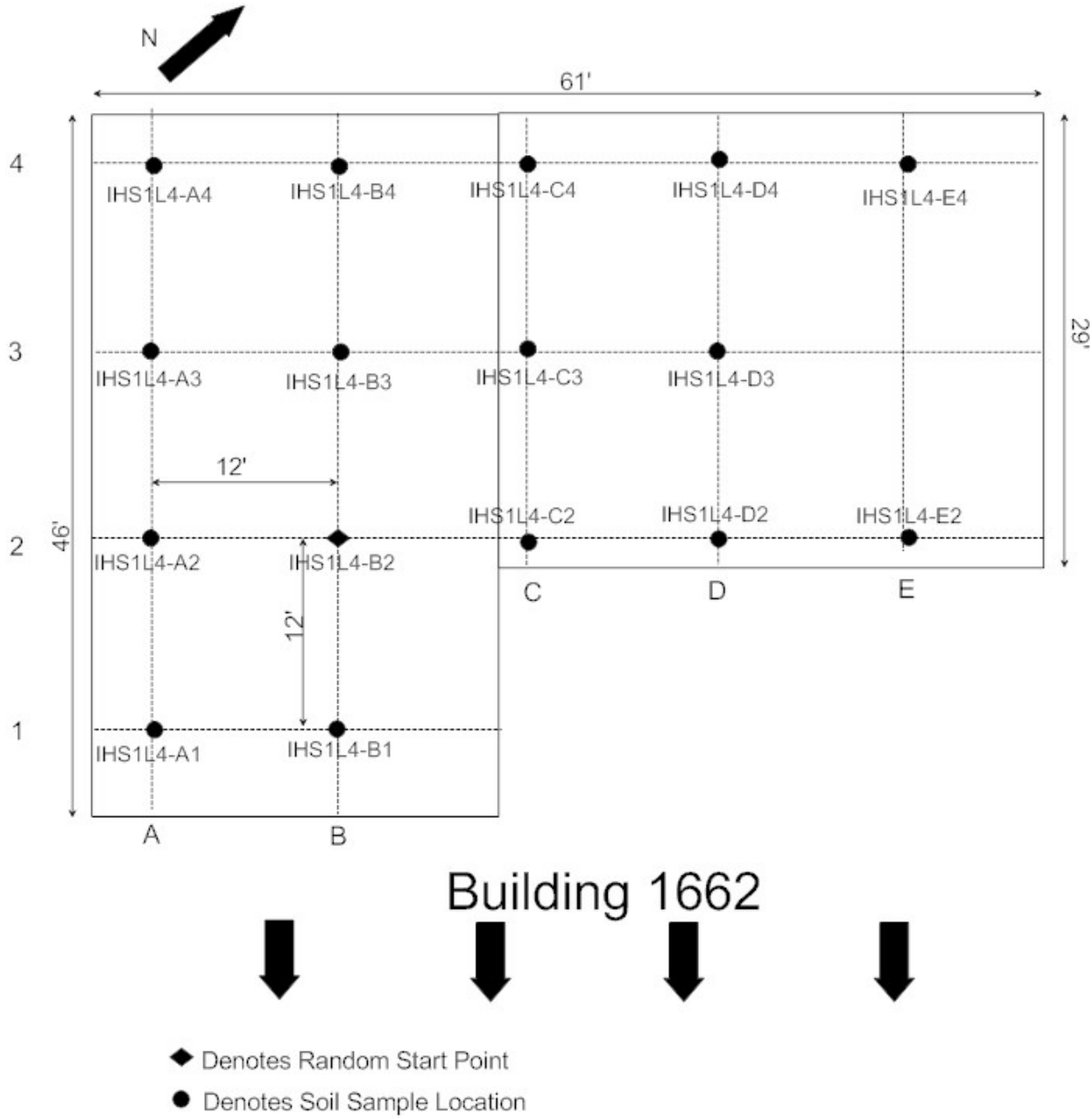
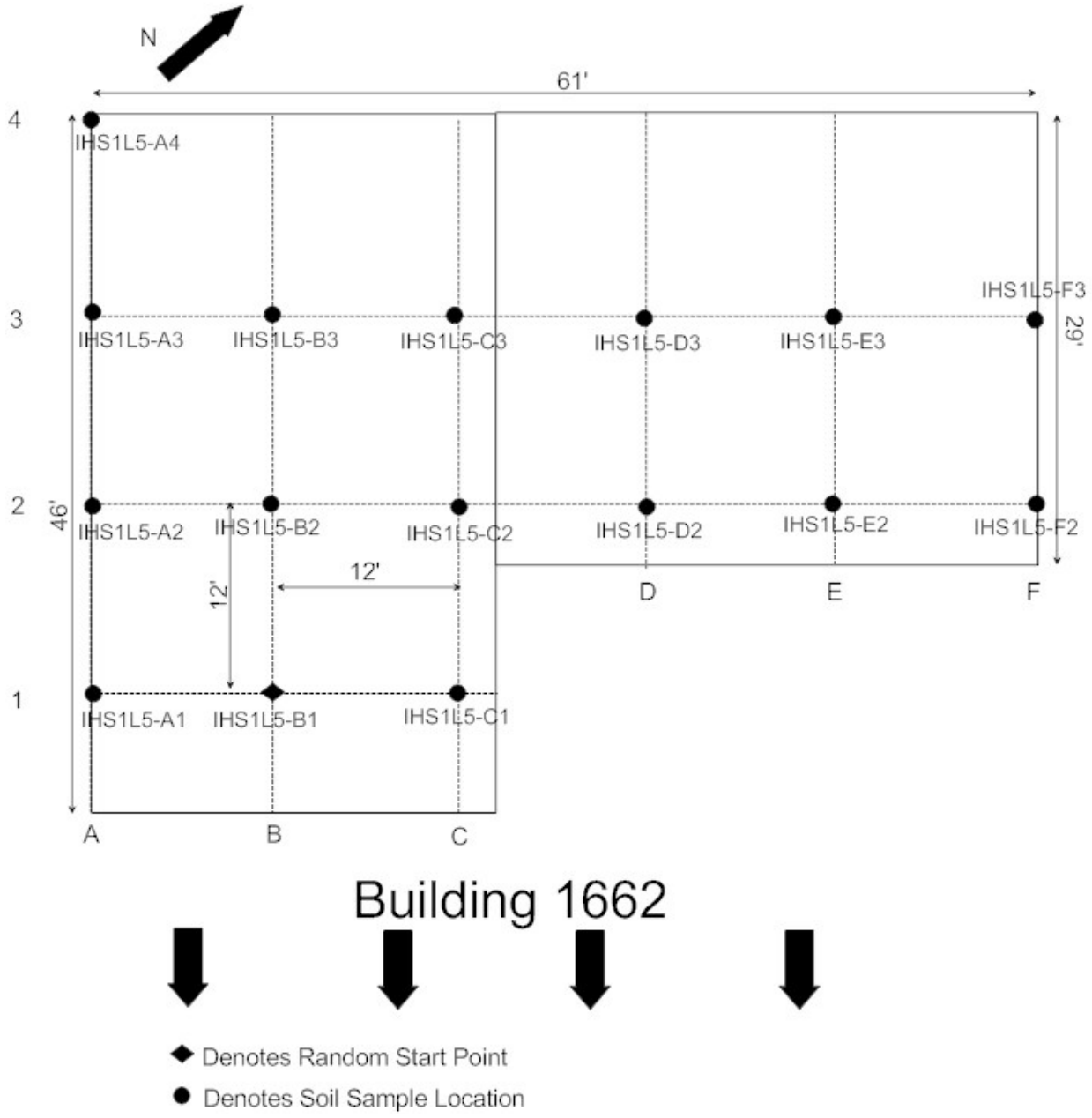


Figure 8 5th 6" Lift Soil Sample Map



A summary of the soil sample results are provided in Tables 1, 2, 3, 4, and 5 below.

Sample results highlighted in yellow were between 2.0 and 3.0 pCi/g.

Sample results highlighted in red were greater than the DCGL of 3.0 pCi/g.

Table 1 1st 6" Lift Soil Sample Result Summary Table

Sample ID#	Date Sampled	Depth Below Grade Surface in	Sample Matrix	Location/Description	Ac-228/ Th-232 Results in pCi/g	
IHS1L1-A1	2/20/2013	0-6"	Soil	First 6" Lift Sample	1.08	
IHS1L1-A2	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.45	U
IHS1L1-A3	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.59	
IHS1L1-A4	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.84	
IHS1L1-B1	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.38	
IHS1L1-B2	2/20/2013	0-6"	Soil	First 6" Lift Sample	22.80	
IHS1L1-B3	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.74	
IHS1L1-B4	2/20/2013	0-6"	Soil	First 6" Lift Sample	1.15	
IHS1L1-C1	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.47	
IHS1L1-C2	2/20/2013	0-6"	Soil	First 6" Lift Sample	2.13	
IHS1L1-D3	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.99	
IHS1L1-D4	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.71	
IHS1L1-E3	2/20/2013	0-6"	Soil	First 6" Lift Sample	1.07	
IHS1L1-E4	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.97	
IHS1L1-F3	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.90	
IHS1L1-F4	2/20/2013	0-6"	Soil	First 6" Lift Sample	0.56	U
				Maximum:	**22.800**	
				Average:	**2.239**	
				Standard Deviation:	**5.499**	

U-Result is less than the sample detection limit.
ND- Not detected.

Table 2 2nd 6" Lift Soil Sample Result Summary Table

Sample ID#	Date Sampled	Depth Below Grade Surface in	Sample Matrix	Location/Description	Ac-228/ Th-232 Results in pCi/g
IHS1L2-A1	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.87
IHS1L2-A2	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.46
IHS1L2-A3	2/21/2013	6-12"	Soil	Second 6" Lift Sample	1.01
IHS1L2-A4	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.91
IHS1L2-B1	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.47
IHS1L2-B2	2/21/2013	6-12"	Soil	Second 6" Lift Sample	9.16
IHS1L2-B3	2/21/2013	6-12"	Soil	Second 6" Lift Sample	1.30
IHS1L2-B4	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.85
IHS1L2-C2	2/21/2013	6-12"	Soil	Second 6" Lift Sample	2.80
IHS1L2-D3	2/21/2013	6-12"	Soil	Second 6" Lift Sample	1.26
IHS1L2-D4	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.49
IHS1L2-E2	2/21/2013	6-12"	Soil	Second 6" Lift Sample	7.47
IHS1L2-E3	2/21/2013	6-12"	Soil	Second 6" Lift Sample	1.14
IHS1L2-E4	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.88
IHS1L2-F3	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.81
IHS1L2-F4	2/21/2013	6-12"	Soil	Second 6" Lift Sample	0.77
				Maximum:	**9.160**
				Average:	**1.917**
				Standard Deviation:	**2.574**

U-Result is less than the sample detection limit.
ND- Not detected.

Table 3 3rd 6" Lift Soil Sample Result Summary Table

Sample ID#	Date Sampled	Depth Below Grade Surface in	Sample Matrix	Location/Description	Ac-228/ Th-232 Results in pCi/g
IHS1L3-A1	2/25/2013	12-18"	Soil	Third 6" Lift Sample	0.94
IHS1L3-A2	2/25/2013	12-18"	Soil	Third 6" Lift Sample	0.51
IHS1L3-A3	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.20
IHS1L3-A4	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.36
IHS1L3-B1	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.54
IHS1L3-B2	2/25/2013	12-18"	Soil	Third 6" Lift Sample	11.00
IHS1L3-B3	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.13
IHS1L3-B4	2/25/2013	12-18"	Soil	Third 6" Lift Sample	0.85
IHS1L3-C2	2/25/2013	12-18"	Soil	Third 6" Lift Sample	41.10
IHS1L3-C3	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.03
IHS1L3-C4	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.42
IHS1L3-D2	2/25/2013	12-18"	Soil	Third 6" Lift Sample	
IHS1L3-D3	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.01
IHS1L3-D4	2/25/2013	12-18"	Soil	Third 6" Lift Sample	0.71
IHS1L3-E3	2/25/2013	12-18"	Soil	Third 6" Lift Sample	1.16
IHS1L3-E4	2/25/2013	12-18"	Soil	Third 6" Lift Sample	0.73
				Maximum:	**41.100**
				Average:	**4.380**
				Standard Deviation:	**10.481**

U-Result is less than the sample detection limit.
ND- Not detected.

Table 4 4th 6" Lift Soil Sample Result Summary Table

Sample ID#	Date Sampled	Depth Below Grade Surface in	Sample Matrix	Location/Description	Ac-228/ Th-232 Results in pCi/g	
IHS1L4-A1	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	0.48	U
IHS1L4-A2	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	1.70	
IHS1L4-A3	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	4.37	
IHS1L4-A4	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	13.00	
IHS1L4-B1	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	1.19	
IHS1L4-B2	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	143.00	
IHS1L4-B3	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	8.65	
IHS1L4-B4	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	1.51	
IHS1L4-C2	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	0.92	
IHS1L4-C3	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	1.24	
IHS1L4-C4	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	0.49	U
IHS1L4-D2	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	2.70	
IHS1L4-D3	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	1.16	
IHS1L4-D4	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	1.35	
IHS1L4-E2	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	0.88	
IHS1L2-E4	2/26/2013	18-24"	Soil	Fourth 6" Lift Sample	0.57	
				Maximum:	**143.000**	
				Average:	**11.451**	
				Standard Deviation:	**35.247**	

U-Result is less than the sample detection limit.
ND- Not detected.

Table 5 5th 6" Lift Soil Sample Result Summary Table

Sample ID#	Date Sampled	Depth Below Grade Surface in	Sample Matrix	Location/Description	Ac-228/ Th-232 Results in pCi/g
IHS1L5-A1	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	0.71
IHS1L5-A2	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	0.59
IHS1L5-A3	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	0.87
IHS1L5-A4	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	0.86
IHS1L5-B1	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	71.20
IHS1L5-B2	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	2.50
IHS1L5-B3	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	2.12
IHS1L5-C1	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	0.49
IHS1L5-C2	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	1.17
IHS1L5-C3	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	1.56
IHS1L5-D2	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	1.18
IHS1L5-D3	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	3.00
IHS1L5-E2	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	0.81
IHS1L5-E3	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	1.51
IHS1L5-F2	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	0.72
IHS1L5-F3	3/1/2013	24-30"	Soil	Fifth 6" Lift Sample	1.08
				Maximum:	**71.200**
				Average:	**5.648**
				Standard Deviation:	**17.495**

U-Result is less than the sample detection limit.
ND- Not detected.

5.3 Radiologically Impacted Soil Removal Site 1

The soil was excavated in four 6" lifts with an excavator and placed directly into a front end loader. The front end loader then placed the excavated soils directly into a designated soil stockpile located in the soil laydown area. Each excavator and front end loader bucket was gamma scan surveyed to identify point sources of radioactive material and to determine if soils were radiologically impacted. No point sources were discovered in any of the bucket loads.

Approximately 98 cubic yards of radiologically impacted soils were removed from the excavation area.

The excavated soils were stored and covered in the soil laydown area in accordance with the requirements of the E & SC Plan.

5.4 Concrete Slabs

Excavated concrete slabs were screened manually for alpha and beta/gamma emitters. The surveys consisted of 100% alpha-beta and gamma scans and alpha-beta direct measurements. The alpha/beta scans were conducted in accordance with Section 7.6.2 of this report. The alpha/beta direct measurements were conducted in accordance with Section 7.6.3 of this report. The gamma scans were conducted in accordance with Section 7.6.5 of this report. All of the survey results were less than the DCGL's presented in Table 8 of this report.

The survey data for the concrete slabs is in this report in Appendix I.

5.5 Dust Suppression

Water was used to lightly wet the soils if dust levels increased during excavation activities when necessary.

5.6 Air Sampling

Concentrations of radioactive material in air was determined, as needed, by sampling the air. Air samples were collected downwind during excavation activities in the immediate vicinity of the area being excavated. Air sampling was conducted in accordance with the guidance provided in NRC Regulatory Guide 8.25, "Air Sampling in the Workplace", July 1992 (NRC 1992a). The samples were collected under known physical conditions (e.g. filter, sample time, flow rate). The flow meters of air samplers were calibrated at least annually.

Air samples were collected from general and localized areas when there was potential for generation of airborne radioactive material (during excavation activities) These samples were used to verify that the confinement of radioactive material is effective, and provide warning of elevated concentrations for planning or response actions. In each case, the sampling point was located in the airflow pathway near the known or suspected release point(s). If necessary, more than one air sample location was used in order to provide a reasonable estimate of the general concentration of radioactive material in air.

The air sample filters were analyzed onsite for gross alpha-beta activity with a Ludlum Model-2929 Dual Channel Scaler phoswich detector or equivalent.

The following equation was used to calculate the initial and decayed count airborne activity:

$$A_F = \frac{(GrossCounts / CountTime) - BackgroundCountRate}{F * 2.22E+6 * V * \varepsilon_i * 2.83E+4}$$

Where,

A_F	Air Sample Activity in µCi/ml
F	Filter Efficiency Factor
V	Total Volume of Air Collected on Air Sample Filter in cubic feet
2.22E+6	Conversion Factor for dpm to µCi
ε_i	2 π Instrument Efficiency
2.83E+4	Conversion Factor for cubic feet to milliliter

The AWS Project Manager or his designee applied professional judgment and experience to identify air sampling appropriate for the specific situation. Such judgment was based on historical air sampling and characterization results, quantity of contamination of the material being handled, potential for release of contaminants based on physical form and activity, type of confinement or containment, and other factors specific to the activity.

An administrative action level was established for breathing zone air samples of 10% of the derived air concentration (DAC); air sample results greater than this administrative action level shall be reported to the AWS Project Manager or his/her designee. Individual exposure greater than this action level required the individual to be restricted from work involving potential exposure to airborne radioactive material unless approved by the AWS RSO or his/her designee. This condition never arose during remediation activities.

The 10% DAC value for Th-232 is 1.0 E-13 µCi/ml which can be found in 10 CFR Part 20, Appendix B, Table 1, Column 3.

All of the air sample results were less than the 10% DAC value for Th-232 for all work conducted during remediation activities. The air sample results are in Appendix J of this report.

Table 6 presents a summary of the air sample results.

Table 6 Air Sample Result Summary Table

Sample ID	Date	Location	Initial Count α Results In µCi/ml	Initial Count βγ Results In µCi/ml	Decayed Count α Results In µCi/ml	Decayed Count βγ Results In µCi/ml	# of Hours Decayed
AS-01	2/21/13	Downwind During Excavation	4.5 E-11	9.0 E-11	4.7 E-14	2.4 E-13	20
AS-02	2/21/13	Downwind During Excavation	2.7 E-11	6.1 E-11	3.5 E-14	< MDC	24
AS-03	2/25/13	Downwind During Excavation	3.3 E-11	6.9 E-11	4.7 E-14	< MDC	20
AS-04	2/26/13	Downwind During Excavation	3.1 E-11	6.6 E-11	7.9 E-14	< MDC	24
AS-05	2/28/13	Downwind During Excavation	3.0 E-11	6.0 E-11	5.7 E-14	< MDC	20
AS-06	2/28/13	Downwind During Excavation	2.6 E-11	5.8 E-11	4.2 E-14	1.6 E-13	20

6.0 PLANNING PHASE OF RADIOLOGICAL SURVEYS

6.1 Radionuclide of Concern

Based upon historical information from previous investigations and soil sample analysis conducted at Site 1 the radionuclide of concern is Thorium-232 (^{232}Th). Table 7 lists the radionuclide of concern with the half-life and principle types of radiation (alpha, beta, or gamma).

The radionuclide of concern is the radionuclide at a particular site that could potentially contribute to the dose received by the public, or in this case, military personnel.

Table 7 Radionuclide of Concern

Radionuclide	Half-life	Radiations
Thorium-232	1.405 E+10 years	Alpha (α)/gamma (γ)

6.2 Surface Activity Derived Concentration Guideline Limits (DCGLs) for Radionuclide of Concern for Equipment, Materials, and Tools

The surface activity DCGL's are stated in the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses, By-product, Source, or Special Nuclear Materials, (NRC 1987)", and "Termination of Operating Licenses for Nuclear Reactors, Regulatory Guide 1.86, (AEC 1974)."

These DCGL's were applied to incoming and outgoing surveys of equipment used during remediation activities, and surveys of debris and various surfaces (concrete, etc.). Table 8 presents the DCGL's. None of the values in Table 8 were exceeded during any phase of work performed.

Table 8 Surface Activity DCGL's for Equipment, Materials, and Tools

Radionuclide	Removable in dpm/100cm^2	Average [1] in dpm/100cm^2	Maximum [2] in dpm/100cm^2	Radiations Emitted
Th-232	200	1,000	3,000	α
1. Measurements of average contaminant should not be over more than 1 m^2 2. The maximum contamination level applies to an area of not more than 100 cm^2				

6.3 Derived Concentration Guideline Limit (DCGL) for Radionuclide of Concern for Soil

The DCGL for soils was calculated during the Engineering Evaluation and Cost Analysis (EE/CA) that was performed by Tetra Tech NUS, Inc. in September of 2010. The goal was to develop a DCGL that corresponded to a cancer risk within the EPA acceptable (or presumably not unacceptable) risk range of 1×10^{-4} (1 in 10,000) and $1\times^{10-6}$ (1 in 1,000,000). The calculations were performed using the RESRAD Version 6.3 Modeling Code developed by Argonne National Laboratory to evaluate doses from exposure to radioactively open land areas.

RESRAD is a computer model designed to estimate radiation doses and risks from residual radioactive materials. It is the only code designated by the DOE in for the evaluation of radioactively contaminated sites.

NRC has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff.

The maximum DCGL that resulted in a cancer risk less than 1×10-4 was 3 pCi/g.

The maximum calculated total effective dose equivalent (TEDE) was 4.47 mrem/y at a period of 23.05 years. The NRC has a current target dose of 25 mrem/y TEDE for unrestricted release.

NOTE: SINCE WORK WAS STOPPED IN THE EXCAVATION AREA AT 2' BGS, THE FOLLOWING SECTIONS (6.4) ARE FOR INFORMATIONAL PURPOSES ONLY AS NO FINAL STATUS SURVEYS WERE PERFORMED IN THE AREA.

6.4 Data Quality Objectives

A multi-agency committee representing the Department of Defense (DOD), Department of Energy (DOE), the Environmental Protection Agency (EPA), and the Nuclear Regulatory Commission (NRC) has addressed this need by producing a guidance document known as the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).

Published in December 1997, MARSSIM provides detailed guidance for planning, implementing and evaluating environmental and facility radiological surveys to demonstrate compliance with a dose- or risk-based regulation. MARSSIM focuses on the demonstration of compliance during the final status survey once scoping, characterization and any necessary remedial actions are completed.

MARSSIM provides a single, nationally consistent guide for verifying that radioactively contaminated sites have been cleaned up to standards. Combining this information into one manual has increased efficiency, and has eliminated the confusion that can result from contractors working from multiple manuals.

The survey of the Site 1 area would require sufficient detail to determine if the release criteria was met. The data from the Final Status Surveys that would have been performed as defined in MARSSIM would have met the data quality objectives stated below.

The final status survey design process for the excavation bottom and sidewall soil began with development of data quality objectives (DQOs) in accordance with the guidelines outlined in Appendix D of MARSSIM and EPA QA/G4 "Guidance for the Data Quality Objectives Process" (EPA, 2000). The DQOs were then used in conjunction with the radiological conditions at the site to calculate the number and locations of measurement and sampling points to demonstrate compliance with the release criterion of 3 pCi/g for Th-232 calculated using the RESRAD Version 6.3 Modeling Code as discussed in Section 6.3. Survey techniques and analytical methodologies were selected to generate the required analytical data. Once the data would have been received from the surveys and laboratory and was validated, it would be evaluated using statistical techniques to test against the hypothesis stated in Section 7.9.2. Sampling, as discussed in this and subsequent sections, refers to the collection of measurement data. “Sampling” includes soil samples for off-site analysis, alpha/beta direct measurements, and swipe samples.

6.4.1 Statement of the Problem

6.4.1.1 Excavation Bottoms/Excavation Sidewalls

For the Final Status Surveys of the excavation areas bottom and sidewalls it would be determined if the allowable release limits have been met or if investigation/remediation is warranted. Therefore, the decision to be made can be stated: “Do the Final Status Survey Units meet the allowable soil concentration release limit of 3 pCi/g”. The null hypothesis (H_o) as required by MARSSIM is stated and tested in the negative form: “The median concentration in the survey unit exceeds the soil concentration release limit.”

Final Status Surveys are surveys, measurements, and sampling, once performed that describe the radiological conditions of a site, following completion of decontamination/remediation activities (if any) in preparation for unrestricted release.

It was anticipated that successful completion of activities described in the Work Plan would provide sufficient data for the unrestricted release of the areas undergoing survey (AWS, 2012). Resources available to provide the necessary data included the following:

Activities outlined in the Work Plan (AWS, 2012).

Guidance provided in the Multi Agency Radiation Survey & Site Investigation Manual (MARSSIM) for performing Final Status Surveys (FSS).

Process knowledge, inspections, and various radiological survey reports previously conducted in the areas.

Statistical analysis of survey data collected during survey activities outlined in the Work Plan (AWS, 2012).

6.4.2 Identification of Decisions

The need to provide data for unrestricted release of the Site 1 equipment would require the performance of radiological surveys as specified in the Work Plan (AWS, 2012).

The primary uses of the data expected to result from completion of the Work Plan was to provide information and data to support the unrestricted release of excavation bottoms and sidewalls in Site 1 (AWS, 2012).

6.4.3 Inputs to the Decision

Radiological surveys and sampling required to support the unrestricted release of the areas included:

Locate, survey, and sample background reference area(s) where meaningful background radiation levels can be determined (See Section 7.1 of this report);

100 % gamma scan survey of the excavation area bottom and sidewalls with Ludlum Model 2350-1 Data Loggers coupled to Ludlum Model 44-10 2-inch by 2-inch NaI detectors would have been performed;

Systematic soil samples in the survey units (soil,);

Laboratory data validation and statistical analysis of collected data.

6.4.4 Definition of Study Boundaries

The spatial boundary for this survey effort was the entire excavation area bottom and sidewalls for Site 1. Each survey unit would have been 100 % gamma scan surveyed. Systematic soil samples would also have been collected from each survey unit.

6.4.5 Development of a Decision Rule

6.4.5.1 Surface Activity Release Limits

The surface activity release limits are presented in Table 8.

If during performance of the FSS the values found were greater than the values presented in Table 8 further investigation and decontamination/remediation was required. If the values found are less than the values presented in Table 14 no further action was required.

6.4.5.2 Soil Concentration Release Limits

The soil concentration limit was 3 pCi/g for Th-232. This includes background levels of Th-232.

6.4.5.3 Investigation Levels

Investigation levels are specific levels of radioactivity used to indicate when additional investigation and/or remediation may be necessary. Investigation levels also serve as a Quality Control (QC) check. For example, in addition to indicating potential contamination, a measurement that exceeds the investigation level may indicate a failing instrument.

When determining an investigation level using a statistical-based parameter (e.g., standard deviation), the following may be considered: survey objectives, underlying radionuclide distributions (e.g., normal, log normal, non-parametric), data population descriptors (e.g., standard deviation, mean, median), and prior survey and historical information.

For gamma surveys, the investigation level was established at the reference area mean + 3σ, where σ is the standard deviation of the gamma readings in the reference area.

The location of the background reference area for Site 1 is presented in this report in Figure 10.

6.4.6 Limits on Decision Errors

Actions to minimize errors need to be implemented during the data collection phase of the radiological survey. Qualified radiation survey personnel will perform the survey and record the data. Additional actions, such as instrument calibration, daily instrument source checks, and backup surveys with separate instruments provide the primary steps to be taken to avoid errors in the data collection phase of the survey process.

In order to minimize errors, the applicable requirements of AWS Standard Operating Procedures (SOPs) for performing surveys and instrumentation calibration and use will be followed. Copies of the SOPs will be provided upon request.

Data collection and transcribing is the first phase where errors may arise. To avoid data errors for manual surveys, experienced personnel will record and transcribe the data.

The ongoing on-site analyses and evaluation of survey results provides a final check for errors, which if detected, can be corrected.

There are two types of decision errors that can be made when performing the statistical tests described in this plan. The first type of decision error, called a Type I error, occurs when the null hypothesis is rejected when it is actually true. A Type I error is sometimes called a “false positive.” The probability of a Type I error is usually denoted by α. The Type I error rate is often referred to as the significance level or size of the test.

The second type of decision error, called a Type II error, occurs when the null hypothesis is not rejected when it is actually false. A Type II error is sometimes called a “false negative.” The probability of a Type II error is usually denoted by β. The *power* of a statistical test is defined as the probability of rejecting the null hypotheses when it is false. It is numerically equal to $1-\beta$, where β is the Type II error rate.

The Final Status Surveys were designed to limit Type I and Type II errors to 5%. It is important to minimize the chances that survey units exceeding the release limits will be missed (Type I Error) and survey units meeting the release limits will be rejected as too high (Type II Error). The probability of either of these occurring was set at a maximum of 5%.

6.4.7 Optimizing Data Collection

6.4.7.1 Review Outputs and Existing Data for Consistency

Radioactive source readings were used to check instruments for consistency prior to use in each daily shift. The instruments were only used after readings were compared and agreed within +/- 20 %. The Project Manager reviewed the information each day to verify that the equipment was operating satisfactorily.

The Project Manager reviewed the survey data on a daily basis. This ensured an ongoing independent review for consistency of all survey data collected.

6.4.7.2 Determination of Scan Percentage

100% of the excavated area bottoms and excavation area sidewall soils were gamma scan surveyed. This would be necessary to determine the extent, if any, of residual contamination that might have been present.

6.4.7.3 Data Collection Decision Alternatives

The data collection design alternatives may change slightly based on conditions found in the field being different than the information furnished based on prior surveys and available information.

In the event that a survey unit classification was revised as a result of detecting unexpected contamination, the Navy would be notified and changes to the Work Plan would have been required prior to resumption of survey activity.

6.4.7.4 Select Most Resource Effective Survey Design

As indicated above, the survey design specified for use in the Work Plan was developed in accordance with best management practices and MARSSIM guidelines and provided the necessary data for a radiological final status survey (AWS, 2012). Coupled with the use of experienced personnel and proper instrumentation, the design was the most efficient and resource effective.

6.4.7.5 Document Operational Details and Theoretical Assumptions

Operational details for the radiological survey process were developed for and were included as part of the Work Plan (AWS,

2012). The theoretical assumptions were based on guidelines contained in MARSSIM (MARSSIM, 2000). Specific assumptions regarding types of radiation measurements, instrument detection capabilities, quantities and locations of data to be collected, and action levels were contained in the Work Plan (AWS, 2012).

6.4.8 Sampling Process Design

The sampling process design included the following elements:

The *types of samples and sampling matrices* for the Final Status Survey of the areas were gamma scans and soil samples.

The *sampling frequency* at the areas was set at a minimum of 16 soil samples for each of the survey units.

6.5 ALARA Considerations

Based upon previous surveys performed, dose rates, and the anticipated total amount of residual radioactive materials at the NSF Indian Head work areas, direct exposure to radiation to the survey workers was minimal during remediation and survey activities. During performance of the excavation, surveys and any potential decontamination activities, the workers exposures did not exceed 10 millirem TEDE during any phase of work performed.

The following controls were implemented to keep workers exposure ALARA during remediation activities:

- Use of airborne contamination controls (i.e. light wetting of soils during excavation) to ensure that doses to workers were below AWS administrative limits;
- Performing remediation control surveys during excavation activities;
- The use of personnel protective equipment (PPE) when necessary;
- Use of a RWP to provide guidance to workers (See Section 3.1 for details);
- Personnel contamination monitoring (i.e. “frisking”) when exiting radiologically impacted areas;
- Use of temporary fencing and proper radiological posting to control access to radiologically impacted areas during remediation activities;
- Prohibiting eating, drinking, and smoking in radiologically posted areas.

7.0 IMPLEMENTATION PHASE OF SURVEYS

7.1 Background Reference Radiation Levels

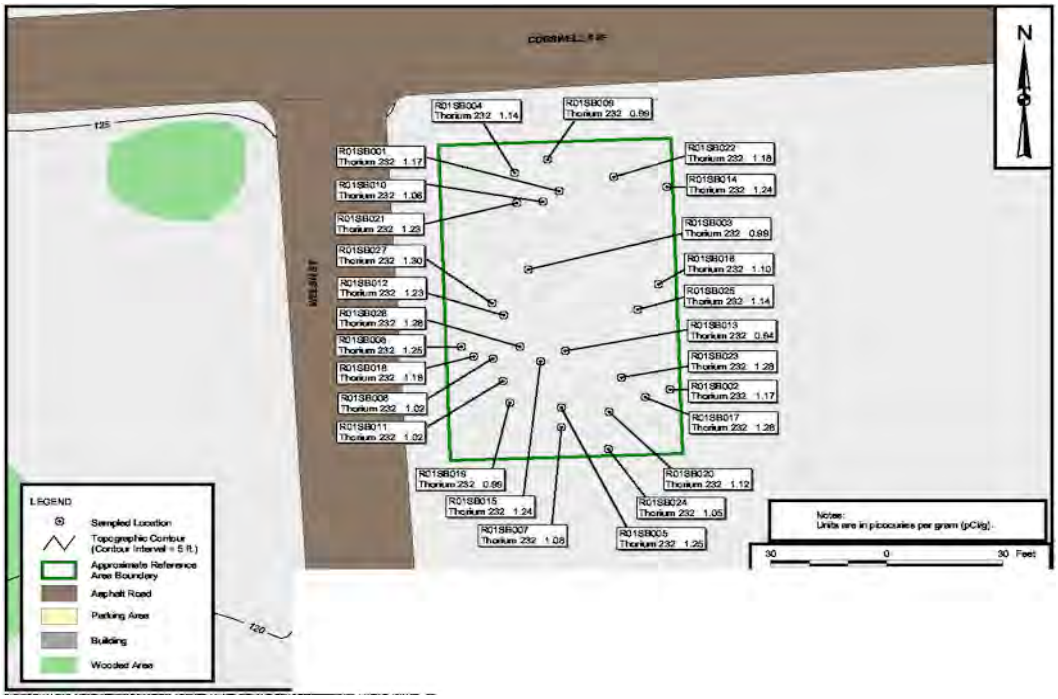
Site background reference areas were chosen that had similar physical, chemical, geological, radiological, and biological characteristics as the survey unit being evaluated. Background reference areas are normally selected from non-impacted areas, but are not limited to natural areas undisturbed by human activities. In some situations, a reference area may be associated with the survey unit being evaluated, but cannot be potentially contaminated by site activities. Generally, reference areas should not be part of the survey unit being evaluated.

The site background count rate levels were established for the final status surveys by obtaining thirty, 1-minute static readings (with each instrument to be used), taken at 4” from the surface of soil for gamma surveys from areas unlikely to be affected by the residual radioactive materials that could be present at the different survey areas. The average value for these readings will be used as the area background radiation levels.

The readings were documented on Form AWS QA003 or equivalent electronic spreadsheet.

Twenty-seven background reference area soil samples were collected during previous site investigations. The average Th-232 concentration was 1.15 pCi/g. Figure 9 below presents a map of the sample locations and results.

Figure 9 Background Reference Area Soil Samples

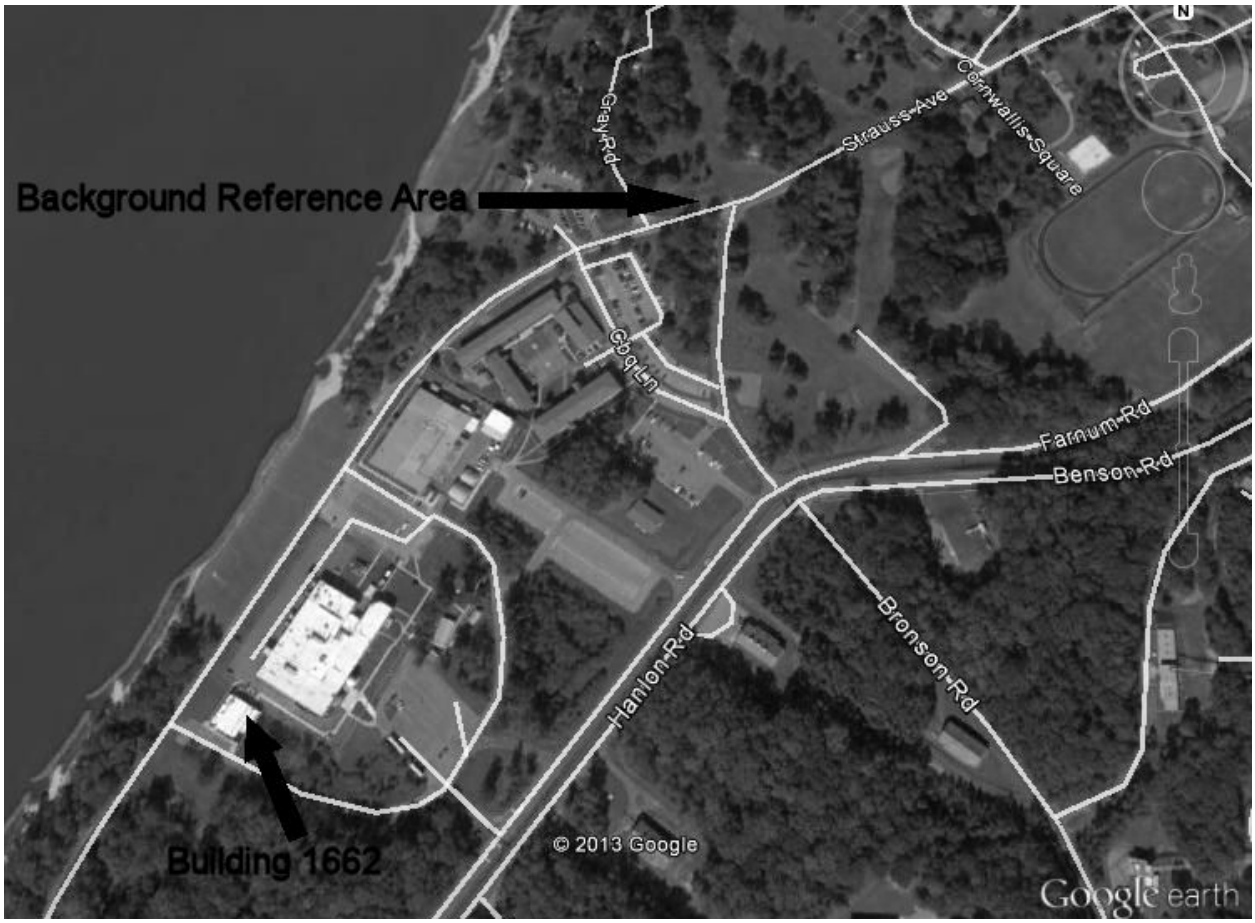


NOTE: The background reference area previously used has been developed and is now a residential housing area, therefore, the Navy directed AWS to choose a different background reference area.

Figure 10 presents a satellite image of the new background reference area.

The background reference area data is in this report in Appendix K.

Figure 10 Background Reference Area Map



NOTE: SINCE WORK WAS STOPPED IN THE EXCAVATION AREA AT 2' BGS, THE FOLLOWING SECTION (7.2) IS FOR INFORMATIONAL PURPOSES ONLY AS NO FINAL STATUS SURVEYS WERE PERFORMED IN THE AREA.

7.2 Area Classifications

For the purposes of establishing the sampling and measurement frequency and pattern, the excavation bottoms and sidewalls were divided into impacted areas with one of three following classifications:

Class 1 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operational history) or known contamination (based on previous radiation surveys) above the release limits. Examples of Class 1 areas include:

- site areas previously subjected to remedial actions
- locations where leaks or spills are known (or suspected) to have occurred
- radioactive material storage areas
- areas with contaminants in discrete solid pieces of material or high specific activity

Note: Areas classified as *Class 1 Areas* require 100% scan surveys.

*Class 2 Area*s: Areas that have, or had prior to remediation, a potential for radioactive contamination or known contamination but are not expected to exceed the DCGL's provided in Sections 6.3 and 6.4. To justify changing the classification from Class 1 to Class 2, there should be measurement data that provides a high degree of confidence that no individual measurement would exceed the release limits. Other justifications for reclassifying an area, as Class 2 may be appropriate, based on site-specific considerations. Examples of areas that might be classified as Class 2 include:

- locations where radioactive materials were present in an unsealed form
- areas downwind from the main areas of concern (AOC)
- areas handling radioactive materials
- areas on the perimeter of former contamination control areas

*Class 3 Area*s: Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the release limits, based on site operating history and previous radiation surveys. Examples of areas that might be classified as Class 3 include buffer zones around Class 1 or Class 2 areas and areas with very low potential for residual contamination but insufficient information to justify a non-impacted classification.

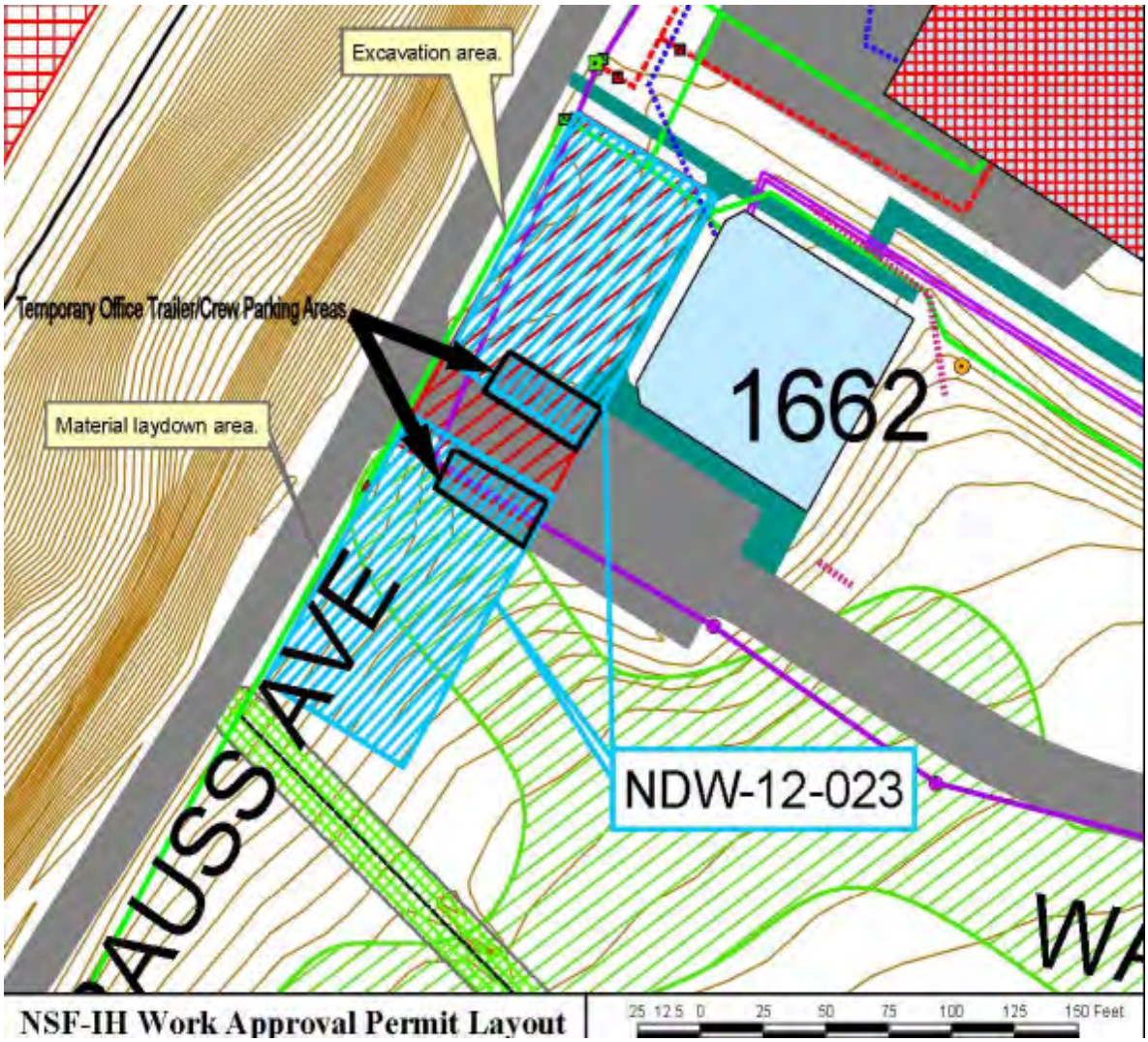
Based upon process knowledge, prior surveys, and operational history, the Site 1 excavation area was classified as *Class 1* area. The soil laydown area was classified as a *Class 3* area.

Survey units are limited in size based on classification, exposure pathway modeling assumptions, and site-specific conditions. MARSSIM (Rev. 1, August 2000) recommends areas for survey units according to the following:

Classification	Suggested Area
Class 1 Open Land Areas	up to 2,000 m^2/21,527 ft^2 land area
Class 2 Open Land Areas	2,000 m^2/21,527 ft^2 to 10,000 m^2/107,639 ft^2
Class 3 Open Land Areas	no limit

Figure 11 below presents a map showing the approximate locations of the Class 1 and Class 2 survey units.

Figure 11 Survey Unit Location Map



7.3 Systematic vs. Biased Sampling

It is important to randomly survey a site, so that each part of the site has an equal chance of being surveyed. This type of survey is called systematic. However, knowledge of the site can identify areas that are more likely to contain contaminants. These should be examined closely. This type of survey is called biased.

Since more contamination was found in the soils than was previously anticipated, biased and systematic sampling was employed in the excavation area following each 6” lift.

7.4 Survey Instrumentation

7.4.1 Instrumentation Selection

Instruments were selected that are suitable for the physical and environmental conditions at the site. The instruments and measurement methods selected were able to detect the radionuclide of concern or radiation types of interest, and are, in relation to the survey or analytical technique, capable of measuring levels that are equal to or less than the release limits.

7.4.2 Instrument for the Scan Surveys for Alpha and Beta Surface Activity (Concrete/Asphalt Surfaces, Material, Equipment, and Tools)

Surface scan surveys for alpha and beta radiation were conducted with Ludlum Model 43-89 large area scintillation probes or equivalent coupled to Ludlum Model 2360 Data Loggers or equivalent. The probes had 1.2 mg/cm^2 thick Mylar windows. The detector was moved over the surface being surveyed at a rate of 1 cm per second. The detector was held within ¼” of the surface being surveyed. Audible indicators were used during the surveys

7.4.3 Instrument for the Direct Measurements for Alpha and Beta Surface Activity (Concrete/Asphalt Surfaces, Material, Equipment, and Tools)

Direct surface contamination surveys for alpha and beta radiation were conducted with Ludlum Model 43-89 large area scintillation probes or equivalent coupled to Ludlum Model 2360 Data Loggers or equivalent. The probes had 1.2 mg/cm^2 thick Mylar windows. Direct measurements were conducted with the detector on contact with the surface for a period of 2 minutes.

7.4.4 Gross Beta-Gamma-Alpha Loose Surface Contamination Surveys

Loose surface contamination surveys of alpha and beta/gamma emitters were performed using cloth smears.

The swipe surveys were performed by wiping over an area of 100 cm^2 (~ 4" by 4") with a cloth smear, and applying moderate pressure.

The smears were analyzed with a Ludlum Model-2929 Dual Channel Scaler phoswich detector or equivalent.

7.4.5 Instrument for the Measurement of Gamma Surface Activity

Static and scan surveys for gamma (photon) radiation were performed using a Ludlum Model 2350-1 data logger. This instrument is equipped with Ludlum Model 44-10 scintillation detector assemblies that featured a 2-inch by 2-inch sodium iodide (NaI) crystal. Capable of detecting gamma photon energies ranging from 60 kilo-electron volts (keV) to 3 mega-electron volts (MeV), the instruments were programmed to respond to the full spectrum of gamma photon energies.

Static gamma measurements require positioning the detector assembly 4 inches (10 centimeters [cm]) above the designated surveillance surface and recording a stationary 60-second integrated count. NaI scintillation detectors are very sensitive to photon gamma radiation and are ideal for locating elevated radiation levels above background when performing gamma scans and static measurements.

Scan measurements of excavation bottoms and horizontal surfaces were obtained by traversing a path at a maximum speed (scan rate) of approximately 0.5 meters per second (m/s) and slowly sweeping the detector assembly in a serpentine (snakelike, S-shaped) pattern, while maintaining the detector between 2.5 to 4 inches (6 to 10 cm) above the area to be surveyed. The probe was held perpendicular to the area being surveyed.

Scan measurements or excavation sidewalls and vertical surfaces were obtained by traversing a path at a maximum speed (scan rate) of approximately 0.5 meters per second (m/s) and slowly sweeping the detector assembly in a serpentine (snakelike, S-shaped) pattern, while maintaining the detector between 2.5 to 4 inches (6 to 10 cm) above the area to be surveyed. The probe was held perpendicular to the area being surveyed.

7.5 Detection Sensitivity—Static and Scan Minimum Detectable Concentration (MDC), Gross Alpha-Gross Beta Surveys

7.5.1 Determination of Instrument Efficiency (ε_I) for Alpha and Beta Surface Activity Measurements

The instrument efficiency (ε_I) is determined during calibration and is defined as the ratio between the net count rate (in counts per minute (cpm)) of the instrument and the surface emission rate of the calibration source for a specified geometry. The surface emission rate is the 2π particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the calibration source. Equation 1 will be used to calculate the instrument efficiency in counts per particle, although efficiency is typically reported as having no units or unitless.

Equation 1

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\Pi}\left(W_A / S_A\right)}$$

Where,

R_{S+B} = the gross count rate of the calibration measurement (cpm)

R_B = the background count rate in cpm

$q_{2\pi}$ = surface emission rate of the calibration source (NIST traceable)

W_A = Active Area of the detector window (cm^2)

S_A = Area of the source (cm^2)

Note: This equation assumes that the dimensions of the calibration source are sufficient to cover the window of the instrument detector. If the dimensions of the calibration source are smaller than the detector's window, set W_A equal to the dimensions of the calibration source, i.e., set the quotient of W_A and S_A equal to 1.

The instrument efficiency is determined during calibration by obtaining static counts with the detector over a calibration source that has a National Institute of Standards and Technology (NIST) traceable surface emission rate. The 2π particle fluence rate is corrected for decay, attenuation and scatter, then; the surface emission rate of the source must be corrected for the area subtended by the probe. Factors that can also affect the instruments efficiency are discussed below:

Calibration Sources: The calibration sources selected emit alpha or beta radiation with energies similar to those expected from the contaminant in the field, i.e., similar to the expected radionuclide(s) of concern.

Source Geometry Factors: The instrument efficiency is determined with a calibration source equal to or greater than the area of the probe.

Source-to-Detector Distance: The detector is calibrated at a source-to-detector distance that is the same as the detector-to-surface distance used in the field.

Window Density Thickness: The detector is calibrated with a probe window density thickness that is the same as the probe window density thickness used in the field.

Detector-Related Factors - Ambient Conditions: If ambient conditions such as the temperature, pressure, and humidity vary significantly, during calibration and during field use, corrections to the detector's response will be considered.

7.5.2 Surface Efficiency (ε_s) for Surface Activity Measurements

The surface efficiency term in Equation 2 is used to determine the 4π total efficiency for a particular surface and condition. Suitable values are based on the radiation and radiation energy, and are primarily impacted by the backscatter and self-absorption characteristics of the surface on which the contamination exists in the field. Backscatter is most affected by the energy of the radiation and the density of the surface material. Self-absorption characteristics or attenuation are also a function of the radiation's energy and surface condition. Surfaces typically encountered in the field include concrete, wood, dry wall, plaster, carpet, and metal. Surface conditions include both physical effects, such as scabbled concrete, and the effect of surface coatings, i.e., dust, paint, rust, water, and oil.

In the absence of experimentally determined surface efficiencies, ISO-7503-1 and NUREG 1507, provide conservative recommendations for surface efficiencies. ISO-7503-1, recommends a surface efficiency of 0.5 for maximum beta energies exceeding 0.5 MeV, and to use a surface efficiency of 0.25 for beta energies between 0.15 and 0.4 MeV and for alpha emitters (ISO, 1998), (NRC, 1997). NUREG-1507 provides surface efficiencies based on studies performed primarily at ehe Oak Ridge Institute for Science and Education (ORISE). In general, NUREG-1507 indicates that the ISO rule-of-thumb for surface efficiencies is conservative, particularly for beta-emitting radionuclides with end-point energies between 0.25 MeV and 0.4 MeV.

The surface condition on the areas, equipment, materials, and tools will be metal/concrete surfaces that may be slightly covered with dust. The surface efficiency for alpha emitters used in accordance with ISO-7503-1 is 0.25 and for beta emitters is 0.25.

7.5.3 Probe Area Correction Factor for Surface Activity Measurements

In Equation 2, W_A is the size of the "active" area of the detector window. If the area of the detector window (cm^2) does not equal 100 cm^2, it is necessary to convert the detector response to units of dpm per 100 cm^2.

7.5.4 Static MDC for Gross Alpha-Beta Surveys

The static MDC is the level of radioactivity, on a surface, that is practically achievable by the overall measurement process. The conventional equation, Equation 2, was used to calculate instrument MDCs in dpm per 100 cm^2 when the background and sample were counted for the same time intervals.

Equation 2

$$MDC = \frac{3 + 4.65\sqrt{C_B * T_B}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_B}$$

where;

C_B = background count rate (cpm)

T_B = background counting time (min)

ε_i = instrument efficiency (count per particle)

ε_s = contaminated surface efficiency (particle per disintegration)

W_A= area of the detector window (cm^2)

If the background and sample were counted for different time intervals, Equation 3 was used to calculate the MDC in dpm per 100 cm^2.

Equation 3

$$MDC = \frac{3 + 3.29\sqrt{R_B T_{S+B}\left(1 + \frac{T_{S+B}}{T_B}\right)}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_{S+B}}$$

where;

R_B = background count rate (cpm)

T_B = background counting time (min)

T_{S+B} = sample counting time (min)

ε_ι = the instrument efficiency (count per particle)

ε_s = the contaminated surface efficiency (particle per disintegration)

W_A = the area of the detector window (cm^2)

7.5.5 Scanning Minimal Detectable Count Rate, (MDCR)

The minimum detectable number of net source counts in the scan interval, for an ideal observer, was arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in *d'*) as shown in Equation 4.

Equation 4

$$MDCR = d'\sqrt{b_i} \times 60/i$$

where,

d' = index of sensitivity (α and β error) – MARSSIM Table 6.5

b_i = number of background counts in scan time interval (count)

i = scan or observation interval (s) (time that a typical source remains under the probe during the scan)

7.5.6 Scan MDC

The scan MDC was determined from the minimum detectable count rate (MDCR) by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. As discussed above, the MDCR accounts for the background level, performance criteria (d'), and observation interval. The observation interval during scanning is the actual time that the detector can respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity.

The scan MDC for equipment, material, and tool surfaces was calculated using Equation 5 below.

Equation 5

$$Scan\ MDC = \frac{MDCR}{\sqrt{p}\ \varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

Where;

MDCR = discussed in Section 7.5.5

p = surveyor efficiency factor

ε_ι = instrument efficiency (count per particle)

ε_s = contaminated surface efficiency (particles per disintegration)

W_A = area of the detector window (cm^2)

7.5.7 Scan MDCs for Alpha Emitters (125 cm^2 probe)

Scanning for alpha emitters differs significantly from scanning for beta and gamma emitters in that the expected background response of most alpha detectors is very close to zero. The following sections cover scanning for alpha emitters and assumes that the surface being surveyed is similar in nature to the material on which the detector was

calibrated. In this respect, the approach is purely theoretical. Surveying surfaces that are dirty, non-planar, or weathered can significantly affect the detection efficiency and therefore bias the expected MDC for the scan. The use of reasonable detection efficiency values instead of optimistic values is highly recommended.

Since the time a contaminated area is under the probe varies and the background count rate of some alpha instruments is less than 1 cpm, it is not reasonable to determine a fixed MDC for scanning. Instead, it is more practical to determine the probability of detecting an area of contamination at a predetermined DCGL for given scan rates.

For alpha survey instrumentation with backgrounds ranging from <1 to 3 cpm, a single count provides a surveyor sufficient cause to stop and investigate further. Assuming this to be true, the probability of detecting given levels of alpha surface contamination can be calculated by use of Poisson summation statistics.

Given a known scan rate and a surface contamination release limit, the probability of detecting a single count while passing over the contaminated area was calculated using Equation 6 below.

Equation 6

$$P(n \geq 1) = 1 - e^{\frac{-GEd}{60v}}$$

Where

P(n≥1)	=	probability of observing a single count
G	=	contamination activity (dpm)
E	=	detector efficiency (4π)
d	=	width of detector in direction of scan (cm)
v	=	scan speed (cm/s)

Once a count is recorded and the guideline level of contamination is present the surveyor should stop and wait until the probability of getting another count is at least 90%. This time interval can be calculated by:

$$t = \frac{13,800}{CAE}$$

Where

t	=	time period for static count(s)
C	=	contamination guideline (dpm/100cm^2)
A	=	physical probe area (cm^2)
E	=	detector efficiency (4π)

7.7.9 Scan MDC (Alpha, 125 cm^2 Probes)

Using the following equation (Abelquist, 2001), one can calculate the activity of a 100 cm^2 "hot spot" with a 90 % probability of detection using Equation 7 below.

Equation 7

$$\alpha\ scanMDC = \frac{[-\ln(1-P(n \geq 1))]60}{t\varepsilon_s\varepsilon_i}$$

Where

t	=	dwell time over source (seconds)
ε_i	=	Instrument efficiency (counts per particle)
ε_s	=	contaminated surface efficiency (particles per disintegration)

7.6 Detection Sensitivity—Static and Scan Minimum Detectable Concentration (MDC), Gamma Surveys

7.6.1 Static MDC

The static MDC represents the smallest level of radioactivity, on a surface, that is statistically detectable by the measurement process. Equation 8 was used to calculate the MDC for gamma radiation.

Equation 8

$$MDC_{\gamma} = \frac{3 + 3.29\sqrt{R_B T_B}}{T_B}$$

Where:

R_B = background count rate (cpm)
T_B = background counting time (min)

7.6.2 Scanning Minimum Detectable Count Rate, Gamma

The minimum detectable number of net source counts in the scan interval, for an ideal observer, can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in *d'*) as shown in Equation 9 below.

Equation 9

$$MDCR = d'\sqrt{b_i}\left(\frac{60}{i}\right)$$

Where:

d' = index of sensitivity (α and β error)
b_i = number of background counts in scan time interval (count)
i = scan or observation interval(s)

7.6.3 Scan MDC for Gamma Surveys (2-inch by 2-inch NaI Probe)

The gamma scan MDC (in pCi/g) for land areas is based on the area of elevated activity, depth of contamination, and the radionuclide (i.e., energy and yield of gamma emissions). Table 6.7 of MARSSIM states a scan MDC for a 2” by 2” NaI detector as 1.8 pCi/g for Th-232.

Table 9 presents a summary of the instrumentation that was used while performing the surveys.

Table 9 Instrumentation for AWS Radiological Surveys

Information	Alpha Measurements		Beta Measurements		Gamma Measurements
Areas Surveyed	Metal/Concrete	Metal	Metal/Concrete	Metal	Site 1 Soils
Instrument Model	Ludlum 2360	Ludlum 2360	Ludlum 2360	Ludlum 2360	Ludlum 2350
Instrument Serial No.	184949	297848	184949	297848	126197
Instrument Detector	Scintillation 43-93	Scintillation 43-93	Scintillation 43-93	Scintillation 43-93	NaI 44-10
Probe Serial No.	PR268605	PR 323069	PR268605	PR 323069	PR 192598
Calibration Source	Th-230 100 cm^2	Th-230 100 cm^2	Tc-99 100 cm^2	Tc-99 100 cm^2	Cs-137 Button
Probe Window Thickness mg/cm^2	1.2	1.2	1.2	1.2	N/A
Probe Size in cm^2	100	100	100	100	2" by 2"
Instrument Efficiency (ε_i)	0.351	.409	.281	.324	N/A
Instrument Background (CPM)	3/3	3	147/158	154	5,907
Static Count Time (Minutes)	2	2	2	2	N/A
Surface Efficiency (ε_s)	0.25	0.25	0.25	0.25	N/A
Total Efficiency (4π) (ε_t)	.088	.102	.070	.081	N/A
Radionuclides of Concern	Th-232	Th-232	Th-232	Th-232	Th-232
Static MDC in $dpm/100cm^2$	82/82	70	589/610	522	N/A
Scan Observation Interval (Seconds)	7	7	7	7	2
Scan Probability % Alpha Measurements			N/A	N/A	N/A
Scan MDC in $dpm/100cm^2$ Beta Measurements	N/A	N/A			N/A
Scan MDC in $dpm/100cm^2$ @ 90% Probability Alpha Measurements	461	282	N/A	N/A	N/A
Investigation Level in CPM Gamma	N/A	N/A	N/A	N/A	6,624
Gross DCGL	1,000	1,000	N/A	N/A	3 pCi/g

7.7 Survey Design

7.7.1 Class1 Areas Excavation Area Bottom, Site 1

7.10.1.1 Gamma Scan Surveys

The surveys consisted of 100% gamma scan surveys of the excavation bottom and sidewalls using a Ludlum Mode 2350-1 Data Logger coupled to a Ludlum Model-44-10 2-inch by 2-inch NaI detector.

7.10.1.2 Excavation Soil Samples

In each 6” lift in the excavation area, a minimum of 16 soil samples were collected from biased and systematic locations following excavation and gamma scan activities. Sixteen surface (0-15 cm below the excavated grade surface) samples were collected from each sampling location within each excavation. Section 5.2 of this report provides a discussion of the soil sample and analysis results.

Sampling equipment and tools were wiped down and surveyed after each sample to ensure no cross contamination occurred during the sampling process. If contamination was found above the minimum detectable count rate of the survey instrument, the equipment was then decontaminated.

Approximately 300 to 500 grams of soil were collected from each sample location. Samples were prepared by removing vegetation, rocks, and foreign objects exceeding ¼ inch in diameter. The samples, once prepared, were placed into an appropriate container. Collection methodology, chain of custody, and analysis requirements are detailed in AWS's SOP’s. Copies of the applicable SOP’s will be furnished upon request.

The samples were sent to an off-site laboratory for gamma spectroscopy analysis. Test Method: EML GA-01-R MOD.

The off-site laboratory that was used is:

Test America Laboratories Inc.
13715 Rider Trail North
Earth City, MO 63045

7.7.2 Equipment, Materials, and Tools

7.10.2.1 Gross Alpha/Gross Beta Scan Surveys

The surveys consisted of 100% direct scan surveys for alpha-beta radiations using a large area scintillation detector system (Ludlum Instruments Model 2360 Data Logger or equivalent coupled to a Ludlum Instruments Model 43-93 scintillation detectors or the equivalent).

7.10.2.2 Gross Alpha/Gross Beta Direct Measurements

The surveys consisted of 2-minute direct measurement surveys for alpha-beta radiations using a large scintillation detector system (Ludlum Instruments Model 2360 Data Logger or equivalent coupled to a Ludlum Instruments Model 43-93 sctintillation detectors or the equivalent).

The results of the direct measurements were recorded on form AWS-001RCS, Radiation Contamination Survey Cover Sheet or equivalent electronic spreadsheet.

7.10.2.3 Gross Beta-Gamma-Alpha Loose Surface Contaminations Surveys

Loose surface contamination surveys of alpha and beta/gamma emitters were performed using cloth smears.

The swipe survey was performed by wiping over an area of 100 cm^2 (~ 4" by 4") with a cloth smear, and applying moderate pressure.

The smears were analyzed with a Ludlum Model-2929 Dual Channel Scaler phoswich detector or equivalent in accordance with AWS Instrument Operating Procedure IOP-002, “Operation and Calibration of the Ludlum Model 2929 Dual Channel Scaler”.

The results of the smears analysis were recorded on form AWS-006, Smear Counting Analysis Report or equivalent electronic spreadsheet.

8.0 HEALTH AND SAFETY CONSIDERATIONS

The removal of radiologically impacted soils and surveys at the NSF Indian Head were conducted in accordance with the applicable sections of the AWS Health and Safety Plan (HASP). Excavation health and safety considerations were described in this plan. All on site personnel read and understood the contents of the plan prior to beginning work on the project. All on-site workers signed a statement that they read and understood the requirements of the HASP.

8.1 Hazard Analysis

The job hazard Analysis identifies potential safety, health and environmental hazards and provides for the protection of personnel, the community, and the environment.

8.1.1 Radiological Exposure

Residual amounts of low-level radioactive material may be present in the soil in the work area at the NSF Indian Head Site 1 area. Personnel performing the surveys and soil removal wore dosimetry and modified Level D PPE as described in Sections 3.2 and 8.2.2 of this report.

8.2 Hazard Controls

The following control measures were implemented during the survey activities. The control measures were intended to supplement the HASP.

8.2.1 Radiation Work Permit

A Radiation Work Permit (RWP) was prepared and specified the activities to be performed and all radiological control requirements and safety requirements for the work. All personnel assigned to site work were required to read and sign the RWP acknowledging that they understood the requirements prior to beginning work.

The RWP was also used as an information document for industrial safety. Hazards other than radiological were included in the RWP so proper protection could be taken for all possible hazards from one controlling document. Implicit in any RWP was the need for a briefing on the radiological conditions present in the work environment.

The RWP listed and specified levels of protection for each worker covered by the RWP. The RWP also detailed the dosimetry requirements, the protective clothing

requirements, and the expected radiation and contamination levels to be encountered during the job.

8.2.2 PPE

Personnel performing the work at NSF Indian Head wore modified Level D PPE in accordance with the PPE selection matrix in the HASP.

The modified Level D PPE consisted of:

- Steel-toed shoes;
- Hard hat;
- Safety glasses;
- Rubber shoe covers;
- Latex or equivalent gloves (when collecting soil samples).

8.2.3 Safety Equipment

In addition to other equipment specified in the HASP, the following safety equipment was staged at the NSF Indian Head temporary office space:

- First aid kit
- Fire extinguisher
- Eye wash kit

8.3 Training

Personnel performing activities associated with the NSF Indian Head work activities received training covering the Work Plan and HASP.

All on-site project personnel shall have completed at least 40 hours of hazardous waste operations-related training, as required by the Occupational Safety and Health administration (OSHA) Regulation 29 CFR Part 1910.120. Those personnel who have completed the 40-hour training more than 12 months prior to start of field activities shall have completed an 8-hour refresher course within the past twelve months.

The Project Manager shall have completed an additional 8 hours of relevant supervisory health and safety training.

Personnel operating the survey detection equipment were qualified ANSI 3.1 Senior Health Physics Technicians based on training and experience outlined in Section 4.4.6 and 4.5.3.2 of ANSI standard ANSI/ANS-3.1-1993 (ANSI/ANS, 1993).

A formal review and documentation of the key personnel qualifications to perform the required work was made by management and verified during the pre job briefing that was conducted prior to start of work.

The personnel were familiar with the handling and storage of radioactive materials, contamination controls, and the use of radiation survey equipment.

8.4 Hazard Communications

The Project Manager ensured that crewmembers understood their obligation to safety and ensured that members were familiar with the elements of the safety program. A copy of the Health and Safety Plan was maintained in the on-site project office.

Daily tailgate safety meetings were conducted and documented as specified in the Health and Safety Plan. Material Safety Data Sheets (MSDSs) for all hazardous substances and materials that were used on site were maintained in the on-site project office.

9.0 QUALITY ASSURANCE

9.1 Equipment

The instruments and systems used for the work effort were calibrated on an annual frequency using the manufacturer's calibration protocol to National Institute of Standards and Technology (NIST) traceable sources.

Copies of the instrument calibration data are presented in this report in Appendix L.

The survey instruments were source checked each day prior to the start of the survey activities.

Copies of the instrument daily response checks are presented in this report in Appendix M.

9.2 Records and Reports

All survey records and reports were completed in accordance with Section 9.2 of the approved Work Plan (AWS, 2012).

9.3 Quality Control Samples

Paired duplicates of 10 % of the swipe samples were collected and counted on site. The results of the QC duplicate samples were compared to each other. A maximum deviation of ± 20% was the satisfactory objective of the comparison of the samples. All of the results of the duplicate swipe samples were within the ± 20% range and are included in the Radiation/Contamination survey reports in the applicable appendices of this report.

9.4 Data Management

Data was maintained in the on-site office. Back up copies of data was made routinely and maintained on the computer provided. Further, back up copies of survey and sample results were routinely made to CDs or other electronic media.

10.0 SURVEY PROCEDURES AND MEASUREMENT DATA INTERPRETATION

10.1 Surface Activity Measurements

Measurements to quantify surface activity levels represent the fundamental compliance measurements for buildings and structures. ISO-7503, NUREG-1507, and ASTM were used as technical guidance to ensure the accurate measurement of surface activity.

Equation 12 was used to document and calculate the surface activity in dpm per 100 cm^2.

Equation 10

$$A_S = \frac{R_{S+B} - R_B}{\varepsilon_i \varepsilon_s \frac{W_A}{100\, cm^2}}$$

Where;

A_S = total surface activity (dpm/100 cm^2)

R_{S+B} = the gross count rate of the measurement in cpm,

R_B = the background count rate in cpm

ε_ι = the instrument efficiency (counts per particle)

ε_s = the contaminated surface efficiency (particles per disintegration)

W_A = the area of the detector window (cm^2)

This equation has two efficiency terms, which account for differences between the conditions under which the detector is calibrated, and conditions under which the detector is used in the field. The instrument efficiency (ε_i) is discussed in Section 7.5.1, and is determined under ideal conditions in the laboratory. The surface efficiency is discussed in Section 7.5.2 and is used to determine the 4π total efficiency for a particular surface and condition.

10.2 Investigation Level Calculations

The gamma scan investigation level in gross cpm, discussed in Section 6.4.5.3 was calculated by using Equation 15 below:

Equation 11

$$\text{Investigation Level in CPM} = R_B + 3\sigma$$

Where;

R_B = Average Background Count Rate

σ = Standard Deviation of Background Count Rate

Table 10 presents a summary of the investigation level values.

Table 10 Investigation Level Values

Dates Of Survey	Type of Survey/Area Surveyed	Instrument Model #/Detector Model #	Instrument Serial #/Detector Serial #	Instrument Mean Background Level in Gross CPM γ	Investigation Level in Gross CPM γ
February, March, 2013	Gamma Scans/Site 1 Soils	2350-1/44-10	126197/192598	5,907 cpm	6,624 cpm
February, March, 2013	Gamma Scans/Site 1 Soils	2350-1/44-10	120633/316939	6,217 cpm	6,740 cpm
February, March, 2013	Gamma Scans/Site 1 Soils	2350-1/44-10	79037/316936	5,599 cpm	6,361 cpm
August, 2013	Gamma Scans/Site 1 Soils	2350-1/44-10	117014/316939	5,730 cpm	6,365 cpm
August, 2013	Gamma Scans/Site 1 Soils	2350-1/44-10	98639/316936	5,670 cpm	6,264 cpm

10.3 Data Interpretation

Basic statistical quantities were calculated for the data in order to identify patterns, relationships and any type anomaly.

The Project Manager reviewed the data at the end of each phase of the survey to determine the validity of the results and adequate coverage of the survey areas. The survey results are presented various appendices of this report.

11.0 SURVEY ANALYSIS AND RESULTS

The survey design always makes use of the statistical tests in helping to assure that the number of sampling points and the instrument measurement sensitivities are adequate, but not excessive, for the decision made. Radiological survey data was obtained in units of cpm and activity that have no intrinsic meaning to the release limits. Soil sample data was converted to pCi/g and surface area readings to dpm/100cm^2 to evaluate results with the release limits and to help identify areas which would require additional remediation.

11.1 Site 1 Characterization

The decision was made by the Navy to stop excavation at 2' bgs in the excavation area instead of going to 4' bgs. A limited characterization survey and sampling effort was performed in order to delineate the remaining contaminated soils that would require remediation in the future. The objective was to define the lateral and vertical boundaries of the contaminated soils.

The characterization survey and sampling effort was conducted prior to backfill of the excavation area. UXO avoidance protocol was adhered to when collecting the samples. A mini excavator was used to excavate down to the depths where the samples were collected.

11.1.1 Soil Samples

Twenty three soil samples were collected during the effort. Figure 12 presents a map of the sample locations.

Sampling equipment and tools were wiped down and surveyed after each sample to ensure no cross contamination occurred during the sampling process. If contamination was found above the minimum detectable count rate of the survey instrument, the equipment was then decontaminated.

Approximately 300 to 500 grams of soil were collected from each sample location. Samples were prepared by removing vegetation, rocks, and foreign objects exceeding ¼ inch in diameter. The samples, once prepared, were placed into an appropriate container. Collection methodology, chain of custody, and analysis requirements are detailed in AWS's SOP's. Copies of the applicable SOP's will be furnished upon request.

The samples were sent to an off-site laboratory for isotopic thorium analysis by alpha spectroscopy. Test Method: A-01-R.

The off-site laboratory that was used is:

Test America Laboratories Inc.
13715 Rider Trail North
Earth City, MO 63045

Figure 12 Characterization Sample Map

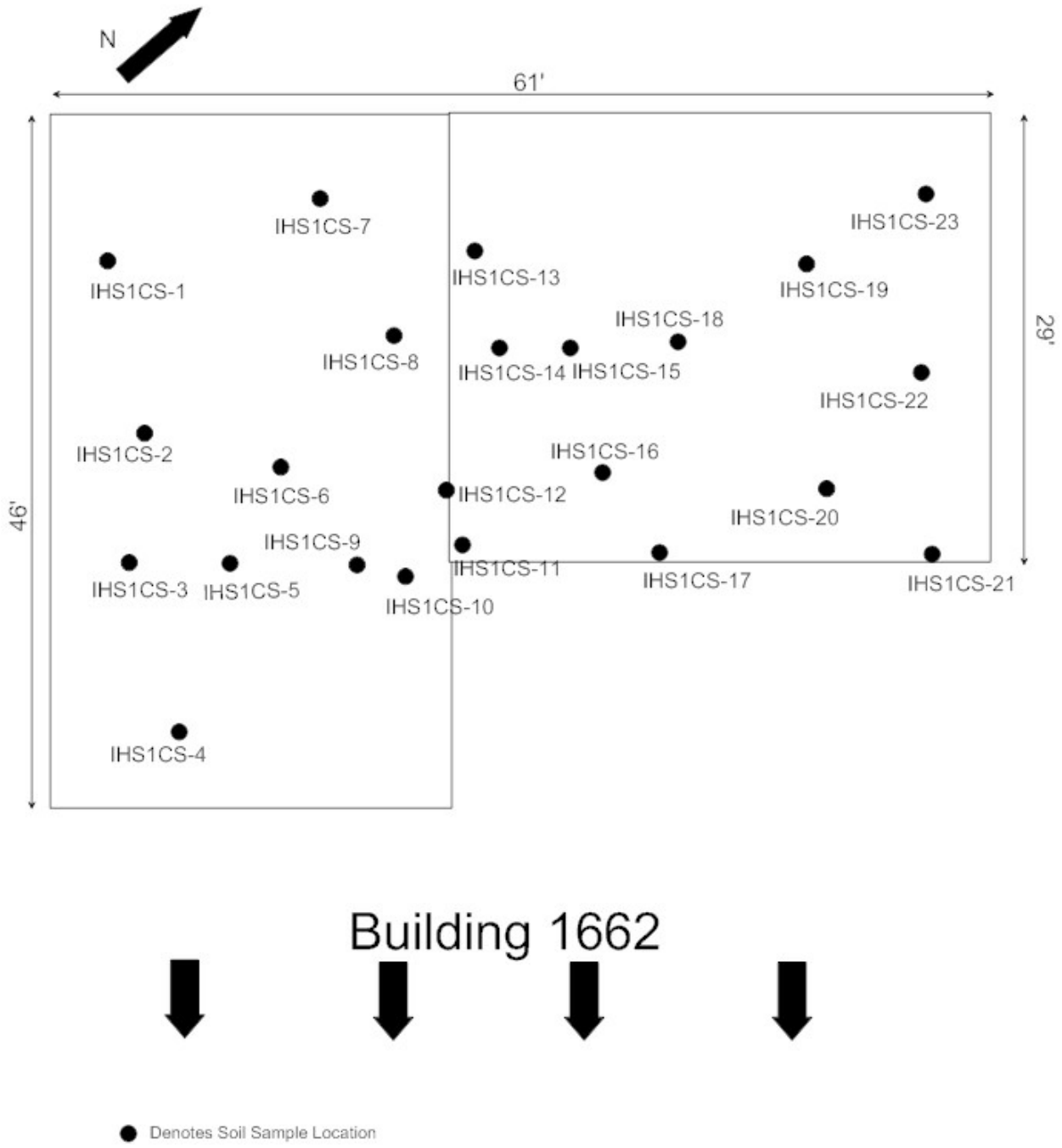


Table 11 presents a summary of the sample results. The laboratory data for the samples is in this report in Appendix N.

11.1.2 Gamma Count Rates

Gamma count rates were collected at each sample location with 2-inch by 2-inch NaI detectors. The readings are summarized in Table 11.

Table 11 Characterization Sample Summary Table

Sample ID	Sample Date	Sample Time	Th-228 results in pCi/g	Th-230 results in pCi/g	Th-232 results in pCi/g	Sample Depth Below Original Grade Surface	Gamma Reading in CPM				
							2' BGS	3' BGS	4' BGS	5' BGS	6' BGS
IHS1CS-1	8/20/2013	1100	0.466	0.634	0.528	4'	7K	6K	7K		
IHS1CS-2	8/20/2013	1114	0.620	0.895	0.517	5'	13K	8K	7K	7K	
IHS1CS-3	8/20/2013	1120	0.216	0.710	0.467	5'	9K	8.5K	6.5K	7K	
IHS1CS-4	8/20/2013	1245	0.480	0.561	0.797	5'	11K	11K	10K	9K	
IHS1CS-5	8/20/2013	1255	0.704	0.554	0.614	6'	10K	8K	8.5K	6.5K	8.5K
IHS1CS-6	8/20/2013	1305	0.435	0.346	0.390	4'	15K	10K	9K		
IHS1CS-7	8/20/2013	1315	0.476	0.714	0.498	5'	7.5K	7K	6.5K	7K	
IHS1CS-8	8/20/2013	1326	0.604	0.843	0.605	5'	41K	20K	11K	8K	
IHS1CS-9	8/20/2013	1340	0.590	0.462	0.481	4'	9K	8K	8K		
IHS1CS-10	8/20/2013	1402	0.415	0.456	0.317	5'	10K	9K	8.5K	7K	
IHS1CS-11	8/20/2013	1408	0.452	0.560	0.350	4'	10K	7K	7K		
IHS1CS-12	8/20/2013	1415	0.340	0.412	0.422	5'	10K	8K	8K	8.5K	
IHS1CS-13	8/20/2013	1425	0.493	0.520	0.479	4'	8K	8K	9K		
IHS1CS-14	8/20/2013	1435	0.773	0.562	0.652	5'	70K	42K	16K	11K	
IHS1CS-15	8/20/2013	1442	0.735	0.606	0.679	4'	10K	9K	9K		
IHS1CS-16	8/20/2013	1450	0.440	0.371	0.458	5'	16K	10K	9K	8K	
IHS1CS-17	8/20/2013	1458	1.730	0.670	1.790	4'	50K	26K	10K		
IHS1CS-18	8/20/2013	1512	7.660	0.764	6.270	4'	12K	92K	50K		
IHS1CS-19	8/20/2013	1518	0.557	0.498	0.447	5'	8K	7K	9K	9K	
IHS1CS-20	8/20/2013	1528	0.463	0.423	0.466	6'	9K	9K	8K	7K	6K
IHS1CS-21	8/20/2013	1535	0.466	0.632	0.538	5'	7K	6K	6K	7K	
IHS1CS-22	8/20/2013	1543	0.650	0.739	0.668	6'	8K	7.5K	6.5K	7K	7.5K
IHS1CS-23	8/20/2013	1555	0.494	0.470	0.552	5'	10K	8K	8K	7K	

K=1,000 cpm

11.2 Waste Profile Samples

Representative composite waste profile soil samples were collected from Site 1 and sent to Test America, Inc. for Toxicity Characteristic Leaching Procedure (TCLP) analysis. In accordance with 40 CFR Part 261.21 through 40 CFR Part 261.24 the samples were analyzed for:

- Volatiles
- Metals
- Semi-Volatiles
- Herbicides
- Pesticides
- Reactive Sulfide
- Reactive Cyanide
- pH
- Ignitability
- Percent Moisture

Based upon review of the sample analysis, there was no RCRA Hazardous waste present other than radioactive material, therefore not a mixed waste. The soils were determined not to contain a RCRA hazardous substance.

The laboratory sample data is in this report in Appendix O.

The results of these samples were forwarded to the disposal facility for approval of the waste streams prior to disposal.

11.3 Soil Laydown Area Surveys

Gamma scan walkover surveys were performed in the soil laydown area prior to setup of the area and at the end of the job when the laydown area was removed. The surveys covered 75% of the areas. The results of the surveys were ~5,000 to 6,000 cpm gamma. The surveys are in this report in Appendix P.

12.0 WASTE MANAGEMENT

12.1 Packaging of Waste Materials

The soils were packaged into seven 25 cubic yard intermodal roll-off containers with hard tops and then loaded onto flatbed rail cars. Each container was lined with a plastic liner prior to loading. The container(s) met all applicable Department of Transportation (DOT) requirements.

Once loaded, a radiological survey of the container's exterior surface was performed and documented to ensure compliance with the applicable DOT regulations. The surveys consisted of exposure rate surveys and loose surface contamination surveys.

All of the container exterior survey results were in compliance with DOT regulations.

The containers exterior surveys are present in this report in Appendix Q.

A total of seven 25 cubic-yard intermodal roll-off containers were shipped during the project. The total volume of the soils shipped was approximately 120 cubic yards.

12.2 Shipment and Disposal of the Waste Materials

The waste materials were shipped shortly after loading to the licensed disposal facility, U.S. Ecology of Grandview, ID, a permitted disposal site for this waste classification by rail.

Roll-off trucks were used to transport the loaded bins to a transload facility located in North Bergen, NJ, located approximately 250 miles from NSF Indian Head. At the rail facility, the loaded bins were loaded onto the rail cars with a crane.

The waste was classified as and all shipping manifests, appropriate DOT labeling and shipping documentation was completed by a U.S. Army JMC approved senior waste broker employed by AWS prior to the containers leaving NSF Indian Head property.

Once the material was received by the disposal facility, manifests, and appropriate documents were completed and then sent to AWS by the disposal facility.

Copies of the appropriate shipping documents and waste disposal certificates are in this report in Appendix R.

12.3 Liquid Radioactive Waste

No liquid radioactive waste was generated during project activities.

12.4 Mixed Waste

No mixed waste was generated as defined by 40 CFR Section 261 requirements during project activities.

13.0 SITE RESTORATION/POST JOB SURVEYS

13.1 Backfill and Seeding of Excavation Area

The excavation area was backfilled in six inch lifts with select fill with a four inch layer of screened topsoil on top. The area was compacted using a walk behind vibratory plate compactor. The area was seeded and covered with straw following backfill and compaction. The silt fencing and diversion fence that were installed in accordance with the E & SC Plan remained in place.

13.2 Bin Storage Area Post Job Surveys

The area underwent a 100% gamma scan survey following completion of work to identify areas of elevated activity from work activities. The result of the survey was compared to the pre job survey results. No areas exceeded the investigation level, established at 3 standard deviations above the pre-determined background levels, or were greater than the results of the pre work survey. All gamma scan results were between 3,000 to 4,000 gross cpm gamma. The bin storage area surveys are in this report in Appendix S.

13.3 Miscellaneous Surveys

Other miscellaneous surveys were performed during the course of work activities. These surveys included material and equipment release surveys.

All of the material and equipment release survey results were below the DCGLs presented in Table 8 of this report.

The miscellaneous surveys are in this report in Appendix T.

14.0 CONCLUSION

Since two feet of clean backfill was placed in the excavation area, Site 1 is currently in a stable condition which poses no health risks to personnel or the environment from radioactive materials. However, for the site was to be released radiologically for unrestricted use, further excavation of soils would be required.

Based upon the results of the gamma scan surveys and characterization samples, it is estimated that approximately 195 cubic yards of soil would be required to be removed in order to release the site for unrestricted use. Additional characterization survey and sampling are recommended to obtain a more accurate estimate of soils that would be required to be removed.

15.0 REFERENCES

American National Standards Institute/American Nuclear Society (ANSI/ANS), 1993. *Selection, Qualification, and Training of Personnel for Nuclear Power Plants*, ANSI/ANS, 1993.

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U.S. Nuclear Regulatory Commission (NRC), 2003. *Consolidated NMSS Decommissioning Guidance, Decommissioning Process for Materials Licensees*, NUREG-1757, Volumes 1, 2, 3, September, 2003.

Appendix A
Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING

Between
Naval District Washington;
Naval Sea Systems Command Detachment, Radiological Affairs Support Office;
U.S. Army Joint Munitions Command, Rock Island, Illinois; and
Aleut World Solutions (Contractor)

RE: PERFORMANCE OF RADIOLOGICAL REMEDIAL ACTION UNDER ALEUT WORLD SOLUTIONS NRC LICENSE NO. 50-29273-01 AT NAVAL SUPPORT FACILITY INDIAN HEAD

1. Background

a. The Naval Sea Systems Command Detachment, Radiological Affairs Support Office (NAVSEADET RASO) has requested that Aleut World Solutions (AWS) (in a joint venture with Bering Sea Environmental BSE) provide radiological services in support of remedial and final status survey actions at Installation Restoration Site 1 at Naval Support Activity South Potomac (NSASP), Naval Support Facility Indian Head (NSF IHD), Indian Head, MD, a component of Naval District Washington. These services have been contracted by the U.S. Army Joint Munitions Command (JMC), Rock Island, Illinois, through the Naval Low Level Radioactive Waste (LLRW) Disposal Program which functions as part of the Department of Defense LLRW Disposal Program managed by JMC. As a requirement of the contract W52P1J-08-D-0034, radiological services will be performed under BSE's Nuclear Regulatory Commission (NRC) Radioactive Materials License No. 50-29273-01.

b. For the purposes of this Memorandum Of Understanding (MOU), AWS will perform radiological remediation, final status surveys, and low-level radioactive waste management at IR Site 1 located at NSF IHD. AWS notified NRC Region IV on 23 January 2013 of their intent to perform the contracted work at under their NRC license.

c. The intent of this MOU is to outline the general applicability and responsibilities of each organization as it applies to the performance work statement, approved work practices, health and safety plan, radiation health plan, and license implementation.

2. Organizational Responsibilities. Each organization has distinct areas of responsibility as defined by their respective functions.

a. AWS shall:

(1) Perform work using radiologically sound work practices following standard operating procedures approved under the BSE NRC license, approved work practices in the Work Plan and Final Status Survey Plan - Site 1 Removal Action (Work Plan) dated 20 Dec 2012, health and safety plan, radiation health plan, and performance work statement.

(2) Maintain training and dose records for AWS employees and subcontractors, as appropriate.

(3) Ensure all contractor and subcontractor personnel wear appropriate dosimetry.

(4) Control radioactive materials used for operational checks of radiation detection and laboratory equipment.

(5) Control access to individual work areas under AWS control for activities where radioactive materials are known or suspected of being present, or low-level radioactive waste is stored.

(6) Control waste materials in accordance with the Work Plans.

(7) Issue and maintain Radiation Work Permits for work controlled by AWS.

(8) Maintain inventories of radioactive materials, including low-level radioactive waste, under AWS's control.

(9) Submit reports and other administrative requirements concerning the work, including daily progress reports, to the NAVSEADET RASO, JMC, NSASP, or additional Navy offices as requested. Information will be provided regarding the radiological conditions of all work areas, radioactive contamination found, and status of any identified waste.

b. NSASP shall:

(1) Allow AWS to perform work using radiologically sound work practices in accordance with the Work Plan following standard operating procedures approved under the BSE NRC license, approved work practices, health and safety plan, radiation health plan, and performance work statement.

(2) Notify NAVSEADET RASO or JMC regarding any contractor performance issues.

c. NAVSEADET RASO shall: Ensure AWS performs work using radiologically sound work practices following standard operating procedures approved under the BSE NRC license, approved work practices, health and safety plan, radiation health plan, and performance work statement.

d. JMC shall: Provide necessary contracting services and oversight to ensure AWS performs radiologically sound work practices following standard operating procedures approved under the BSE NRC license, approved work practices, health and safety plan, radiation health plan, and performance work statement.

3. Responsibilities for Performance of Site Work

a. AWS shall:

(1) Perform radiological remediation in accordance with approved work practices in accordance with the Work Plan, standard operating procedures, and direction from NAVSEADET RASO and JMC.

(2) Secure the AWS work areas allocated by NSASP in accordance with the Work Plan by use of a method controlled by AWS during performance of work.

(3) Assess contamination levels, as required, on building materials, outdoor areas and materials and equipment.

(4) Provide a trailer as a temporary office equipped with temporary electrical power.

(5) Free release of all equipment, areas, and spaces used during the performance of this project prior to conclusion of the project.

(6) Control access to all work and storage areas under the BSE NRC license and post, and secure such areas in accordance with the BSE NRC license, standard operating procedures, and NAVSEADET RASO and JMC approved work plan.

(7) Coordinate public health and safety assurance issues with NAVSEADET RASO, JMC and NSASP.

(8) AWS Site Project Manager will be Dan Spicuzza.

b. NSASP shall:

(1) Provide access to radiologically impacted areas to AWS for performance of work as necessary and in accordance with NSASP Access Control Policy.

(2) Provide an area to AWS for use as temporary office, equipment storage area, and LLRW storage area.

(3) Comply with AWS radiological controls of work and storage areas.

(4) Coordinate public health and safety assurance issues with NAVSEADET RASO and JMC.

(5) Ensure direction to the contractor is only provided by the JMC Contracting Officer or Contracting Officer's Representative.

(6) NSASP point of contact is LCDR Segalla.

c. NAVSEADET RASO shall:

(1) Monitor site work by performing on-site visits, tracking on daily site reports and/or participating in conference calls.

(2) Review all site investigative data.

(3) Work with the contractor, JMC and NSASP to address any unexpected contamination or radiological control issues.

(4) Provide assistance with public health and safety assurance issues, in coordination with NSASP and JMC.

(5) Approve public statements regarding radiological issues before issuance after obtaining approval by the NSASP Public Affairs Officer.

(6) Approve clearance of areas prior to turnover of the areas for unrestricted use to NSASP.

(7) Points of contact for NAVSEADET RASO are Laurie Lowman and Allen Stambaugh.

d. JMC shall:

(1) Monitor site work by performing on-site visits, tracking on daily site reports and/or participating in conference calls.

(2) Work with the contractor (AWS), NAVSEADET RASO, and NSASP to contractually address any unexpected contamination issues.

(3) Point of contact for JMC is Frank Whitaker.

4. Jurisdictional Issues and Changes. Jurisdictional issues or specific situations not covered under this agreement will be discussed between NSA South Potomac, NAVSEADET RASO, JMC, and AWS for resolution and documented by amendment of this memorandum of understanding.

5. Effective Period: This MOU is effective upon signatures by all parties and will expire in 6 months. Either party may terminate this agreement by giving 90 days advance written notice of the effective date of termination, or upon the written agreement of both parties at a mutually agreeable date.

6. Approval:

NAVSEADET RASO Representative — Date

Naval District Washington:

Robert Inaba, Comptroller — Date 2/7/13

Thomas McGuire, Executive Director — Date 2/8/13

Daniel Spicuzza, AWS Project Manager — Date 01/24/2013

WHITAKER.FRANK.C.JR.1270398916

Frank Whitaker, JMC COR — Date 17 January 2013

Appendix B
Radiation Work Permits (RWPs)

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2013-01 Regular X Extended

SECTION I

Contract # USN-2011-008	Date: 2/12/2013	Time: 0800

Location/Project: NSF Indian Head, MD IR Site 1

Exposure Category: D&D Source Transfer Waste Processing Characterization

Job Description: Excavation and remediation of thorium contaminated soils. Stockpiling of soils.

Estimated Start Date: 2/12/2013 Estimated End Date: 3/16/2013

SECTION II

Existing Radiological Conditions:

Radiation Survey No. N/A Airborne Survey No. N/A Contamination Survey No. N/A .

Existing General Area Radiation Level(s):	Existing General Contamination Levels:	Airborne DAC Level(s):
.006-.01 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	< 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 100 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	< 10 % P < 10 % P N/A % H_3
Existing Maximum Radiation Level(s): .010 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	Existing Maximum Contamination Level(s) < 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 20 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	Hot Particle? Yes No

Remarks: None.

SECTION III

Radiological Limits:

Maximum Allowed WB Exposure Rate : 5 mr/hr γ or mrem/hr η

Corrected : N/A mrad/hr Maximum Extremity Exposure Rate: 5 mr/hr

Maximum Allowed Contamination Level : 20 dpm/100cm² α Loose : 200 dpm/100cm² βγ Loose

Maximum Allowed Contamination Level : 100 dpm/100cm² α Fixed : 1,000 dpm/100cm² βγ Fixed

Maximum Allowed Airborne Concentration Level: 10 % DAC

Remarks:

Industrial Hygiene/Safety Concerns: Open excavation, Cold stress.

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2013-01 Regular X Extended

SECTION IV

WORKER REQUIREMENTS

CLOTHING:	DOSIMETRY:	INSTRUCTIONS:	RESPIRATORY:
☐ Coveralls ☐ Lab Coat ☐ Cloth Hood ☒ Paper Coveralls[1] ☐ Plastic Suit ☒ Plastic Booties[1] ☐ Rubber Shoe Covers ☐ Canvas Shoe Covers ☐ Cotton Gloves ☒ Rubber Gloves[1 2] ☒ Leather Gloves[1] ☐ Beta Goggles/Face Shield ☐ Extra ☐ Other Clothing Stay Time (Heat Stress, Radiaton, Exposure Limits, etc.): 6 hrs.	☒ TLD ☐ Film Badge ☐ SRD ☒ Standard ☐ Elbows ☐ Gonad Pack ☐ Hot Cell Entry ☐ Extremity ☐ Head Pack ☐ Special ☐ Knees ☐ Varying Field ☐ Upper Field ☐ Ground Field ☐ Alarming Dosimetry ☐ None	☒ Contact HP for Line Breaks ☒ Protect Cuts ☒ Pre-Job Briefing ☒ Post-Job Briefing ☒ Contact HP Prior to Work In New Areas ☐ Modesty Required ☒ Site Specific Instructions ☒ Equipment Monitor at Job End ☒ Clean Up Work Area During and After Job ☒ Eating, Drinking, Smoking, Chewing Prohibited ☒ Frisk Upon Exiting Contaminated Area ☒ Have Prescribed HP Coverage or Stop Work ☒ Exit Area Immediately Upon Emergency or Injury. Notify HP Immediately	☐ FFNP ☐ FFAL ☐ SCBA ☐ PAPR ☒ Dust Mask[1] ☐ Half Face ☐ Bubble Hood Cartridges: ☐ Particulate ☐ Vapor ☐ Combination ☐ Other

Special Instructions: [1] Per HP supervision instructions. [2] When collecting soil samples and handling potentially contaminated items.

SECTION V

Health Physics Requirements

1. Job Coverage: Continuous ☐ Intermittent ☒ Start ☐ End of Job ☐
2. Air Sampling: General Area ☒ Breathing Zone ☒ Lapel ☐ AgZ ☐
   Tritium/C-14 ☐ Particulate ☐ Charcoal ☐ LoVol ☒ HiVol ☒
3. Exposure Rate Surveys: Start of Job ☒ Continuous Monitoring ☐ Area Monitoring ☐
   Intermittent Monitoring ☐ End of Job ☒
4. Contamination Surveys: Start of Job ☐ Continuous Monitoring ☐
   Intermittent Monitoring ☒ End of Job ☒
5. Is the ALARA Consideration Complete and Attached? Yes No Why?_____
6. Other: _____

RWP #: NSFIH-2013-01 Regular X Extended

SECTION VI

Personnel Authorized to Perform Work & Acceptance of Responsibility
*My signature verifies that I have read and fully understand the RWP Requirements

Date	Name (Print)	Signature*	Last Four Digits SSN	HPS Init	Year Dose to Date (Rem) TEDE	TODE	LDE	SDE WB	SDE EX
2/12/13	Harry P Obregon	Harry P Obregon	3122	HO	0	0	0	0	0
2/12/13	GEOFF RYMER	Geoff Rymer	5977	DR	0	0	0	0	0
2/12/13	William R. Wylie	William R. Wylie	1205	WW	0	0	0	0	0
2/12/13	Adolfo Matus	Adolfo Matus	6734	MJ	0	0	0	0	0
2-12-13	Dan Spencer	Dan L	4551	DL	0	0	0	0	0
2-19-13	JAMES YOUNG	J Cliff	5555	[illegible]	0	0	0	0	0
2-19-13	Gary Wilson	[illegible]	4227	[illegible]	0	0	0	0	0

H	Approvals/Reviews	I	Termination
Technician Generating RWP: Adolfo Matus Date/Time: 2-12-13 / 0700		Date: 03-06-2013 Time: ~~03/06/2013~~ (AMT) 0800	
Industrial Hygiene Approval: Date/Time: N/A		Health Physics Rep: Adolfo Matus	
HP Supervisor Approval: Date/Time: N/A		Reason: Job Complete RWP Revision	
RSO Manager Approval: Dan Spencer Date/Time: 2-12-13 / 0800		HP Supervisor Review: Dan Spencer 3-6-2013	

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2013-02 Regular X Extended

SECTION I

Contract # USN-2011-008	Date: 8/19/2013	Time: 0800

Location/Project: NSF Indian Head, MD IR Site 1

Exposure Category: D&D Source Transfer Waste Processing Characterization

Job Description: Backfilling of excavated area. Collection of characterization samples in excavation area. Loading and shipping of contaminated soils into intermodal roll-off containers.

Estimated Start Date: 8/19/2013 Estimated End Date: 9/6/2013

SECTION II

Existing Radiological Conditions:

Radiation Survey No. N/A Airborne Survey No. N/A Contamination Survey No. N/A .

Existing General Area Radiation Level(s):	Existing General Contamination Levels:	Airborne DAC Level(s):
.006-.01 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	< 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 100 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	< 10 % P < 10 % P N/A % H_3
Existing Maximum Radiation Level(s):	Existing Maximum Contamination Level(s)	Hot Particle?
.010 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	< 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 20 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	Yes No

Remarks: None.

SECTION III

Radiological Limits:

Maximum Allowed WB Exposure Rate : 5 mr/hr γ or mrem/hr η

Corrected : N/A mrad/hr Maximum Extremity Exposure Rate: 5 mr/hr

Maximum Allowed Contamination Level : 20 dpm/100cm² α Loose : 200 dpm/100cm² βγ Loose

Maximum Allowed Contamination Level : 100 dpm/100cm² α Fixed : 1,000 dpm/100cm² βγ Fixed

Maximum Allowed Airborne Concentration Level: 10 % DAC

Remarks: _____

Industrial Hygiene/Safety Concerns: Open excavation, Heat stress.

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2013-02 Regular X Extended

SECTION IV

WORKER REQUIREMENTS

CLOTHING:	DOSIMETRY:	INSTRUCTIONS:	RESPIRATORY:
☐ Coveralls	☒ TLD	☒ Contact HP for Line Breaks	☐ FFNP
☐ Lab Coat	☐ Film Badge	☒ Protect Cuts	☐ FFAL
☐ Cloth Hood	☐ SRD	☒ Pre-Job Briefing	☐ SCBA
☒ Paper Coveralls[1]	☒ Standard	☒ Post-Job Briefing	☐ PAPR
☐ Plastic Suit	☐ Elbows	☒ Contact HP Prior to Work In New Areas	☒ Dust Mask[1]
☒ Plastic Booties[1]	☐ Gonad Pack	☐ Modesty Required	☐ Half Face
☐ Rubber Shoe Covers	☐ Hot Cell Entry	☒ Site Specific Instructions	☐ Bubble Hood
☐ Canvas Shoe Covers	☐ Extremity	☒ Equipment Monitor at Job End	
☐ Cotton Gloves	☐ Head Pack	☒ Clean Up Work Area During and After Job	Cartridges:
☒ Rubber Gloves[1 2]	☐ Special	☒ Eating, Drinking, Smoking, Chewing Prohibited	☐ Particulate
☒ Leather Gloves[1]	☐ Knees	☒ Frisk Upon Exiting Contaminated Area	☐ Vapor
☐ Beta Goggles/Face Shield	☐ Varying Field	☒ Have Prescribed HP Coverage or Stop Work	☐ Combination
☐ Extra	☐ Upper Field	☒ Exit Area Immediately Upon Emergency or Injury. Notify HP Immediately	☐ Other
☐ Other Clothing	☐ Ground Field		
	☐ Alarming Dosimetry		
	☐ None		
Stay Time (Heat Stress, Radiaton, Exposure Limits, etc.): 6 hrs.			

Special Instructions: [1] Per HP supervision instructions. [2] When collecting soil samples and handling potentially contaminated items.

SECTION V

Health Physics Requirements

1. Job Coverage: Continuous ☐ Intermittent ☒ Start ☐ End of Job ☐
2. Air Sampling: General Area ☒ Breathing Zone ☒ Lapel ☐ AgZ ☐
   Tritium/C-14 ☐ Particulate ☐ Charcoal ☐ LoVol ☒ HiVol ☒
3. Exposure Rate Surveys: Start of Job ☒ Continuous Monitoring ☐ Area Monitoring ☐
   Intermittent Monitoring ☐ End of Job ☒
4. Contamination Surveys: Start of Job ☐ Continuous Monitoring ☐
   Intermittent Monitoring ☒ End of Job ☒
5. Is the ALARA Consideration Complete and Attached? Yes No Why?_____
6. Other: _____

RWP #: NSFIH-2013-02 Regular X Extended

SECTION VI

Personnel Authorized to Perform Work & Acceptance of Responsibility

*My signature verifies that I have read and fully understand the RWP Requirements

Date	Name (Print)	Signature*	Last Four Digits SSN	HPS Init	Year Dose to Date (Rem) TEDE	TODE	LDE	SDE WB	SDE EX
20 Aug 13	Kathy A Brooks	Kathy A Brooks	1799		0	0	0	0	0
20 Aug 13	Ken Brooks	[illegible]	7370		0	0	0	0	0
20 Aug-13	William R. Wylie	[illegible]	1205		0	0	0	0	0
20 Aug-13	Harry P Obregon	Harry P Obregon	3122		0	0	0	0	0
8-20-13	Adolfo Matus Jr	[illegible]	6734		0	0	0	0	0
8-20-13	[illegible]	[illegible]	4551		0	0	0	0	0

N/A

H	Approvals/Reviews	I	Termination
Technician Generating RWP: [illegible] Date/Time: 8-19-13 / 0900		Date: 9-4-13 Time: 0800	
Industrial Hygiene Approval: Date/Time: N/A		Health Physics Rep: N/A	
HP Supervisor Approval: Date/Time: N/A		Reason: Job Complete RWP Revision	
RSO Manager Approval: [illegible] Date/Time: 8-19-13 / 0905		HP Supervisor Review: [illegible] 9-4-13 0805	

Site-Specific Health and Safety Plan Acknowledgment

I have read this Site-Specific Health and Safety Plan, I understand the contents, and I agree to abide by its requirements I also have been properly trained, medically monitored, and fit tested for the work that I am to perform and those dates are provided below. Documentation will be placed in the Project Records.

Date	Name (Printed)	Signature	Company Represented	40-hr Date	8-hr Date*	Medical Date	Fit Test Date
8-19-13	Dan Spaulding	[illegible]	AWS	3-92	6-13	8-13	NA
8-19-13	Kenneth G Brooks	[illegible]	Bering sea	9-2002	1-13	6-13	
8-19-13	Kathy A. Brooks	Kathy A Brooks	Bering Sea Env.	9-2002	1-13	6-13	
8-19-13	Harry P Obregon	Harry P Obregon	AWS	7 2001	2-4-13	2-26-13	
8-19-13	William R. Wylie	William R. Wylie	AWS	8-92	11-13	9-13	
8-19-13	Adolfo Matus Jr	[illegible]	AWS	4-8-96	2-11-13	4-22-13	N/A

*If 40-hr training is less than one year old, then the 8-hr refresher training is not required. Indicate this with NR

Site-Specific Health and Safety Plan Acknowledgment

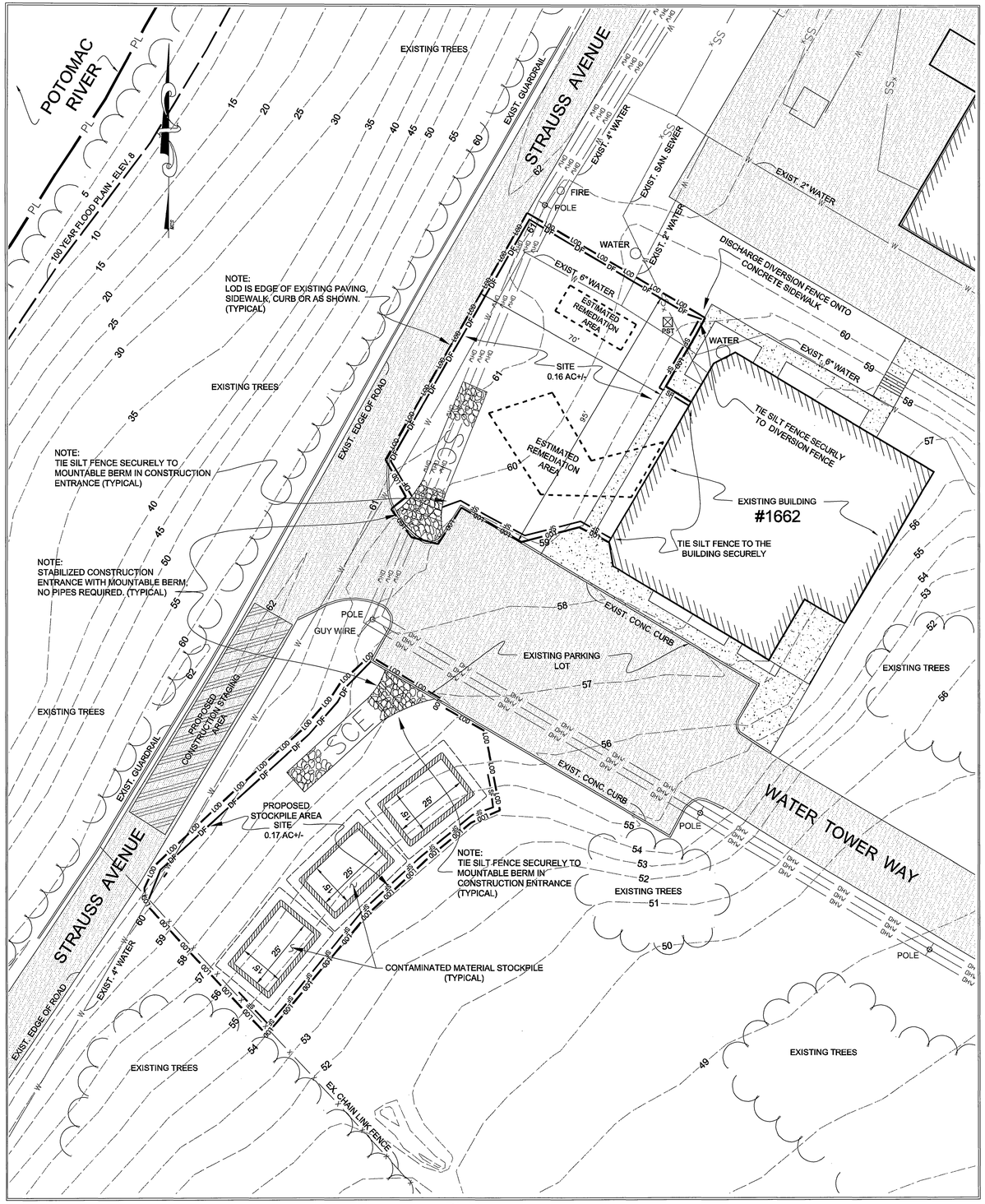
I have read this Site-Specific Health and Safety Plan, I understand the contents, and I agree to abide by its requirements I also have been properly trained, medically monitored, and fit tested for the work that I am to perform and those dates are provided below. Documentation will be placed in the Project Records.

Date	Name (Printed)	Signature	Company Represented	40-hr Date	8-hr Date*	Medical Date	Fit Test Date
2-15-13	Adolfo Matus Jr		AWS	4-8-96	6-8-12	5-18-12	N/A
2-15-13	Geoff Rymer		AWS	11-12	11-12	11-12	N/A
2-15-13	William Wylie		AWS	7-93	11-12	9-12	N/A
2-15-13	Harry P Obregon		AWS	9.19.03	11-6-12	7-26-12	N/A
2-15-13	Craig Wilson		AWS	8-96	8-12	7-12	NA
2-19-13	JAMIE YOUNG		AWS	3-92	6-12	10-12	NA
2-15-13	DAN SPIGNER		AWS	3-92	5-12	8-12	NA

NA

*If 40-hr training is less than one year old, then the 8-hr refresher training is not required. Indicate this with NR

Appendix C
Erosion and Sediment Control Plan



PLAN

SCALE: 1"=20'

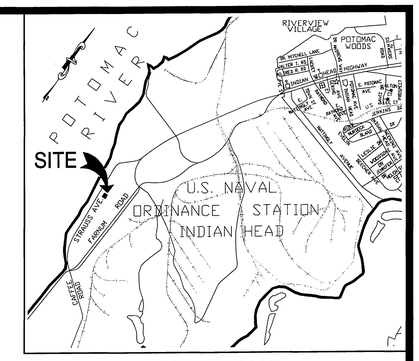
SEQUENCE OF OPERATIONS

1. THE CONTRACTOR SHALL NOTIFY THE NSF INDIAN HEAD BASE ROIC AND

   FEDERAL FACILITIES DIVISION
   LAND RESTORATION PROGRAM
   LAND MANAGEMENT ADMINISTRATION
   1800 WASHINGTON BLVD, SUITE 625
   BALTIMORE MARYLAND 21230-1719
   TELEPHONE: 410-537-3741

   SEVEN (7) DAYS BEFORE COMMENCING ANY LAND DISTURBING ACTIVITY AND, UNLESS WAIVED BY THE ADMINISTRATION, SHALL BE REQUIRED TO HOLD A PRE-CONSTRUCTION MEETING BETWEEN PROJECT REPRESENTATIVES AND A REPRESENTATIVE OF MA.

2. OBTAIN PROPER PERMITS.
3. WITH THE APPROVAL OF THE SEDIMENT CONTROL INSPECTOR, CLEAR AND GRUB FOR SCES AND PERIMETER CONTROLS. INSTALL.
4. DESIGNATE STOCKPILE AREAS FOR RELATED TOPSOIL AND RELATED FILL. DESIGNATE CONTRACTOR'S STAGING AREA.
5. PERFORM SURVEY/EXCAVATION/SOIL TESTING/REMOVAL TASKS WITHN LOD.
6. APPLY TEMP./PERM. STABILIZATION.
7. FINE GRADE PROJECT SITE AND PROVIDE PERMANENT STABILIZATION AS PER STABILIZATION SCHEDULE.
8. WITH PRIOR WRITTEN APPROVAL FROM THE SEDIMENT CONTROL INSPECTOR AND ROIC, REMOVE SEDIMENT CONTROLS AND STABILIZE AREAS DISTURBED BY SEDIMENT CONTROL REMOVAL.



VICINITY MAP

SCALE: 1"=2000'

KEY

- PL — PROPERTY LINE
- EXISTING BUILDING
- EXISTING CONTOURS
- PROP CONTOURS
- LOD — LIMIT OF DISTURBANCE
- DF — DIVERSION FENCE
- SF — SILT FENCE-LATH REINFORCED (1)
- SCE — STABILIZED CONSTRUCTION ENTRANCE
- ESTIMATED REMEDIATION AREA
- OHW — OVERHEAD WIRES
- EXISTING CONCRETE SIDEWALK
- CONTRACTOR STAGING AREA
- EXISTING BITUMINOUS PAVING
- PBT — PORTABLE SEDIMENT TANK

NOTE:
1. THE PROJECT SITE IS OUTSIDE THE 100-YR FLOOD PLAIN.
2. THERE ARE NO WETLANDS OR WETLAND BUFFERS WITHIN THE PROJECT AREA.
3. THE SITE IS IN THE CHESAPEAKE BAY CRITICAL AREA.

NOTE:
SILT FENCE AND LOD ARE SHOWN OFFSET FROM EDGE OF PAVING FOR CLARITY. SILT FENCE SHALL BE PLACED AT EDGE OF PAVEMENT.

NOTE:
"EROSION AND SEDIMENT CONTROL WILL BE STRICTLY ENFORCED."

MDE No. 13-WM-0001

LOD = 13,252 SF+/- = 0.30 AC+/-

EROSION AND SEDIMENT CONTROL PLAN

SITE 1 RADIOLOGICAL REMOVAL ACTION

ADJACENT TO BUILDING #1662

NAVAL SUPPORT FACILITY INDIAN HEAD

CONTRACT NO. W52PIJ-08-D-0034 DO:0054

INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

Colbert Matz Rosenfelt, Inc.

*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

8.17.12

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.

License No. 15104 Expiration Date: 10/11/12

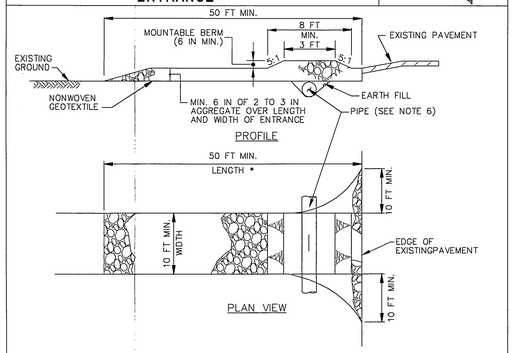
NO.	DATE	REVISIONS:	BY
1	8/17/12	ADDED LATH REINFORCED SILT FENCE AT NAVY REQUEST	KML
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-1

SHEET 1 OF 4

DETAIL B-1 STABILIZED CONSTRUCTION ENTRANCE

STANDARD SYMBOL — SCE



CONSTRUCTION SPECIFICATIONS

1. PLACE STABILIZED CONSTRUCTION ENTRANCE IN ACCORDANCE WITH THE APPROVED PLAN. VEHICLES MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. USE MINIMUM LENGTH OF 50 FEET (*30 FEET FOR SINGLE RESIDENCE LOT). USE MINIMUM WIDTH OF 10 FEET. FLARE SCE 10 FEET MINIMUM AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
2. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PROTECT PIPE INSTALLED THROUGH THE SCE WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 12 INCHES OF STONE OVER THE PIPE. PROVIDE PIPE AS SPECIFIED ON APPROVED PLAN. WHEN THE SCE IS LOCATED AT A HIGH SPOT AND HAS NO DRAINAGE TO CONVEY, A PIPE IS NOT NECESSARY. A MOUNTABLE BERM IS REQUIRED WHEN SCE IS NOT LOCATED AT A HIGH SPOT.
3. PREPARE SUBGRADE AND PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS.
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. MAINTAIN ENTRANCE IN A CONDITION THAT MINIMIZES TRACKING OF SEDIMENT. ADD STONE OR MAKE OTHER REPAIRS AS CONDITIONS DEMAND TO MAINTAIN CLEAN SURFACE, MOUNTABLE BERM, AND SPECIFIED DIMENSIONS. IMMEDIATELY REMOVE STONE AND/OR SEDIMENT SPILLED, DROPPED, OR TRACKED ONTO ADJACENT ROADWAY BY VACUUMING, SCRAPING, AND/OR SWEEPING. WASHING ROADWAY TO REMOVE MUD TRACKED ONTO PAVEMENT IS NOT ACCEPTABLE UNLESS WASH WATER IS DIRECTED TO AN APPROVED SEDIMENT CONTROL PRACTICE.

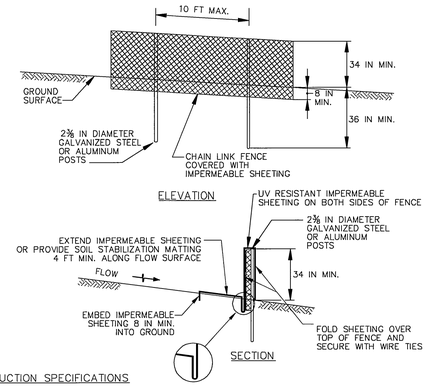
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL C-9 DIVERSION FENCE

STANDARD SYMBOL — DF

MAXIMUM DRAINAGE AREA = 2 ACRES



CONSTRUCTION SPECIFICATIONS

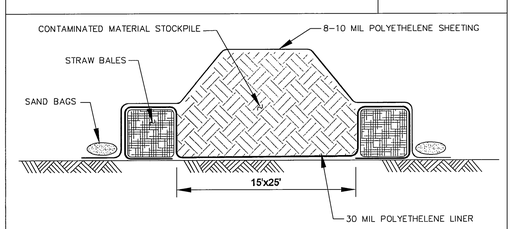
1. USE 42 INCH HIGH, 9 GAUGE OR THICKER CHAIN LINK FENCING (2⅜ INCH MAXIMUM OPENING).
2. USE 2⅜ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. THE POSTS DO NOT NEED TO BE SET IN CONCRETE.
3. FASTEN CHAIN LINK FENCE SECURELY TO THE FENCE POSTS WITH WIRE TIES.
4. SECURE 10 MIL OR THICKER UV RESISTANT, IMPERMEABLE SHEETING TO CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT TOP, MID SECTION, AND BELOW GROUND SURFACE.
5. EXTEND SHEETING A MINIMUM OF 4 FEET ALONG FLOW SURFACE AND EMBED END A MINIMUM OF 8 INCHES INTO GROUND. SOIL STABILIZATION MATTING MAY BE USED IN LIEU OF IMPERMEABLE SHEETING ALONG FLOW SURFACE.
6. WHEN TWO SECTIONS OF SHEETING ADJOIN EACH OTHER, OVERLAP BY 6 INCHES AND FOLD WITH SEAM FACING DOWNGRADE.
7. KEEP FLOW SURFACE ALONG DIVERSION FENCE AND POINT OF DISCHARGE FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. MAINTAIN POSITIVE DRAINAGE. REPLACE IMPERMEABLE SHEETING IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL CONTAMINATED MATERIAL STOCKPILE

SYMBOL

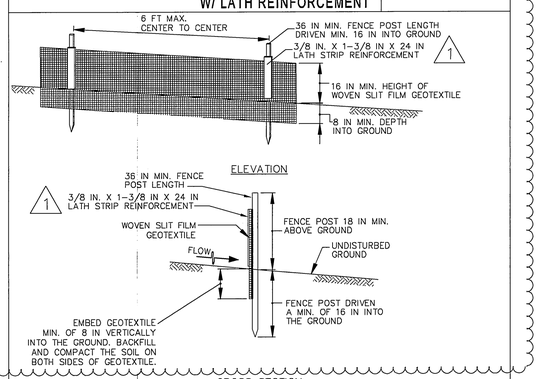


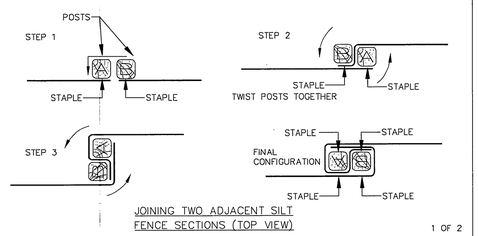
SPECIFICATIONS FOR CONTAMINATED MATERIAL STORAGE

1. THE CONTAINMENT AREA FOR CONTAMINATED MATERIAL STORAGE WILL HAVE SEDIMENT AND EROSION CONTROLS IN PLACE PRIOR TO BEGINNING EXCAVATION.
2. CONTAINMENT AREA MUST HAVE SILT FENCE INSTALLED FOR CONTAINMENT PURPOSES, AND APPROVED BY THE MDE INSPECTOR.
3. ALL EXCAVATED MATERIAL WILL BE PLACED INSIDE THE CONTAINMENT AREA.
4. ALL EXCAVATED MATERIAL WILL BE COVERED IN INCLEMENT WEATHER, END OF WORKING DAY, OR WHEN NOT IN USE. MATERIAL WILL BE COVERED UNTIL REMOVED FROM SITE.
5. EXCAVATED MATERIAL WILL NOT EXCEED 5' IN HEIGHT.
6. ALL HAZARDOUS OR CONTAMINATED MATERIAL WILL BE PLACED IN THE CONTAMINATED MATERIALS STOCKPILE WITHIN THE CONTAINMENT AREA.
   - A. A CONTINUOUS 30 MILI POLYETHYLENE LINER SHALL COVER THE BOTTOM AREA OF THE CONTAMINATED MATERIALS STOCKPILE.
   - B. STRAW BALES SHALL BE PLACED ON THE BOTTOM TARP, AND THE TARP FOLDED OVER INTO THE STOCKPILE AREA TO PREVENT FLOWS FROM INSIDE THE STOCKPILE AREA FROM EXITING THE STOCKPILE AREA.
   - C. CAUTION SHOULD BE TAKEN NOT TO RIP OR TEAR THE BOTTOM POLYETHYLENE LINER WHEN HANDLING OR REMOVING MATERIAL.
   - D. THE MATERIAL WILL BE PLACED ON THE LINER INSIDE THE CONTAMINATED MATERIALS STOCKPILE AREA, NOT TO EXCEED 5 FEET HIGH AND COVERED WITH A 8-10 MIL POLYETHYLENE SHEETING AND SECURED WITH SANDBAGS.
   - E. ALL CONTAMINATED OR HAZARDOUS MATERIAL WILL BE REMOVED FROM SITE AS SOON AS POSSIBLE OR WITHIN 3 WORKING DAYS.
   - F. ALL CONTAMINATED MATERIALS WILL BE DISPOSED OF ACCORDING TO EPA STANDARDS AND SPECIFICATIONS FOR CONTAMINATED OR HAZARDOUS MATERIALS.

MODIFIED DETAIL E-1 SILT FENCE W/ LATH REINFORCEMENT

STANDARD SYMBOL — SF





1 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL E-1 SILT FENCE

STANDARD SYMBOL — SF

CONSTRUCTION SPECIFICATIONS

1. USE WOOD POSTS 1⅜ X 1⅜ ± 1/16 INCH (MINIMUM) SQUARE CUT OF SOUND QUALITY HARDWOOD. AS AN ALTERNATIVE TO WOODEN POST USE STANDARD "T" OR "U" SECTION STEEL POSTS WEIGHING NOT LESS THAN 1 POUND PER LINEAR FOOT.
2. USE 36 INCH MINIMUM POSTS DRIVEN 16 INCH MINIMUM INTO GROUND NO MORE THAN 6 FEET APART.
3. USE WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS AND FASTEN GEOTEXTILE SECURELY TO UPSLOPE SIDE OF FENCE POSTS WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION.
4. PROVIDE MANUFACTURER CERTIFICATION TO THE AUTHORIZED REPRESENTATIVE OF THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT THE GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H-1 MATERIALS.
5. EMBED GEOTEXTILE A MINIMUM OF 8 INCHES VERTICALLY INTO THE GROUND. BACKFILL AND COMPACT THE SOIL ON BOTH SIDES OF FABRIC.
6. WHERE TWO SECTIONS OF GEOTEXTILE ADJOIN: OVERLAP, TWIST, AND STAPLE TO POST IN ACCORDANCE WITH THIS DETAIL.
7. EXTEND BOTH ENDS OF THE SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SILT FENCE.
8. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN SILT FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL FENCE.

NOTE:
LATH STRIP REINFORCED SILT FENCE IS A DELDOT STANDARD PRODUCT. MANUFACTURER: ACF PRODUCT #3036751DE OR APPROVED EQUIVALENT.

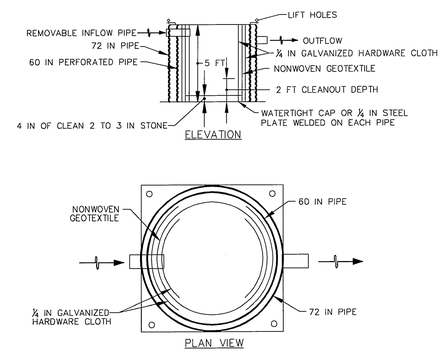
2 OF 2

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

DETAIL F-3 PORTABLE SEDIMENT TANK

STANDARD SYMBOL — PST



CONSTRUCTION SPECIFICATIONS

1. PROVIDE 1 CUBIC FOOT OF STORAGE FOR EACH GALLON PER MINUTE OF PUMP CAPACITY. REQUIRED STORAGE VOLUME MAY BE ATTAINED BY PLACEMENT OF TANKS IN PARALLEL WITH INFLOW EVENLY DISTRIBUTED AMONG TANKS. OVERTOPPING OF TANKS IS NOT PERMITTED.
2. USE 60 INCH CORRUGATED METAL OR PLASTIC PIPE WITH 1 INCH DIAMETER PERFORATIONS, 6 INCHES ON CENTER FOR THE INNER PIPE. LINE PIPE WITH NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, SANDWICHED BETWEEN, AND ATTACHED TO, ¼ INCH HARDWARE CLOTH.
3. OVERLAP GEOTEXTILE 8 INCHES MINIMUM AT VERTICAL SEAM AND AT THE BOTTOM PLATE.
4. ANCHOR GEOTEXTILE AT BOTTOM OF TANK WITH 4 INCHES OF 2 TO 3 INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE.
5. USE 72 INCH CORRUGATED METAL OR PLASTIC OUTER PIPE WITH PERMANENT OUTFLOW PIPE WITH INVERT LOWER THAN INFLOW PIPE
6. INFLOW PIPE MUST DISCHARGE INTO INNER PIPE AND BE REMOVABLE.
7. PLACE TANK ON LEVEL SURFACE AND DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
8. A PORTABLE SEDIMENT TANK REQUIRES FREQUENT MAINTENANCE. REMOVE ACCUMULATED SEDIMENT FROM INNER PIPE WHEN IT REACHES TWO FEET IN DEPTH. IF SYSTEM CLOGS, PULL OUT INNER PIPE, REMOVE ACCUMULATED SEDIMENT, AND REPLACE GEOTEXTILE. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

MDE No. 13-WM-0001

EROSION AND SEDIMENT CONTROL DETAILS

SITE 1 RADIOLOGICAL REMOVAL ACTION

ADJACENT TO BUILDING #1662

NAVAL SUPPORT FACILITY INDIAN HEAD

CONTRACT NO. W52PIJ-08-D-0034 DO: 0054

INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

Colbert Matz Rosenfelt, Inc.
*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

8-17-12

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 15104 Expiration Date: 10/11/12

NO.	DATE	REVISIONS:	BY
1	8/17/12	ADDED LATH REINFORCED SILT FENCE AT NAVY REQUEST	KML
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-2
SHEET 2 OF 4

STANDARD EROSION AND SEDIMENT CONTROL NOTES

1. THE CONTRACTOR SHALL NOTIFY THE FEDERAL FACILITIES DIVISION, LAND RESTORATION PROGRAM, LAND MANAGEMENT ADMINISTRATION, 1800 WASHINGTON BLVD. SUTIE 625 BALTIMORE, MARYLAND 21230-1719 TELEPHONE: 410-537-3791, SEVEN (7) DAYS BEFORE COMMENCING ANY LAND DISTURBING ACTIVITY AND, UNLESS WAIVED BY THE ADMINISTRATION, SHALL BE REQUIRED TO HOLD A PRE-CONSTRUCTION MEETING BETWEEN PROJECT REPRESENTATIVES AND A REPRESENTATIVE OF WMA.

2. THE CONTRACTOR MUST NOTIFY WMA IN WRITING AND BY TELEPHONE AT THE FOLLOWING POINTS:
   A. THE REQUIRED PRE-CONSTRUCTION MEETING.
   B. FOLLOWING INSTALLATION OF SEDIMENT CONTROL MEASURES.
   C. DURING THE INSTALLATION OF SEDIMENT BASINS (TO BE CONVERTED INTO PERMANENT STORMWATER MANAGEMENT STRUCTURES) AT THE REQUIRED INSPECTION POINTS (SEE INSPECTION CHECKLIST ON PLAN). NOTIFICATION PRIOR TO COMMENCING CONSTRUCTION OF EACH STEP IS MANDATORY.
   D. PRIOR TO REMOVAL OR MODIFICATION OF ANY SEDIMENT CONTROL STRUCTURE(S).
   E. PRIOR TO REMOVAL OF ALL SEDIMENT CONTROL DEVICES.
   F. PRIOR TO FINAL ACCEPTANCE.

3. THE CONTRACTOR SHALL CONSTRUCT ALL EROSION AND SEDIMENT CONTROL MEASURES PER THE APPROVED PLAN AND CONSTRUCTION SEQUENCE AND SHALL HAVE THEM INSPECTED AND APPROVED BY THE AGENCY INSPECTOR OR WMA INSPECTOR PRIOR TO BEGINNING ANY OTHER LAND DISTURBANCES. MINOR SEDIMENT CONTROL DEVICE LOCATION ADJUSTMENTS MAY BE MADE IN THE FIELD WITH THE APPROVAL OF THE WMA INSPECTOR. THE CONTRACTOR SHALL ENSURE THAT ALL RUNOFF FROM DISTURBED AREAS IS DIRECTED TO THE SEDIMENT CONTROL DEVICES AND SHALL NOT REMOVE ANY EROSION OR SEDIMENT CONTROL MEASURE WITHOUT PRIOR PERMISSION FROM WMA INSPECTOR AND AGENCY INSPECTOR. THE CONTRACTOR MUST OBTAIN PRIOR AGENCY AND WMA APPROVAL FOR CHANGES TO THE SEDIMENT CONTROL PLAN AND/OR SEQUENCE OF CONSTRUCTION.

4. THE CONTRACTOR SHALL PROTECT ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS TO PREVENT THE DEPOSITION OF MATERIALS ONTO PUBLIC ROADS. ALL MATERIALS DEPOSITED ONTO PUBLIC ROADS SHALL BE REMOVED IMMEDIATELY.

5. THE CONTRACTOR SHALL INSPECT DAILY AND MAINTAIN CONTINUOUSLY IN AN EFFECTIVE OPERATING CONDITION ALL EROSION AND SEDIMENT CONTROL MEASURES UNTIL SUCH TIMES AS THEY ARE REMOVED WITH PRIOR PERMISSION FROM WMA INSPECTOR AND AGENCY INSPECTOR.

6. ALL SEDIMENT BASINS, TRAP EMBANKMENTS AND SLOPES, PERIMETER DIKES, SWALES AND ALL DISTURBED SLOPES STEEPER OR EQUAL TO 3:1 SHALL BE STABILIZED WITH SOD OR SEED AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES, AS SOON AS POSSIBLE BUT NO LATER THAN SEVEN (7) CALENDAR DAYS AFTER ESTABLISHMENT. ALL AREAS DISTURBED OUTSIDE OF THE PERIMETER SEDIMENT CONTROL SYSTEM MUST BE MINIMIZED. MAINTENANCE MUST BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION. (REQUIREMENT FOR STABILIZATION MAY BE REDUCED TO THREE (3) DAYS FOR SENSITIVE AREAS.)

7. THE CONTRACTOR SHALL APPLY SOD OR SEED AND ANCHORED STRAW MULCH, OR OTHER APPROVED STABILIZATION MEASURES TO ALL DISTURBED AREAS AND STOCKPILES WITHIN FOURTEEN (14) CALENDAR DAYS AFTER STRIPPING AND GRADING ACTIVITIES HAVE CEASED IN THE AREA. MAINTENANCE SHALL BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION. (REQUIREMENT MAY BE REDUCED TO SEVEN (7) DAYS FOR SENSITIVE AREAS.)

8. PRIOR TO REMOVAL OF SEDIMENT CONTROL MEASURES, THE CONTRACTOR SHALL STABILIZE AND HAVE ESTABLISHED PERMANENT STABILIZATION FOR ALL CONTRIBUTORY DISTURBED AREAS USING SOD OR AN APPROVED PERMANENT SEED MIXTURE WITH REQUIRED SOIL AMENDMENTS AND AN APPROVED ANCHORED MULCH. WOOD FIBER MULCH MAY ONLY BE USED IN SEEDING SEASON WHERE THE SLOPE DOES NOT EXCEED 10% AND GRADING HAS BEEN DONE TO PROMOTE
SHEET FLOW DRAINAGE. AREAS BROUGHT TO FINISHED GRADE DURING THE SEEDING SEASON SHALL BE PERMANENTLY STABILIZED AS SOON AS POSSIBLE, BUT NOT LATER THAN FOURTEEN (14) CALENDAR DAYS AFTER ESTABLISHMENT. WHEN PROPERTY IS BROUGHT TO FINISHED GRADE DURING THE MONTHS OF NOVEMBER THROUGH FEBRUARY, AND PERMANENT STABILIZATION IS FOUND TO BE IMPRACTICAL, TEMPORARY SEED AND ANCHORED STRAW MULCH SHALL BE APPLIED TO DISTURBED AREAS. THE FINAL PERMANENT STABILIZATION OF SUCH PROPERTY SHALL BE APPLIED BY MARCH 15 OR EARLIER IF GROUND AND WEATHER CONDITIONS ALLOW.

9. THE SITE'S APPROVAL LETTER, APPROVED EROSION AND SEDIMENT CONTROL PLANS, DAILY LOG BOOKS, AND TESTS REPORTS SHALL BE AVAILABLE AT THE SITE FOR INSPECTION BY DULY AUTHORIZED OFFICIALS OF WMA AND THE AGENCY RESPONSIBLE FOR PROJECT.

10. SURFACE DRAINAGE FLOWS OVER UNSTABILIZED CUT AND FILL SLOPES SHALL BE CONTROLLED BY EITHER PREVENTING DRAINAGE FLOWS FROM TRAVERSING THE SLOPES OR BY INSTALLING PROTECTIVE DEVICES TO LOWER THE WATER DOWN SLOPE WITHOUT CAUSING EROSION. DIKES SHALL BE INSTALLED AND MAINTAINED AT THE TOP OF A CUT OR FILL SLOPE UNTIL THE SLOPE AND DRAINAGE AREA TO IT ARE FULLY STABILIZED, AT WHICH TIME THEY MUST BE REMOVED AND FINAL GRADING DONE TO PROMOTE SHEET FLOW DRAINAGE. PROTECTIVE METHODS MUST BE PROVIDED AT POINTS OF CONCENTRATED FLOW WHERE EROSION IS LIKELY TO OCCUR.

11. PERMANENT SWALES OR OTHER POINTS OF CONCENTRATED WATER FLOW SHALL BE STABILIZED WITH SOD OR SEED WITH AN APPROVED EROSION CONTROL MATTING, RIP-RAP, OR BY OTHER APPROVED STABILIZATION MEASURES.

12. TEMPORARY SEDIMENT CONTROL DEVICES MAY BE REMOVED, WITH PERMISSION OF WMA INSPECTOR AND AGENCY INSPECTORS, WITHIN THIRTY (30) CALENDAR DAYS FOLLOWING ESTABLISHMENT OF PERMANENT STABILIZATION IN ALL CONTRIBUTORY DRAINAGE AREAS. STORMWATER MANAGEMENT STRUCTURES USED TEMPORARILY FOR SEDIMENT CONTROL SHALL BE CONVERTED TO THE PERMANENT CONFIGURATION WITHIN THIS TIME PERIOD AS WELL.

13. NO PERMANENT CUT OR FILL SLOPE WITH A GRADIENT STEEPER THAN 3:1 WILL BE PERMITTED IN LAWN MAINTENANCE AREAS. A SLOPE GRADIENT OF UP TO 2:1 WILL BE PERMITTED IN NON-MAINTENANCE AREAS PROVIDED THAT THOSE AREAS ARE INDICATED ON THE EROSION AND SEDIMENT CONTROL PLAN WITH A LOW-MAINTENANCE GROUND COVER SPECIFIED FOR PERMANENT STABILIZATION. SLOPE GRADIENT STEEPER THAN 2:1 WILL NOT BE PERMITTED WITH VEGETATIVE STABILIZATION.

14. FOR FINISHED GRADING, THE CONTRACTOR SHALL PROVIDE ADEQUATE GRADIENTS TO PREVENT WATER FROM PONDING FOR MORE THAN TWENTY-FOUR (24) HOURS AFTER THE END OF A RAINFALL EVENT. DRAINAGE COURSES AND SWALE FLOW AREAS MAY TAKE AS LONG AS FORTY-EIGHT (48) HOURS AFTER THE END OF A RAINFALL EVENT TO DRAIN. AREAS DESIGNED TO HAVE STANDING WATER SHALL NOT BE REQUIRED TO MEET THIS REQUIREMENT.

15. SEDIMENT TRAPS OR BASINS ARE NOT PERMITTED WITHIN 20 FEET OF A FOUNDATION THAT EXISTS OR IS UNDER CONSTRUCTION. NO STRUCTURE MAY BE CONSTRUCTED WITHIN 20 FEET OF AN ACTIVE SEDIMENT TRAP OR BASIN.

16. THE WMA INSPECTOR HAS THE OPTION OF REQUIRING ADDITIONAL SAFETY OR SEDIMENT CONTROL MEASURES, IF DEEMED NECESSARY.

17. ALL TRAP DEPTH DIMENSIONS ARE RELATIVE TO THE OUTLET ELEVATION. ALL TRAPS MUST HAVE A STABLE OUTFALL. ALL TRAPS AND BASINS SHALL HAVE STABLE INFLOW POINTS.

18. VEGETATIVE STABILIZATION SHALL BE PERFORMED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL. REFER TO APPROPRIATE SPECIFICATIONS FOR TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, SODDING AND GROUND COVERS.

19. SEDIMENT SHALL BE REMOVED AND THE TRAP OR BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO ONE QUARTER OF THE TOTAL DEPTH OF THE TRAP OR BASIN. TOTAL DEPTH SHALL BE MEASURED FROM THE TRAP OR BASIN BOTTOM TO THE CREST OF THE OUTLET.

20. SEDIMENT REMOVED FROM TRAPS (AND BASINS) SHALL BE PLACED AND STABILIZED IN APPROVED AREAS, BUT NOT WITHIN A FLOODPLAIN, WETLAND OR TREE-SAVE AREA. WHEN PUMPING SEDIMENT LADEN WATER, THE DISCHARGE MUST BE DIRECTED TO A SEDIMENT TRAPPING DEVICE PRIOR TO RELEASE FROM THE SITE. A SUMP PIT MAY BE USED IF SEDIMENT TRAPS THEMSELVES ARE BEING PUMPED OUT.

21. ALL WATER REMOVED FROM EXCAVATED AREAS (E.G. UTILITY TRENCHES) SHALL BE PASSED THROUGH AN APPROVED DEWATERING PRACTICE OR PUMPED TO A SEDIMENT TRAP OR BASIN PRIOR TO DISCHARGE FROM THE SITE)I.E. VIA FUNCTIONAL STORM DRAIN SYSTEM OR TO STABLE GROUND SURFACE).

22. SEDIMENT CONTROL FOR UTILITY CONSTRUCTION FOR AREAS OUTSIDE OF DESIGNED CONTROLS OR AS DIRECTED BY THE ENGINEER OR WMA INSPECTOR:
   A. CALL "MISS UTILITY" AT 1-800-257-7777 48 HOURS PRIOR TO THE START OF WORK.
   B. EXCAVATED TRENCH MATERIAL SHALL BE PLACED ON THE HIGH SIDE OF THE TRENCH.
   C. TRENCHES FOR UTILITY INSTALLATION SHALL BE BACKFILLED, COMPACTED, AND STABILIZED AT THE END OF EACH WORKING DAY. NO MORE TRENCH SHALL BE OPENED THAT CAN BE COMPLETED THE SAME DAY, UNLESS;
   D. TEMPORARY SILT FENCE SHALL BE PLACED IMMEDIATELY DOWNSTREAM OF ANY DISTURBED AREA INTENDED TO REMAIN DISTURBED FOR MORE THAN ONE DAY.

23. WHERE DEEMED APPROPRIATE BY THE ENGINEER OR INSPECTOR, SEDIMENT BASINS AND TRAPS MAY NEED TO BE SURROUNDED WITH AN APPROVED SAFETY FENCE. THE FENCE MUST CONFORM TO LOCAL ORDINANCES AND REGULATIONS. THE DEVELOPER OR OWNER SHALL CHECK WITH THE LOCAL BUILDING OFFICIALS ON APPLICABLE SAFETY REQUIREMENTS. WHERE SAFETY FENCE IS DEEMED APPROPRIATE AND LOCAL ORDINANCES DO NOT SPECIFY FENCING SIZES OR TYPES, THE FOLLOWING SHALL BE USED AS A MINIMUM STANDARD: THE SAFETY FENCE MUST BE MADE OF WELDED WIRE AND AT LEAST 42 INCHES HIGH, HAVE POSTS SPACED NO FARTHER APART THAN 8 FEET, HAVE MESH OPENINGS NO GREATER THAN 2 INCHES IN WIDTH AND 4 INCHED IN HEIGHT WITH A MINIMUM OF 14 GAUGE WIRE. SAFETY FENCE MUST BE MAINTAINED AND IN GOOD CONDITION AT ALL TIMES.

24. OFF-SITE SPOIL OR BORROW AREAS ON STATE OR FEDERAL PROPERTY MUST HAVE PRIOR APPROVAL BY WMA AND OTHER APPLICABLE STATE, FEDERAL AND LOCAL AGENCIES; OTHERWISE APPROVAL MUST BE GRANTED BY THE LOCAL AUTHORITIES. ALL WASTE AND BORROW AREAS OFF-SITE MUST BE PROTECTED BY SEDIMENT CONTROL MEASURES AND STABILIZED.

25. SITES WHERE INFILTRATION DEVICES ARE USED FOR THE CONTROL OF STORMWATER, EXTREME CARE MUST BE TAKEN TO PREVENT RUNOFF FROM UNSTABILIZED AREAS FROM ENTERING THE STRUCTURE DURING CONSTRUCTION. SEDIMENT CONTROL DEVICES PLACED IN INFILTRATION AREAS MUST HAVE BOTTOM ELEVATIONS AT LEAST TWO (2) FEET HIGHER THAN THE FINISH GRADE BOTTOM ELEVATION OF THE INFILTRATION PRACTICE. WHEN CONVERTING A SEDIMENT TRAP TO AN INFILTRATION DEVICE, ALL ACCUMULATED SEDIMENT MUST BE REMOVED AND DISPOSED OF PRIOR TO FINAL GRADING OF INFILTRATION DEVICE.

26. WHEN A STORM DRAIN SYSTEM OUTFALL IS DIRECTED TO A SEDIMENT TRAP OR SEDIMENT BASIN AND THE SYSTEM IS TO BE USED FOR TEMPORARILY CONVEYING SEDIMENT LADEN WATER, ALL STORM DRAIN INLETS IN NON-SUMP AREAS SHALL HAVE TEMPORARY ASPHALT BERMS CONSTRUCTED AT THE TIME OF BASE PAVING TO DIRECT GUTTER FLOW INTO THE INLETS TO AVOID SURCHARGING AND OVERFLOW OF INLETS IN SUMP AREAS.

27. SITE INFORMATION:

A. TOTAL AREA OF FACILITY (BASE, CAMPUS, PARK, ETC.)	3400	ACRES
B. TOTAL AREA OF PROJECT SITE	0.30	ACRES
C. AREA DISTURBED	0.30	ACRES
D. AREA TO BE ROOFED OR PAVED	0.00	ACRES
E. TOTAL CUT	150	CU. YDS.
F. TOTAL FILL	150	CU. YDS.
G. OFF-SITE WASTE/BORROW AREA LOCATION	TO BE DETERMINED (MUST BE APPROVED BY MDE)	

B-4 STANDARDS AND SPECIFICATIONS FOR VEGETATIVE STABILIZATION

Definition

Using vegetation as cover to protect exposed soil from erosion.

Purpose

To promote the establishment of vegetation on exposed soil.

Conditions Where Practice Applies

On all disturbed areas not stabilized by other methods. This specification is divided into sections on incremental stabilization; soil preparation, soil amendments and topsoiling; seeding and mulching; temporary stabilization; and permanent stabilization.

Effects on Water Quality and Quantity

Stabilization practices are used to promote the establishment of vegetation on exposed soil. When soil is stabilized with vegetation, the soil is less likely to erode and more likely to allow infiltration of rainfall, thereby reducing sediment loads and runoff to downstream areas.

Planting vegetation in disturbed areas will have an effect on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, percolation, and groundwater recharge. Over time, vegetation will increase organic matter content and improve the water holding capacity of the soil and subsequent plant growth.

Vegetation will help reduce the movement of sediment, nutrients, and other chemicals carried by runoff to receiving waters. Plants will also help protect groundwater supplies by assimilating those substances present within the root zone.

Sediment control practices must remain in place during grading, seedbed preparation, seeding, mulching, and vegetative establishment.

Adequate Vegetative Establishment

Inspect seeded areas for vegetative establishment and make necessary repairs, replacements, and reseedings within the planting season.

1. Adequate vegetative stabilization requires 95 percent groundcover.

2. If an area has less than 40 percent groundcover, restabilize following the original recommendations for lime, fertilizer, seedbed preparation, and seeding.

3. If an area has between 40 and 94 percent groundcover, over-seed and fertilize using half of the rates originally specified.

4. Maintenance fertilizer rates for permanent seeding are shown in Table B.6.

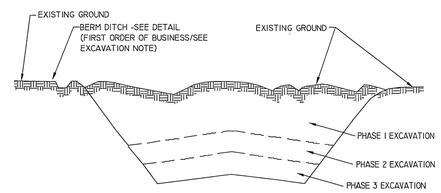


FIGURE B-I: INCREMENTAL STABILIZATION - CUT

B-4-1 STANDARDS AND SPECIFICATIONS FOR INCREMENTAL STABILIZATION

Definition

Establishment of vegetative cover on cut and fill slopes.

Purpose

To provide timely vegetative cover on cut and fill slopes as work progresses.

Conditions Where Practice Applies

Any cut or fill slope greater than 15 feet in height. This practice also applies to stockpiles.

Criteria

A. Incremental Stabilization - Cut Slopes
   1. Excavate and stabilize cut slopes in increments not to exceed 15 feet in height. Prepare seedbed and apply seed and mulch on all cut slopes as the work progresses.
   2. Construction sequence example (Refer to Figure B.1):
      a. Construct and stabilize all temporary swales or dikes that will be used to convey runoff around the excavation.
   b. Perform Phase 1 excavation, prepare seedbed, and stabilize.
   c. Perform Phase 2 excavation, prepare seedbed, and stabilize. Overseed Phase 1 areas as necessary.
   d. Perform final phase excavation, prepare seedbed, and stabilize. Overseed previously seeded areas as necessary.

Note: Once excavation has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

B. Incremental Stabilization - Fill Slopes
   1. Construct and stabilize fill slopes in increments not to exceed 15 feet in height. Prepare seedbed and apply seed and mulch on all slopes as the work progresses.
   2. Stabilize slopes immediately when the vertical height of a lift reaches 15 feet, or when the grading operation ceases as prescribed in the plans.
   3. At the end of each day, install temporary water conveyance practice(s), as necessary, to intercept surface runoff and convey it down the slope in a non-erosive manner.
   4. Construction sequence example (Refer to Figure B.2):
      a. Construct and stabilize all temporary swales or dikes that will be used to divert runoff around the fill. Construct silt fence on low side of fill unless other methods shown on the plans address this area.
      b. At the end of each day, install temporary water conveyance practice(s), as necessary, to intercept surface runoff and convey it down the slope in a non-erosive manner.
      c. Place Phase 1 fill, prepare seedbed, and stabilize.
      d. Place Phase 2 fill, prepare seedbed, and stabilize.
      e. Place final phase fill, prepare seedbed, and stabilize. Overseed previously seeded areas as necessary.

Note: Once the placement of fill has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

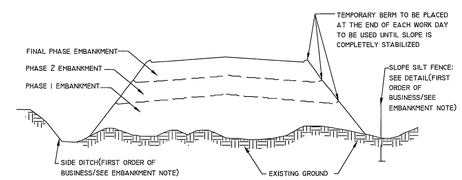


FIGURE B-2: INCREMENTAL STABILIZATION-FILL

MDE No. 13-WM-0001

EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED.

NO DISTURBED AREA SHALL BE LEFT UNSTABILIZED OVERNIGHT UNLESS THE RUNOFF IS DIRECTED TO AN MDE APPROVED SEDIMENT CONTROL DEVICE.

STANDARD STABILIZATION NOTE:

"FOLLOWNG INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN SEVEN (7) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND FOURTEEN DAYS (14) AS TO ALL DISTURBED OR GRADED AREAS ON THE PROJECT SITE."

DESIGN CERTIFICATION

"I HEREBY CERTIFY THAT THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH THE MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL, THE 2000 MARYLAND STORMWATER DESIGN MANUAL, VOLUMES I & II INCLUDING SUPPLEMENTS, THE ENVIRONMENT ARTICLE SECTION 4-101 THROUGH 116 AND SECTIONS 4-201 AND 215, AND THE CODE OF MARYLAND REGULATIONS (COMAR) 26.17.01 COMAR 26.17.02 FOR EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT, RESPECTIVELY."

Kevin Larrowe
NAME

15104
MARYLAND. REGISTRATION NUMBER.
P.E. R.L.S. OR R.L.A. (circle)

SIGNATURE

8.17.12
DATE

EROSION AND SEDIMENT CONTROL NOTES

SITE 1 RADIOLOGICAL REMOVAL ACTION
ADJACENT TO BUILDING #1662
NAVAL SUPPORT FACILITY
INDIAN HEAD
CONTRACT NO. W52PIJ-08-D-0034 DO:0054
INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

STATE OF MARYLAND REGISTERED PROFESSIONAL ENGINEER KEVIN LARROWE 15104
8.17.12

Colbert Matz Rosenfelt, Inc.
*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 15104 Expiration Date: 10/11/12

NO.	DATE	REVISIONS:	BY
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-3
SHEET 3 OF 4

B-4-2 STANDARDS AND SPECIFICATIONS FOR SOIL PREPARATION, TOPSOILING, AND SOIL AMENDMENTS

Definition

The process of preparing the soils to sustain adequate vegetative stabilization.

Purpose

To provide a suitable soil medium for vegetative growth.

Conditions Where Practice Applies

Where vegetative stabilization is to be established.

Criteria

A. Soil Preparation
1. Temporary Stabilization
a. Seedbed preparation consists of loosening soil to a depth of 3 to 5 inches by means of suitable agricultural or construction equipment, such as disc harrows or chisel plows or rippers mounted on construction equipment. After the soil is loosened, it must not be rolled or dragged smooth but left in the roughened condition. Slopes 3:1 or flatter are to be tracked with ridges running parallel to the contour of the slope.
b. Apply fertilizer and lime as prescribed on the plans.
c. Incorporate lime and fertilizer into the top 3 to 5 inches of soil by disking or other suitable means.
2. Permanent Stabilization
a. A soil test is required for any earth disturbance of 5 acres or more. The minimum soil conditions required for permanent vegetative establishment are:
i. Soil pH between 6.0 and 7.0.
ii. Soluble salts less than 500 parts per million (ppm).
iii. Soil contains less than 40 percent clay but enough fine grained material (greater than 30 percent silt plus clay) to provide the capacity to hold a moderate amount of moisture. An exception: if lovegrass will be planted, then a sandy soil (less than 30 percent silt plus clay) would be acceptable.
iv. Soil contains 1.5 percent minimum organic matter by weight.
v. Soil contains sufficient pore space to permit adequate root penetration.
b. Application of amendments or topsoil is required if on-site soils do not meet the above conditions.
c. Graded areas must be maintained in a true and even grade as specified on the approved plan, then scarified or otherwise loosened to a depth of 3 to 5 inches.
d. Apply soil amendments as specified on the approved plan or as indicated by the results of a soil test.
e. Mix soil amendments into the top 3 to 5 inches of soil by disking or other suitable means. Rake lawn areas to smooth the surface, remove large objects like stones and branches, and ready the area for seed application. Loosen surface soil by dragging with a heavy chain or other equipment to roughen the surface where site conditions will not permit normal seedbed preparation. Track slopes 3:1 or flatter with tracked equipment leaving the soil in an irregular condition with ridges running parallel to the contour of the slope. Leave the top 1 to 3 inches of soil loose and friable. Seedbed loosening may be unnecessary on newly disturbed areas.

B. Topsoiling
1. Topsoil is placed over prepared subsoil prior to establishment of permanent vegetation. The purpose is to provide a suitable soil medium for vegetative growth. Soils of concern have low moisture content, low nutrient levels, low pH, materials toxic to plants, and/or unacceptable soil gradation.
2. Topsoil salvaged from an existing site may be used provided it meets the standards as set forth in these specifications. Typically, the depth of topsoil to be salvaged for a given soil type can be found in the representative soil profile section in the Soil Survey published by USDA-NRCS.
3. Topsoiling is limited to areas having 2:1 or flatter slopes where:
a. The texture of the exposed subsoil/parent material is not adequate to produce vegetative growth.
b. The soil material is so shallow that the rooting zone is not deep enough to support plants or furnish continuing supplies of moisture and plant nutrients.
c. The original soil to be vegetated contains material toxic to plant growth.
d. The soil is so acidic that treatment with limestone is not feasible.
4. Areas having slopes steeper than 2:1 require special consideration and design.
5. Topsoil Specifications: Soil to be used as topsoil must meet the following criteria:
a. Topsoil must be a loam, sandy loam, clay loam, silt loam, sandy clay loam, or loamy sand. Other soils may be used if recommended by an agronomist or soil scientist and approved by the appropriate approval authority. Topsoil must not be a mixture of contrasting textured subsoils and must contain less than 5 percent by volume of cinders, stones, slag, coarse fragments, gravel, sticks, roots, trash, or other materials larger than 1½ inches in diameter.
b. Topsoil must be free of noxious plants or plant parts such as Bermuda grass, quack grass, Johnson grass, nut sedge, poison ivy, thistle, or others as specified.
c. Topsoil substitutes or amendments, as recommended by a qualified agronomist or soil scientist and approved by the appropriate approval authority, may be used in lieu of natural topsoil.
6. Topsoil Application
a. Erosion and sediment control practices must be maintained when applying topsoil.
b. Uniformly distribute topsoil in a 5 to 8 inch layer and lightly compact to a minimum thickness of 4 inches. Spreading is to be performed in such a manner that sodding or seeding can proceed with a minimum of additional soil preparation and tillage. Any irregularities in the surface resulting from topsoiling or other operations must be corrected in order to prevent the formation of depressions or water pockets.
c. Topsoil must not be placed if the topsoil or subsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper grading and seedbed preparation.

C. Soil Amendments (Fertilizer and Lime Specifications)
1. Soil tests must be performed to determine the exact ratios and application rates for both lime and fertilizer on sites having disturbed areas of 5 acres or more. Soil analysis may be performed by a recognized private or commercial laboratory. Soil samples taken for engineering purposes may also be used for chemical analyses.
2. Fertilizers must be uniform in composition, free flowing and suitable for accurate application by appropriate equipment. Manure may be substituted for fertilizer with prior approval from the appropriate approval authority. Fertilizers must all be delivered to the site fully labeled according to the applicable laws and must bear the name, trade name or trademark and warranty of the producer.
3. Lime materials must be ground limestone (hydrated or burnt lime may be substituted except when hydroseeding) which contains at least 50 percent total oxides (calcium oxide plus magnesium oxide). Limestone must be ground to such fineness that at least 50 percent will pass through a #100 mesh sieve and 98 to 100 percent will pass through a #20 mesh sieve.
4. Lime and fertilizer are to be evenly distributed and incorporated into the top 3 to 5 inches of soil by disking or other suitable means.
5. Where the subsoil is either highly acidic or composed of heavy clays, spread ground limestone at the rate of 4 to 8 tons/acre (200-400 pounds per 1,000 square feet) prior to the placement of topsoil.

Purpose

To protect disturbed soils from erosion during and at the end of construction.

Conditions Where Practice Applies

To the surface of all perimeter controls, slopes, and any disturbed area not under active grading.

Criteria

A. Seeding
1. Specifications
a. All seed must meet the requirements of the Maryland State Seed Law. All seed must be subject to retesting by a recognized seed laboratory. All seed used must have been tested within the 6 months immediately preceding the date of sowing such material on any project. Refer to Table B.4 regarding the quality of seed. Seed tags must be available upon request to the inspector to verify type of seed and seeding rate.
b. Mulch alone may be applied between the fall and spring seeding dates only if the ground is frozen. The appropriate seeding mixture must be applied when the ground thaws.
c. Inoculants: The inoculant for treating legume seed in the seed mixtures must be a pure culture of nitrogen fixing bacteria prepared specifically for the species. Inoculants must not be used later than the date indicated on the container. Add fresh inoculants as directed on the package. Use four times the recommended rate when hydroseeding. Note: It is very important to keep inoculant as cool as possible until used. Temperatures above 75 to 80 degrees Fahrenheit can weaken bacteria and make the inoculant less effective.
d. Sod or seed must not be placed on soil which has been treated with soil sterilants or chemicals used for weed control until sufficient time has elapsed (14 days min.) to permit dissipation of phyto-toxic materials.
2. Application
a. Dry Seeding: This includes use of conventional drop or broadcast spreaders.
i. Incorporate seed into the subsoil at the rates prescribed on Temporary Seeding Table B.1, Permanent Seeding Table B.3, or site-specific seeding summaries.
ii. Apply seed in two directions, perpendicular to each other. Apply half the seeding rate in each direction. Roll the seeded area with a weighted roller to provide good seed to soil contact.
b. Drill or Cultipacker Seeding: Mechanized seeders that apply and cover seed with soil.
i. Cultipacking seeders are required to bury the seed in such a fashion as to provide at least 1/4 inch of soil covering. Seedbed must be firm after planting.
ii. Apply seed in two directions, perpendicular to each other. Apply half the seeding rate in each direction.
c. Hydroseeding: Apply seed uniformly with hydroseeder (slurry includes seed and fertilizer).
i. If fertilizer is being applied at the time of seeding, the application rates should not exceed the following: nitrogen, 100 pounds per acre total of soluble nitrogen; P2O5 (phosphorous), 200 pounds per acre; K2O (potassium), 200 pounds per acre.
ii. Lime: Use only ground agricultural limestone (up to 3 tons per acre may be applied by hydroseeding). Normally, not more than 2 tons are applied by hydroseeding at any one time. Do not use burnt or hydrated lime when hydroseeding.
iii. Mix seed and fertilizer on site and seed immediately and without interruption.
iv. When hydroseeding do not incorporate seed into the soil.

B. Mulching
1. Mulch Materials (in order of preference)
a. Straw consisting of thoroughly threshed wheat, rye, oat, or barley and reasonably bright in color. Straw is to be free of noxious weed seeds as specified in the Maryland Seed Law and not musty, moldy, caked, decayed, or excessively dusty. Note: Use only sterile straw mulch in areas where one species of grass is desired.
b. Wood Cellulose Fiber Mulch (WCFM) consisting of specially prepared wood cellulose processed into a uniform fibrous physical state.
i. WCFM is to be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry.
ii. WCFM, including dye, must contain no germination or growth inhibiting factors.
iii. WCFM materials are to be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with seed, fertilizer and other additives to form a homogeneous slurry. The mulch material must form a blotter-like ground cover, on application, having moisture absorption and percolation properties and must cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.
iv. WCFM material must not contain elements or compounds at concentration levels that will be phyto-toxic.
v. WCFM must conform to the following physical requirements: fiber length of approximately 10 millimeters, diameter approximately 1 millimeter, pH range of 4.0 to 8.5, ash content of 1.6 percent maximum and water holding capacity of 90 percent minimum.
2. Application
a. Apply mulch to all seeded areas immediately after seeding.
b. When straw mulch is used, spread it over all seeded areas at the rate of 2 tons per acre to a uniform loose depth of 1 to 2 inches. Apply mulch to achieve a uniform distribution and depth so that the soil surface is not exposed. When using a mulch anchoring tool, increase the application rate to 2.5 tons per acre.
c. Wood cellulose fiber used as mulch must be applied at a net dry weight of 1500 pounds per acre. Mix the wood cellulose fiber with water to attain a mixture with a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
3. Anchoring
a. Perform mulch anchoring immediately following application of mulch to minimize loss by wind or water. This may be done by one of the following methods (listed by preference), depending upon the size of the area and erosion hazard:
i. A mulch anchoring tool is a tractor drawn implement designed to punch and anchor mulch into the soil surface a minimum of 2 inches. This practice is most effective on large areas, but is limited to flatter slopes where equipment can operate safely. If used on sloping land, this practice should follow the contour.
ii. Wood cellulose fiber may be used for anchoring straw. Apply the fiber binder at a net dry weight of 750 pounds per acre. Mix the wood cellulose fiber with water at a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.
iii. Synthetic binders such as Acrylic DLR (Agro-Tack), DCAij0, Petroset, Terra Tax II, Terra Tack AR or other approved equal may be used. Follow application rates as specified by the manufacturer. Application of liquid binders needs to be heavier at the edges where wind catches mulch, such as in valleys and on crests of banks. Use of asphalt binders is strictly prohibited.
iv. Lightweight plastic netting may be stapled over the mulch according to manufacturer recommendations. Netting is usually available in rolls 4 to 15 feet wide and 300 to 3,000 feet long.

B-4-4 STANDARDS AND SPECIFICATIONS FOR TEMPORARY STABILIZATION

Definition

To stabilize disturbed soils with vegetation for up to 6 months.

Purpose

To use fast growing vegetation that provides cover on disturbed soils.

Conditions Where Practice Applies

Exposed soils where ground cover is needed for a period of 6 months or less. For longer duration of time, permanent stabilization practices are required.

Criteria

1. Select one or more of the species or seed mixtures listed in Table B.1 for the appropriate Plant Hardiness Zone (from Figure B.3), and enter them in the Temporary Seeding Summary below along with application rates, seeding dates and seeding depths. If this Summary is not put on the plan and completed, then Table B.1 plus fertilizer and lime rates must be put on the plan.
2. For sites having soil tests performed, use and show the recommended rates by the testing agency. Soil tests are not required for Temporary Seeding.
3. When stabilization is required outside of a seeding season, apply seed and mulch or straw mulch alone as prescribed in Section B-4-3.A.1.b and maintain until the next seeding season.

B-4-5 STANDARDS AND SPECIFICATIONS FOR PERMANENT STABILIZATION

Definition

To stabilize disturbed soils with permanent vegetation.

Purpose

To use long-lived perennial grasses and legumes to establish permanent ground cover on disturbed soils.

Conditions Where Practice Applies

Exposed soils where ground cover is needed for 6 months or more.

Criteria

A. Seed Mixtures
1. General Use
a. Select one or more of the species or mixtures listed in Table B.3 for the appropriate Plant Hardiness Zone (from Figure B.3) and based on the site condition or purpose found on Table B.2. Enter selected mixture(s), application rates, and seeding dates in the Permanent Seeding Summary. The Summary is to be placed on the plan.
b. Additional planting specifications for exceptional sites such as shorelines, stream banks, or dunes or for special purposes such as wildlife or aesthetic treatment may be found in USDA-NRCS Technical Field Office Guide, Section 342 Critical Area Planting.
c. For sites having disturbed area over 5 acres, use and show the rates recommended by the soil testing agency.
d. For areas receiving low maintenance, apply urea form fertilizer (46-0-0) at 3 ½ pounds per 1000 square feet (150 pounds per acre) at the time of seeding in addition to the soil amendments shown in the Permanent Seeding Summary .
2. Turfgrass Mixtures
a. Areas where turfgrass may be desired include lawns, parks, playgrounds, and commercial sites which will receive a medium to high level of maintenance.
b. Select one or more of the species or mixtures listed below based on the site conditions or purpose. Enter selected mixture(s), application rates, and seeding dates in the Permanent Seeding Summary. The summary is to be placed on the plan.
i. Kentucky Bluegrass: Full Sun Mixture: For use in areas that receive intensive management. Irrigation required in the areas of central Maryland and Eastern Shore. Recommended Certified Kentucky Bluegrass Cultivars Seeding Rate: 1.5 to 2.0 pounds per 1000 square feet. Choose a minimum of three Kentucky bluegrass cultivars with each ranging from 10 to 35 percent of the total mixture by weight.
ii. Kentucky Bluegrass/Perennial Rye: Full Sun Mixture: For use in full sun areas where rapid establishment is necessary and when turf will receive medium to intensive management. Certified Perennial Ryegrass Cultivars/Certified Kentucky Bluegrass Seeding Rate: 2 pounds mixture per 1000 square feet. Choose a minimum of three Kentucky bluegrass cultivars with each ranging from 10 to 35 percent of the total mixture by weight.
iii. Tall Fescue/Kentucky Bluegrass: Full Sun Mixture: For use in drought prone areas and/or for areas receiving low to medium management in full sun to medium shade. Recommended mixture includes; Certified Tall Fescue Cultivars 95 to 100 percent, Certified Kentucky Bluegrass Cultivars 0 to 5 percent. Seeding Rate: 5 to 8 pounds per 1000 square feet. One or more cultivars may be blended.
iv. Kentucky Bluegrass/Fine Fescue: Shade Mixture: For use in areas with shade in Bluegrass lawns. For establishment in high quality, intensively managed turf area. Mixture includes; Certified Kentucky Bluegrass Cultivars 30 to 40 percent and Certified Fine Fescue and 60 to 70 percent. Seeding Rate: 1½ to 3 pounds per 1000 square feet.

Notes:
Select turfgrass varieties from those listed in the most current University of Maryland Publication, Agronomy Memo #77, "Turfgrass Cultivar Recommendations for Maryland"

Choose certified material. Certified material is the best guarantee of cultivar purity. The certification program of the Maryland Department of Agriculture, Turf and Seed Section, provides a reliable means of consumer protection and assures a pure genetic line

c. Ideal Times of Seeding for Turf Grass Mixtures
Western MD: March 15 to June 1, August 1 to October 1 (Hardiness Zones: 5b, 6a)

Central MD: March 1 to May 15, August 15 to October 15 (Hardiness Zone: 6b)

Southern MD, Eastern Shore: March 1 to May 15, August 15 to October 15 (Hardiness Zones: 7a, 7b)

d. Till areas to receive seed by disking or other approved methods to a depth of 2 to 4 inches, level and rake the areas to prepare a proper seedbed. Remove stones and debris over 1½ inches in diameter. The resulting seedbed must be in such condition that future mowing of grasses will pose no difficulty.
e. If soil moisture is deficient, supply new seedings with adequate water for plant growth (½ to 1 inch every 3 to 4 days depending on soil texture) until they are firmly established. This is especially true when seedings are made late in the planting season, in abnormally dry or hot seasons, or on adverse sites.

B. Sod: To provide quick cover on disturbed areas (2:1 grade or flatter).
1. General Specifications
a. Class of turfgrass sod must be Maryland State Certified. Sod labels must be made available to the job foreman and inspector.
b. Sod must be machine cut at a uniform soil thickness of ¾ inch, plus or minus ¼ inch, at the time of cutting. Measurement for thickness must exclude top growth and thatch. Broken pads and torn or uneven ends will not be acceptable.
c. Standard size sections of sod must be strong enough to support their own weight and retain their size and shape when suspended vertically with a firm grasp on the upper 10 percent of the section.
d. Sod must not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.
e. Sod must be harvested, delivered, and installed within a period of 36 hours. Sod not transplanted within this period must be approved by an agronomist or soil scientist prior to its installation.
2. Sod Installation
a. During periods of excessively high temperature or in areas having dry subsoil, lightly irrigate the subsoil immediately prior to laying the sod.
b. Lay the first row of sod in a straight line with subsequent rows placed parallel to it and tightly wedged against each other. Stagger lateral joints to promote more uniform growth and strength. Ensure that sod is not stretched or overlapped and that all joints are butted tight in order to prevent voids which would cause air drying of the roots.
c. Wherever possible, lay sod with the long edges parallel to the contour and with staggering joints. Roll and tamp, peg or otherwise secure the sod to prevent slippage on slopes. Ensure solid contact exists between sod roots and the underlying soil surface.
d. Water the sod immediately following rolling and tamping until the underside of the new sod pad and soil surface below the sod are thoroughly wet. Complete the operations of laying, tamping and irrigating for any piece of sod within eight hours.
3. Sod Maintenance
a. In the absence of adequate rainfall, water daily during the first week or as often and sufficiently as necessary to maintain moist soil to a depth of 4 inches. Water sod during the heat of the day to prevent wilting.
b. After the first week, sod watering is required as necessary to maintain adequate moisture content.
c. Do not mow until the sod is firmly rooted. No more than 1/3 of the grass leaf must be removed by the initial cutting or subsequent cuttings. Maintain a grass height of at least 3 inches unless otherwise specified.

Temporary Seeding Summary

Hardiness Zone (from Figure B.3): 7a Seed Mixture (from Table B.1)					Fertilizer Rate (10-20-20)	Lime Rate
Mix	Species	Application Rate (lb/ac)	Seeding Dates	Seeding Depths (in)		
Mix	CEREAL RYE	112	2/15-4/30 8/15-12/15	1.0	436 lb/ac (10 lb/1000 sf)	2 tons/ac (90 lb/1000 sf)
Mix	FOXTAIL MILLET	30	5/1-8/15	0.5		

Permanent Seeding Summary

Hardiness Zone (from Figure B.3): 7a Seed Mixture (from Table B.1)					Fertilizer Rate (10-20-20)			Lime Rate
Mix	Species	Application Rate (lb/ac)	Seeding Dates	Seeding Depths (in)	N	P_2O_5	K_2O	
8	TALL FESCUE	100	2/15-4/30 8/15-11/30	$\frac{1}{4}-\frac{1}{2}$ in	45 lb/ac (1.0 lb/1000 sf)	90 lb/ac (2 lb/1000 sf)	90 lb/ac (2 lb/1000 sf)	2 tons/ac (90 lb/1000 sf)
9	TALL FESCUE OR	60						
	HARD FESCUE AND ADD	40						
	KENTUCKY BLUEGRASS	40						
	AND PERENNIAL RYEGRASS	20						

EROSION AND SEDIMENT CONTROL SHALL BE STRICTLY ENFORCED.

NO DISTURBED AREA SHALL BE LEFT UNSTABILIZED OVERNIGHT UNLESS THE RUNOFF IS DIRECTED TO AN MDE APPROVED SEDIMENT CONTROL DEVICE.

B-4-8 STANDARDS AND SPECIFICATIONS FOR STOCKPILE AREA

Definition

A mound or pile of soil protected by appropriately designed erosion and sediment control measures.

Purpose

To provide a designated location for the temporary storage of soil that controls the potential for erosion, sedimentation, and changes to drainage patterns.

Conditions Where Practice Applies

Stockpile areas are utilized when it is necessary to salvage and store soil for later use.

Criteria

1. The stockpile location and all related sediment control practices must be clearly indicated on the erosion and sediment control plan.
2. The footprint of the stockpile must be sized to accommodate the anticipated volume of material and based on a side slope ratio no steeper than 2:1. Benching must be provided in accordance with Section B-3 Land Grading.
3. Runoff from the stockpile area must drain to a suitable sediment control practice.
4. Access the stockpile area from the upgrade side.
5. Clear water runoff into the stockpile area must be minimized by use of a diversion device such as an earth dike, temporary swale or diversion fence. Provisions must be made for discharging concentrated flow in a non-erosive manner.
6. Where runoff concentrates along the toe of the stockpile fill, an appropriate erosion/sediment control practice must be used to intercept the discharge.
7. Stockpiles must be stabilized in accordance with the 3/7 day stabilization requirement as well as Standard B-4-1 Incremental Stabilization and Standard B-4-4 Temporary Stabilization.
8. If the stockpile is located on an impervious surface, a liner should be provided below the stockpile to facilitate cleanup. Stockpiles containing contaminated material must be covered with impermeable sheeting.

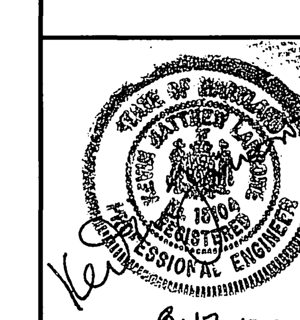
Maintenance

The stockpile area must continuously meet the requirements for Adequate Vegetative Establishment in accordance with Section B-4 Vegetative Stabilization. Side slopes must be maintained at no steeper than a 2:1 ratio. The stockpile area must be kept free of erosion. If the vertical height of a stockpile exceeds 20 feet for 2:1 slopes, 30 feet for 3:1 slopes, or 40 feet for 4:1 slopes, benching must be provided in accordance with Section B-3 Land Grading.

MDE No. 13-WM-0001

EROSION AND SEDIMENT CONTROL NOTES
SITE 1 RADIOLOGICAL REMOVAL ACTION
ADJACENT TO BUILDING #1662
NAVAL SUPPORT FACILITY
INDIAN HEAD
CONTRACT NO. W52PIJ-08-D-0034 D0:0054
INDIAN HEAD, CHARLES COUNTY, MARYLAND

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.



Colbert Matz Rosenfelt, Inc.
*Engineers * Surveyors * Planners*
2835 Smith Avenue, Suite G
Baltimore, Maryland 21209
Telephone: (410) 653-3838
Facsimile: (410) 653-7953

8·17·12

Professional Certification
I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland.
License No. 15104 Expiration Date: 10/11/12

NO.	DATE	REVISIONS:	BY
0	8/16/12	MDE ISSUED "SUBSTANTIVE REQUIREMENTS MET" MEMO	KML

SCALE: 1"=20'
DATE: 07-09-12
JOB NO.: 2012072
DESIGNED: KML
DRAWN: KBH
CHECKED: DS/KL
FILE: 2012072_Site 1 Bldg 1662 ESC.dwg
DRAWING NUMBER: ESC-4
SHEET 4 OF 4

Appendix D
Import Backfill Soil Sample Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-3051-1
Client Project/Site: NSF Indian Head

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Daniel Spicuzza

Authorized for release by:
8/16/2013 5:35:13 PM

Erika Gish, Project Manager I
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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QC Association Summary 40
Surrogate Summary 44

Job ID: 160-3051-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: NSF Indian Head

Report Number: 160-3051-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-3051-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 7/19/2013 9:15 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 3.0º C.

Exception: Encores were received out of hold. Ok to proceed per client.

VOLATILE ORGANIC COMPOUNDS BY GC/MS

Sample 1HBF-5 (160-3051-5) was analyzed for Volatile Organic Compounds by GC/MS in accordance with EPA SW-846 Method 8260C. The samples were prepared and analyzed on 07/30/2013.

Insufficient sample volume was available to perform batch matrix spike/matrix spike duplicate (MS/MSD) associated with batch 64629. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.

2-Butanone (MEK) exceeded the RPD limit for LCSD 160-63739/3-A. The %RPD of the laboratory control sample (LCS) and laboratory control standard duplicate (LCSD) for preparation batch 64629 also recovered outside control limits.

The continuing calibration verification (CCV) for Bromomethane and Chloroethane associated with batch 64629 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

No other difficulties were encountered during the Volatiles analysis.

All other quality control parameters were within the acceptance limits.

Organic Prep

Method 8081

Insufficient sample volume was available to perform batch matrix spike/matrix spike duplicate (MS/MSD) associated with batch _62920. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.

No other analytical or quality issues were noted.

SEMIVOLATILE ORGANIC COMPOUNDS (GC/MS)

Sample 1HBF-6 (160-3051-6) was analyzed for Semivolatile Organic Compounds (GC/MS) in accordance with EPA SW-846 Method 8270D. The samples were prepared on 07/30/2013 and analyzed on 08/05/2013.

Butyl benzyl phthalate was detected in method blank MB 160-63746/1-A at a level that was above the method detection limit but below the reporting limit.

Terphenyl-d14 (Surr) failed the surrogate recovery criteria low for 1HBF-6 (160-3051-6). Terphenyl-d14 (Surr) failed the surrogate recovery criteria low for 1HBF-6MS (160-3051-6MS). Tthe laboratory allows one acid surrogate and/or one base surrogate to be outside acceptance limits; therefore, re-extraction/re-analysis was not performed. These results have been reported and qualified.

4-Nitrophenol failed the recovery criteria low for LCS 160-63746/2-A. A full list spike was utilized for this method. Due to the large number of spiked analytes, there is a high probability that one or more analytes will recover outside acceptance limits. The laboratory's SOP allows for 3 analytes to recover outside criteria for this method when a full list spike is utilized. The LCS associated with batch 65003 had 1 analyte outside control limits; therefore, re-extraction/re-analysis was not performed. These results have been reported and qualified.

No other difficulties were encountered during the Semi-VOA analysis.

All other quality control parameters were within the acceptance limits.

GASOLINE RANGE ORGANICS (GRO)

Sample 1HBF-5 (160-3051-5) was analyzed for gasoline range organics (GRO) in accordance with EPA SW-846 Method 8015B - GRO. The samples were analyzed on 07/30/2013.

Job ID: 160-3051-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

Gasoline Range Organics (C6-C12) was detected in method blank MB 160-63753/1-A at a level that was above the method detection limit but below the reporting limit.

The following samples in batch 64066 contained peaks which were within the Gasoline Range Organics (GRO) retention time window: 1HBF-5 (160-3051-5). These peaks were large enough that there is a reportable concentration; however, there is no resemblance between the reportable peak and the pattern of GRO.

No other difficulties were encountered during the GRO analysis.

All other quality control parameters were within the acceptance limits.

DIESEL RANGE ORGANICS (DRO)

Sample 1HBF-4 (160-3051-4) was analyzed for diesel range organics (DRO) in accordance with EPA SW-846 Method 8015B - DRO. The samples were prepared on 07/22/2013 and analyzed on 07/23/2013.

The CCV surrogate recovery is outside the upper QC limits of greater than 20%D. The surrogate recovery in the associated samples is acceptable; therefore the sample data has been reported with this narrative.

No difficulties were encountered during the DRO analysis.

All quality control parameters were within the acceptance limits.

ORGANOCHLORINE PESTICIDES (GC)

Sample 1HBF-4 (160-3051-4) was analyzed for Organochlorine Pesticides (GC) in accordance with EPA SW-846 Method 8081B. The samples were prepared on 07/25/2013 and analyzed on 07/30/2013.

The %RPD between the primary and confirmation column exceeded 40% for alpha-Chlordane for the following sample: 1HBF-4 (160-3051-4). The lower value has been reported and qualified in accordance with the laboratory's SOP.

The following sample has clear evidence of the presence of chlordane based on the presence of alpha and gamma chlordane; however, the chlordane peaks in the sample do not closely match the laboratory's Technical Chlordane standard: 1HBF-4 (160-3051-4). As a result, there is increased quantitative uncertainty associated with this result. Only 3 of 4 peaks were used to quantitate the compound.

No difficulties were encountered during the pesticides analysis.

All quality control parameters were within the acceptance limits.

CHLORINATED HERBICIDES

Sample 1HBF-2 (160-3051-2) was analyzed for chlorinated herbicides in accordance with EPA SW-846 Method 8151A. The samples were prepared on 08/09/2013 and analyzed on 08/14/2013.

Surrogates are added during the extraction process prior to dilution. When the sample dilution is 5X or greater, surrogate recoveries are diluted out and no corrective action is required.

The matrix spike percent recoveries and %RPD for batch 65908 were outside control limits for Dinoseb, which is a know poor performing analyte. The LCS, MS, and MSD recoveries still meed inhouse limits. The sample is ND for this target analye; therefore the sample data has been reported with this narrative

The continuing calibration verification (CCV) for several compound (MCPA, Dichlorprop, Dinoseb, 2,4,5-T, and 2,4,5-TP on the confirmation column only; and 2,4-D on both columns) associated with batch 65908 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

No other difficulties were encountered during the herbicides analysis.

All other quality control parameters were within the acceptance limits.

Job ID: 160-3051-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

TOTAL METALS (ICP)

Sample 1HBF-3 (160-3051-3) was analyzed for total metals (ICP) in accordance with EPA SW-846 Method 6010C. The samples were prepared on 08/08/2013 and analyzed on 08/09/2013.

The following samples were diluted due to the nature of the sample matrix. The sample digestates were yellow in color: (160-3051-3 MS), (160-3051-3 MSD), (160-3051-3 SD), 1HBF-3 (160-3051-3). Elevated reporting limits (RLs) are provided.

The matrix spike and/or matrix spike duplicate (MS/MSD) recoveries for batch 65521 were outside control limits for aluminum, calcium, potassium, magnesium, silver, and antimony. The RPD was within method limits indicating a potential matrix interference. The associated laboratory control sample (LCS) recovery met acceptance criteria.

Due to the high concentration of iron, the matrix spike / matrix spike duplicate (MS/MSD) for batch 65521 could not be evaluated for accuracy and precision. The presence of the '4' qualifier in the data indicates analytes where the concentration in the unspiked sample exceeded four times the spiking amount. The associated laboratory control sample (LCS) met acceptance criteria.

The serial dilution performed for the following samples associated with batch 65968 was outside control limits for calcium. All the other target analytes were within control limits indicating a possible matrix interference: (160-3051-3 SD)

No other difficulties were encountered during the metals analysis.

All other quality control parameters were within the acceptance limits.

MERCURY

Sample 1HBF-3 (160-3051-3) was analyzed for mercury in accordance with EPA SW-846 Method 7471B. The samples were prepared on 07/31/2013 and analyzed on 08/01/2013.

No difficulties were encountered during the mercury analysis.

All quality control parameters were within the acceptance limits.

PERCENT SOLIDS

Samples 1HBF-2 (160-3051-2), 1HBF-3 (160-3051-3), 1HBF-4 (160-3051-4), 1HBF-5 (160-3051-5) and 1HBF-6 (160-3051-6) were analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 07/27/2013.

No difficulties were encountered during the % solids analysis.

All quality control parameters were within the acceptance limits.

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Sample 1HBF-1 (160-3051-1) was analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 07/22/2013, prepared on 07/24/2013 and analyzed on 08/06/2013.

No other difficulties were encountered during the Gamma spec analysis.

All other quality control parameters were within the acceptance limits.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

CUR282

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler: Spicuzza	Lab PM: Gish, Erika K	Carrier Tracking No(s): Fed Ex	COC No: 160-550-282.1
Client Contact: Daniel Spicuzza	Phone: (412)848-7012	E-Mail: erika.gish@testamericainc.com		Page: Page 1 of 1
Company: Aleut World Solutions				Job #: USN-2011-008
Address: 4300 B Street Suite 402	Due Date Requested: 8-16-2013			
City: Anchorage	TAT Requested (days): 21			
State, Zip: AK, 99503				
Phone: (907)278-1311	PO #: Purchase Order Requested			
Email: radconpro@verizon.net	WO #:			
Project Name: Waste Characterizations	Project #: 16001906			
Site: NSF Indian Head	SSOW#:			

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	8015B_GRO - GRO/Total VOC	8151A - Total Herbicides	8015B_DRO, 8081B	8270D - Total SVOC	6010C, 7471B	Y Spec-TL-132	Total Number of containers	Special Instructions/Note:	
			Preservation Code:				N	N	N	N	N	N			
1HBF-1	7-17-13	0835	C	S	N	N						X	1	TL-132	500g
1HBF-2		0840	C	S	N	N		X					1		250g
1HBF-3		0842	C	S	N	N					X		1		60g
1HBF-4		0844	C	S	N	N			X				1		120g
1HBF-5		0846	C	S	N	N	X						1		120g
1HBF-6		0850	C	S	N	N				X			3	3 Containers	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify) IV

Special Instructions/QC Requirements: Level IV

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by:	Date/Time: 7-18-13 1800	Company NSF	Received by:	Date/Time: 7-19-13 0915	Company TASTL
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: Δ Yes Δ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-3051-1

Login Number: 3051

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	False	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
Q	One or more quality control criteria failed.
J	Estimated: The analyte was positively identified; the quantitation is an estimation

GC/MS Semi VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
Q	One or more quality control criteria failed.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
M	Manual integrated compound.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

GC VOA

Qualifier	Qualifier Description
J	Estimated: The analyte was positively identified; the quantitation is an estimation
M	Manual integrated compound.

GC Semi VOA

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
M	Manual integrated compound.

Metals

Qualifier	Qualifier Description
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
U	Undetected at the Limit of Detection.
J	Estimated: The analyte was positively identified; the quantitation is an estimation
4	MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit

Glossary (Continued)

Abbreviation	These commonly used abbreviations may or may not be present in this report.
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	TAL SL
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL SL
8015B	Gasoline Range Organics - (GC)	SW846	TAL SL
8015B	Diesel Range Organics (DRO) (GC)	SW846	TAL SL
8081B	Organochlorine Pesticides (GC)	SW846	TAL SL
8151A	Herbicides (GC)	SW846	TAL SL
6010C	Metals (ICP)	SW846	TAL SL
7471B	Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-3051-1	1HBF-1	Solid	07/17/13 08:35	07/19/13 09:15
160-3051-2	1HBF-2	Solid	07/17/13 08:40	07/19/13 09:15
160-3051-3	1HBF-3	Solid	07/17/13 08:42	07/19/13 09:15
160-3051-4	1HBF-4	Solid	07/17/13 08:44	07/19/13 09:15
160-3051-5	1HBF-5	Solid	07/17/13 08:46	07/19/13 09:15
160-3051-6	1HBF-6	Solid	07/17/13 08:50	07/19/13 09:15

Detection Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-1 — Lab Sample ID: 160-3051-1

No Detections.

Client Sample ID: 1HBF-2 — Lab Sample ID: 160-3051-2

No Detections.

Client Sample ID: 1HBF-3 — Lab Sample ID: 160-3051-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Aluminum	3510	J	40.1	28.0	mg/Kg	2	☼	6010C	Total/NA
Arsenic	3.33		2.00	0.635	mg/Kg	2	☼	6010C	Total/NA
Barium	18.0		10.0	0.501	mg/Kg	2	☼	6010C	Total/NA
Calcium	2070	J	501	26.6	mg/Kg	2	☼	6010C	Total/NA
Chromium	14.4		2.00	0.615	mg/Kg	2	☼	6010C	Total/NA
Cobalt	4.51	J	10.0	1.88	mg/Kg	2	☼	6010C	Total/NA
Copper	5.59		5.01	1.46	mg/Kg	2	☼	6010C	Total/NA
Iron	10500	J	20.0	5.95	mg/Kg	2	☼	6010C	Total/NA
Lead	7.07		2.00	0.345	mg/Kg	2	☼	6010C	Total/NA
Magnesium	845	J	200	16.6	mg/Kg	2	☼	6010C	Total/NA
Manganese	86.8		2.00	0.308	mg/Kg	2	☼	6010C	Total/NA
Nickel	5.29	J	8.01	0.451	mg/Kg	2	☼	6010C	Total/NA
Potassium	885	J	1000	675	mg/Kg	2	☼	6010C	Total/NA
Vanadium	15.1		10.0	2.52	mg/Kg	2	☼	6010C	Total/NA
Zinc	19.1		10.0	3.97	mg/Kg	2	☼	6010C	Total/NA
Mercury	0.0481		0.0329	0.0110	mg/Kg	1	☼	7471B	Total/NA

Client Sample ID: 1HBF-4 — Lab Sample ID: 160-3051-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
alpha-Chlordane	0.668	J	1.89	0.630	ug/Kg	1	☼	8081B	Total/NA
gamma-Chlordane	0.573	J	1.89	0.175	ug/Kg	1	☼	8081B	Total/NA
4,4'-DDD	1.50	J	1.89	0.245	ug/Kg	1	☼	8081B	Total/NA
4,4'-DDE	5.33		1.89	0.433	ug/Kg	1	☼	8081B	Total/NA
Technical Chlordane	5.24	J	18.9	4.14	ug/Kg	1	☼	8081B	Total/NA

Client Sample ID: 1HBF-5 — Lab Sample ID: 160-3051-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Toluene	4.66	J	6.00	0.840	ug/Kg	1	☼	8260C	Total/NA
Gasoline Range Organics (C6-C12)	0.0312	J	0.127	0.0127	mg/Kg	1	☼	8015B	Total/NA

Client Sample ID: 1HBF-6 — Lab Sample ID: 160-3051-6

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Benzo[b]fluoranthene	37.3	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Dimethyl phthalate	71.2	J M	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Fluoranthene	48.8	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Phenanthrene	47.6	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA
Pyrene	47.1	J	366	36.9	ug/Kg	1	☼	8270D	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-1

Lab Sample ID: 160-3051-1

Date Collected: 07/17/13 08:35
Matrix: Solid
Date Received: 07/19/13 09:15

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.518**		0.161	0.170		0.126	pCi/g	07/24/13 15:46	08/06/13 17:08	1
Cesium-137	0.00971	U	0.0336	0.0336	0.200	0.0604	pCi/g	07/24/13 15:46	08/06/13 17:08	1
Thorium-232	**0.518**		0.161	0.170		0.126	pCi/g	07/24/13 15:46	08/06/13 17:08	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.531*		*0.120*	*0.132*		*0.107*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
K-40	*7.13*		*1.12*	*1.34*		*0.600*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
Pb-212	*0.434*		*0.0947*	*0.110*		*0.0997*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
Pb-214	*0.584*		*0.116*	*0.131*		*0.125*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*
Tl-208	*0.192*		*0.0598*	*0.0630*		*0.0567*	*pCi/g*	*07/24/13 15:46*	*08/06/13 17:08*	*1*

Client Sample ID: 1HBF-2

Lab Sample ID: 160-3051-2

Date Collected: 07/17/13 08:40
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8151A - Herbicides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-T	8.79	U H	22.2	8.79	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
2,4-D	24.4	U H	88.7	24.4	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
2,4-DB	48.6	U H	88.7	48.6	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dalapon	42.7	U H	44.3	42.7	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dinoseb	15.1	U H J	27.7	15.1	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dicamba	4.36	U H	44.3	4.36	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Dichlorprop	25.9	U H	88.7	25.9	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
MCPA	3400	U H	8870	3400	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
Silvex (2,4,5-TP)	3.64	U H	22.2	3.64	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1
MCPP	5320	U H	8870	5320	ug/Kg	☼	08/09/13 15:17	08/14/13 01:38	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*83*		*50 - 150*	*08/09/13 15:17*	*08/14/13 01:38*	*1*

Client Sample ID: 1HBF-3

Lab Sample ID: 160-3051-3

Date Collected: 07/17/13 08:42
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 6010C - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**3510**	**J**	40.1	28.0	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Antimony	1.28	U J	2.00	1.28	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Arsenic	**3.33**		2.00	0.635	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Barium	**18.0**		10.0	0.501	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Beryllium	0.339	U	1.00	0.339	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Cadmium	0.200	U	1.00	0.200	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Calcium	**2070**	**J**	501	26.6	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Chromium	**14.4**		2.00	0.615	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Cobalt	**4.51**	**J**	10.0	1.88	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Copper	**5.59**		5.01	1.46	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-3

Lab Sample ID: 160-3051-3
Date Collected: 07/17/13 08:42
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 6010C - Metals (ICP) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Iron	**10500**	**J**	20.0	5.95	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Lead	**7.07**		2.00	0.345	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Magnesium	**845**	**J**	200	16.6	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Manganese	**86.8**		2.00	0.308	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Nickel	**5.29**	**J**	8.01	0.451	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Potassium	**885**	**J**	1000	675	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Selenium	0.579	U	3.00	0.579	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Silver	0.469	U J	2.00	0.469	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Sodium	94.4	U	200	94.4	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Thallium	3.02	U	4.01	3.02	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Vanadium	**15.1**		10.0	2.52	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2
Zinc	**19.1**		10.0	3.97	mg/Kg	☼	08/08/13 09:12	08/09/13 18:53	2

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	**0.0481**		0.0329	0.0110	mg/Kg	☼	07/31/13 10:00	08/01/13 06:36	1

Client Sample ID: 1HBF-4

Lab Sample ID: 160-3051-4
Date Collected: 07/17/13 08:44
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8015B - Diesel Range Organics (DRO) (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10-C28]	0.368	U	27.6	0.368	mg/Kg	☼	07/22/13 16:48	07/23/13 14:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl	*98*	*M*	*49 - 133*	*07/22/13 16:48*	*07/23/13 14:59*	*1*

Method: 8081B - Organochlorine Pesticides (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aldrin	0.340	U	1.89	0.340	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
alpha-BHC	0.205	U	2.22	0.205	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
beta-BHC	0.333	U	1.89	0.333	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
delta-BHC	0.269	U	1.89	0.269	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
gamma-BHC (Lindane)	0.187	U	1.89	0.187	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
alpha-Chlordane	**0.668**	**J**	1.89	0.630	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
gamma-Chlordane	**0.573**	**J**	1.89	0.175	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
4,4'-DDD	**1.50**	**J**	1.89	0.245	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
4,4'-DDE	**5.33**		1.89	0.433	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
4,4'-DDT	0.697	U	1.89	0.697	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Dieldrin	0.239	U	1.89	0.239	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endosulfan I	0.633	U	1.89	0.633	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endosulfan II	0.261	U	1.89	0.261	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endosulfan sulfate	0.378	U	1.89	0.378	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endrin	0.175	U	1.89	0.175	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endrin aldehyde	0.432	U	1.89	0.432	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Endrin ketone	0.463	U	1.89	0.463	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Heptachlor	0.227	U	2.22	0.227	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Heptachlor epoxide	0.476	U	1.89	0.476	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Methoxychlor	0.798	U	3.66	0.798	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-4

Lab Sample ID: 160-3051-4
Date Collected: 07/17/13 08:44
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Toxaphene	16.8	U	74.4	16.8	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1
Technical Chlordane	**5.24**	**J**	18.9	4.14	ug/Kg	☼	07/25/13 15:00	07/30/13 05:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*80*	*M*	*29 - 150*	*07/25/13 15:00*	*07/30/13 05:21*	*1*
Tetrachloro-m-xylene	*88*	*M*	*41 - 125*	*07/25/13 15:00*	*07/30/13 05:21*	*1*

Client Sample ID: 1HBF-5

Lab Sample ID: 160-3051-5
Date Collected: 07/17/13 08:46
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8260C - Volatile Organic Compounds by GC/MS

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	0.516	U	6.00	0.516	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1,2,2-Tetrachloroethane	0.480	U	6.00	0.480	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1,2-Trichloro-1,2,2-trifluoroethane	2.02	U	6.00	2.02	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1,2-Trichloroethane	0.684	U	6.00	0.684	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1-Dichloroethane	0.468	U	6.00	0.468	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,1-Dichloroethene	1.93	U	6.00	1.93	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2,4-Trichlorobenzene	0.516	U	6.00	0.516	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dibromo-3-Chloropropane	1.74	U	12.0	1.74	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dichlorobenzene	0.336	U	6.00	0.336	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dichloroethane	1.04	U	6.00	1.04	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dichloropropane	0.456	U	6.00	0.456	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,3-Dichlorobenzene	0.336	U	6.00	0.336	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,4-Dichlorobenzene	0.720	U	6.00	0.720	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
2-Butanone (MEK)	2.30	U Q	24.0	2.30	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
2-Hexanone	2.12	U	24.0	2.12	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
4-Methyl-2-pentanone (MIBK)	0.876	U	24.0	0.876	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Acetone	7.77	U	24.0	7.77	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Benzene	0.300	U	6.00	0.300	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Bromoform	0.444	U	6.00	0.444	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Bromomethane	1.32	U	12.0	1.32	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Carbon disulfide	0.828	U	6.00	0.828	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Carbon tetrachloride	0.612	U	6.00	0.612	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chlorobenzene	0.456	U	6.00	0.456	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Dibromochloromethane	0.492	U	6.00	0.492	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chloroethane	0.624	U	12.0	0.624	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chloroform	0.456	U	6.00	0.456	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Chloromethane	0.780	U	12.0	0.780	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
cis-1,2-Dichloroethene	0.720	U	6.00	0.720	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
cis-1,3-Dichloropropene	0.720	U	6.00	0.720	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Cyclohexane	0.432	U	12.0	0.432	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Bromodichloromethane	0.300	U	6.00	0.300	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Dichlorodifluoromethane	1.57	U	12.0	1.57	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Ethylbenzene	0.360	U	6.00	0.360	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
1,2-Dibromoethane (EDB)	0.840	U	6.00	0.840	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Isopropylbenzene	0.312	U	6.00	0.312	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Methyl acetate	1.66	U	30.0	1.66	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Methyl tert-butyl ether	0.576	U	6.00	0.576	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1

Client Sample ID: 1HBF-5

Lab Sample ID: 160-3051-5
Date Collected: 07/17/13 08:46
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methylcyclohexane	0.312	U	12.0	0.312	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Methylene Chloride	1.90	U	6.00	1.90	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
m-Xylene & p-Xylene	0.684	U	6.00	0.684	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
o-Xylene	0.408	U	6.00	0.408	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Styrene	0.420	U	6.00	0.420	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Tetrachloroethene	0.384	U	6.00	0.384	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Toluene	**4.66**	**J**	6.00	0.840	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
trans-1,2-Dichloroethene	1.13	U	6.00	1.13	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
trans-1,3-Dichloropropene	0.420	U	6.00	0.420	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Trichloroethene	0.468	U	6.00	0.468	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Trichlorofluoromethane	0.600	U	6.00	0.600	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Vinyl chloride	0.516	U	6.00	0.516	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1
Xylenes, Total	1.02	U	12.0	1.02	ug/Kg	☼	07/30/13 13:17	07/30/13 20:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*93*		*78 - 133*	*07/30/13 13:17*	*07/30/13 20:55*	*1*
Dibromofluoromethane (Surr)	*102*		*83 - 122*	*07/30/13 13:17*	*07/30/13 20:55*	*1*
4-Bromofluorobenzene (Surr)	*105*		*65 - 140*	*07/30/13 13:17*	*07/30/13 20:55*	*1*
1,2-Dichloroethane-d4 (Surr)	*97*		*78 - 132*	*07/30/13 13:17*	*07/30/13 20:55*	*1*

Method: 8015B - Gasoline Range Organics - (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (C6-C12)	**0.0312**	**J**	0.127	0.0127	mg/Kg	☼	07/30/13 13:04	07/30/13 17:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Trifluorotoluene (Surr)	*110*		*49 - 112*	*07/30/13 13:04*	*07/30/13 17:04*	*1*

Client Sample ID: 1HBF-6

Lab Sample ID: 160-3051-6
Date Collected: 07/17/13 08:50
Matrix: Solid
Date Received: 07/19/13 09:15
Percent Solids: 90.0

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Acenaphthylene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Anthracene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[a]anthracene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[b]fluoranthene	**37.3**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[k]fluoranthene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[g,h,i]perylene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Benzo[a]pyrene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Bis(2-chloroethoxy)methane	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Bis(2-chloroethyl)ether	37.1	U	366	37.1	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Bis(2-ethylhexyl) phthalate	50.3	U	366	50.3	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Bromophenyl phenyl ether	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Butyl benzyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Carbazole	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Chloroaniline	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Chloro-3-methylphenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Chloronaphthalene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-6
Date Collected: 07/17/13 08:50
Date Received: 07/19/13 09:15

Lab Sample ID: 160-3051-6
Matrix: Solid
Percent Solids: 90.0

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Chlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Chlorophenyl phenyl ether	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Chrysene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Dibenz(a,h)anthracene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Dibenzofuran	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Di-n-butyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,2-Dichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,3-Dichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,4-Dichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
3,3'-Dichlorobenzidine	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dichlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Diethyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dimethylphenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Dimethyl phthalate	**71.2**	**J M**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4,6-Dinitro-2-methylphenol	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dinitrophenol	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4-Dinitrotoluene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,6-Dinitrotoluene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Di-n-octyl phthalate	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Fluoranthene	**48.8**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Fluorene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachlorobutadiene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachlorocyclopentadiene	366	U	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Hexachloroethane	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Indeno[1,2,3-cd]pyrene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Isophorone	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Methylnaphthalene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Methylphenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
3 & 4 Methylphenol	73.9	U	732	73.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Naphthalene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Nitroaniline	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
3-Nitroaniline	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Nitroaniline	366	U	366	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Nitrobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2-Nitrophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
4-Nitrophenol	366	U Q	1770	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
N-Nitrosodiphenylamine	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
N-Nitrosodi-n-propylamine	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
bis (2-chloroisopropyl) ether	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Pentachlorophenol	366	U	732	366	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Phenanthrene	**47.6**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Phenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Pyrene	**47.1**	**J**	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,2,4-Trichlorobenzene	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4,5-Trichlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
2,4,6-Trichlorophenol	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Aniline	66.5	U	366	66.5	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
1,4-Dioxane	36.9	U	366	36.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Client Sample ID: 1HBF-6

Date Collected: 07/17/13 08:50
Date Received: 07/19/13 09:15

Lab Sample ID: 160-3051-6

Matrix: Solid
Percent Solids: 90.0

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzyl alcohol	57.5	U	366	57.5	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1
Pyridine	73.9	U	732	73.9	ug/Kg	☼	07/30/13 12:29	08/05/13 17:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorophenol (Surr)	*53*		*43 - 103*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
2,4,6-Tribromophenol (Surr)	*53*		*53 - 111*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
Nitrobenzene-d5 (Surr)	*53*		*47 - 105*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
Phenol-d5 (Surr)	*53*		*52 - 99*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
Terphenyl-d14 (Surr)	*48*	*J*	*58 - 124*	*07/30/13 12:29*	*08/05/13 17:35*	*1*
2-Fluorobiphenyl (Surr)	*56*		*55 - 97*	*07/30/13 12:29*	*08/05/13 17:35*	*1*

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: MB 160-63739/1-A
Matrix: Solid
Analysis Batch: 64629

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 63739

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1-Trichloroethane	0.430	U	5.00	0.430	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1,2,2-Tetrachloroethane	0.400	U	5.00	0.400	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1,2-Trichloro-1,2,2-trifluoroethane	1.68	U	5.00	1.68	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1,2-Trichloroethane	0.570	U	5.00	0.570	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1-Dichloroethane	0.390	U	5.00	0.390	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,1-Dichloroethene	1.61	U	5.00	1.61	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2,4-Trichlorobenzene	0.430	U	5.00	0.430	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dibromo-3-Chloropropane	1.45	U	10.0	1.45	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dichlorobenzene	0.280	U	5.00	0.280	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dichloroethane	0.870	U	5.00	0.870	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dichloropropane	0.380	U	5.00	0.380	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,3-Dichlorobenzene	0.280	U	5.00	0.280	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,4-Dichlorobenzene	0.600	U	5.00	0.600	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
2-Butanone (MEK)	1.92	U	20.0	1.92	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
2-Hexanone	1.77	U	20.0	1.77	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
4-Methyl-2-pentanone (MIBK)	0.730	U	20.0	0.730	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Acetone	6.47	U	20.0	6.47	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Benzene	0.250	U	5.00	0.250	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Bromoform	0.370	U	5.00	0.370	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Bromomethane	1.10	U	10.0	1.10	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Carbon disulfide	0.690	U	5.00	0.690	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Carbon tetrachloride	0.510	U	5.00	0.510	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chlorobenzene	0.380	U	5.00	0.380	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Dibromochloromethane	0.410	U	5.00	0.410	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chloroethane	0.520	U	10.0	0.520	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chloroform	0.380	U	5.00	0.380	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Chloromethane	0.650	U	10.0	0.650	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
cis-1,2-Dichloroethene	0.600	U	5.00	0.600	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
cis-1,3-Dichloropropene	0.600	U	5.00	0.600	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Cyclohexane	0.360	U	10.0	0.360	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Bromodichloromethane	0.250	U	5.00	0.250	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Dichlorodifluoromethane	1.31	U	10.0	1.31	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Ethylbenzene	0.300	U	5.00	0.300	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
1,2-Dibromoethane (EDB)	0.700	U	5.00	0.700	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Isopropylbenzene	0.260	U	5.00	0.260	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methyl acetate	1.38	U	25.0	1.38	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methyl tert-butyl ether	0.480	U	5.00	0.480	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methylcyclohexane	0.260	U	10.0	0.260	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Methylene Chloride	1.58	U	5.00	1.58	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
m-Xylene & p-Xylene	0.570	U	5.00	0.570	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
o-Xylene	0.340	U	5.00	0.340	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Styrene	0.350	U	5.00	0.350	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Tetrachloroethene	0.320	U	5.00	0.320	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Toluene	0.700	U	5.00	0.700	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
trans-1,2-Dichloroethene	0.940	U	5.00	0.940	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
trans-1,3-Dichloropropene	0.350	U	5.00	0.350	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Trichloroethene	0.390	U	5.00	0.390	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Trichlorofluoromethane	0.500	U	5.00	0.500	ug/Kg		07/30/13 10:30	07/30/13 12:07	1

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: MB 160-63739/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64629 — **Prep Batch: 63739**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Vinyl chloride	0.430	U	5.00	0.430	ug/Kg		07/30/13 10:30	07/30/13 12:07	1
Xylenes, Total	0.850	U	10.0	0.850	ug/Kg		07/30/13 10:30	07/30/13 12:07	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*94*		*78 - 133*	*07/30/13 10:30*	*07/30/13 12:07*	*1*
Dibromofluoromethane (Surr)	*100*		*83 - 122*	*07/30/13 10:30*	*07/30/13 12:07*	*1*
4-Bromofluorobenzene (Surr)	*104*		*65 - 140*	*07/30/13 10:30*	*07/30/13 12:07*	*1*
1,2-Dichloroethane-d4 (Surr)	*102*		*78 - 132*	*07/30/13 10:30*	*07/30/13 12:07*	*1*

Lab Sample ID: LCS 160-63739/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64629 — **Prep Batch: 63739**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1-Trichloroethane	50.0	52.9		ug/Kg		106	85 - 120
1,1,2,2-Tetrachloroethane	50.0	45.7		ug/Kg		91	81 - 115
1,1,2-Trichloroethane	50.0	48.4		ug/Kg		97	85 - 115
1,1-Dichloroethane	50.0	51.3		ug/Kg		103	85 - 115
1,1-Dichloroethene	50.0	50.8		ug/Kg		102	85 - 117
1,2,4-Trichlorobenzene	50.0	51.7		ug/Kg		103	74 - 126
1,2-Dibromo-3-Chloropropane	50.0	50.6		ug/Kg		101	70 - 126
1,2-Dichlorobenzene	50.0	48.1		ug/Kg		96	84 - 115
1,2-Dichloroethane	50.0	50.6		ug/Kg		101	77 - 122
1,2-Dichloropropane	50.0	51.4		ug/Kg		103	85 - 115
1,3-Dichlorobenzene	50.0	48.7		ug/Kg		97	84 - 115
1,4-Dichlorobenzene	50.0	47.3		ug/Kg		95	85 - 115
2-Butanone (MEK)	50.0	49.5		ug/Kg		99	64 - 130
2-Hexanone	50.0	49.6		ug/Kg		99	72 - 119
4-Methyl-2-pentanone (MIBK)	50.0	49.6		ug/Kg		99	75 - 156
Acetone	50.0	53.0		ug/Kg		106	41 - 140
Benzene	50.0	48.7		ug/Kg		97	85 - 110
Bromoform	50.0	46.9		ug/Kg		94	79 - 121
Bromomethane	50.0	63.7		ug/Kg		127	71 - 127
Carbon disulfide	50.0	51.9		ug/Kg		104	85 - 131
Carbon tetrachloride	50.0	53.4		ug/Kg		107	85 - 123
Chlorobenzene	50.0	48.6		ug/Kg		97	83 - 115
Dibromochloromethane	50.0	48.6		ug/Kg		97	85 - 118
Chloroethane	50.0	61.3		ug/Kg		123	71 - 127
Chloroform	50.0	50.3		ug/Kg		101	85 - 115
Chloromethane	50.0	53.1		ug/Kg		106	72 - 127
cis-1,2-Dichloroethene	50.0	50.1		ug/Kg		100	85 - 115
cis-1,3-Dichloropropene	50.0	51.0		ug/Kg		102	85 - 125
Cyclohexane	50.0	53.9		ug/Kg		108	73 - 140
Bromodichloromethane	50.0	49.6		ug/Kg		99	46 - 132
Dichlorodifluoromethane	50.0	49.7		ug/Kg		99	85 - 115
Ethylbenzene	50.0	51.4		ug/Kg		103	85 - 115
1,2-Dibromoethane (EDB)	50.0	49.1		ug/Kg		98	84 - 115
Isopropylbenzene	50.0	53.0		ug/Kg		106	85 - 127

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 160-63739/2-A
Matrix: Solid
Analysis Batch: 64629

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63739

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Methyl acetate	250	249		ug/Kg		100	70 - 137
Methyl tert-butyl ether	50.0	53.5		ug/Kg		107	71 - 116
Methylcyclohexane	50.0	53.2		ug/Kg		106	84 - 138
Methylene Chloride	50.0	48.9		ug/Kg		98	85 - 115
m-Xylene & p-Xylene	50.0	54.0		ug/Kg		108	85 - 115
o-Xylene	50.0	55.5		ug/Kg		111	85 - 117
Styrene	50.0	51.7		ug/Kg		103	85 - 116
Tetrachloroethene	50.0	49.8		ug/Kg		100	85 - 116
Toluene	50.0	51.5		ug/Kg		103	85 - 115
trans-1,2-Dichloroethene	50.0	51.6		ug/Kg		103	85 - 115
trans-1,3-Dichloropropene	50.0	47.3		ug/Kg		95	85 - 127
Trichloroethene	50.0	49.2		ug/Kg		98	85 - 115
Trichlorofluoromethane	50.0	53.1		ug/Kg		106	77 - 125
Vinyl chloride	50.0	51.1		ug/Kg		102	72 - 124
Xylenes, Total	100	110		ug/Kg		110	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*105*		*78 - 133*
Dibromofluoromethane (Surr)	*101*		*83 - 122*
4-Bromofluorobenzene (Surr)	*101*		*65 - 140*
1,2-Dichloroethane-d4 (Surr)	*103*		*78 - 132*

Lab Sample ID: LCSD 160-63739/3-A
Matrix: Solid
Analysis Batch: 64629

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 63739

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1,1-Trichloroethane	50.0	51.7		ug/Kg		103	85 - 120	2	20
1,1,2,2-Tetrachloroethane	50.0	45.3		ug/Kg		91	81 - 115	1	20
1,1,2-Trichloroethane	50.0	46.6		ug/Kg		93	85 - 115	4	20
1,1-Dichloroethane	50.0	49.3		ug/Kg		99	85 - 115	4	20
1,1-Dichloroethene	50.0	49.3		ug/Kg		99	85 - 117	3	20
1,2,4-Trichlorobenzene	50.0	51.9		ug/Kg		104	74 - 126	0	20
1,2-Dibromo-3-Chloropropane	50.0	47.3		ug/Kg		95	70 - 126	7	20
1,2-Dichlorobenzene	50.0	48.3		ug/Kg		97	84 - 115	0	20
1,2-Dichloroethane	50.0	49.5		ug/Kg		99	77 - 122	2	20
1,2-Dichloropropane	50.0	48.8		ug/Kg		98	85 - 115	5	20
1,3-Dichlorobenzene	50.0	48.3		ug/Kg		97	84 - 115	1	20
1,4-Dichlorobenzene	50.0	47.4		ug/Kg		95	85 - 115	0	20
2-Butanone (MEK)	50.0	64.0	Q	ug/Kg		128	64 - 130	26	20
2-Hexanone	50.0	46.8		ug/Kg		94	72 - 119	6	20
4-Methyl-2-pentanone (MIBK)	50.0	48.0		ug/Kg		96	75 - 156	3	20
Acetone	50.0	53.5		ug/Kg		107	41 - 140	1	20
Benzene	50.0	47.7		ug/Kg		95	85 - 110	2	20
Bromoform	50.0	46.2		ug/Kg		92	79 - 121	2	20
Bromomethane	50.0	59.3		ug/Kg		119	71 - 127	7	20
Carbon disulfide	50.0	48.8		ug/Kg		98	85 - 131	6	20
Carbon tetrachloride	50.0	51.9		ug/Kg		104	85 - 123	3	20

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCSD 160-63739/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64629 — **Prep Batch: 63739**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chlorobenzene	50.0	47.9		ug/Kg		96	83 - 115	1	20
Dibromochloromethane	50.0	47.1		ug/Kg		94	85 - 118	3	20
Chloroethane	50.0	60.4		ug/Kg		121	71 - 127	1	20
Chloroform	50.0	49.3		ug/Kg		99	85 - 115	2	20
Chloromethane	50.0	48.6		ug/Kg		97	72 - 127	9	20
cis-1,2-Dichloroethene	50.0	47.9		ug/Kg		96	85 - 115	5	20
cis-1,3-Dichloropropene	50.0	49.3		ug/Kg		99	85 - 125	3	20
Cyclohexane	50.0	51.2		ug/Kg		102	73 - 140	5	20
Bromodichloromethane	50.0	49.7		ug/Kg		99	46 - 132	0	20
Dichlorodifluoromethane	50.0	49.0		ug/Kg		98	85 - 115	1	20
Ethylbenzene	50.0	51.9		ug/Kg		104	85 - 115	1	20
1,2-Dibromoethane (EDB)	50.0	49.1		ug/Kg		98	84 - 115	0	20
Isopropylbenzene	50.0	52.7		ug/Kg		105	85 - 127	1	20
Methyl acetate	250	242		ug/Kg		97	70 - 137	3	20
Methyl tert-butyl ether	50.0	51.4		ug/Kg		103	71 - 116	4	20
Methylcyclohexane	50.0	51.2		ug/Kg		102	84 - 138	4	20
Methylene Chloride	50.0	47.9		ug/Kg		96	85 - 115	2	20
m-Xylene & p-Xylene	50.0	53.3		ug/Kg		107	85 - 115	1	20
o-Xylene	50.0	54.5		ug/Kg		109	85 - 117	2	20
Styrene	50.0	51.6		ug/Kg		103	85 - 116	0	20
Tetrachloroethene	50.0	50.2		ug/Kg		100	85 - 116	1	20
Toluene	50.0	51.8		ug/Kg		104	85 - 115	1	20
trans-1,2-Dichloroethene	50.0	49.1		ug/Kg		98	85 - 115	5	20
trans-1,3-Dichloropropene	50.0	49.0		ug/Kg		98	85 - 127	4	20
Trichloroethene	50.0	49.2		ug/Kg		98	85 - 115	0	20
Trichlorofluoromethane	50.0	50.1		ug/Kg		100	77 - 125	6	20
Vinyl chloride	50.0	49.0		ug/Kg		98	72 - 124	4	20
Xylenes, Total	100	108		ug/Kg		108	70 - 130	2	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*104*		*78 - 133*
Dibromofluoromethane (Surr)	*98*		*83 - 122*
4-Bromofluorobenzene (Surr)	*101*		*65 - 140*
1,2-Dichloroethane-d4 (Surr)	*99*		*78 - 132*

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: MB 160-63746/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65003 — **Prep Batch: 63746**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Acenaphthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Acenaphthylene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Anthracene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[a]anthracene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[b]fluoranthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[k]fluoranthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 160-63746/1-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 63746

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzo[g,h,i]perylene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzo[a]pyrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Bis(2-chloroethoxy)methane	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Bis(2-chloroethyl)ether	33.4	U	330	33.4	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Bis(2-ethylhexyl) phthalate	45.3	U	330	45.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Bromophenyl phenyl ether	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Butyl benzyl phthalate	40.3	J	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Carbazole	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Chloroaniline	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Chloro-3-methylphenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Chloronaphthalene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Chlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Chlorophenyl phenyl ether	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Chrysene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Dibenz(a,h)anthracene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Dibenzofuran	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Di-n-butyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,2-Dichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,3-Dichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,4-Dichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
3,3'-Dichlorobenzidine	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dichlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Diethyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dimethylphenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Dimethyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4,6-Dinitro-2-methylphenol	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dinitrophenol	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4-Dinitrotoluene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,6-Dinitrotoluene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Di-n-octyl phthalate	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Fluoranthene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Fluorene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachlorobutadiene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachlorocyclopentadiene	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Hexachloroethane	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Indeno[1,2,3-cd]pyrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Isophorone	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Methylnaphthalene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Methylphenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
3 & 4 Methylphenol	66.6	U	660	66.6	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Naphthalene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Nitroaniline	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
3-Nitroaniline	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Nitroaniline	330	U	330	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Nitrobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2-Nitrophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
4-Nitrophenol	330	U	1600	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 160-63746/1-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 63746

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
N-Nitrosodiphenylamine	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
N-Nitrosodi-n-propylamine	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
bis (2-chloroisopropyl) ether	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Pentachlorophenol	330	U	660	330	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Phenanthrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Phenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Pyrene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,2,4-Trichlorobenzene	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4,5-Trichlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
2,4,6-Trichlorophenol	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Aniline	59.9	U	330	59.9	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
1,4-Dioxane	33.3	U	330	33.3	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Benzyl alcohol	51.8	U	330	51.8	ug/Kg		07/30/13 12:29	08/05/13 12:45	1
Pyridine	66.6	U	660	66.6	ug/Kg		07/30/13 12:29	08/05/13 12:45	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2-Fluorophenol (Surr)	*75*		*43 - 103*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
2,4,6-Tribromophenol (Surr)	*61*		*53 - 111*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
Nitrobenzene-d5 (Surr)	*71*		*47 - 105*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
Phenol-d5 (Surr)	*75*		*52 - 99*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
Terphenyl-d14 (Surr)	*72*		*58 - 124*	*07/30/13 12:29*	*08/05/13 12:45*	*1*
2-Fluorobiphenyl (Surr)	*73*		*55 - 97*	*07/30/13 12:29*	*08/05/13 12:45*	*1*

Lab Sample ID: LCS 160-63746/2-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	3330	2360		ug/Kg		71	59 - 91
Acenaphthylene	3330	2440		ug/Kg		73	60 - 93
Anthracene	3330	2380		ug/Kg		71	61 - 95
Benzo[a]anthracene	3330	2660		ug/Kg		80	68 - 112
Benzo[b]fluoranthene	3330	2490		ug/Kg		75	63 - 109
Benzo[k]fluoranthene	3330	2660		ug/Kg		80	66 - 107
Benzo[g,h,i]perylene	3330	2650		ug/Kg		79	61 - 113
Benzo[a]pyrene	3330	2450		ug/Kg		74	63 - 101
Bis(2-chloroethoxy)methane	3330	2310		ug/Kg		69	54 - 91
Bis(2-chloroethyl)ether	3330	2420		ug/Kg		73	49 - 98
Bis(2-ethylhexyl) phthalate	3330	2500		ug/Kg		75	60 - 108
4-Bromophenyl phenyl ether	3330	2520		ug/Kg		76	60 - 101
Butyl benzyl phthalate	3330	2510		ug/Kg		75	59 - 105
Carbazole	3330	2360		ug/Kg		71	61 - 97
4-Chloroaniline	3330	1540		ug/Kg		46	32 - 77
4-Chloro-3-methylphenol	3330	2040		ug/Kg		61	52 - 94
2-Chloronaphthalene	3330	2470		ug/Kg		74	57 - 91
2-Chlorophenol	3330	2160		ug/Kg		65	54 - 91
4-Chlorophenyl phenyl ether	3330	2250		ug/Kg		67	58 - 92
Chrysene	3330	2400		ug/Kg		72	60 - 100

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 160-63746/2-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Dibenz(a,h)anthracene	3330	2680		ug/Kg		80	58 - 114
Dibenzofuran	3330	2260		ug/Kg		68	57 - 88
Di-n-butyl phthalate	3330	2320		ug/Kg		70	60 - 99
1,2-Dichlorobenzene	3330	2240		ug/Kg		67	52 - 91
1,3-Dichlorobenzene	3330	2220		ug/Kg		67	52 - 86
1,4-Dichlorobenzene	3330	2180		ug/Kg		65	53 - 85
3,3'-Dichlorobenzidine	3330	1780		ug/Kg		53	41 - 93
2,4-Dichlorophenol	3330	2040		ug/Kg		61	54 - 87
Diethyl phthalate	3330	2160		ug/Kg		65	58 - 94
2,4-Dimethylphenol	3330	2070		ug/Kg		62	52 - 91
Dimethyl phthalate	3330	2270		ug/Kg		68	59 - 96
4,6-Dinitro-2-methylphenol	3330	2010		ug/Kg		60	20 - 102
2,4-Dinitrophenol	3330	1440	J M	ug/Kg		43	20 - 79
2,4-Dinitrotoluene	3330	2300		ug/Kg		69	59 - 97
2,6-Dinitrotoluene	3330	2320		ug/Kg		70	61 - 95
Di-n-octyl phthalate	3330	2440		ug/Kg		73	60 - 107
Fluoranthene	3330	2350		ug/Kg		71	61 - 98
Fluorene	3330	2310		ug/Kg		69	60 - 93
Hexachlorobenzene	3330	2380		ug/Kg		72	60 - 100
Hexachlorobutadiene	3330	2130		ug/Kg		64	50 - 92
Hexachlorocyclopentadiene	3330	2420		ug/Kg		73	44 - 140
Hexachloroethane	3330	2250		ug/Kg		67	53 - 90
Indeno[1,2,3-cd]pyrene	3330	2560		ug/Kg		77	56 - 123
Isophorone	3330	1730		ug/Kg		52	47 - 97
2-Methylnaphthalene	3330	2170		ug/Kg		65	51 - 92
2-Methylphenol	3330	2220		ug/Kg		67	52 - 94
3 & 4 Methylphenol	3330	2560		ug/Kg		77	64 - 103
Naphthalene	3330	2240		ug/Kg		67	56 - 87
2-Nitroaniline	3330	2260		ug/Kg		68	57 - 97
3-Nitroaniline	3330	2100		ug/Kg		63	48 - 94
4-Nitroaniline	3330	2080		ug/Kg		62	52 - 92
Nitrobenzene	3330	2180		ug/Kg		65	54 - 91
2-Nitrophenol	3330	2190		ug/Kg		66	55 - 92
4-Nitrophenol	3330	1570	J Q	ug/Kg		47	49 - 95
N-Nitrosodiphenylamine	3330	3150		ug/Kg		94	76 - 123
N-Nitrosodi-n-propylamine	3330	2560		ug/Kg		77	56 - 102
bis (2-chloroisopropyl) ether	3330	2750		ug/Kg		83	43 - 103
Pentachlorophenol	3330	1610		ug/Kg		48	45 - 97
Phenanthrene	3330	2480		ug/Kg		74	61 - 95
Phenol	3330	2220		ug/Kg		66	47 - 92
Pyrene	3330	2490		ug/Kg		75	59 - 107
1,2,4-Trichlorobenzene	3330	2200		ug/Kg		66	55 - 88
2,4,5-Trichlorophenol	3330	2020		ug/Kg		61	57 - 96
2,4,6-Trichlorophenol	3330	2110		ug/Kg		63	54 - 94

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2-Fluorophenol (Surr)	*74*		*43 - 103*
2,4,6-Tribromophenol (Surr)	*65*		*53 - 111*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 160-63746/2-A
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 63746

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Nitrobenzene-d5 (Surr)	*70*		*47 - 105*
Phenol-d5 (Surr)	*73*		*52 - 99*
Terphenyl-d14 (Surr)	*64*		*58 - 124*
2-Fluorobiphenyl (Surr)	*75*		*55 - 97*

Lab Sample ID: 160-3051-6 MS
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: 1HBF-6
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Acenaphthene	36.9	U	3700	2420		ug/Kg	☼	65	55 - 93
Acenaphthylene	36.9	U	3700	2450		ug/Kg	☼	66	56 - 92
Anthracene	36.9	U	3700	2420		ug/Kg	☼	65	57 - 97
Benzo[a]anthracene	36.9	U	3700	2700		ug/Kg	☼	73	61 - 116
Benzo[b]fluoranthene	37.3	J	3700	2380		ug/Kg	☼	63	51 - 116
Benzo[k]fluoranthene	36.9	U	3700	2580		ug/Kg	☼	70	53 - 111
Benzo[g,h,i]perylene	36.9	U	3700	3140		ug/Kg	☼	85	33 - 137
Benzo[a]pyrene	36.9	U	3700	2480		ug/Kg	☼	67	50 - 109
Bis(2-chloroethoxy)methane	36.9	U	3700	2310		ug/Kg	☼	62	49 - 93
Bis(2-chloroethyl)ether	37.1	U	3700	2240		ug/Kg	☼	61	42 - 95
Bis(2-ethylhexyl) phthalate	50.3	U	3700	2480		ug/Kg	☼	67	55 - 110
4-Bromophenyl phenyl ether	36.9	U	3700	2480		ug/Kg	☼	67	57 - 102
Butyl benzyl phthalate	36.9	U	3700	2550		ug/Kg	☼	69	54 - 105
Carbazole	36.9	U	3700	2420		ug/Kg	☼	65	58 - 98
4-Chloroaniline	36.9	U	3700	1610		ug/Kg	☼	43	32 - 74
4-Chloro-3-methylphenol	36.9	U	3700	2170		ug/Kg	☼	59	48 - 98
2-Chloronaphthalene	36.9	U	3700	2480		ug/Kg	☼	67	51 - 91
2-Chlorophenol	36.9	U	3700	2020		ug/Kg	☼	55	47 - 88
4-Chlorophenyl phenyl ether	36.9	U	3700	2370		ug/Kg	☼	64	55 - 94
Chrysene	36.9	U	3700	2410		ug/Kg	☼	65	52 - 104
Dibenz(a,h)anthracene	36.9	U	3700	3150		ug/Kg	☼	85	40 - 130
Dibenzofuran	36.9	U	3700	2310		ug/Kg	☼	63	54 - 89
Di-n-butyl phthalate	36.9	U	3700	2440		ug/Kg	☼	66	59 - 101
1,2-Dichlorobenzene	36.9	U	3700	2050		ug/Kg	☼	55	35 - 91
1,3-Dichlorobenzene	36.9	U	3700	2050		ug/Kg	☼	55	32 - 87
1,4-Dichlorobenzene	36.9	U	3700	2010		ug/Kg	☼	54	34 - 86
3,3'-Dichlorobenzidine	366	U	3700	1470	J	ug/Kg	☼	40	10 - 96
2,4-Dichlorophenol	36.9	U	3700	2090		ug/Kg	☼	57	48 - 90
Diethyl phthalate	36.9	U	3700	2350		ug/Kg	☼	63	57 - 97
2,4-Dimethylphenol	36.9	U	3700	2190		ug/Kg	☼	59	36 - 95
Dimethyl phthalate	71.2	J M	3700	2460		ug/Kg	☼	64	56 - 99
4,6-Dinitro-2-methylphenol	366	U	3700	2060		ug/Kg	☼	56	10 - 112
2,4-Dinitrophenol	366	U	3700	1680	J M	ug/Kg	☼	45	10 - 92
2,4-Dinitrotoluene	36.9	U	3700	2510		ug/Kg	☼	68	57 - 100
2,6-Dinitrotoluene	36.9	U	3700	2470		ug/Kg	☼	67	59 - 97
Di-n-octyl phthalate	36.9	U	3700	2500		ug/Kg	☼	68	59 - 110
Fluoranthene	48.8	J	3700	2460		ug/Kg	☼	65	49 - 111
Fluorene	36.9	U	3700	2450		ug/Kg	☼	66	57 - 95

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-3051-6 MS
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: 1HBF-6
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Hexachlorobenzene	36.9	U	3700	2420		ug/Kg	☼	65	54 - 103
Hexachlorobutadiene	36.9	U	3700	1980		ug/Kg	☼	54	36 - 92
Hexachlorocyclopentadiene	366	U	3700	1600	J	ug/Kg	☼	43	10 - 141
Hexachloroethane	36.9	U	3700	2020		ug/Kg	☼	55	26 - 93
Indeno[1,2,3-cd]pyrene	36.9	U	3700	3050		ug/Kg	☼	82	31 - 148
Isophorone	36.9	U	3700	1790		ug/Kg	☼	48	40 - 102
2-Methylnaphthalene	36.9	U	3700	2140		ug/Kg	☼	58	41 - 98
2-Methylphenol	36.9	U	3700	2150		ug/Kg	☼	58	45 - 93
3 & 4 Methylphenol	73.9	U	3700	2540		ug/Kg	☼	69	53 - 103
Naphthalene	36.9	U	3700	2180		ug/Kg	☼	59	46 - 88
2-Nitroaniline	36.9	U	3700	2370		ug/Kg	☼	64	55 - 98
3-Nitroaniline	36.9	U	3700	2350		ug/Kg	☼	64	48 - 95
4-Nitroaniline	366	U	3700	2190		ug/Kg	☼	59	47 - 95
Nitrobenzene	36.9	U	3700	2210		ug/Kg	☼	60	41 - 99
2-Nitrophenol	36.9	U	3700	2120		ug/Kg	☼	57	46 - 95
4-Nitrophenol	366	U Q	3700	1650	J	ug/Kg	☼	45	44 - 103
N-Nitrosodiphenylamine	36.9	U	3700	3220		ug/Kg	☼	87	53 - 127
N-Nitrosodi-n-propylamine	36.9	U	3700	2410		ug/Kg	☼	65	51 - 100
bis (2-chloroisopropyl) ether	36.9	U	3700	2650		ug/Kg	☼	72	37 - 98
Pentachlorophenol	366	U	3700	1490		ug/Kg	☼	40	27 - 104
Phenanthrene	47.6	J	3700	2520		ug/Kg	☼	67	56 - 98
Phenol	36.9	U	3700	2110		ug/Kg	☼	57	44 - 89
Pyrene	47.1	J	3700	2490		ug/Kg	☼	66	46 - 110
1,2,4-Trichlorobenzene	36.9	U	3700	2170		ug/Kg	☼	59	41 - 90
2,4,5-Trichlorophenol	36.9	U	3700	2100		ug/Kg	☼	57	53 - 98
2,4,6-Trichlorophenol	36.9	U	3700	2190		ug/Kg	☼	59	49 - 94

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2-Fluorophenol (Surr)	*63*		*43 - 103*
2,4,6-Tribromophenol (Surr)	*64*		*53 - 111*
Nitrobenzene-d5 (Surr)	*64*		*47 - 105*
Phenol-d5 (Surr)	*64*		*52 - 99*
Terphenyl-d14 (Surr)	*56*	*J*	*58 - 124*
2-Fluorobiphenyl (Surr)	*69*		*55 - 97*

Lab Sample ID: 160-3051-6 MSD
Matrix: Solid
Analysis Batch: 65003

Client Sample ID: 1HBF-6
Prep Type: Total/NA
Prep Batch: 63746

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Acenaphthene	36.9	U	3700	2540		ug/Kg	☼	69	55 - 93	5	30
Acenaphthylene	36.9	U	3700	2580		ug/Kg	☼	70	56 - 92	5	30
Anthracene	36.9	U	3700	2570		ug/Kg	☼	70	57 - 97	6	30
Benzo[a]anthracene	36.9	U	3700	2930		ug/Kg	☼	79	61 - 116	8	30
Benzo[b]fluoranthene	37.3	J	3700	2550		ug/Kg	☼	68	51 - 116	7	30
Benzo[k]fluoranthene	36.9	U	3700	2830		ug/Kg	☼	77	53 - 111	9	30
Benzo[g,h,i]perylene	36.9	U	3700	3460		ug/Kg	☼	93	33 - 137	10	30
Benzo[a]pyrene	36.9	U	3700	2700		ug/Kg	☼	73	50 - 109	8	30

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-3051-6 MSD | **Client Sample ID: 1HBF-6**
Matrix: Solid | **Prep Type: Total/NA**
Analysis Batch: 65003 | **Prep Batch: 63746**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Bis(2-chloroethoxy)methane	36.9	U	3700	2520		ug/Kg	☼	68	49 - 93	9	30
Bis(2-chloroethyl)ether	37.1	U	3700	2460		ug/Kg	☼	67	42 - 95	9	30
Bis(2-ethylhexyl) phthalate	50.3	U	3700	2750		ug/Kg	☼	74	55 - 110	10	30
4-Bromophenyl phenyl ether	36.9	U	3700	2680		ug/Kg	☼	72	57 - 102	8	30
Butyl benzyl phthalate	36.9	U	3700	2760		ug/Kg	☼	75	54 - 105	8	30
Carbazole	36.9	U	3690	2610		ug/Kg	☼	71	58 - 98	8	30
4-Chloroaniline	36.9	U	3700	1690		ug/Kg	☼	46	32 - 74	5	30
4-Chloro-3-methylphenol	36.9	U	3700	2380		ug/Kg	☼	64	48 - 98	9	30
2-Chloronaphthalene	36.9	U	3700	2570		ug/Kg	☼	70	51 - 91	4	30
2-Chlorophenol	36.9	U	3700	2240		ug/Kg	☼	61	47 - 88	10	30
4-Chlorophenyl phenyl ether	36.9	U	3700	2480		ug/Kg	☼	67	55 - 94	4	30
Chrysene	36.9	U	3700	2600		ug/Kg	☼	70	52 - 104	8	30
Dibenz(a,h)anthracene	36.9	U	3700	3500		ug/Kg	☼	95	40 - 130	11	30
Dibenzofuran	36.9	U	3700	2440		ug/Kg	☼	66	54 - 89	5	30
Di-n-butyl phthalate	36.9	U	3700	2600		ug/Kg	☼	70	59 - 101	6	30
1,2-Dichlorobenzene	36.9	U	3700	2230		ug/Kg	☼	60	35 - 91	8	30
1,3-Dichlorobenzene	36.9	U	3700	2220		ug/Kg	☼	60	32 - 87	8	30
1,4-Dichlorobenzene	36.9	U	3700	2210		ug/Kg	☼	60	34 - 86	9	30
3,3'-Dichlorobenzidine	366	U	3700	1610	J	ug/Kg	☼	44	10 - 96	9	30
2,4-Dichlorophenol	36.9	U	3700	2260		ug/Kg	☼	61	48 - 90	7	30
Diethyl phthalate	36.9	U	3700	2490		ug/Kg	☼	67	57 - 97	6	30
2,4-Dimethylphenol	36.9	U	3700	2330		ug/Kg	☼	63	36 - 95	6	30
Dimethyl phthalate	71.2	J M	3700	2600		ug/Kg	☼	68	56 - 99	6	30
4,6-Dinitro-2-methylphenol	366	U	3700	2140		ug/Kg	☼	58	10 - 112	4	30
2,4-Dinitrophenol	366	U	3700	1610	J	ug/Kg	☼	43	10 - 92	4	30
2,4-Dinitrotoluene	36.9	U	3700	2630		ug/Kg	☼	71	57 - 100	5	30
2,6-Dinitrotoluene	36.9	U	3700	2590		ug/Kg	☼	70	59 - 97	5	30
Di-n-octyl phthalate	36.9	U	3700	2690		ug/Kg	☼	73	59 - 110	7	30
Fluoranthene	48.8	J	3700	2660		ug/Kg	☼	71	49 - 111	8	30
Fluorene	36.9	U	3700	2540		ug/Kg	☼	69	57 - 95	4	30
Hexachlorobenzene	36.9	U	3700	2610		ug/Kg	☼	71	54 - 103	8	30
Hexachlorobutadiene	36.9	U	3700	2180		ug/Kg	☼	59	36 - 92	10	30
Hexachlorocyclopentadiene	366	U	3700	1690	J	ug/Kg	☼	46	10 - 141	5	30
Hexachloroethane	36.9	U	3700	2270		ug/Kg	☼	61	26 - 93	12	30
Indeno[1,2,3-cd]pyrene	36.9	U	3700	3490		ug/Kg	☼	94	31 - 148	13	30
Isophorone	36.9	U	3700	1910		ug/Kg	☼	52	40 - 102	6	30
2-Methylnaphthalene	36.9	U	3700	2330		ug/Kg	☼	63	41 - 98	8	30
2-Methylphenol	36.9	U	3700	2290		ug/Kg	☼	62	45 - 93	6	30
3 & 4 Methylphenol	73.9	U	3700	2730		ug/Kg	☼	74	53 - 103	7	30
Naphthalene	36.9	U	3700	2340		ug/Kg	☼	63	46 - 88	7	30
2-Nitroaniline	36.9	U	3700	2570		ug/Kg	☼	69	55 - 98	8	30
3-Nitroaniline	36.9	U	3700	2440		ug/Kg	☼	66	48 - 95	4	30
4-Nitroaniline	366	U	3700	2360		ug/Kg	☼	64	47 - 95	8	30
Nitrobenzene	36.9	U	3700	2400		ug/Kg	☼	65	41 - 99	8	30
2-Nitrophenol	36.9	U	3700	2300		ug/Kg	☼	62	46 - 95	8	30
4-Nitrophenol	366	U Q	3700	1910		ug/Kg	☼	52	44 - 103	15	30
N-Nitrosodiphenylamine	36.9	U	3700	3420		ug/Kg	☼	93	53 - 127	6	30
N-Nitrosodi-n-propylamine	36.9	U	3700	2580		ug/Kg	☼	70	51 - 100	7	30

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-3051-6 MSD — **Client Sample ID: 1HBF-6**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65003 — **Prep Batch: 63746**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
bis (2-chloroisopropyl) ether	36.9	U	3700	2850		ug/Kg	☼	77	37 - 98	8	30
Pentachlorophenol	366	U	3700	1760		ug/Kg	☼	48	27 - 104	17	30
Phenanthrene	47.6	J	3700	2690		ug/Kg	☼	71	56 - 98	7	30
Phenol	36.9	U	3700	2290		ug/Kg	☼	62	44 - 89	8	30
Pyrene	47.1	J	3700	2730		ug/Kg	☼	73	46 - 110	9	30
1,2,4-Trichlorobenzene	36.9	U	3690	2310		ug/Kg	☼	63	41 - 90	6	30
2,4,5-Trichlorophenol	36.9	U	3700	2270		ug/Kg	☼	61	53 - 98	8	30
2,4,6-Trichlorophenol	36.9	U	3700	2340		ug/Kg	☼	63	49 - 94	7	30

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
2-Fluorophenol (Surr)	*69*		*43 - 103*
2,4,6-Tribromophenol (Surr)	*66*		*53 - 111*
Nitrobenzene-d5 (Surr)	*69*		*47 - 105*
Phenol-d5 (Surr)	*68*		*52 - 99*
Terphenyl-d14 (Surr)	*59*		*58 - 124*
2-Fluorobiphenyl (Surr)	*70*		*55 - 97*

Method: 8015B - Gasoline Range Organics - (GC)

Lab Sample ID: MB 160-63753/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (C6-C12)	0.0217	J	0.100	0.0100	mg/Kg		07/30/13 13:04	07/30/13 15:23	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Trifluorotoluene (Surr)	*107*		*49 - 112*	*07/30/13 13:04*	*07/30/13 15:23*	*1*

Lab Sample ID: LCS 160-63753/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Gasoline Range Organics (C6-C12)	1.00	0.998	M	mg/Kg		100	64 - 133

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Trifluorotoluene (Surr)	*100*	*M*	*49 - 112*

Lab Sample ID: LCSD 160-63753/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Gasoline Range Organics (C6-C12)	1.00	1.02	M	mg/Kg		102	64 - 133	2	20

Method: 8015B - Gasoline Range Organics - (GC) (Continued)

Lab Sample ID: LCSD 160-63753/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64066 — **Prep Batch: 63753**

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
Trifluorotoluene (Surr)	102	M	49 - 112

Method: 8015B - Diesel Range Organics (DRO) (GC)

Lab Sample ID: MB 160-61811/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics [C10-C28]	0.333	U	25.0	0.333	mg/Kg		07/22/13 16:48	07/23/13 11:50	1

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	107		49 - 133	07/22/13 16:48	07/23/13 11:50	1

Lab Sample ID: LCS 160-61811/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Diesel Range Organics [C10-C28]	83.3	57.3	M	mg/Kg		69	48 - 102

Surrogate	LCS %Recovery	LCS Qualifier	Limits
o-Terphenyl	86	M	49 - 133

Lab Sample ID: 160-3051-4 MS — **Client Sample ID: 1HBF-4**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Diesel Range Organics [C10-C28]	0.368	U	92.1	96.4	M	mg/Kg	☼	105	18 - 140

Surrogate	MS %Recovery	MS Qualifier	Limits
o-Terphenyl	106	M	49 - 133

Lab Sample ID: 160-3051-4 MSD — **Client Sample ID: 1HBF-4**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62106 — **Prep Batch: 61811**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Diesel Range Organics [C10-C28]	0.368	U	92.5	94.2	M	mg/Kg	☼	102	18 - 140	2	30

Surrogate	MSD %Recovery	MSD Qualifier	Limits
o-Terphenyl	103	M	49 - 133

Method: 8081B - Organochlorine Pesticides (GC)

Lab Sample ID: MB 160-62920/1-A
Matrix: Solid
Analysis Batch: 63749

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 62920

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aldrin	0.306	U	1.70	0.306	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
alpha-BHC	0.185	U	2.00	0.185	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
beta-BHC	0.300	U	1.70	0.300	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
delta-BHC	0.242	U	1.70	0.242	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
gamma-BHC (Lindane)	0.168	U	1.70	0.168	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
alpha-Chlordane	0.567	U	1.70	0.567	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
gamma-Chlordane	0.158	U	1.70	0.158	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
4,4'-DDD	0.221	U	1.70	0.221	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
4,4'-DDE	0.390	U	1.70	0.390	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
4,4'-DDT	0.628	U	1.70	0.628	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Dieldrin	0.215	U	1.70	0.215	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endosulfan I	0.570	U	1.70	0.570	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endosulfan II	0.235	U	1.70	0.235	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endosulfan sulfate	0.340	U	1.70	0.340	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endrin	0.158	U	1.70	0.158	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endrin aldehyde	0.389	U	1.70	0.389	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Endrin ketone	0.417	U	1.70	0.417	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Heptachlor	0.204	U	2.00	0.204	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Heptachlor epoxide	0.429	U	1.70	0.429	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Methoxychlor	0.719	U	3.30	0.719	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Toxaphene	15.2	U	67.0	15.2	ug/Kg		07/25/13 15:00	07/30/13 02:41	1
Technical Chlordane	3.73	U	17.0	3.73	ug/Kg		07/25/13 15:00	07/30/13 02:41	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*76*		*29 - 150*	*07/25/13 15:00*	*07/30/13 02:41*	*1*
Tetrachloro-m-xylene	*87*		*41 - 125*	*07/25/13 15:00*	*07/30/13 02:41*	*1*

Lab Sample ID: LCS 160-62920/2-A
Matrix: Solid
Analysis Batch: 63749

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 62920

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aldrin	16.7	13.8		ug/Kg		83	51 - 116
alpha-BHC	16.7	13.9		ug/Kg		83	50 - 117
beta-BHC	16.7	13.5		ug/Kg		81	50 - 113
delta-BHC	16.7	14.6		ug/Kg		88	53 - 121
gamma-BHC (Lindane)	16.7	13.9		ug/Kg		83	50 - 114
alpha-Chlordane	16.7	14.7		ug/Kg		88	55 - 119
gamma-Chlordane	16.7	14.1		ug/Kg		85	52 - 120
4,4'-DDD	16.7	15.4		ug/Kg		92	53 - 134
4,4'-DDE	16.7	14.6		ug/Kg		88	55 - 123
4,4'-DDT	16.7	15.8		ug/Kg		95	57 - 138
Dieldrin	16.7	14.3		ug/Kg		86	54 - 124
Endosulfan I	16.7	8.33		ug/Kg		50	38 - 99
Endosulfan II	16.7	9.43		ug/Kg		57	42 - 105
Endosulfan sulfate	16.7	14.3		ug/Kg		86	54 - 126
Endrin	16.7	14.6	M	ug/Kg		88	55 - 124
Endrin aldehyde	16.7	13.2		ug/Kg		79	50 - 116

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: LCS 160-62920/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 63749 — **Prep Batch: 62920**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Endrin ketone	16.7	14.6		ug/Kg		87	53 - 129
Heptachlor	16.7	13.0		ug/Kg		78	40 - 140
Heptachlor epoxide	16.7	14.1		ug/Kg		85	53 - 118
Methoxychlor	16.7	16.8		ug/Kg		101	54 - 140

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*82*		*29 - 150*
Tetrachloro-m-xylene	*88*		*41 - 125*

Lab Sample ID: LCSD 160-62920/3-A — **Client Sample ID: Lab Control Sample Dup**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 63749 — **Prep Batch: 62920**

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aldrin	16.7	13.4		ug/Kg		80	51 - 116	3	30
alpha-BHC	16.7	13.6		ug/Kg		82	50 - 117	2	30
beta-BHC	16.7	12.8		ug/Kg		77	50 - 113	5	30
delta-BHC	16.7	13.6		ug/Kg		82	53 - 121	7	30
gamma-BHC (Lindane)	16.7	13.6		ug/Kg		81	50 - 114	2	30
alpha-Chlordane	16.7	13.9		ug/Kg		84	55 - 119	5	30
gamma-Chlordane	16.7	13.3		ug/Kg		80	52 - 120	6	30
4,4'-DDD	16.7	14.2		ug/Kg		85	53 - 134	8	30
4,4'-DDE	16.7	13.7		ug/Kg		82	55 - 123	7	30
4,4'-DDT	16.7	14.2		ug/Kg		85	57 - 138	11	30
Dieldrin	16.7	13.5		ug/Kg		81	54 - 124	6	30
Endosulfan I	16.7	7.78		ug/Kg		47	38 - 99	7	30
Endosulfan II	16.7	8.72		ug/Kg		52	42 - 105	8	30
Endosulfan sulfate	16.7	13.2		ug/Kg		79	54 - 126	8	30
Endrin	16.7	13.6		ug/Kg		82	55 - 124	7	30
Endrin aldehyde	16.7	12.3		ug/Kg		74	50 - 116	7	30
Endrin ketone	16.7	13.1		ug/Kg		79	53 - 129	11	30
Heptachlor	16.7	12.9		ug/Kg		77	40 - 140	1	30
Heptachlor epoxide	16.7	13.4		ug/Kg		80	53 - 118	5	30
Methoxychlor	16.7	14.1		ug/Kg		84	54 - 140	18	30

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*70*		*29 - 150*
Tetrachloro-m-xylene	*84*		*41 - 125*

Method: 8151A - Herbicides (GC)

Lab Sample ID: MB 160-65908/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4,5-T	7.93	U	20.0	7.93	ug/Kg		08/09/13 15:17	08/13/13 22:07	1

Method: 8151A - Herbicides (GC) (Continued)

Lab Sample ID: MB 160-65908/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	22.0	U	80.0	22.0	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
2,4-DB	43.8	U	80.0	43.8	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dalapon	38.5	U	40.0	38.5	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dinoseb	13.6	U	25.0	13.6	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dicamba	3.93	U	40.0	3.93	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Dichlorprop	23.4	U	80.0	23.4	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
MCPA	3070	U	8000	3070	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
Silvex (2,4,5-TP)	3.28	U	20.0	3.28	ug/Kg		08/09/13 15:17	08/13/13 22:07	1
MCPP	4800	U	8000	4800	ug/Kg		08/09/13 15:17	08/13/13 22:07	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*82*		*50 - 150*	*08/09/13 15:17*	*08/13/13 22:07*	*1*

Lab Sample ID: LCS 160-65908/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4,5-T	50.0	37.2		ug/Kg		74	57 - 140
2,4-D	500	382		ug/Kg		76	68 - 140
2,4-DB	500	387		ug/Kg		77	54 - 140
Dalapon	1250	742		ug/Kg		59	25 - 121
Dinoseb	250	67.5		ug/Kg		27	10 - 108
Dicamba	50.0	38.0	J	ug/Kg		76	62 - 140
Dichlorprop	500	443		ug/Kg		89	59 - 140
MCPA	50200	43200		ug/Kg		86	48 - 140
Silvex (2,4,5-TP)	50.0	40.6		ug/Kg		81	51 - 140
MCPP	50100	40900		ug/Kg		82	45 - 140

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*79*		*50 - 150*

Lab Sample ID: 160-3051-2 MS — **Client Sample ID: 1HBF-2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 66551 — **Prep Batch: 65908**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4,5-T	8.79	U H	55.4	41.4		ug/Kg	☼	75	36 - 150
2,4-D	24.4	U H	554	441		ug/Kg	☼	80	29 - 150
2,4-DB	48.6	U H	554	470		ug/Kg	☼	85	35 - 150
Dalapon	42.7	U H	1390	732		ug/Kg	☼	53	14 - 129
Dinoseb	15.1	U H J	277	22.7	J	ug/Kg	☼	8	10 - 108
Dicamba	4.36	U H	55.4	49.8		ug/Kg	☼	90	33 - 150
Dichlorprop	25.9	U H	554	531		ug/Kg	☼	96	27 - 150
MCPA	3400	U H	55700	47600		ug/Kg	☼	85	43 - 150
Silvex (2,4,5-TP)	3.64	U H	55.4	48.9		ug/Kg	☼	88	50 - 150
MCPP	5320	U H	55600	48400		ug/Kg	☼	87	39 - 150

Method: 8151A - Herbicides (GC) (Continued)

Lab Sample ID: 160-3051-2 MS
Matrix: Solid
Analysis Batch: 66551

Client Sample ID: 1HBF-2
Prep Type: Total/NA
Prep Batch: 65908

Surrogate	MS %Recovery	MS Qualifier	Limits
2,4-Dichlorophenylacetic acid	*91*		*50 - 150*

Lab Sample ID: 160-3051-2 MSD
Matrix: Solid
Analysis Batch: 66551

Client Sample ID: 1HBF-2
Prep Type: Total/NA
Prep Batch: 65908

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2,4,5-T	8.79	U H	55.5	45.1		ug/Kg	☼	81	36 - 150	9	30
2,4-D	24.4	U H	555	504		ug/Kg	☼	91	29 - 150	13	30
2,4-DB	48.6	U H	555	546		ug/Kg	☼	98	35 - 150	15	30
Dalapon	42.7	U H	1390	892		ug/Kg	☼	64	14 - 129	20	30
Dinoseb	15.1	U H J	278	33.4	J	ug/Kg	☼	12	10 - 108	38	30
Dicamba	4.36	U H	55.5	47.9		ug/Kg	☼	86	33 - 150	4	30
Dichlorprop	25.9	U H	555	558		ug/Kg	☼	100	27 - 150	5	30
MCPA	3400	U H	55800	49900		ug/Kg	☼	89	43 - 150	5	30
Silvex (2,4,5-TP)	3.64	U H	55.5	50.5		ug/Kg	☼	91	50 - 150	3	30
MCPP	5320	U H	55700	51000		ug/Kg	☼	92	39 - 150	5	30

Surrogate	MSD %Recovery	MSD Qualifier	Limits
2,4-Dichlorophenylacetic acid	*90*		*50 - 150*

Method: 6010C - Metals (ICP)

Lab Sample ID: MB 160-65521/1-A
Matrix: Solid
Analysis Batch: 65968

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 65521

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	12.7	U	18.1	12.7	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Antimony	0.580	U	0.905	0.580	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Arsenic	0.287	U	0.905	0.287	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Barium	0.226	U	4.53	0.226	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Beryllium	0.153	U	0.453	0.153	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Cadmium	0.0905	U	0.453	0.0905	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Calcium	12.0	U	226	12.0	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Chromium	0.278	U	0.905	0.278	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Cobalt	0.850	U	4.53	0.850	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Copper	0.658	U	2.26	0.658	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Iron	2.69	U	9.05	2.69	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Lead	0.156	U	0.905	0.156	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Magnesium	7.52	U	90.5	7.52	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Manganese	0.139	U	0.905	0.139	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Nickel	0.204	U	3.62	0.204	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Potassium	305	U	453	305	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Selenium	0.262	U	1.36	0.262	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Silver	0.212	U	0.905	0.212	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Sodium	42.6	U	90.5	42.6	mg/Kg		08/08/13 09:12	08/09/13 18:42	1

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: MB 160-65521/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Thallium	1.37	U	1.81	1.37	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Vanadium	1.14	U	4.53	1.14	mg/Kg		08/08/13 09:12	08/09/13 18:42	1
Zinc	1.79	U	4.53	1.79	mg/Kg		08/08/13 09:12	08/09/13 18:42	1

Lab Sample ID: LCS 160-65521/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	9780	5650		mg/Kg		58	44 - 155
Antimony	121	61.7		mg/Kg		51	21 - 251
Arsenic	109	95.9		mg/Kg		88	70 - 131
Barium	325	285		mg/Kg		88	74 - 125
Beryllium	92.1	81.6		mg/Kg		89	74 - 126
Cadmium	110	98.7		mg/Kg		90	73 - 139
Calcium	6700	5660		mg/Kg		84	74 - 125
Chromium	93.4	82.0		mg/Kg		88	69 - 130
Cobalt	133	126		mg/Kg		94	74 - 125
Copper	74.7	65.0		mg/Kg		87	73 - 126
Iron	13100	9380		mg/Kg		72	32 - 167
Lead	152	137		mg/Kg		90	73 - 126
Magnesium	2980	2280		mg/Kg		77	66 - 134
Manganese	443	374		mg/Kg		84	77 - 124
Nickel	109	100		mg/Kg		92	72 - 126
Potassium	2770	1940		mg/Kg		70	61 - 138
Selenium	207	176		mg/Kg		85	69 - 131
Silver	51.9	43.6		mg/Kg		84	66 - 133
Sodium	724	613		mg/Kg		85	56 - 144
Thallium	171	163		mg/Kg		95	68 - 131
Vanadium	110	89.4		mg/Kg		81	67 - 132
Zinc	299	264		mg/Kg		88	71 - 128

Lab Sample ID: 160-3051-3 MS — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	3510	J	927	7800	J	mg/Kg	☼	463	75 - 125
Antimony	1.28	U J	46.4	25.8	J	mg/Kg	☼	56	75 - 125
Arsenic	3.33		92.7	90.7		mg/Kg	☼	94	75 - 125
Barium	18.0		92.7	112		mg/Kg	☼	101	75 - 125
Beryllium	0.339	U	92.7	87.8		mg/Kg	☼	95	75 - 125
Cadmium	0.200	U	92.7	89.6		mg/Kg	☼	97	75 - 125
Calcium	2070	J	927	2000	J	mg/Kg	☼	-8	75 - 125
Chromium	14.4		92.7	120		mg/Kg	☼	113	75 - 125
Cobalt	4.51	J	92.7	99.9		mg/Kg	☼	103	75 - 125
Copper	5.59		92.7	95.2		mg/Kg	☼	97	75 - 125
Iron	10500	J	927	15900	4	mg/Kg	☼	575	75 - 125
Lead	7.07		92.7	101		mg/Kg	☼	101	75 - 125

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: 160-3051-3 MS — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Magnesium	845	J	927	2460	J	mg/Kg	☼	174	75 - 125
Manganese	86.8		92.7	182		mg/Kg	☼	103	75 - 125
Nickel	5.29	J	92.7	102		mg/Kg	☼	104	75 - 125
Potassium	885	J	927	3000	J	mg/Kg	☼	228	75 - 125
Selenium	0.579	U	92.7	86.7		mg/Kg	☼	94	75 - 125
Silver	0.469	U J	9.27	7.14		mg/Kg	☼	77	75 - 125
Sodium	94.4	U	927	922		mg/Kg	☼	99	75 - 125
Thallium	3.02	U	18.5	19.5		mg/Kg	☼	105	75 - 125
Vanadium	15.1		92.7	109		mg/Kg	☼	101	75 - 125
Zinc	19.1		92.7	115		mg/Kg	☼	104	75 - 125

Lab Sample ID: 160-3051-3 MSD — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 65968 — **Prep Batch: 65521**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	3510	J	994	7010	J	mg/Kg	☼	353	75 - 125	11	30
Antimony	1.28	U J	49.7	30.2	J	mg/Kg	☼	61	75 - 125	16	30
Arsenic	3.33		99.4	93.9		mg/Kg	☼	91	75 - 125	3	30
Barium	18.0		99.4	114		mg/Kg	☼	97	75 - 125	2	30
Beryllium	0.339	U	99.4	92.5		mg/Kg	☼	93	75 - 125	5	30
Cadmium	0.200	U	99.4	92.9		mg/Kg	☼	93	75 - 125	4	30
Calcium	2070	J	994	2140	J	mg/Kg	☼	7	75 - 125	7	30
Chromium	14.4		99.4	118		mg/Kg	☼	104	75 - 125	2	30
Cobalt	4.51	J	99.4	103		mg/Kg	☼	99	75 - 125	3	30
Copper	5.59		99.4	97.8		mg/Kg	☼	93	75 - 125	3	30
Iron	10500	J	994	14600	4	mg/Kg	☼	406	75 - 125	9	30
Lead	7.07		99.4	101		mg/Kg	☼	95	75 - 125	0	30
Magnesium	845	J	994	2310	J	mg/Kg	☼	148	75 - 125	6	30
Manganese	86.8		99.4	194		mg/Kg	☼	108	75 - 125	6	30
Nickel	5.29	J	99.4	104		mg/Kg	☼	99	75 - 125	2	30
Potassium	885	J	994	2960	J	mg/Kg	☼	209	75 - 125	1	30
Selenium	0.579	U	99.4	90.2		mg/Kg	☼	91	75 - 125	4	30
Silver	0.469	U J	9.94	7.35	J	mg/Kg	☼	74	75 - 125	3	30
Sodium	94.4	U	994	969		mg/Kg	☼	97	75 - 125	5	30
Thallium	3.02	U	19.9	20.3		mg/Kg	☼	102	75 - 125	4	30
Vanadium	15.1		99.4	111		mg/Kg	☼	97	75 - 125	2	30
Zinc	19.1		99.4	113		mg/Kg	☼	95	75 - 125	2	30

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique)

Lab Sample ID: MB 160-63941/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0104	U	0.0313	0.0104	mg/Kg		07/31/13 10:00	08/01/13 06:33	1

Method: 7471B - Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique) (Continued)

Lab Sample ID: LCS 160-63941/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	16.3	16.9		mg/Kg		103	51 - 148

Lab Sample ID: 160-3051-3 MS — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.0481		0.857	0.971		mg/Kg	☼	108	80 - 120

Lab Sample ID: 160-3051-3 MSD — **Client Sample ID: 1HBF-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 64289 — **Prep Batch: 63941**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	0.0481		0.882	1.01		mg/Kg	☼	109	80 - 120	4	30

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-62495/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62943 — **Prep Batch: 62495**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.04266	U	0.102	0.102		0.208	pCi/g	07/24/13 15:46	07/25/13 07:27	1
Cesium-137	-0.003458	U	0.0292	0.0292	0.200	0.0571	pCi/g	07/24/13 15:46	07/25/13 07:27	1
Thorium-232	0.04266	U	0.102	0.102		0.208	pCi/g	07/24/13 15:46	07/25/13 07:27	1

Other Detected Radionuclides	*MB Result*	*MB Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Other Detected Radionuclide	*None*						*pCi/g*	*07/24/13 15:46*	*07/25/13 07:27*	*1*

Lab Sample ID: LCS 160-62495/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 62944 — **Prep Batch: 62495**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	103.2		10.8		1.16	pCi/g	106	87 - 116
Cesium-137	31.7	31.51		3.36	0.200	0.325	pCi/g	99	87 - 120
Cobalt-60	25.0	25.05		2.57		0.188	pCi/g	100	87 - 115

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: 160-3051-1 DU
Matrix: Solid
Analysis Batch: 62943

Client Sample ID: 1HBF-1
Prep Type: Total/NA
Prep Batch: 62495

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium-228	0.351		0.4107		0.152		0.160	pCi/g	0.16	1
Cesium-137	0.0239	U	0.01356	U	0.0336	0.200	0.0590	pCi/g	0.11	1
Thorium-232	0.351		0.4107		0.152		0.160	pCi/g	0.16	1

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

GC/MS VOA

Prep Batch: 63739

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	5035	
LCS 160-63739/2-A	Lab Control Sample	Total/NA	Solid	5035	
LCSD 160-63739/3-A	Lab Control Sample Dup	Total/NA	Solid	5035	
MB 160-63739/1-A	Method Blank	Total/NA	Solid	5035	

Analysis Batch: 64629

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	8260C	63739
LCS 160-63739/2-A	Lab Control Sample	Total/NA	Solid	8260C	63739
LCSD 160-63739/3-A	Lab Control Sample Dup	Total/NA	Solid	8260C	63739
MB 160-63739/1-A	Method Blank	Total/NA	Solid	8260C	63739

GC/MS Semi VOA

Prep Batch: 63746

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-6	1HBF-6	Total/NA	Solid	3550C	
160-3051-6 MS	1HBF-6	Total/NA	Solid	3550C	
160-3051-6 MSD	1HBF-6	Total/NA	Solid	3550C	
LCS 160-63746/2-A	Lab Control Sample	Total/NA	Solid	3550C	
MB 160-63746/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 65003

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-6	1HBF-6	Total/NA	Solid	8270D	63746
160-3051-6 MS	1HBF-6	Total/NA	Solid	8270D	63746
160-3051-6 MSD	1HBF-6	Total/NA	Solid	8270D	63746
LCS 160-63746/2-A	Lab Control Sample	Total/NA	Solid	8270D	63746
MB 160-63746/1-A	Method Blank	Total/NA	Solid	8270D	63746

GC VOA

Prep Batch: 63753

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	5030B	
LCS 160-63753/2-A	Lab Control Sample	Total/NA	Solid	5030B	
LCSD 160-63753/3-A	Lab Control Sample Dup	Total/NA	Solid	5030B	
MB 160-63753/1-A	Method Blank	Total/NA	Solid	5030B	

Analysis Batch: 64066

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-5	1HBF-5	Total/NA	Solid	8015B	63753
LCS 160-63753/2-A	Lab Control Sample	Total/NA	Solid	8015B	63753
LCSD 160-63753/3-A	Lab Control Sample Dup	Total/NA	Solid	8015B	63753
MB 160-63753/1-A	Method Blank	Total/NA	Solid	8015B	63753

QC Association Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

GC Semi VOA

Prep Batch: 61811

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	3550C	
160-3051-4 MS	1HBF-4	Total/NA	Solid	3550C	
160-3051-4 MSD	1HBF-4	Total/NA	Solid	3550C	
LCS 160-61811/2-A	Lab Control Sample	Total/NA	Solid	3550C	
MB 160-61811/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 62106

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	8015B	61811
160-3051-4 MS	1HBF-4	Total/NA	Solid	8015B	61811
160-3051-4 MSD	1HBF-4	Total/NA	Solid	8015B	61811
LCS 160-61811/2-A	Lab Control Sample	Total/NA	Solid	8015B	61811
MB 160-61811/1-A	Method Blank	Total/NA	Solid	8015B	61811

Prep Batch: 62920

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	3550C	
LCS 160-62920/2-A	Lab Control Sample	Total/NA	Solid	3550C	
LCSD 160-62920/3-A	Lab Control Sample Dup	Total/NA	Solid	3550C	
MB 160-62920/1-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 63749

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-4	1HBF-4	Total/NA	Solid	8081B	62920
LCS 160-62920/2-A	Lab Control Sample	Total/NA	Solid	8081B	62920
LCSD 160-62920/3-A	Lab Control Sample Dup	Total/NA	Solid	8081B	62920
MB 160-62920/1-A	Method Blank	Total/NA	Solid	8081B	62920

Prep Batch: 65908

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-2	1HBF-2	Total/NA	Solid	8151A	
160-3051-2 MS	1HBF-2	Total/NA	Solid	8151A	
160-3051-2 MSD	1HBF-2	Total/NA	Solid	8151A	
LCS 160-65908/2-A	Lab Control Sample	Total/NA	Solid	8151A	
MB 160-65908/1-A	Method Blank	Total/NA	Solid	8151A	

Analysis Batch: 66551

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-2	1HBF-2	Total/NA	Solid	8151A	65908
160-3051-2 MS	1HBF-2	Total/NA	Solid	8151A	65908
160-3051-2 MSD	1HBF-2	Total/NA	Solid	8151A	65908
LCS 160-65908/2-A	Lab Control Sample	Total/NA	Solid	8151A	65908
MB 160-65908/1-A	Method Blank	Total/NA	Solid	8151A	65908

Metals

Prep Batch: 63941

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	7471B	
160-3051-3 MS	1HBF-3	Total/NA	Solid	7471B	

Metals (Continued)

Prep Batch: 63941 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3 MSD	1HBF-3	Total/NA	Solid	7471B	
LCS 160-63941/2-A	Lab Control Sample	Total/NA	Solid	7471B	
MB 160-63941/1-A	Method Blank	Total/NA	Solid	7471B	

Analysis Batch: 64289

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	7471B	63941
160-3051-3 MS	1HBF-3	Total/NA	Solid	7471B	63941
160-3051-3 MSD	1HBF-3	Total/NA	Solid	7471B	63941
LCS 160-63941/2-A	Lab Control Sample	Total/NA	Solid	7471B	63941
MB 160-63941/1-A	Method Blank	Total/NA	Solid	7471B	63941

Prep Batch: 65521

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	3050B	
160-3051-3 MS	1HBF-3	Total/NA	Solid	3050B	
160-3051-3 MSD	1HBF-3	Total/NA	Solid	3050B	
LCS 160-65521/2-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 160-65521/1-A	Method Blank	Total/NA	Solid	3050B	

Analysis Batch: 65968

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-3	1HBF-3	Total/NA	Solid	6010C	65521
160-3051-3 MS	1HBF-3	Total/NA	Solid	6010C	65521
160-3051-3 MSD	1HBF-3	Total/NA	Solid	6010C	65521
LCS 160-65521/2-A	Lab Control Sample	Total/NA	Solid	6010C	65521
MB 160-65521/1-A	Method Blank	Total/NA	Solid	6010C	65521

General Chemistry

Analysis Batch: 63231

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-2	1HBF-2	Total/NA	Solid	Moisture	
160-3051-3	1HBF-3	Total/NA	Solid	Moisture	
160-3051-4	1HBF-4	Total/NA	Solid	Moisture	
160-3051-5	1HBF-5	Total/NA	Solid	Moisture	
160-3051-6	1HBF-6	Total/NA	Solid	Moisture	
160-3069-A-10 DU	Duplicate	Total/NA	Solid	Moisture	
160-3139-A-7 MS	Matrix Spike	Total/NA	Solid	Moisture	
160-3139-A-7 MSD	Matrix Spike Duplicate	Total/NA	Solid	Moisture	

Rad

Leach Batch: 61789

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-1	1HBF-1	Total/NA	Solid	Dry and Grind	
160-3051-1 DU	1HBF-1	Total/NA	Solid	Dry and Grind	

Rad (Continued)

Prep Batch: 62495

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3051-1	1HBF-1	Total/NA	Solid	Fill_Geo-0	61789
160-3051-1 DU	1HBF-1	Total/NA	Solid	Fill_Geo-0	61789
LCS 160-62495/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-62495/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Surrogate Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	12DCE
Lab Sample ID	Client Sample ID	(78-133)	(83-122)	(65-140)	(78-132)
160-3051-5	1HBF-5	93	102	105	97
LCS 160-63739/2-A	Lab Control Sample	105	101	101	103
LCSD 160-63739/3-A	Lab Control Sample Dup	104	98	101	99
MB 160-63739/1-A	Method Blank	94	100	104	102

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)					
		2FP	TBP	NBZ	PHL	TPH	FBP
Lab Sample ID	Client Sample ID	(43-103)	(53-111)	(47-105)	(52-99)	(58-124)	(55-97)
160-3051-6	1HBF-6	53	53	53	53	48 J	56
160-3051-6 MS	1HBF-6	63	64	64	64	56 J	69
160-3051-6 MSD	1HBF-6	69	66	69	68	59	70
LCS 160-63746/2-A	Lab Control Sample	74	65	70	73	64	75
MB 160-63746/1-A	Method Blank	75	61	71	75	72	73

Surrogate Legend

2FP = 2-Fluorophenol (Surr)
TBP = 2,4,6-Tribromophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPH = Terphenyl-d14 (Surr)
FBP = 2-Fluorobiphenyl (Surr)

Method: 8015B - Gasoline Range Organics - (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		TFT1
Lab Sample ID	Client Sample ID	(49-112)
160-3051-5	1HBF-5	110
LCS 160-63753/2-A	Lab Control Sample	100 M
LCSD 160-63753/3-A	Lab Control Sample Dup	102 M
MB 160-63753/1-A	Method Blank	107

Surrogate Legend

TFT = Trifluorotoluene (Surr)

Surrogate Summary

Client: Aleut World Solutions
Project/Site: NSF Indian Head

TestAmerica Job ID: 160-3051-1

Method: 8015B - Diesel Range Organics (DRO) (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		OTPH1
Lab Sample ID	Client Sample ID	(49-133)
160-3051-4	1HBF-4	98 M
160-3051-4 MS	1HBF-4	106 M
160-3051-4 MSD	1HBF-4	103 M
LCS 160-61811/2-A	Lab Control Sample	86 M
MB 160-61811/1-A	Method Blank	107

Surrogate Legend

OTPH = o-Terphenyl

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		DCB1	DCB2	TCX1	TCX2
Lab Sample ID	Client Sample ID	(29-150)	(29-150)	(41-125)	(41-125)
160-3051-4	1HBF-4	100 M	80 M	97	88 M
LCS 160-62920/2-A	Lab Control Sample	92	82	91	88
LCSD 160-62920/3-A	Lab Control Sample Dup	79	70	87	84
MB 160-62920/1-A	Method Blank	82	76	88	87

Surrogate Legend

DCB = DCB Decachlorobiphenyl (Surr)
TCX = Tetrachloro-m-xylene

Method: 8151A - Herbicides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		DCPA2
Lab Sample ID	Client Sample ID	(50-150)
160-3051-2	1HBF-2	83
160-3051-2 MS	1HBF-2	91
160-3051-2 MSD	1HBF-2	90
LCS 160-65908/2-A	Lab Control Sample	79
MB 160-65908/1-A	Method Blank	82

Surrogate Legend

DCPA = 2,4-Dichlorophenylacetic acid

Appendix E
IR Work Approval Permits

IR Work Approval Permit

1/24/2011 Revision

NSASP Comprehensive Work Approval Process (CWAP) – NSF Indian Head

Section A. Customer Information

Real Estate Package Required? ◯ Yes ◉ No

IMIG/RMIG Review Required? ◯ Yes ◉ No

Project Cost: Less than $100,000

Tracking Number: NDW-12-023

Project Name: Site 1 Removal Action

Application Date: 2/13/2012 **Building Number(s):** 1662

Organization Submitting Application: NAVFAC **Organization Funding Proposed Action:** NAVFAC

Name of Applicant: Nick Carros **POC from Funding Organization:** Joe Rail

Phone Ext: x2263 **POC Phone Ext:** 202-685-3105

Email: nicholas.carros@navy.mil **POC Email:** joseph.rail@navy.mil

Contract Number: N/A

Anticipated Dates of Work: Start: 4/1/2012 **Completion:** 5/1/2012 **Expiration Date:** 360 Days from Date of Approval

Section B. Site Issues

Checked Issues must be approved by the appropriate Resource Manager.

Work Restriction Area	Approval Date	Work Restriction Area	Approval Date
☐ Explosives Safety		☐ Air Emissions	
☐ Survey Control/Property Points		☑ Waste (Hazard and Non-Hazard)	3/23/2012
☑ Earth Disturbance	3/16/2012	☐ Archeological Area	
☑ Installation Restoration (IR) Site	3/23/2012	☐ Historic Building	
☑ Worker Safety	3/23/2012	☑ Buried Utilities	3/23/2012
☐ Surface Water/Wetlands/Floodplain		☐ Munitions Response (MRP) Site	
☑ Stormwater Management	3/16/2012	☐ Other Pipe Work	
☐ Eagle Nest Buffer		☑ Other Work Restriction Area	3/19/2012
☐ Natural Resources/Species Protection		☐ No Work Restriction Areas	

Conditions Identified for Work Execution

Earth Disturbance Conditions

Roughly 393 cy of soil will be excavated. MDE must concur with the SEC plans prior to starting remediation.

Stormwater Management Conditions

Workers shall follow the MDE approved SEC plans.

IR Site Conditions

Work must be conducted in accordance with the work plan.

Worker Safety Conditions

Workers must follow the health and safety work plan and wear the proper PPE.

Waste (Hazard and Non-Hazard) Conditions

Coordinate with the Environmental Office (x2268) for storage and disposal of the IDW.

Buried Utilities Conditions

Utility location required before any earth disturbance.

Other Work Restrictions

- Work will impact the parking next to building 1662. Coordinate with Jerry Welch (x5876) prior to starting the project.
- Work may also require the removal of the sidewalk which must be replaced when backfilling is complete.
- Heavy equipment is not to be staged along the paved road behind b. 1662. The shoreline work did not restore the road to handle staging of heavy equipment only regular use by pick-up trucks, etc.

IRT Approval Date: 3/23/2012

Signature of Environmental Division Director or Designee: _____

Signature of Facilities Management Division Director or Designee: _____

This IR Work Approval Permit identifies the conditions that must be satisfied in order to proceed with project execution.
Note: Signed Work Approval Permit must be on site while all work is being performed.

IR Work Approval Permit

1/24/2011 Revision

NSASP Comprehensive Work Approval Process (CWAP) – NSF Indian Head

Section C. Project Details

Project Description:

Project includes the following:

- Site mark-out
- Minimal site clearing
- Utility Clearance
- Establishment of Soil Stockpile areas
- Excavation of soil in 6" lifts (total of 393 cubic yards of disturbance)
- Radiological screening of each stockpiled area
- Disposal of excavated soil (appropriate to its contamination)
- Backfill of excavation to previous grade

Equipment to be used includes motorized vegetation removal equipment, utility location equipment, heavy excavation equipment, portable generators, and radiological detection equipment.

A water truck will be used if dust suppression becomes necessary. Concentrations of radioactive material in air will be determined, as needed, by sampling the air. Air sampling shall be conducted in accordance with (or equivalent to) the guidance provided in NRC Regulatory Guide 8.25, "Air Sampling in the Workplace", July 1992

Work will be performed by 5-10 contractors over the course of two weeks.

Location Description:

Site 1 is located next to building 1662

Will this project involve removing, breaking or opening any piping, tubing or hoses? ○ Yes ◉ No

Section D. Interdisciplinary Review Team (IRT) Contact Information

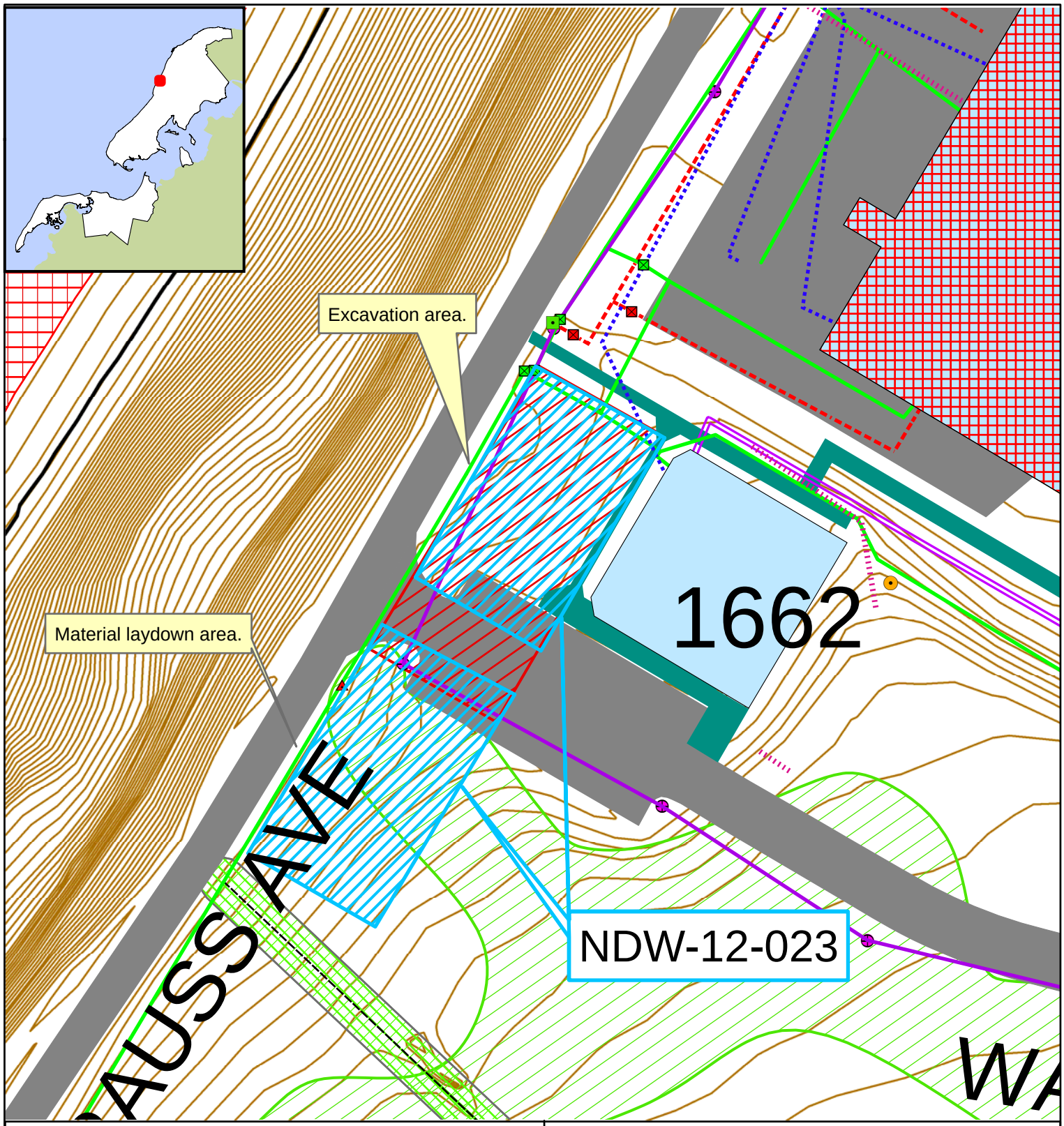
Tommy Wright	NEPA and Cultural Resources	thomas.a.wright@navy.mil	x2260	Bldg. 554
Seth Berry	Natural Resources	seth.m.berry@navy.mil	x2273	Bldg. 554
Billy Fabey	Stormwater	william.fabey@navy.mil	x2275	Bldg. 554
Nick Carros	IR and MRP	nicholas.carros@navy.mil	x2263	Bldg. 554
Stacey Davidson	PWD Environmental Compliance Manager	stacey.davidson@navy.mil	x2257	Bldg. 289
Diana Rose	Sanitary Wastewater	diana.rose@navy.mil	x2267	Bldg. 289
Brooke Shaffer	Industrial Wastewater	brooke.shaffer@navy.mil	x2254	Bldg. 289
Kathy Frey	Potable Water	mary.frey@navy.mil	x2258	Bldg. 289
Mike Schultz	Air	michael.j.schultz4@navy.mil	x2280	Bldg. 289
John Smallhorn	Solid and Hazardous Waste	john.smallhorn@navy.mil	x2268	Bldg. 289
David Hartnett	Tank Management	david.j.hartnett@navy.mil	x2259	Bldg. 289
Jason Claxton	Facilities Planning	jason.claxton@navy.mil	x1451	Bldg. 351
Tim Appleby	NSWC Explosives Safety Officer	timothy.appleby@navy.mil	x2242	Bldg. 436
Larry Kijek	EODTECHDIV Explosives Safety Officer	lawrence.kijek@navy.mil	x6871	Bldg. 2151
Dennis Tomlinson	NSASP Safety	dennis.tomlinson@navy.mil	x2469	Bldg. D-339
Patrick Reitz	PWD Safety	patrick.reitz@navy.mil	x1298	Bldg. 510
Kay Knott	Force Protection and Physical Security	charlotte.knott@navy.mil	x4849	Bldg. D-328
Ray Geckle	NSWC Safety	raymond.geckle@navy.mil	x6799	Bldg. 482
Bob Wetherald	PWD Constructability and Design	bob.wetherald@navy.mil	x2168	Bldg. 551
John Mikles	Asbestos and Lead Saftey	john.mikles@navy.mil	x2272	Bldg. 289
Harry Lehman	Multi Media	harry.w.lehman@navy.mil	x2274	Bldg. 289

IR Work Approval Permit

1/24/2011 Revision

NSASP Comprehensive Work Approval Process (CWAP) – NSF Indian Head

Matthew Gould NDW Fire Prevention matthew.gould@navy.mil x4319 Bldg.D-339



NSF-IH Work Approval Permit Layout

25 12.5 0 25 50 75 100 125 150 Feet

- Work Area
- Buildings
- Trailers
- Cargo Boxes
- Railcars
- Temporary
- Pet Boxes
- Survey Control Points
- Wetlands
- Surface Water Bodies
- Historic Buildings
- IR Sites
- Eagle Protection Areas (Active)
- Eagle Protection Areas (Inactive)
- Worker Notification Area
- Species Protection Area
- Cultural Resources Protection Area
- Munitions Response Area
- K24 Remote Operations
- Intraline (K18) Work Restriction
- Inhabited Building

Streams
- DRY
- INTERMITTENT
- PERMANENT

Roads, Parking Lots
- Paved
- Unpaved
- Fences

Utilities
- Fire Hydrants
- Potable Valve
- River Water Valve
- Stormwater
- Sanitary Sewer
- Potable Water
- Steam
- Compressed Air
- River Water
- Industrial
- Industrial Valve/Pump

Telephone
- Aboveground
- Underground
- Fiber Optic

Electric
- Aboveground
- UnderGround

Wells
- Potable Water
- Monitoring

Utility Poles
- Other
- Light
- Transformer

DISCLAIMER: Utilities depicted are believed to be accurate to +/- 15 feet.

N

NOTE: While performing work, if any underground utilities or item(s) are detected and are not shown on this plan, please detail an approximate location and give description of item(s) to the NAVFAC FMD GIS Analyst (Shelley Alongi, x2256, shelley.alongi@navy.mil).

IR Work Approval Permit

1/24/2011 Revision

NSASP Comprehensive Work Approval Process (CWAP) – NSF Indian Head

Section A. Customer Information

Real Estate Package Required? ◯ Yes ◉ No

IMIG/RMIG Review Required? ◯ Yes ◉ No

Project Cost: Less than $100,000

Tracking Number: NDW-12-023A

Project Name: Site 1 Removal Action (Renewal)

Application Date: 2/13/2012 **Building Number(s):** 1662

Organization Submitting Application: NAVFAC **Organization Funding Proposed Action:** NAVFAC

Name of Applicant: Nick Carros **POC from Funding Organization:** Joe Rail

Phone Ext: x2263 **POC Phone Ext:** 202-685-3105

Email: nicholas.carros@navy.mil **POC Email:** joseph.rail@navy.mil

Contract Number: N/A

Anticipated Dates of Work: Start: 2/14/2013 **Completion:** 3/14/2013 **Expiration Date:** 365 Days from Date of Approval

Section B. Site Issues

Checked Issues must be approved by the appropriate Resource Manager.

Work Restriction Area	Approval Date	Work Restriction Area	Approval Date
☐ Explosives Safety		☐ Air Emissions	
☐ Survey Control/Property Points		☑ Waste (Hazard and Non-Hazard)	2/8/2013
☑ Earth Disturbance	2/1/2013	☐ Archeological Area	
☑ Installation Restoration (IR) Site	2/8/2013	☐ Historic Building	
☑ Worker Safety	2/8/2013	☑ Buried Utilities	2/8/2013
☐ Surface Water/Wetlands/Floodplain		☐ Munitions Response (MRP) Site	
☑ Stormwater Management	2/1/2013	☐ Other Pipe Work	
☐ Eagle Nest Buffer		☑ Other Work Restriction Area	2/4/2013
☐ Natural Resources/Species Protection		☐ No Work Restriction Areas	

See Next Page for Conditions Identified for Work Execution

IRT Approval Date: 2/8/2013

Signature of Environmental Division Director or Designee: _____

Signature of Facilities Management Division Director or Designee: _____

This IR Work Approval Permit identifies the conditions that must be satisfied in order to proceed with project execution.
Note: Signed Work Approval Permit must be on site while all work is being performed.

Earth Disturbance Conditions

Roughly 393 cy of soil will be excavated. MDE must concur with the SEC plans prior to starting remediation.

Stormwater Management Conditions

Workers must follow MDE reviewed plans.

IR Site Conditions

Work must be conducted in accordance with the work plan.

Worker Safety Conditions

Workers must follow the health and safety work plan and wear the proper PPE.

Waste (Hazard and Non-Hazard) Conditions

Coordinate with the Environmental Office (x2268) for storage and disposal of the IDW.

Buried Utilities Conditions

Utility location required before any earth disturbance.

Other Work Restrictions

- Work will impact the parking next to building 1662. Coordinate with Jerry Welch (743-4163) or Ray Hrynko (743-4162) prior to starting the project.
- Work may also require the removal of the sidewalk which must be replaced when backfilling is complete.
- Heavy equipment is not to be staged along the paved road behind b. 1662. The shoreline work did not restore the road to handle staging of heavy equipment only regular use by pick-up trucks, etc.
- Heavy equipment and truck use on the perimeter road shall be minimized at all times and shall not go further than the limits of excavation due to potential impacts to the recently stabilized shoreline bank. The road is currently closed to prevent impacts from traffic.
- If the water truck being used for dust suppression needs to use potable water, they must use a RP backflow preventer when they hook up to the potable hydrant (call Jerome Proctor on x1683 to certify it is on properly) and they need to let Ryland Hock (x4818) know when they hook up in case there is a change in water pressure in the line. If the use river water they do not need the backflow but they should let Enrique Uribe (x5772) know when they use the river water in case of a pressure change.

Section C. Project Details

Project Description:

Project includes the following:

- Site mark-out
- Minimal site clearing
- Utility Clearance
- Establishment of Soil Stockpile areas
- Excavation of soil in 6" lifts (total of 393 cubic yards of disturbance)
- Radiological screening of each stockpiled area
- Disposal of excavated soil (appropriate to its contamination)
- Backfill of excavation to previous grade

Equipment to be used includes motorized vegetation removal equipment, utility location equipment, heavy excavation equipment, portable generators, and radiological detection equipment.

A water truck will be used if dust suppression becomes necessary. Concentrations of radioactive material in air will be determined, as needed, by sampling the air. Air sampling shall be conducted in accordance with (or equivalent to) the guidance provided in NRC Regulatory Guide 8.25, "Air Sampling in the Workplace", July 1992.

Work will be performed by 5-10 contractors over the course of two weeks.

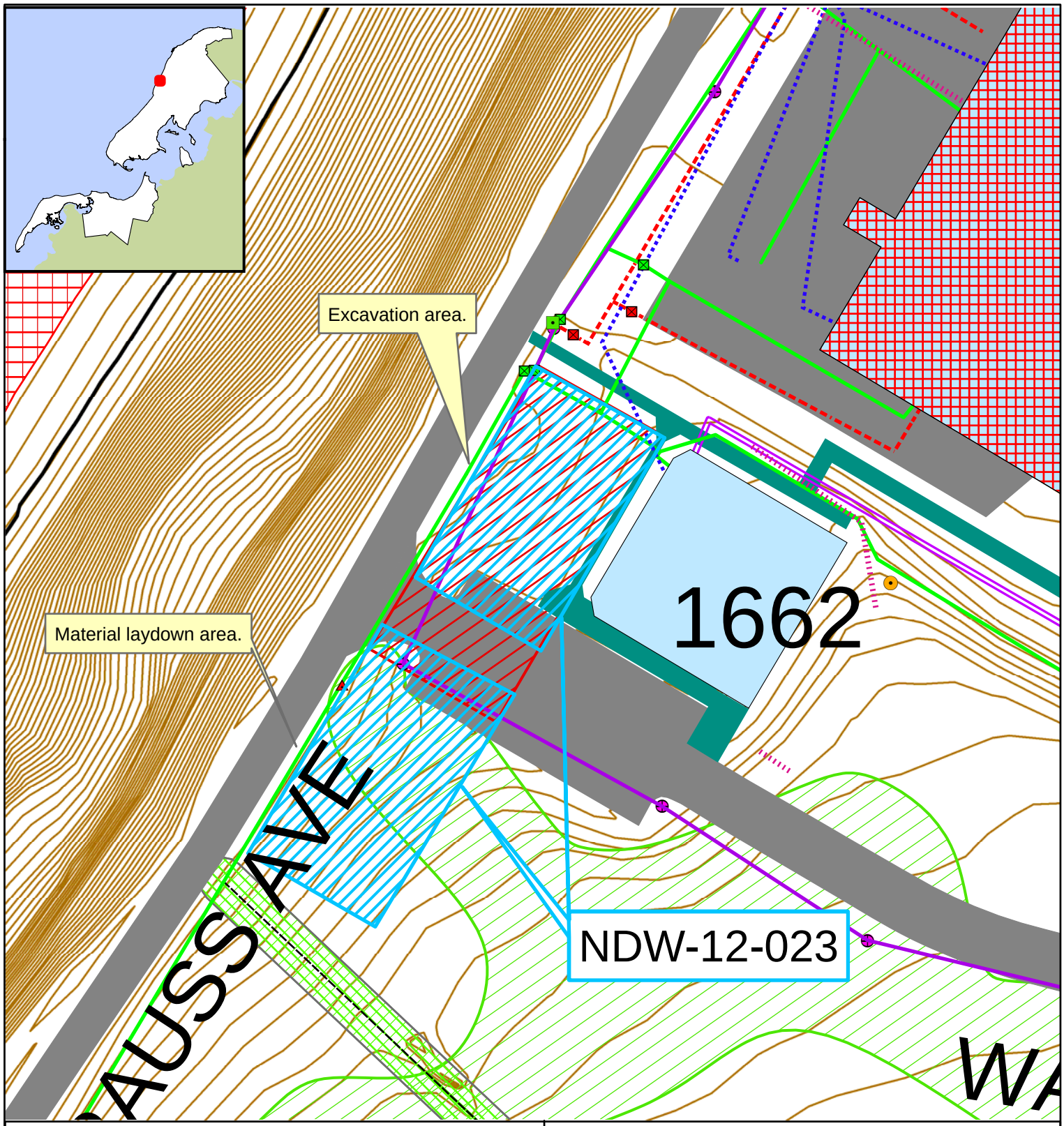
Location Description:

Site 1 is located next to building 1662

Will this project involve removing, breaking or opening any piping, tubing or hoses? ○ Yes ◉ No

Section D. Interdisciplinary Review Team (IRT) Contact Information

Tommy Wright	NEPA and Cultural Resources	thomas.a.wright@navy.mil	x2260	Bldg. 554
Seth Berry	Natural Resources	seth.m.berry@navy.mil	x2273	Bldg. 554
Billy Fabey	Stormwater	william.fabey@navy.mil	x2275	Bldg. 554
Nick Carros	IR and MRP	nicholas.carros@navy.mil	x2263	Bldg. 554
Stacey Davidson	PWD Environmental Compliance Manager	stacey.davidson@navy.mil	x2257	Bldg. 289
Diana Rose	Sanitary Wastewater	diana.rose@navy.mil	x2267	Bldg. 289
Brooke Shaffer	Industrial Wastewater	brooke.shaffer@navy.mil	x2254	Bldg. 289
Kathy Frey	Potable Water	mary.frey@navy.mil	x2258	Bldg. 289
Dave Hoffman	Air	frederick.d.hoffman@navy.mi	x1616	Bldg. 289
John Smallhorn	Solid and Hazardous Waste	john.smallhorn@navy.mil	x2268	Bldg. 289
David Hartnett	Tank Management	david.j.hartnett@navy.mil	x2259	Bldg. 289
Larry Kijek	EODTECHDIV Explosives Safety Officer	lawrence.kijek@navy.mil	x6871	Bldg. 2151
Dennis Tomlinson	NSASP Safety	dennis.tomlinson@navy.mil	x2469	Bldg. D-339
Patrick Reitz	PWD Safety	patrick.reitz@navy.mil	x1298	Bldg. 510
Kay Knott	Force Protection and Physical Security	charlotte.knott@navy.mil	x4849	Bldg. D-328
Ray Geckle	NSWC Safety	raymond.geckle@navy.mil	x6799	Bldg. 482
Bob Wetherald	PWD Constructability and Design	bob.wetherald@navy.mil	x2168	Bldg. 551
John Mikles	Asbestos and Lead Saftey	john.mikles@navy.mil	x2272	Bldg. 289
Harry Lehman	Multi Media	harry.w.lehman@navy.mil	x2274	Bldg. 289
Matthew Gould	NDW Fire Prevention	matthew.gould@navy.mil	x4319	Bldg.D-339
Dianne Newton	NSWC Explosives Safety Officer	dianne.newton@navy.mil	x2375	Bldg. 436
Randy Vanasse	Asbestos Program Supervisor	conrad.j.vanasse@navy.mil	x4391	Bldg. 510
Alphonza Chase	Industrial Hygenist	alphonza.chase@med.navy.	x4910	Bldg. T-1896
Claire Cary	Facilties Planning	claire.cary@navy.mil	x2192	Bldg. 351
Chris Adams	NDW Telecommunciations	chris.a.adams@navy.mil	x6707	Bldg. 698



NSF-IH Work Approval Permit Layout

25 12.5 0 25 50 75 100 125 150 Feet

- Work Area
- Buildings
- Trailers
- Cargo Boxes
- Railcars
- Temporary
- Pet Boxes
- Survey Control Points
- Wetlands
- Surface Water Bodies
- Historic Buildings
- IR Sites
- Eagle Protection Areas (Active)
- Eagle Protection Areas (Inactive)
- Worker Notification Area
- Species Protection Area
- Cultural Resources Protection Area
- Munitions Response Area
- K24 Remote Operations
- Intraline (K18) Work Restriction
- Inhabited Building

Streams
- DRY
- INTERMITTENT
- PERMANENT

Roads, Parking Lots
- Paved
- Unpaved
- Fences

Utilities
- Fire Hydrants
- Potable Valve
- River Water Valve
- Stormwater
- Sanitary Sewer
- Potable Water
- Steam
- Compressed Air
- River Water
- Industrial
- Industrial Valve/Pump

Telephone
- Aboveground
- Underground
- Fiber Optic

Electric
- Aboveground
- UnderGround

Wells
- Potable Water
- Monitoring

Utility Poles
- Other
- Light
- Transformer

DISCLAIMER: Utilities depicted are believed to be accurate to +/- 15 feet.

N

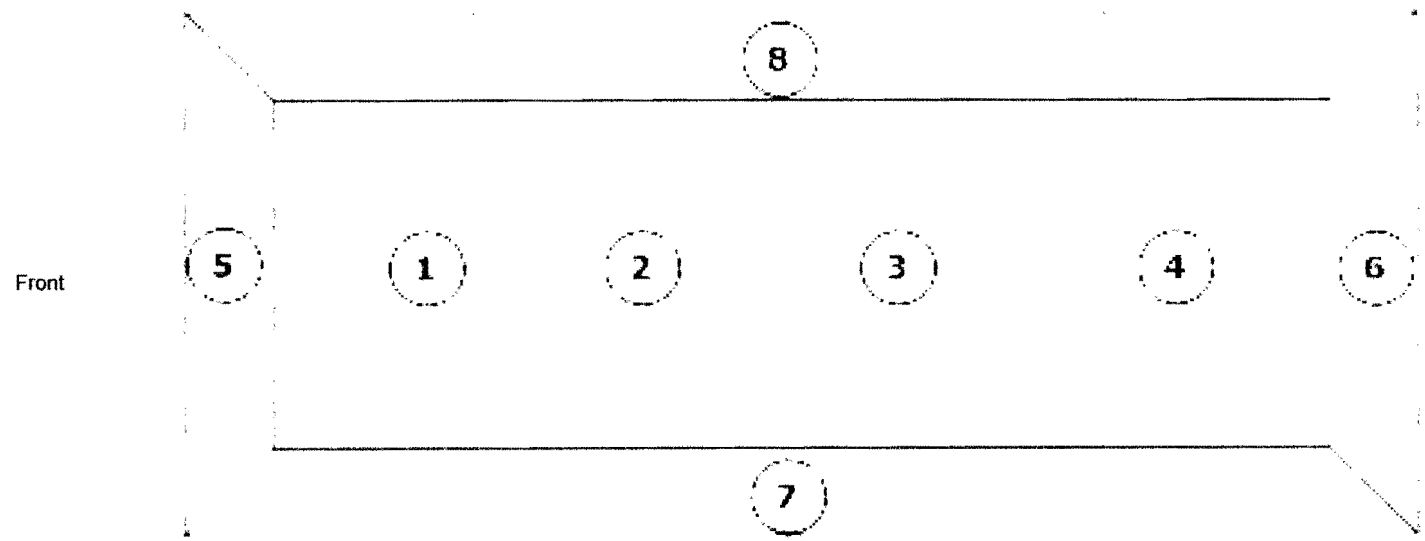
NOTE: While performing work, if any underground utilities or item(s) are detected and are not shown on this plan, please detail an approximate location and give description of item(s) to the NAVFAC FMD GIS Analyst (Shelley Alongi, x2256, shelley.alongi@navy.mil).

Appendix F
Incoming Bin Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/21/2013	15:20	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A								
LOCATION: NSF Indian Head		2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 150.4	α 177.8% βγ 36718.4%
SURVEYOR: William Wylie								
DATE: 8/21/2013	TIME: 16:05 / Reviewed By: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232								

Description of drawing: Roff-Off Bin #GFLU-2204 Interior Incoming Survey



Comments:

Gamma scan range I/S bin 1.5 - 2.0 Kcpm

Tare Weight: 7,200 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-2204 Interior Incoming Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1						10.1	102.9	Bottom
2						7.1	120.6	Bottom
3						10.1	138.4	Bottom
4						13.0	116.2	Bottom
5						10.1	85.1	Front
6						10.1	89.6	Back
7						13.0	94.0	Left Side
8						7.1	67.4	Right Side
9								
10								

Reviewer	Date:	
Daniel Spicuzza	8/21/2013	
	Time: 16:05	

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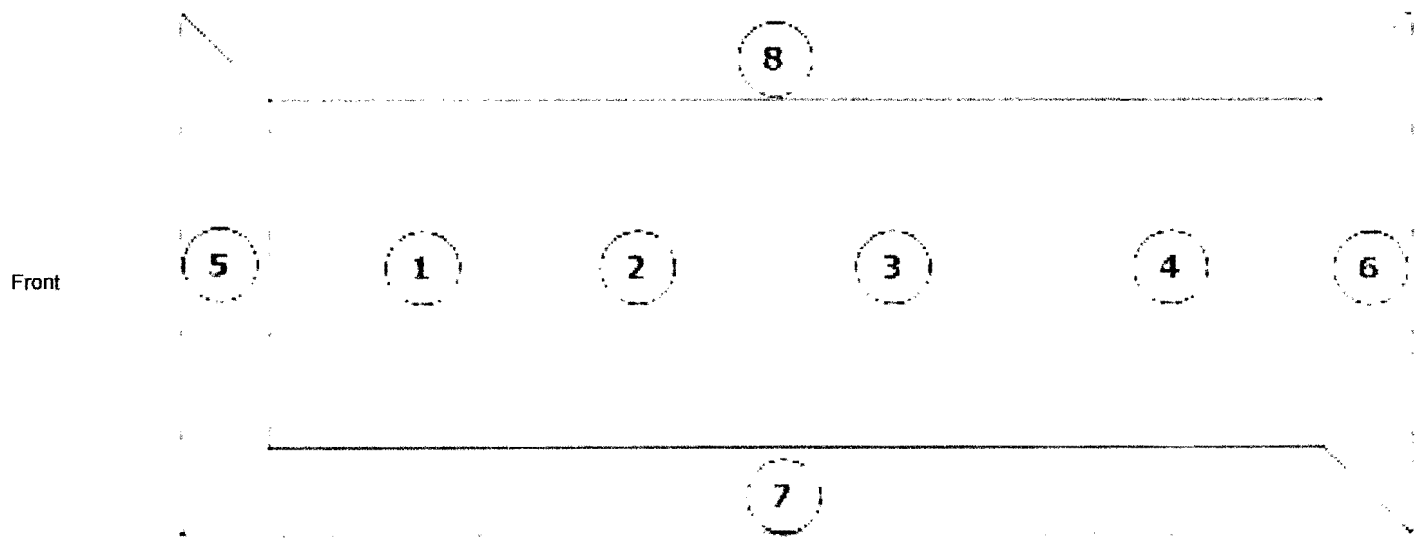
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/22/2013	15:15	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A								
LOCATION: NSF Indian Head		2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 152.9	α 177.8% βγ 38048.8%
SURVEYOR: William Wylie								
DATE: 8/22/2013	TIME: 15:40 / Reviewed By: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232								

Description of drawing: Roff-Off Bin #GFLU-001710 Interior Incoming Survey



Comments:

Gamma scan range I/S bin 2.0 - 3.0 Kcpm

Tare Weight: 7,200 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001710 Interior Incoming Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1						7.1	18.6	Bottom
2						4.1	27.5	Bottom
3						7.1	54.1	Bottom
4						10.1	49.7	Bottom
5						7.1	63.0	Front
6						7.1	18.6	Back
7						10.1	58.5	Left Side
8						7.1	36.4	Right Side
9								
10								

Reviewer	Date: 8/22/2013
Daniel Spicuzza	Time: 15:40

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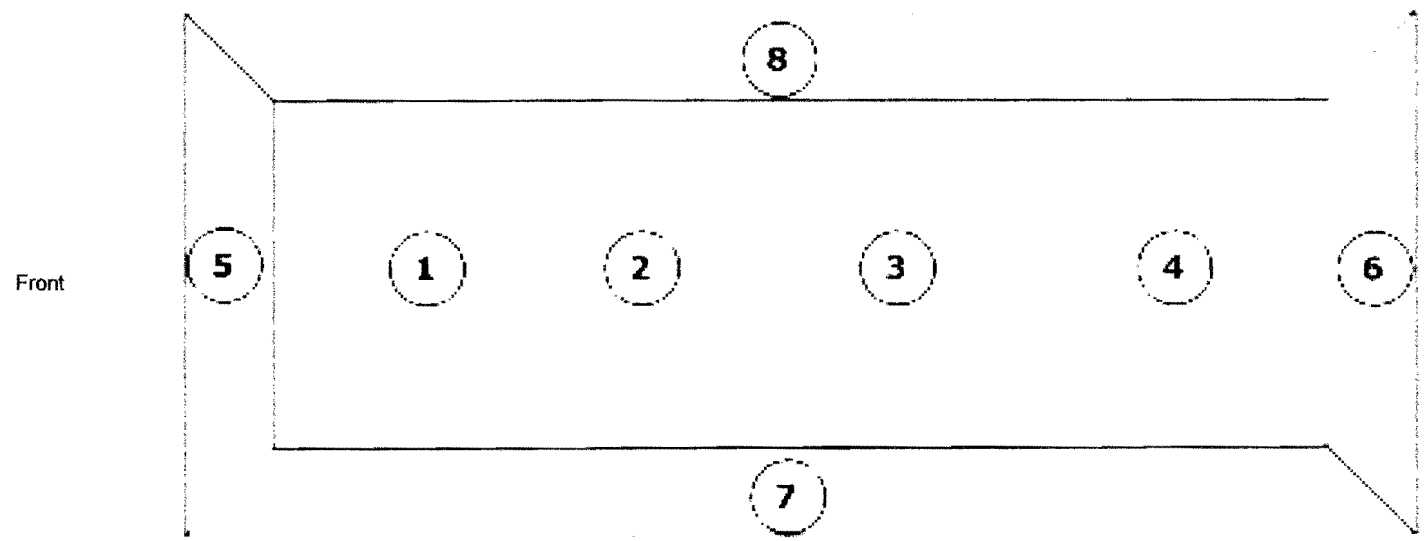
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:		INSTRUMENTATION USED						
8/21/2013	15:10		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 150.4	α 177.8% βγ 36718.4%
SURVEYOR: William Wylie									
DATE: 8/21/2013	TIME: 15:45	Reviewed By: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-001703 Interior Incoming Survey



Comments:

Gamma scan range I/S bin 1.5 - 2.0 Kcpm

Tare Weight: 7,200 lbs.

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☒

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001703 Interior Incoming Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1						7.1	58.5	Bottom
2						7.1	85.1	Bottom
3						10.1	76.3	Bottom
4						7.1	80.7	Bottom
5						10.1	58.5	Front
6						7.1	54.1	Back
7						7.1	71.8	Left Side
8						10.1	98.4	Right Side
9								
10								

Reviewer	Date: 8/21/2013
Daniel Spicuzza	Time: 15:45

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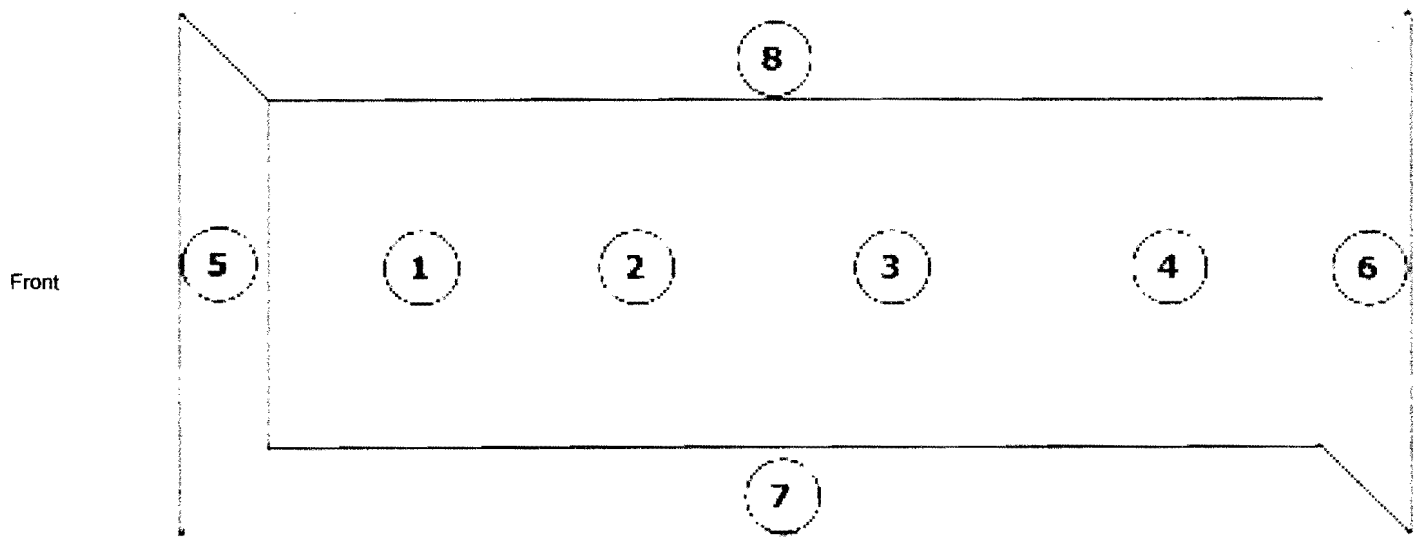
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/21/2013	TIME: 08:15		INSTRUMENTATION USED						
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 150.4	α 177.8% βγ 36718.4%
SURVEYOR: William Wylie									
DATE: 8/21/2013	TIME: 09:40	Reviewed By: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-2205 Interior Incoming Survey



Comments:

Gamma scan range I/S bin 1.5 - 2.0 Kcpm

Tare Weight: 7,500 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-2205 Interior Incoming Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1						4.1	9.8	Bottom
2						-1.8	18.6	Bottom
3						7.1	-12.4	Bottom
4						7.1	36.4	Bottom
5						4.1	31.9	Front
6						1.2	58.5	Back
7						10.1	76.3	Left Side
8						7.1	98.4	Right Side
9								
10								

Reviewer	Date: 8/21/2013
Daniel Spicuzza	Time: 09:40

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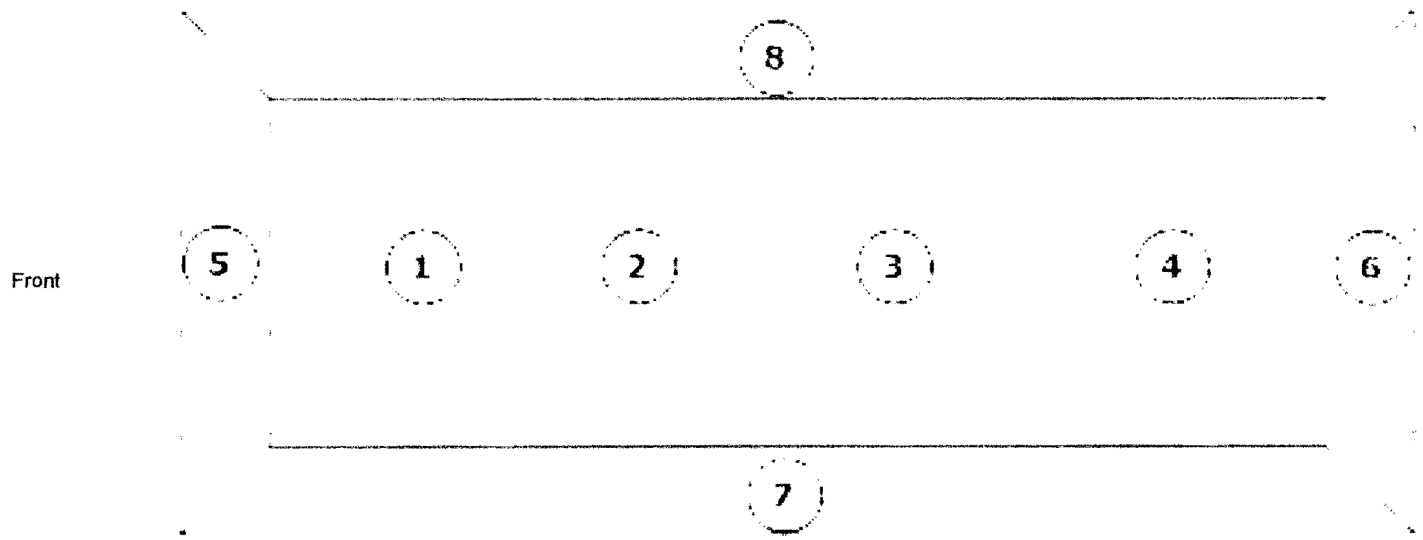
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/21/2013	08:30	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER:	N/A							
LOCATION:	NSF Indian Head	2929	118417	10/26/2013	α 67.5%	α 16.9%	α 16.7	α 177.8%
					βγ 45.1%	βγ 11.3%	βγ 150.4	βγ 36718.4%
SURVEYOR:	William Wylie							
DATE:	TIME: / Reviewed By:	2350-1	98639	6/27/2014				3000
8/21/2013	10:15 / Daniel Spicuzza	44-10	316936					CPM
Isotopes of Concern: Th-232								

Description of drawing: Roff-Off Bin #GFLU-2201 Interior Incoming Survey



Comments:

Gamma scan range I/S bin 1.5 - 2.0 Kcpm

Tare Weight: 7,500 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-2201 Interior Incoming Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1						4.1	23.1	Bottom
2						4.1	58.5	Bottom
3						10.1	36.4	Bottom
4						10.1	58.5	Bottom
5						10.1	67.4	Front
6						7.1	49.7	Back
7						10.1	54.1	Left Side
8						10.1	76.3	Right Side
9								
10								

Reviewer	Date: 8/21/2013
Daniel Spicuzza	Time: 10:15

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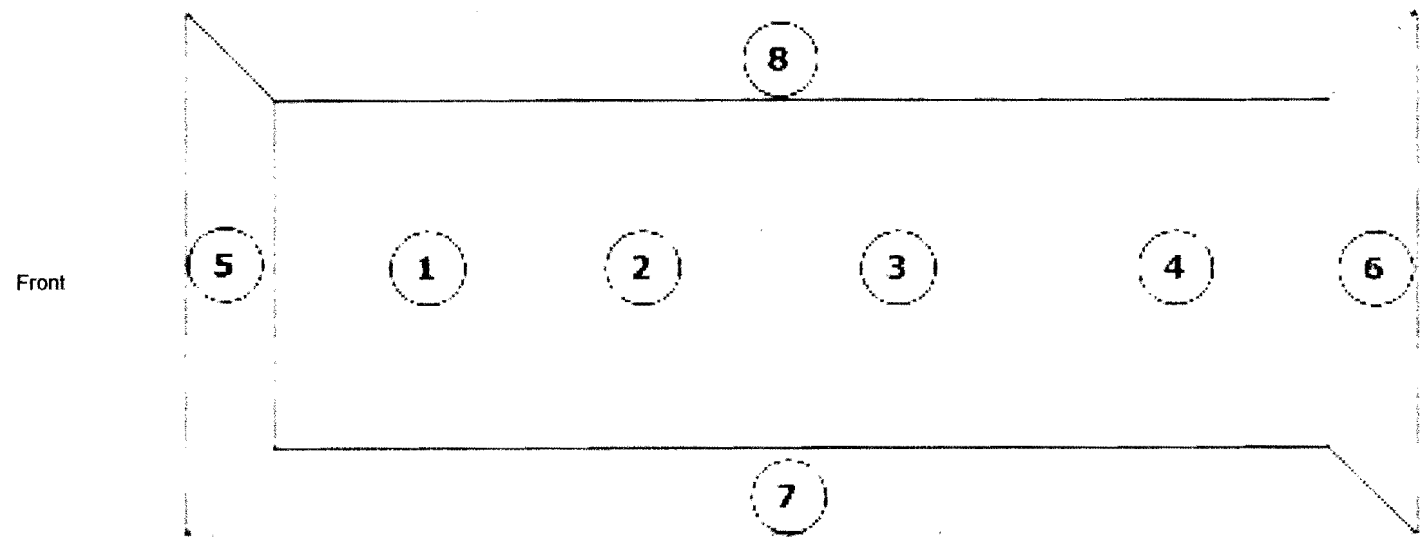
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/21/2013	08:05	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A								
LOCATION: NSF Indian Head		2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 150.4	α 177.8% βγ 36718.4%
SURVEYOR: William Wylie								
DATE: 8/21/2013	TIME: 09:00 / Reviewed By: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232								

Description of drawing: Roff-Off Bin #GFLU-001704 Interior Incoming Survey



Comments:

Gamma scan range I/S bin 1.5 - 2.0 Kcpm

Tare Weight: 7,500 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001704 Interior Incoming Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1						4.1	23.1	Bottom
2						-1.8	14.2	Bottom
3						-1.8	-16.9	Bottom
4						-1.8	14.2	Bottom
5						4.1	49.7	Front
6						-1.8	133.9	Back
7						-1.8	165.0	Left Side
8						-1.8	116.2	Right Side
9								
10								

Reviewer	Date: 8/21/2013
Daniel Spicuzza	Time: 09:00

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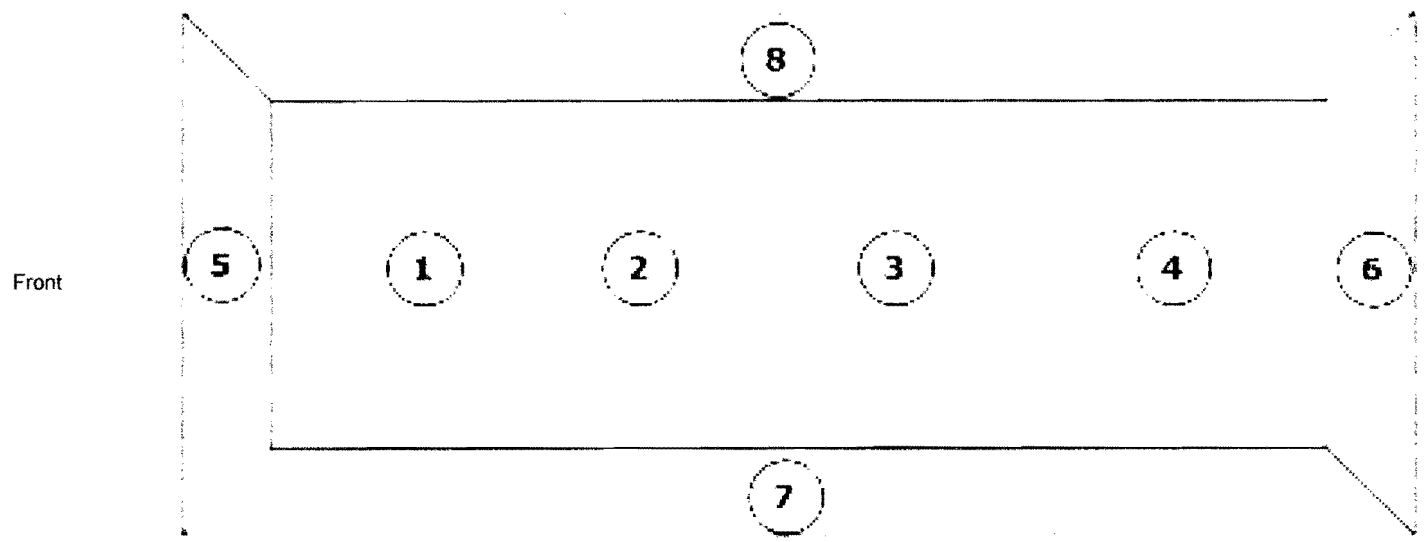
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/22/2013	TIME: 15:00		INSTRUMENTATION USED						
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 152.9	α 177.8% βγ 38048.8%
SURVEYOR: William Wylie									
DATE: 8/22/2013	TIME: 15:35	Reviewed By: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-001706 Interior Incoming Survey



Comments:

Gamma scan range I/S bin 1.5 - 2.5 Kcpm

Tare Weight: 6,450 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001706 Interior Incoming Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1						158.2	63.0	Bottom
2						13.0	58.5	Bottom
3						10.1	85.1	Bottom
4						10.1	76.3	Bottom
5						7.1	89.6	Front
6						10.1	49.7	Back
7						13.0	27.5	Left Side
8						10.1	18.6	Right Side
9								
10								

Reviewer	Date: 8/22/2013
Daniel Spicuzza	Time: 15:35

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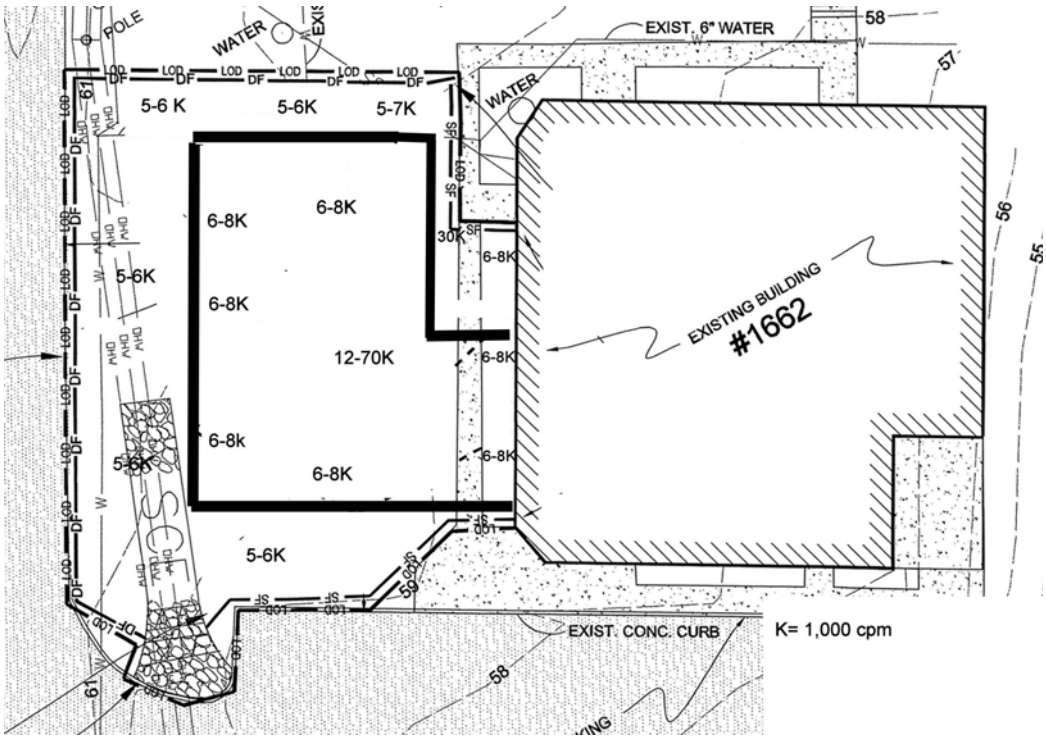
Appendix G
Excavation Area Gamma Scan Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
2/14/2013	11:30	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER:	IHS1-002							
LOCATION:	NSF Indian Head IR Site 1 Removal Area							
SURVEYOR:	William Wylie, Daniel Spicuzza							
DATE: 2/14/2013	TIME: 17:00 / Reviewed by: William Haney	2350-1 44-10	126197 192598	4/20/2013				6000 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey



Comments:

This is a gamma scan survey of the IR Site 1 area.

K=1,000 CPM.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#)	denotes range of gamma scan survey in area
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-002

SURVEYOR: William Wylie, Daniel Spicuzza | LOCATION: NSF Indian Head IR Site 1 Removal Area

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								
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N/A								
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Reviewer
William Haney

Date: 2/14/2013

Time: 17:00

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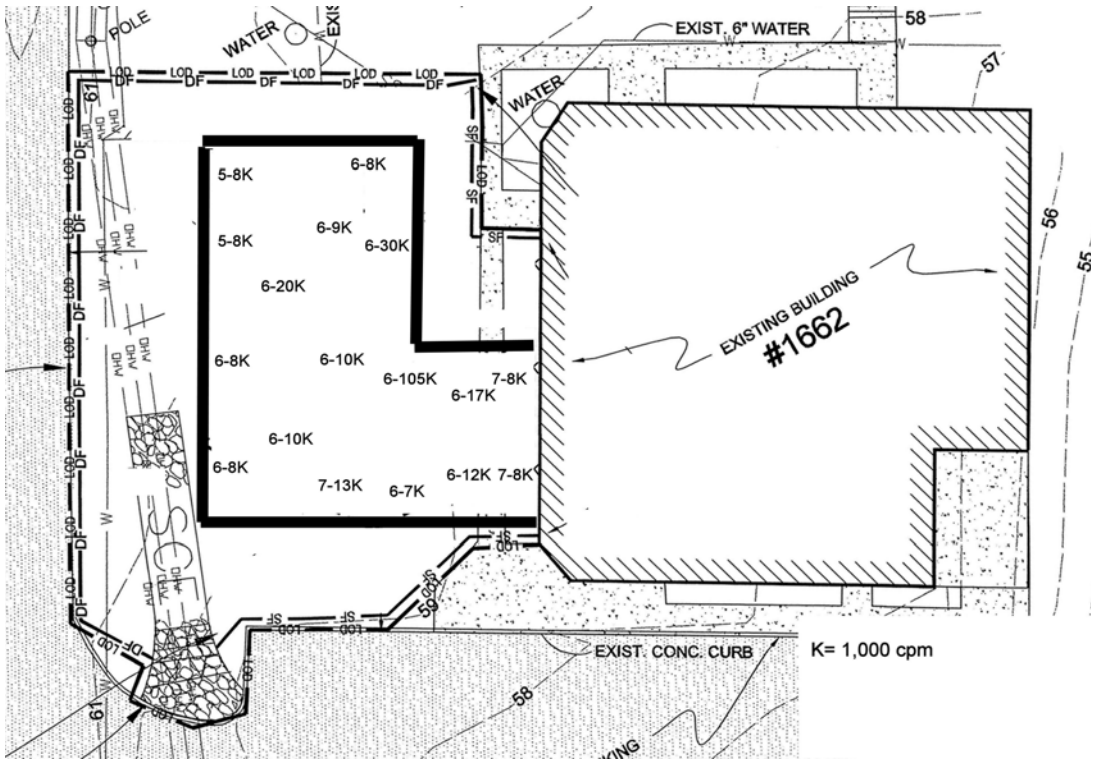
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
2/21/2013	12:30	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-003							
LOCATION:	NSF Indian Head, IR Site 1							
SURVEYOR:	James C. Young Jr.							
DATE: 2/21/2013	TIME: 13:10 / Reviewed by: Daniel Spicuzza	2350-1 44-10	126197 192598	4/20/2013				5900 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

2nd 6" Lift Gamma Scan Survey of Removal Area



Comments:

This is a 100% walkover gamma scan survey of the 2nd 6" lift in the removal area.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-003

SURVEYOR: James C. Young Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1								
2								
3								
4								
5								
6								
7								
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9								
10								
11								
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Reviewer	Date: 2/21/2013	
Daniel Spicuzza	Time: 13:10	

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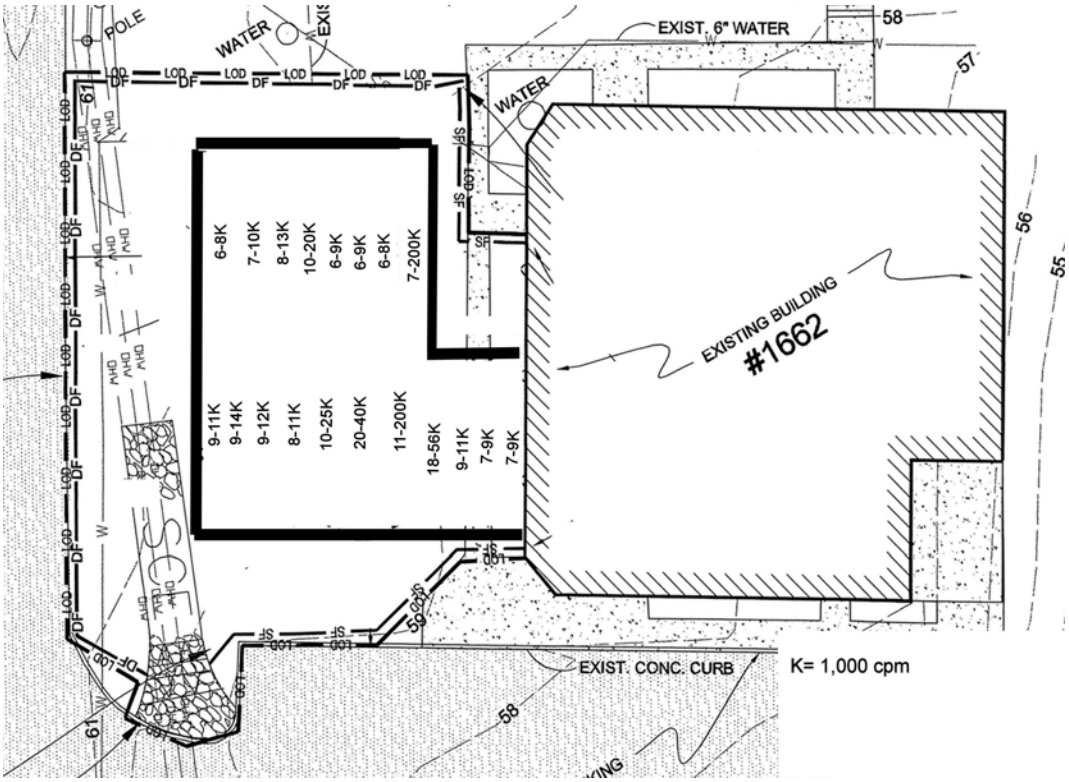
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
2/25/2013	08:15	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER:	IHS1-005							
LOCATION:	NSF Indian Head, IR Site 1							
SURVEYOR:	James C. Young Jr.							
DATE: 2/25/2013	TIME: 09:00 / Reviewed by: Daniel Spicuzza	2350-1 44-10	126197 192598	4/20/2013				5900 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

3rd 6" Lift Gamma Scan Survey of Removal Area



Comments:

This is a 100% walkover gamma scan survey of the 3rd 6" lift in the removal area.

The area was surveyed in lanes running north to south and south to north.

K=1,000 cpm.

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-005

SURVEYOR: James C. Young Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
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Reviewer	Date: 2/25/2013
Daniel Spicuzza	Time: 9:00

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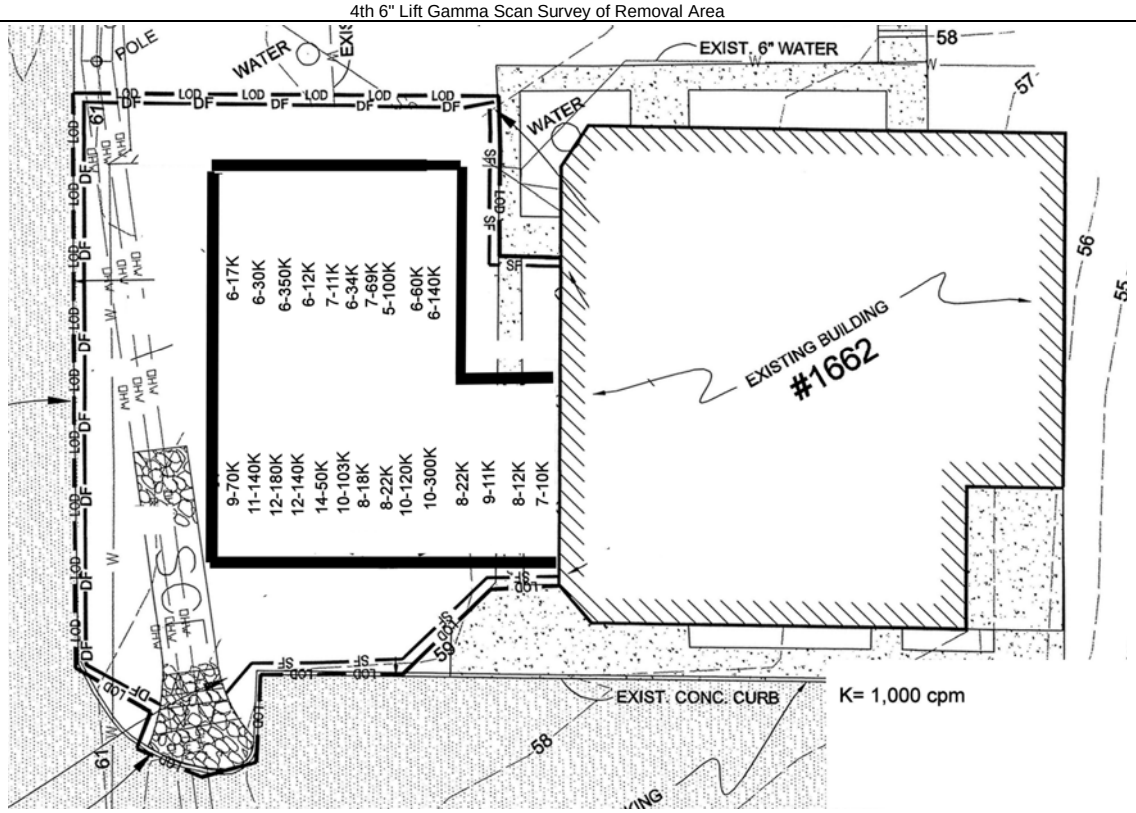
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
2/26/2013	10:35	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-006							
LOCATION:	NSF Indian Head, IR Site 1							
SURVEYOR:	James C. Young Jr.							
DATE: 2/26/2013	TIME: 11:00 / Reviewed by: Daniel Spicuzza	2350-1 44-10	126197 192598	4/20/2013				5900 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

4th 6" Lift Gamma Scan Survey of Removal Area



Comments:

This is a 100% walkover gamma scan survey of the 4th 6" lift in the removal area.

The area was surveyed in lanes running north to south and south to north.

K=1,000 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-006

SURVEYOR: James C. Young Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1								
2								
3								
4								
5								
6								
7								
8								
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Reviewer	Date: 2/26/2013	
Daniel Spicuzza	Time: 11:00	

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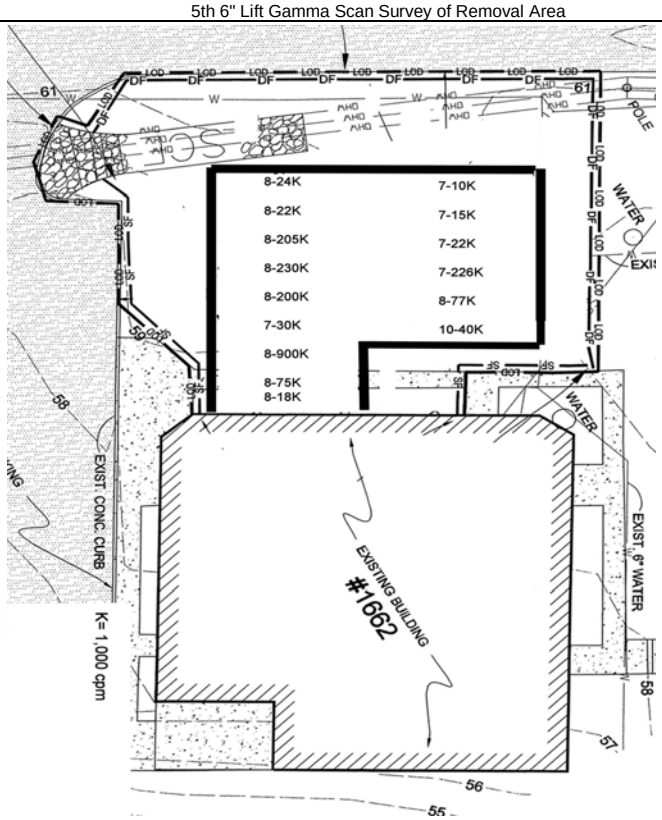
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
3/1/2013	08:00	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-008							
LOCATION:	NSF Indian Head, IR Site 1							
SURVEYOR:	James C. Young Jr.							
DATE: 3/1/2013	TIME: 10:00 / Reviewed by: Daniel Spicuzza	2350-1 44-10	126197 192598	4/20/2013				5900 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

5th 6" Lift Gamma Scan Survey of Removal Area



Comments:

This is a 100% walkover gamma scan survey of the 5th 6" lift in the removal area.

The area was surveyed in lanes running north to south and south to north.

K=1,000 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-008

SURVEYOR: James C. Young Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1								
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3								
4								
5								
6								
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N/A								

Reviewer	Date: 3/1/2013	
Daniel Spicuzza	Time: 10:00	

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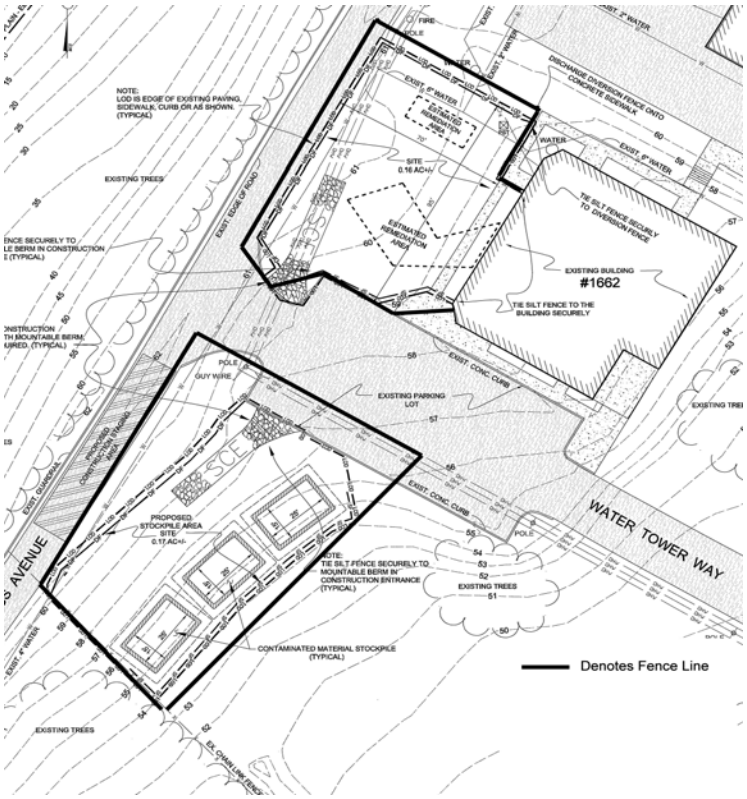
RADIATION/CONTAMINATION SURVEY FORM

DATE: 2/27/2013	TIME: 09:00	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-007							
LOCATION:	NSF Indian Head, IR Site 1							
SURVEYOR:	Daniel Spicuzza	Model 19	167121	8/14/2013				5 µR/hr
DATE: 2/27/2013	TIME: 10:00 / Reviewed by: William Haney							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Fence Exposure Rate Survey



Comments:

This is a exposure rate survey of the fence boundary.

Readings were taken at waist level.

All readings were between 4-5 microR/hr.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-007

SURVEYOR: Daniel Spicuzza

LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1								
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3								
4								
5								
6								
7								
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Reviewer	Date: 2/27/2013	
William Haney	Time: 10:00	

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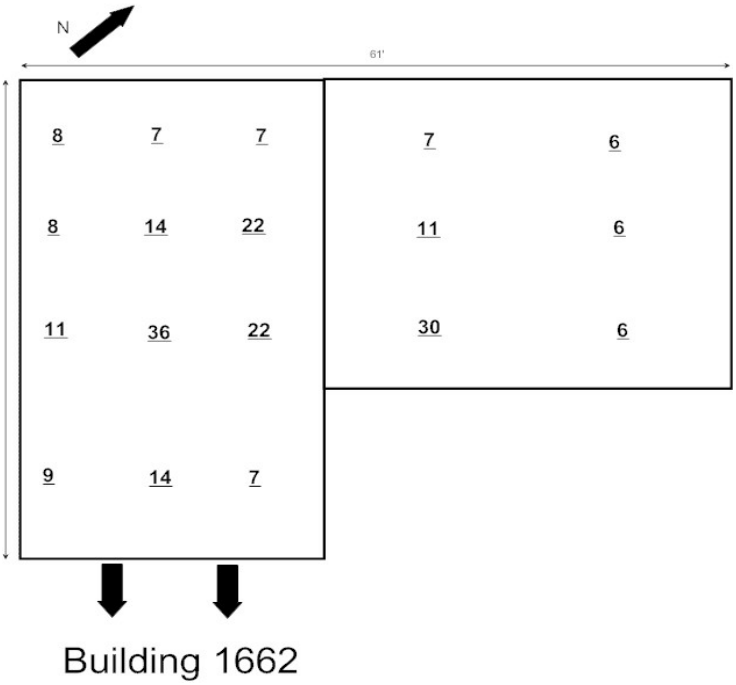
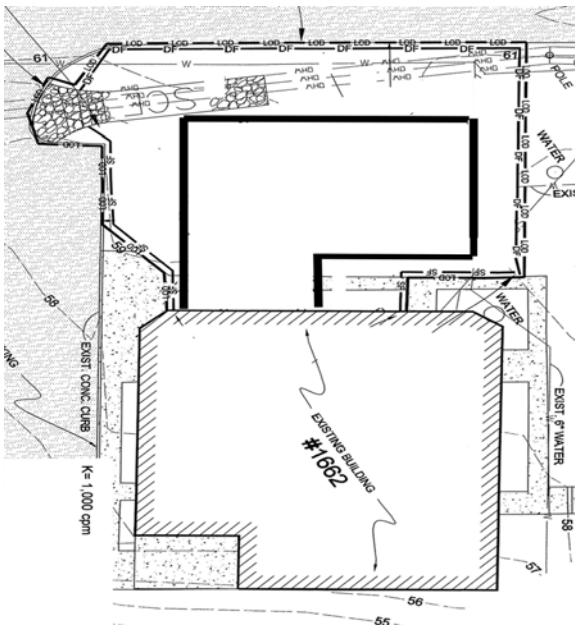
RADIATION/CONTAMINATION SURVEY FORM

DATE: 3/5/2013	TIME: 10:15	INSTRUMENTATION USED					
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-012						
LOCATION:	NSF Indian Head, IR Site 1						
SURVEYOR:	James C. Young Jr.	Model 19	167121	8/14/2013			5 µR/hr
DATE: 3/5/2013	TIME: 11:00 / Reviewed by: Daniel Spicuzza						
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes					

Exposure Rate Survey of Removal Area





Comments:

This is an exposure rate survey. Readings were taken at waist level.

All readings are in microR/hr.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-012

SURVEYOR: James C. Young Jr. LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
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Reviewer	Date: 3/5/2013	
Daniel Spicuzza	Time: 11:00	

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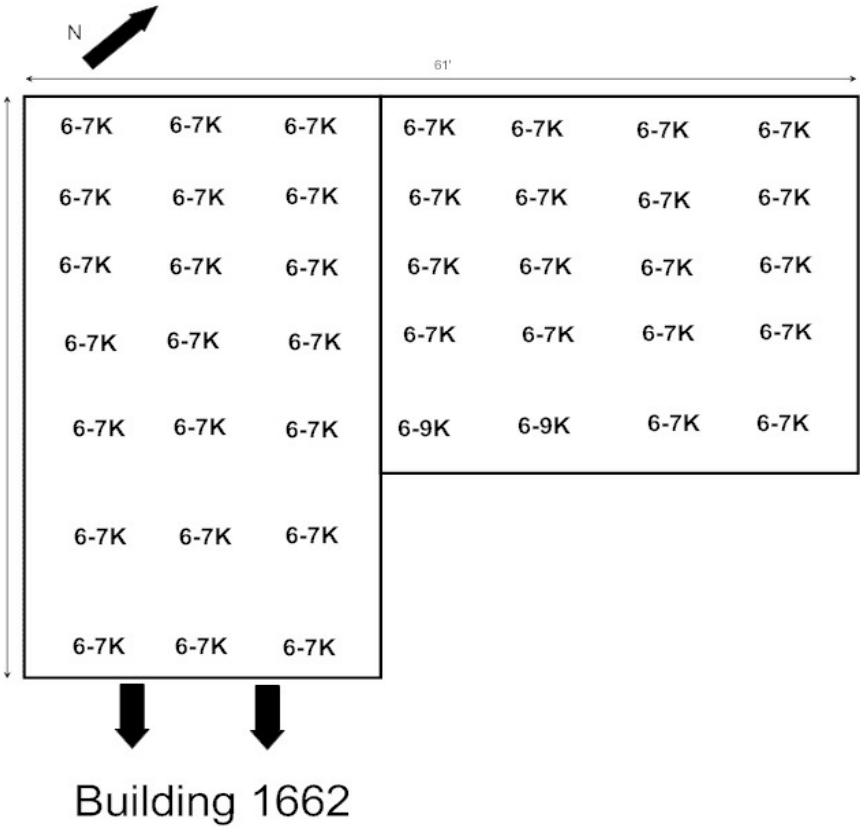
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
9/5/2013	11:30	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-021							
LOCATION:	NSF Indian Head IR Site 1 Excavation Area							
SURVEYOR:	William Wylie							
DATE: 9/5/2013	TIME: 14:25 / Reviewed by: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				6000 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey Following Backfill



Comments:

This is a gamma scan survey of the IR Site 1 area following backfill.

K=1,000 CPM.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes range of gamma scan survey in area
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-021								
SURVEYOR: William Wylie				LOCATION: NSF Indian Head IR Site 1 Excavation Area				
Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
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Reviewer Daniel Spicuzza			Date: 9/5/2013 Time: 14:25					

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Appendix H
Excavation Area Soil Sample Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-1721-2
Client Project/Site: Waste Characterizations

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Mary Ann Tapia

Authorized for release by:
4/4/2013 2:55:19 PM

Erika Starman
Project Manager I
erika.starman@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Receipt Checklists 5
Definitions/Glossary 6
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QC Sample Results 10
QC Association Summary 13
Tracer Carrier Summary 14

Job ID: 160-1721-2

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Waste Characterizations

Report Number: 160-1721-2

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 3/7/2013 1:00 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 18.0º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Sample 1HS1L5-B1 (160-1721-5) was analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were leached on 03/13/2013, prepared on 03/20/2013 and analyzed on 03/22/2013.

Thorium-230 was detected in method blank MB 160-40676/1-A at a level that was above the method detection limit but below the reporting limit. Refer to the QC report for details.

Sample 1HS1L5-B1 (160-1721-5)[16X] required dilution prior to analysis due to the high activity of the sample. The reporting limits have been adjusted accordingly.

The soil sample has little rocks and is non-homogenous. The Thorium samples, (160-1721-5 DU) and 1HS1L5-B1 (160-1721-5), did not pass RER duplicity criteria due to the non-homogeneity of the sample. The data have been qualfied and reported.

Job ID: 160-1721-2 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

No other difficulties were encountered during the Isotopic Thorium analysis.

All other quality control parameters were within the acceptance limits.

ISOTOPIC URANIUM (ALPHA SPECTROMETRY)

Sample 1HS1L5-B1 (160-1721-5) was analyzed for Isotopic Uranium (Alpha Spectrometry) in accordance with DOE. The samples were leached on 03/13/2013, prepared on 03/14/2013 and analyzed on 03/18/2013.

No other difficulties were encountered during the Isotopic Uranium analysis.

All other quality control parameters were within the acceptance limits.

RADIUM-226 BY GAMMA SPEC (21 DAY INGROWTH)

Sample 1HS1L5-B1 (160-1721-5) was analyzed for Radium-226 by gamma spec (21 day ingrowth) in accordance with EPA GA_01_R. The samples were leached on 03/13/2013, prepared on 03/13/2013 and analyzed on 04/03/2013.

No other difficulties were encountered during the Radium 226 analysis.

All other quality control parameters were within the acceptance limits.

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-1721-2

Login Number: 1721

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Uranium (Alpha Spectrometry)	DOE	TAL SL
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL
GA-01-R	Radium-226 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-1721-5	1HS1L5-B1	Solid	03/01/13 08:10	03/07/13 13:00

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Client Sample ID: 1HS1L5-B1

Date Collected: 03/01/13 08:10
Date Received: 03/07/13 13:00

Lab Sample ID: 160-1721-5

Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	152		10.3	16.4	16.0	1.01	pCi/g	03/20/13 05:11	03/22/13 01:07	16
Thorium-230	1.58		1.05	1.06	16.0	0.469	pCi/g	03/20/13 05:11	03/22/13 01:07	16
Thorium-232	123		9.23	13.9	16.0	0.467	pCi/g	03/20/13 05:11	03/22/13 01:07	16

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.9*		*30 - 110*	*03/20/13 05:11*	*03/22/13 01:07*	*16*

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.636		0.159	0.168	1.00	0.0732	pCi/g	03/14/13 08:20	03/18/13 16:58	1
Uranium-235/236	0.0217	U	0.0341	0.0342	1.00	0.0510	pCi/g	03/14/13 08:20	03/18/13 16:58	1
Uranium-238	0.713		0.166	0.177	1.00	0.0558	pCi/g	03/14/13 08:20	03/18/13 16:58	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*94.7*		*30 - 110*	*03/14/13 08:20*	*03/18/13 16:58*	*1*

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	1.23		0.703	0.714	1.00	0.785	pCi/g	03/13/13 11:19	04/03/13 20:10	1

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-40676/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41272 — **Prep Batch: 40676**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.03107	U	0.0443	0.0444	1.00	0.0703	pCi/g	03/20/13 05:11	03/21/13 20:21	1
Thorium-230	0.1375		0.0778	0.0787	1.00	0.0460	pCi/g	03/20/13 05:11	03/21/13 20:21	1
Thorium-232	-0.001160	U	0.00306	0.00306	1.00	0.0418	pCi/g	03/20/13 05:11	03/21/13 20:21	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*83.5*		*30 - 110*	*03/20/13 05:11*	*03/21/13 20:21*	*1*

Lab Sample ID: LCS 160-40676/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41273 — **Prep Batch: 40676**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	24.85		2.56	1.00	0.0600	pCi/g	101	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*80.9*		*30 - 110*

Lab Sample ID: 160-1721-5 DU — **Client Sample ID: 1HS1L5-B1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 42031 — **Prep Batch: 40676**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Thorium-228	152		81.26		11.8	16.0	1.22	pCi/g	2.51	1
Thorium-230	1.58		1.665		1.41	16.0	1.22	pCi/g	0.03	1
Thorium-232	123		62.42		9.93	16.0	0.771	pCi/g	2.56	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*52.6*		*30 - 110*

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Lab Sample ID: MB 160-39988/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40500 — **Prep Batch: 39988**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Uranium-233/234	0.02348	U	0.0291	0.0292	1.00	0.0355	pCi/g	03/14/13 08:20	03/18/13 16:58	1
Uranium-235/236	-0.001948	U	0.00390	0.00390	1.00	0.0442	pCi/g	03/14/13 08:20	03/18/13 16:58	1
Uranium-238	0.005207	U	0.0172	0.0172	1.00	0.0408	pCi/g	03/14/13 08:20	03/18/13 16:58	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Uranium-232	*107*		*30 - 110*	*03/14/13 08:20*	*03/18/13 16:58*	*1*

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-39988/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40501 — **Prep Batch: 39988**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Uranium-233/234	6.53	5.601		0.645	1.00	0.0468	pCi/g	86	84 - 120
Uranium-238	6.78	5.837		0.665	1.00	0.0234	pCi/g	86	82 - 122

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Uranium-232	*102*		*30 - 110*

Lab Sample ID: 160-1721-5 DU — **Client Sample ID: 1HS1L5-B1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40743 — **Prep Batch: 39988**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Uranium-233/234	0.636		0.6248		0.160	1.00	0.0654	pCi/g	0.03	1
Uranium-235/236	0.0217	U	0.01382	U	0.0324	1.00	0.0643	pCi/g	0.12	1
Uranium-238	0.713		0.5100		0.143	1.00	0.0629	pCi/g	0.63	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Uranium-232	*100*		*30 - 110*

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-40055/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43937 — **Prep Batch: 40055**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Radium-226	0.002501	U	0.0740	0.0740	1.00	0.160	pCi/g	03/13/13 11:19	04/03/13 10:14	1

Lab Sample ID: LCS 160-40055/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43938 — **Prep Batch: 40055**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	100.8		10.6		1.22	pCi/g	103	87 - 116
Cesium-137	31.9	32.32		3.44		0.308	pCi/g	101	87 - 120
Cobalt-60	26.0	25.84		2.65		0.184	pCi/g	99	87 - 115

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Method: GA-01-R - Radium-226 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: 160-1721-5 DU
Matrix: Solid
Analysis Batch: 44103

Client Sample ID: 1HS1L5-B1
Prep Type: Total/NA
Prep Batch: 40055

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Radium-226	1.23			1.084		0.649	1.00	0.724	pCi/g			0.10	1

QC Association Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Rad

Leach Batch: 39465

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1721-5	1HS1L5-B1	Total/NA	Solid	Dry and Grind	
160-1721-5 DU	1HS1L5-B1	Total/NA	Solid	Dry and Grind	

Prep Batch: 39988

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1721-5	1HS1L5-B1	Total/NA	Solid	ExtChrom	39465
160-1721-5 DU	1HS1L5-B1	Total/NA	Solid	ExtChrom	39465
LCS 160-39988/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-39988/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 40055

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1721-5	1HS1L5-B1	Total/NA	Solid	Fill_Geo-21	39465
160-1721-5 DU	1HS1L5-B1	Total/NA	Solid	Fill_Geo-21	39465
LCS 160-40055/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-21	
MB 160-40055/1-A	Method Blank	Total/NA	Solid	Fill_Geo-21	

Prep Batch: 40676

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1721-5	1HS1L5-B1	Total/NA	Solid	ExtChrom	39465
160-1721-5 DU	1HS1L5-B1	Total/NA	Solid	ExtChrom	39465
LCS 160-40676/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-40676/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-2

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
		Th-229
Lab Sample ID	Client Sample ID	(30-110)
160-1721-5	1HS1L5-B1	86.9
160-1721-5 DU	1HS1L5-B1	52.6
LCS 160-40676/2-A	Lab Control Sample	80.9
MB 160-40676/1-A	Method Blank	83.5

Tracer/Carrier Legend

Th-229 = Thorium-229

Method: A-01-R - Isotopic Uranium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)
		U-232
Lab Sample ID	Client Sample ID	(30-110)
160-1721-5	1HS1L5-B1	94.7
160-1721-5 DU	1HS1L5-B1	100
LCS 160-39988/2-A	Lab Control Sample	102
MB 160-39988/1-A	Method Blank	107

Tracer/Carrier Legend

U-232 = Uranium-232

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-1721-1
Client Project/Site: Waste Characterizations

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Mary Ann Tapia

Authorized for release by:
4/4/2013 2:51:21 PM

Erika Starman
Project Manager I
erika.starman@testamericainc.com

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Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-1721-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Waste Characterizations

Report Number: 160-1721-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 3/7/2013 1:00 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 18.0º C.

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Samples 1HS1L5-A1 (160-1721-1), 1HS1L5-A2 (160-1721-2), 1HS1L5-A3 (160-1721-3), 1HS1L5-A4 (160-1721-4), 1HS1L5-B1 (160-1721-5), 1HS1L5-B2 (160-1721-6), 1HS1L5-B3 (160-1721-7), 1HS1L5-C1 (160-1721-8), 1HS1L5-C2 (160-1721-9), 1HS1L5-C3 (160-1721-10), 1HS1L5-D2 (160-1721-11), 1HS1L5-D3 (160-1721-12), 1HS1L5-E2 (160-1721-13), 1HS1L5-E3 (160-1721-14), 1HS1L5-F2 (160-1721-15) and 1HS1L5-F3 (160-1721-16) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 03/11/2013, prepared on 03/13/2013 and analyzed on 03/19/2013.

The reporting limit for Cesium-137 analyzed by gamma spectroscopy was not met due to the presence of high activity in the sample. The data is reported with the MDC achieved. 1HS1L5-B1 (160-1721-5)

No other difficulties were encountered during the Gamma spec analyses.

Job ID: 160-1721-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

All other quality control parameters were within the acceptance limits.

CUR 452

St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 3/4/2013	COC No: IH-3
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	1 of 1 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L5-A1	3/1/2013	0750	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-A2	3/1/2013	0755	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-A3	3/1/2013	0800	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-A4	3/1/2013	0805	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-B1	3/1/2013	0810	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-B2	3/1/2013	0815	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-B3	3/1/2013	0820	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-C1	3/1/2013	0825	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-C2	3/1/2013	0830	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-C3	3/1/2013	0835	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-D2	3/1/2013	0840	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-D3	3/1/2013	0845	Grab	S	1		X	Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments: QC Level IV.

Relinquished by:	Company: AWS	Date/Time: 3/4/2013/1600	Received by:	Company: T4	Date/Time: 3/7/13 1300
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 3/4/2013	COC No: IH-3
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	____ of ____ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L5-E2	3/1/2013	0850	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-E3	3/1/2013	0855	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-F2	3/1/2013	0900	Grab	S	1		X	Ac-228 for Th-232
IHS1L5-F3	3/1/2013	0905	Grab	S	1		X	Ac-228 for Th-232
								Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments: QC Level IV.

Relinquished by:	Company: AWS	Date/Time: 3/4/2013/1600	Received by:	Company: TA	Date/Time: 3/7/13 1300
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-1721-1

Login Number: 1721
List Number: 1
Creator: Daniels, Brian

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Method	Method Description	Protocol	Laboratory
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-1721-1	1HS1L5-A1	Solid	03/01/13 07:50	03/07/13 13:00
160-1721-2	1HS1L5-A2	Solid	03/01/13 07:55	03/07/13 13:00
160-1721-3	1HS1L5-A3	Solid	03/01/13 08:00	03/07/13 13:00
160-1721-4	1HS1L5-A4	Solid	03/01/13 08:05	03/07/13 13:00
160-1721-5	1HS1L5-B1	Solid	03/01/13 08:10	03/07/13 13:00
160-1721-6	1HS1L5-B2	Solid	03/01/13 08:15	03/07/13 13:00
160-1721-7	1HS1L5-B3	Solid	03/01/13 08:20	03/07/13 13:00
160-1721-8	1HS1L5-C1	Solid	03/01/13 08:25	03/07/13 13:00
160-1721-9	1HS1L5-C2	Solid	03/01/13 08:30	03/07/13 13:00
160-1721-10	1HS1L5-C3	Solid	03/01/13 08:35	03/07/13 13:00
160-1721-11	1HS1L5-D2	Solid	03/01/13 08:40	03/07/13 13:00
160-1721-12	1HS1L5-D3	Solid	03/01/13 08:45	03/07/13 13:00
160-1721-13	1HS1L5-E2	Solid	03/01/13 08:50	03/07/13 13:00
160-1721-14	1HS1L5-E3	Solid	03/01/13 08:55	03/07/13 13:00
160-1721-15	1HS1L5-F2	Solid	03/01/13 09:00	03/07/13 13:00
160-1721-16	1HS1L5-F3	Solid	03/01/13 09:05	03/07/13 13:00

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Client Sample ID: 1HS1L5-A1

Lab Sample ID: 160-1721-1

Date Collected: 03/01/13 07:50
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.714		0.242	0.253		0.386	pCi/g	03/13/13 11:19	03/19/13 14:05	1
Cesium-137	0.145		0.0780	0.0794	0.200	0.0898	pCi/g	03/13/13 11:19	03/19/13 14:05	1
Thorium-232	0.714		0.242	0.253		0.386	pCi/g	03/13/13 11:19	03/19/13 14:05	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.552*		*0.190*	*0.199*		*0.138*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*
Pb-212	*0.768*		*0.185*	*0.210*		*0.188*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*
Pb-214	*0.610*		*0.167*	*0.179*		*0.170*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*
Tl-208	*0.305*		*0.0932*	*0.0984*		*0.0687*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*

Client Sample ID: 1HS1L5-A2

Lab Sample ID: 160-1721-2

Date Collected: 03/01/13 07:55
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.586		0.171	0.181		0.0918	pCi/g	03/13/13 11:19	03/19/13 14:05	1
Cesium-137	-0.0135	U	0.0411	0.0411	0.200	0.0728	pCi/g	03/13/13 11:19	03/19/13 14:05	1
Thorium-232	0.586		0.171	0.181		0.0918	pCi/g	03/13/13 11:19	03/19/13 14:05	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.405*		*0.117*	*0.125*		*0.0900*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*
K-40	*3.47*		*0.977*	*1.04*		*0.993*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*
Pb-212	*0.424*		*0.0886*	*0.104*		*0.0855*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*
Pb-214	*0.529*		*0.102*	*0.116*		*0.0589*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*
Tl-208	*0.179*		*0.0573*	*0.0603*		*0.0449*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:05*	*1*

Client Sample ID: 1HS1L5-A3

Lab Sample ID: 160-1721-3

Date Collected: 03/01/13 08:00
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.872		0.187	0.207		0.135	pCi/g	03/13/13 11:19	03/19/13 14:12	1
Cesium-137	-0.0219	U	0.120	0.120	0.200	0.130	pCi/g	03/13/13 11:19	03/19/13 14:12	1
Thorium-232	0.872		0.187	0.207		0.135	pCi/g	03/13/13 11:19	03/19/13 14:12	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.697*		*0.160*	*0.176*		*0.0852*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:12*	*1*
K-40	*7.57*		*1.61*	*1.78*		*1.24*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:12*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Client Sample ID: 1HS1L5-A3

Lab Sample ID: 160-1721-3
Date Collected: 03/01/13 08:00
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Pb-212	*0.803*		*0.189*	*0.216*		*0.187*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:12*	*1*
Pb-214	*0.799*		*0.168*	*0.187*		*0.151*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:12*	*1*
Tl-208	*0.276*		*0.0949*	*0.0991*		*0.0804*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:12*	*1*

Client Sample ID: 1HS1L5-A4

Lab Sample ID: 160-1721-4
Date Collected: 03/01/13 08:05
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.862**		0.193	0.212		0.0813	pCi/g	03/13/13 11:19	03/19/13 14:06	1
Cesium-137	0.000	U	0.0144	0.0144	0.200	0.0749	pCi/g	03/13/13 11:19	03/19/13 14:06	1
Thorium-232	**0.862**		0.193	0.212		0.0813	pCi/g	03/13/13 11:19	03/19/13 14:06	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.575*		*0.143*	*0.155*		*0.130*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:06*	*1*
K-40	*6.04*		*1.12*	*1.28*		*0.955*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:06*	*1*
Pb-212	*0.625*		*0.0998*	*0.128*		*0.0800*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:06*	*1*
Pb-214	*0.641*		*0.125*	*0.142*		*0.0974*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:06*	*1*
Tl-208	*0.271*		*0.0663*	*0.0720*		*0.0518*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:06*	*1*

Client Sample ID: 1HS1L5-B1

Lab Sample ID: 160-1721-5
Date Collected: 03/01/13 08:10
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**71.2**		1.75	7.47		0.782	pCi/g	03/13/13 11:19	03/19/13 14:07	1
Cesium-137	0.243	U	0.301	0.302	0.200	0.497	pCi/g	03/13/13 11:19	03/19/13 14:07	1
Thorium-232	**71.2**		1.75	7.47		0.782	pCi/g	03/13/13 11:19	03/19/13 14:07	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*73.8*		*6.12*	*9.80*		*4.87*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
Bi-214	*1.41*		*0.654*	*0.670*		*0.707*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
K-40	*17.3*		*3.59*	*4.00*		*2.64*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
Pb-212	*78.4*		*1.21*	*10.2*		*0.684*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
Pb-214	*1.10*		*0.614*	*0.624*		*0.725*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
Tl-208	*25.5*		*0.768*	*2.75*		*0.439*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Client Sample ID: 1HS1L5-B2

Lab Sample ID: 160-1721-6
Date Collected: 03/01/13 08:15
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	2.50		0.420	0.491		0.179	pCi/g	03/13/13 11:19	03/19/13 14:08	1
Cesium-137	0.0753	U	0.0752	0.0756	0.200	0.120	pCi/g	03/13/13 11:19	03/19/13 14:08	1
Thorium-232	2.50		0.420	0.491		0.179	pCi/g	03/13/13 11:19	03/19/13 14:08	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*2.49*		*0.880*	*0.918*		*0.662*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:08*	*1*
Bi-214	*0.772*		*0.229*	*0.243*		*0.227*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:08*	*1*
K-40	*10.3*		*1.62*	*1.94*		*0.472*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:08*	*1*
Pb-212	*2.18*		*0.260*	*0.383*		*0.227*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:08*	*1*
Pb-214	*0.999*		*0.238*	*0.259*		*0.207*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:08*	*1*
Tl-208	*0.697*		*0.117*	*0.138*		*0.0822*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:08*	*1*

Client Sample ID: 1HS1L5-B3

Lab Sample ID: 160-1721-7
Date Collected: 03/01/13 08:20
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	2.12		0.354	0.415		0.109	pCi/g	03/13/13 11:19	03/19/13 14:11	1
Cesium-137	0.0364	U	0.0694	0.0695	0.200	0.118	pCi/g	03/13/13 11:19	03/19/13 14:11	1
Thorium-232	2.12		0.354	0.415		0.109	pCi/g	03/13/13 11:19	03/19/13 14:11	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*2.92*		*0.817*	*0.871*		*0.515*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
Bi-214	*0.933*		*0.194*	*0.217*		*0.173*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
K-40	*6.89*		*1.34*	*1.52*		*1.04*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
Pb-212	*2.30*		*0.238*	*0.380*		*0.192*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
Pb-214	*1.00*		*0.173*	*0.202*		*0.198*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
Tl-208	*0.796*		*0.116*	*0.143*		*0.0792*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*

Client Sample ID: 1HS1L5-C1

Lab Sample ID: 160-1721-8
Date Collected: 03/01/13 08:25
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.489		0.143	0.151		0.0960	pCi/g	03/13/13 11:19	03/19/13 14:07	1
Cesium-137	0.00275	U	0.0360	0.0360	0.200	0.0678	pCi/g	03/13/13 11:19	03/19/13 14:07	1
Thorium-232	0.489		0.143	0.151		0.0960	pCi/g	03/13/13 11:19	03/19/13 14:07	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Client Sample ID: 1HS1L5-C1

Lab Sample ID: 160-1721-8
Matrix: Solid
Date Collected: 03/01/13 08:25
Date Received: 03/07/13 13:00

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.403*		*0.111*	*0.119*		*0.0989*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
K-40	*3.78*		*0.952*	*1.03*		*0.707*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
Pb-212	*0.480*		*0.0938*	*0.113*		*0.0844*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
Pb-214	*0.429*		*0.0960*	*0.106*		*0.0787*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*
Tl-208	*0.148*		*0.0518*	*0.0541*		*0.0520*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:07*	*1*

Client Sample ID: 1HS1L5-C2

Lab Sample ID: 160-1721-9
Matrix: Solid
Date Collected: 03/01/13 08:30
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.17**		0.230	0.259		0.131	pCi/g	03/13/13 11:19	03/19/13 14:09	1
Cesium-137	0.000	U	0.0301	0.0301	0.200	0.152	pCi/g	03/13/13 11:19	03/19/13 14:09	1
Thorium-232	**1.17**		0.230	0.259		0.131	pCi/g	03/13/13 11:19	03/19/13 14:09	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.828*		*0.223*	*0.239*		*0.204*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:09*	*1*
K-40	*10.4*		*1.73*	*2.04*		*0.998*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:09*	*1*
Pb-212	*1.26*		*0.187*	*0.248*		*0.163*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:09*	*1*
Pb-214	*0.797*		*0.161*	*0.181*		*0.215*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:09*	*1*
Tl-208	*0.419*		*0.0939*	*0.103*		*0.0517*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:09*	*1*

Client Sample ID: 1HS1L5-C3

Lab Sample ID: 160-1721-10
Matrix: Solid
Date Collected: 03/01/13 08:35
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.56**		0.275	0.319		0.286	pCi/g	03/13/13 11:19	03/19/13 14:11	1
Cesium-137	-0.0110	U	0.123	0.123	0.200	0.125	pCi/g	03/13/13 11:19	03/19/13 14:11	1
Thorium-232	**1.56**		0.275	0.319		0.286	pCi/g	03/13/13 11:19	03/19/13 14:11	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.873*		*0.197*	*0.217*		*0.164*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
K-40	*7.98*		*1.52*	*1.73*		*1.20*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
Pb-212	*1.20*		*0.194*	*0.324*		*0.191*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
Pb-214	*1.04*		*0.201*	*0.244*		*0.183*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*
Tl-208	*0.459*		*0.113*	*0.123*		*0.0991*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:11*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Client Sample ID: 1HS1L5-D2

Lab Sample ID: 160-1721-11

Date Collected: 03/01/13 08:40
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.18		0.230	0.260		0.0829	pCi/g	03/13/13 11:19	03/19/13 14:59	1
Cesium-137	0.000335	U	0.0352	0.0352	0.200	0.0658	pCi/g	03/13/13 11:19	03/19/13 14:59	1
Thorium-232	1.18		0.230	0.260		0.0829	pCi/g	03/13/13 11:19	03/19/13 14:59	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.393*		*0.119*	*0.126*		*0.0949*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:59*	*1*
K-40	*2.09*		*0.701*	*0.733*		*0.712*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:59*	*1*
Pb-212	*1.07*		*0.124*	*0.186*		*0.0933*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:59*	*1*
Pb-214	*0.436*		*0.100*	*0.110*		*0.0886*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:59*	*1*
Tl-208	*0.365*		*0.0686*	*0.0784*		*0.0433*	*pCi/g*	*03/13/13 11:19*	*03/19/13 14:59*	*1*

Client Sample ID: 1HS1L5-D3

Lab Sample ID: 160-1721-12

Date Collected: 03/01/13 08:45
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	3.00		0.432	0.530		0.237	pCi/g	03/13/13 11:19	03/19/13 15:00	1
Cesium-137	0.220		0.0997	0.102	0.200	0.129	pCi/g	03/13/13 11:19	03/19/13 15:00	1
Thorium-232	3.00		0.432	0.530		0.237	pCi/g	03/13/13 11:19	03/19/13 15:00	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.872*		*0.229*	*0.246*		*0.172*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:00*	*1*
K-40	*7.66*		*1.66*	*1.84*		*1.03*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:00*	*1*
Pb-212	*3.00*		*0.296*	*0.488*		*0.237*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:00*	*1*
Pb-214	*0.913*		*0.196*	*0.218*		*0.214*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:00*	*1*
Tl-208	*1.14*		*0.167*	*0.205*		*0.0963*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:00*	*1*

Client Sample ID: 1HS1L5-E2

Lab Sample ID: 160-1721-13

Date Collected: 03/01/13 08:50
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.811		0.205	0.221		0.123	pCi/g	03/13/13 11:19	03/19/13 15:03	1
Cesium-137	-0.00961	U	0.0399	0.0399	0.200	0.0712	pCi/g	03/13/13 11:19	03/19/13 15:03	1
Thorium-232	0.811		0.205	0.221		0.123	pCi/g	03/13/13 11:19	03/19/13 15:03	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*1.39*		*0.439*	*0.462*		*0.256*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:03*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Client Sample ID: 1HS1L5-E2

Lab Sample ID: 160-1721-13
Date Collected: 03/01/13 08:50
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.700*		*0.144*	*0.161*		*0.113*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:03*	*1*
K-40	*3.91*		*0.939*	*1.02*		*0.977*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:03*	*1*
Pb-212	*0.791*		*0.128*	*0.164*		*0.115*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:03*	*1*
Pb-214	*0.698*		*0.133*	*0.151*		*0.141*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:03*	*1*
Tl-208	*0.366*		*0.0730*	*0.0822*		*0.0510*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:03*	*1*

Client Sample ID: 1HS1L5-E3

Lab Sample ID: 160-1721-14
Date Collected: 03/01/13 08:55
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.51**		0.270	0.311		0.140	pCi/g	03/13/13 11:19	03/19/13 15:04	1
Cesium-137	0.0315	U	0.0726	0.0727	0.200	0.126	pCi/g	03/13/13 11:19	03/19/13 15:04	1
Thorium-232	**1.51**		0.270	0.311		0.140	pCi/g	03/13/13 11:19	03/19/13 15:04	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.17*		*0.224*	*0.254*		*0.163*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
K-40	*8.36*		*1.62*	*1.83*		*1.02*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
Pb-212	*1.29*		*0.192*	*0.254*		*0.174*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
Pb-214	*1.07*		*0.201*	*0.230*		*0.223*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
Tl-208	*0.427*		*0.101*	*0.110*		*0.0842*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*

Client Sample ID: 1HS1L5-F2

Lab Sample ID: 160-1721-15
Date Collected: 03/01/13 09:00
Matrix: Solid
Date Received: 03/07/13 13:00

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.715**		0.156	0.172		0.222	pCi/g	03/13/13 11:19	03/19/13 15:04	1
Cesium-137	0.0310	U	0.0485	0.0486	0.200	0.0817	pCi/g	03/13/13 11:19	03/19/13 15:04	1
Thorium-232	**0.715**		0.156	0.172		0.222	pCi/g	03/13/13 11:19	03/19/13 15:04	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.630*		*0.177*	*0.189*		*0.174*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
K-40	*5.31*		*1.08*	*1.21*		*0.408*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
Pb-212	*0.665*		*0.148*	*0.171*		*0.154*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
Pb-214	*0.687*		*0.173*	*0.187*		*0.154*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*
Tl-208	*0.238*		*0.0742*	*0.0782*		*0.0755*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:04*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Client Sample ID: 1HS1L5-F3

Date Collected: 03/01/13 09:05
Date Received: 03/07/13 13:00

Lab Sample ID: 160-1721-16

Matrix: Solid

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.08**		0.283	0.304		0.172	pCi/g	03/13/13 11:19	03/19/13 15:05	1
Cesium-137	-0.00534	U	0.0550	0.0550	0.200	0.100	pCi/g	03/13/13 11:19	03/19/13 15:05	1
Thorium-232	**1.08**		0.283	0.304		0.172	pCi/g	03/13/13 11:19	03/19/13 15:05	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*2.04*		*0.644*	*0.678*		*0.366*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:05*	*1*
Bi-214	*0.832*		*0.188*	*0.207*		*0.181*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:05*	*1*
K-40	*8.29*		*1.57*	*1.79*		*1.41*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:05*	*1*
Pb-212	*0.868*		*0.158*	*0.194*		*0.154*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:05*	*1*
Pb-214	*0.903*		*0.163*	*0.188*		*0.149*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:05*	*1*
Tl-208	*0.326*		*0.0924*	*0.0984*		*0.0921*	*pCi/g*	*03/13/13 11:19*	*03/19/13 15:05*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-39448/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40653 — **Prep Batch: 39448**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.02590	U	0.162	0.162		0.316	pCi/g	03/13/13 11:19	03/19/13 14:04	1
Cesium-137	0.01213	U	0.0350	0.0350	0.200	0.0635	pCi/g	03/13/13 11:19	03/19/13 14:04	1
Thorium-232	0.02590	U	0.162	0.162		0.316	pCi/g	03/13/13 11:19	03/19/13 14:04	1

Other Detected Radionuclides	*MB Result*	*MB Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Other Detected Radionuclide	*None*						*pCi/g*	*03/13/13 11:19*	*03/19/13 14:04*	*1*

Lab Sample ID: LCS 160-39448/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40655 — **Prep Batch: 39448**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	98.33		10.4		1.48	pCi/g	101	87 - 116
Cesium-137	31.9	31.35		3.44	0.200	0.461	pCi/g	98	87 - 120
Cobalt-60	26.2	26.28		2.76		0.211	pCi/g	100	87 - 115

Lab Sample ID: 160-1721-1 DU — **Client Sample ID: 1HS1L5-A1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40653 — **Prep Batch: 39448**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium-228	0.714		0.4285		0.172		0.187	pCi/g	0.67	1
Cesium-137	0.145		0.1542		0.0541	0.200	0.0371	pCi/g	0.07	1
Thorium-232	0.714		0.4285		0.172		0.187	pCi/g	0.67	1

QC Association Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1721-1

Rad

Leach Batch: 38973

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1721-1	1HS1L5-A1	Total/NA	Solid	Dry and Grind	
160-1721-1 DU	1HS1L5-A1	Total/NA	Solid	Dry and Grind	
160-1721-2	1HS1L5-A2	Total/NA	Solid	Dry and Grind	
160-1721-3	1HS1L5-A3	Total/NA	Solid	Dry and Grind	
160-1721-4	1HS1L5-A4	Total/NA	Solid	Dry and Grind	
160-1721-5	1HS1L5-B1	Total/NA	Solid	Dry and Grind	
160-1721-6	1HS1L5-B2	Total/NA	Solid	Dry and Grind	
160-1721-7	1HS1L5-B3	Total/NA	Solid	Dry and Grind	
160-1721-8	1HS1L5-C1	Total/NA	Solid	Dry and Grind	
160-1721-9	1HS1L5-C2	Total/NA	Solid	Dry and Grind	
160-1721-10	1HS1L5-C3	Total/NA	Solid	Dry and Grind	
160-1721-11	1HS1L5-D2	Total/NA	Solid	Dry and Grind	
160-1721-12	1HS1L5-D3	Total/NA	Solid	Dry and Grind	
160-1721-13	1HS1L5-E2	Total/NA	Solid	Dry and Grind	
160-1721-14	1HS1L5-E3	Total/NA	Solid	Dry and Grind	
160-1721-15	1HS1L5-F2	Total/NA	Solid	Dry and Grind	
160-1721-16	1HS1L5-F3	Total/NA	Solid	Dry and Grind	

Prep Batch: 39448

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1721-1	1HS1L5-A1	Total/NA	Solid	Fill_Geo-0	38973
160-1721-1 DU	1HS1L5-A1	Total/NA	Solid	Fill_Geo-0	38973
160-1721-2	1HS1L5-A2	Total/NA	Solid	Fill_Geo-0	38973
160-1721-3	1HS1L5-A3	Total/NA	Solid	Fill_Geo-0	38973
160-1721-4	1HS1L5-A4	Total/NA	Solid	Fill_Geo-0	38973
160-1721-5	1HS1L5-B1	Total/NA	Solid	Fill_Geo-0	38973
160-1721-6	1HS1L5-B2	Total/NA	Solid	Fill_Geo-0	38973
160-1721-7	1HS1L5-B3	Total/NA	Solid	Fill_Geo-0	38973
160-1721-8	1HS1L5-C1	Total/NA	Solid	Fill_Geo-0	38973
160-1721-9	1HS1L5-C2	Total/NA	Solid	Fill_Geo-0	38973
160-1721-10	1HS1L5-C3	Total/NA	Solid	Fill_Geo-0	38973
160-1721-11	1HS1L5-D2	Total/NA	Solid	Fill_Geo-0	38973
160-1721-12	1HS1L5-D3	Total/NA	Solid	Fill_Geo-0	38973
160-1721-13	1HS1L5-E2	Total/NA	Solid	Fill_Geo-0	38973
160-1721-14	1HS1L5-E3	Total/NA	Solid	Fill_Geo-0	38973
160-1721-15	1HS1L5-F2	Total/NA	Solid	Fill_Geo-0	38973
160-1721-16	1HS1L5-F3	Total/NA	Solid	Fill_Geo-0	38973
LCS 160-39448/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-39448/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-1639-1
Client Project/Site: Waste Characterizations

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Mary Ann Tapia

Rhonda Ridenhower

Authorized for release by:
3/26/2013 4:25:54 PM
Rhonda Ridenhower
Customer Service Manager
rhonda.ridenhower@testamericainc.com

Designee for

Erika Starman
Project Manager I
erika.starman@testamericainc.com

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www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-1639-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Waste Characterizations

Report Number: 160-1639-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 02/28/2013; the samples arrived in good condition. The temperature of the coolers at receipt was 20.0 C.

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Samples IHS1L3-A1 (160-1639-1), IHS1L3-A2 (160-1639-2), IHS1L3-A3 (160-1639-3), IHS1L3-A4 (160-1639-4), IHS1L3-B1 (160-1639-5), IHS1L3-B3 (160-1639-7), IHS1L3-B4 (160-1639-8), IHS1L3-C2 (160-1639-9), IHS1L3-C3 (160-1639-10), IHS1L3-C4 (160-1639-11), IHS1L3-D2 (160-1639-12), IHS1L3-D3 (160-1639-13), IHS1L3-D4 (160-1639-14), IHS1L3-E3 (160-1639-15), IHS1L3-E4 (160-1639-16), IHS1L4-A1 (160-1639-17), IHS1L4-A2 (160-1639-18), IHS1L4-A3 (160-1639-19), IHS1L4-A4 (160-1639-20), IHS1L4-B1 (160-1639-21), IHS1L4-B3 (160-1639-23), IHS1L4-B4 (160-1639-24), IHS1L4-C2 (160-1639-25), IHS1L4-C3 (160-1639-26), IHS1L4-C4 (160-1639-27), IHS1L4-D2 (160-1639-28), IHS1L4-D3 (160-1639-29), IHS1L4-D4 (160-1639-30), IHS1L4-E2 (160-1639-31) and IHS1L4-E4 (160-1639-32) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 02/28/2013, prepared on 03/12/2013 and analyzed on 03/15/2013, 03/17/2013, 03/19/2013 and 03/20/2013.

The reporting limit for Cesium-137 analyzed by gamma spectroscopy was not met due to the presence of activity in the sample. The data is reported with the MDA achieved. IHS1L3-C2 (160-1639-9)

Job ID: 160-1639-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

No other difficulties were encountered during the Gamma spec analyses.

All other quality control parameters were within the acceptance limits.

.. Rider Trail North
Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

CR336

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 2/26/2013	COC No: IH-2
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	1 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L3-A1	2/25/2013	0815	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-A2	2/25/2013	0820	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-A3	2/25/2013	0825	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-A4	2/25/2013	0830	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-B1	2/25/2013	0835	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-B2	2/25/2013	0840	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-B3	2/25/2013	0845	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-B4	2/25/2013	0850	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-C2	2/25/2013	855	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-C3	2/25/2013	0900	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-C4	2/25/2013	0905	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-D2	2/25/2013	0910	Grab	S	1		X	Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments: QC Level IV

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	AWS	2/26/2013/1400	[signature]	TA SR	2.28.13 1310
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 2/26/2013	COC No: IH-2
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	2 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L3-D3	2/25/2013	0915	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-D4	2/25/2013	0920	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-E3	2/25/2013	0925	Grab	S	1		X	Ac-228 for Th-232
IHS1L3-E4	2/25/2013	0930	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-A1	2/26/2013	1040	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-A2	2/26/2013	1045	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-A3	2/26/2013	1050	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-A4	2/26/2013	1055	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-B1	2/26/2013	1100	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-B2	2/26/2013	1105	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-B3	2/26/2013	1110	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-B4	2/26/2013	1115	Grab	S	1		X	Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments: QC Level IV

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Spicuzza	AWS	2/26/2013/1400	Jill Clark	TA STL	2-28-13 1310
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

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Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 2/26/2013	COC No: IH-2
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	3 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L4-C2	2/26/2013	1120	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-C3	2/26/2013	1125	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-C4	2/26/2013	1130	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-D2	2/26/2013	1135	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-D3	2/26/2013	1140	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-D4	2/26/2013	1145	Grab	S	1		X	Ac-228 for Th-232
IHS1L4-E2	2/26/2013	1155	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-E4	2/26/2013	1150	Grab	S	1		X	Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments: QC Level IV

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Spi	AWS	2/26/2013/1400	Gil Clark	TA SL	2-28-13 1310
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-1639-1

Login Number: 1639

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Method	Method Description	Protocol	Laboratory
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-1639-1	IHS1L3-A1	Solid	02/25/13 08:15	02/28/13 13:10
160-1639-2	IHS1L3-A2	Solid	02/25/13 08:20	02/28/13 13:10
160-1639-3	IHS1L3-A3	Solid	02/25/13 08:25	02/28/13 13:10
160-1639-4	IHS1L3-A4	Solid	02/25/13 08:30	02/28/13 13:10
160-1639-5	IHS1L3-B1	Solid	02/25/13 08:35	02/28/13 13:10
160-1639-7	IHS1L3-B3	Solid	02/25/13 08:45	02/28/13 13:10
160-1639-8	IHS1L3-B4	Solid	02/25/13 08:50	02/28/13 13:10
160-1639-9	IHS1L3-C2	Solid	02/25/13 08:55	02/28/13 13:10
160-1639-10	IHS1L3-C3	Solid	02/25/13 09:00	02/28/13 13:10
160-1639-11	IHS1L3-C4	Solid	02/25/13 09:05	02/28/13 13:10
160-1639-12	IHS1L3-D2	Solid	02/25/13 09:10	02/28/13 13:10
160-1639-13	IHS1L3-D3	Solid	02/25/13 09:15	02/28/13 13:10
160-1639-14	IHS1L3-D4	Solid	02/25/13 09:20	02/28/13 13:10
160-1639-15	IHS1L3-E3	Solid	02/25/13 09:25	02/28/13 13:10
160-1639-16	IHS1L3-E4	Solid	02/25/13 09:30	02/28/13 13:10
160-1639-17	IHS1L4-A1	Solid	02/26/13 10:40	02/28/13 13:10
160-1639-18	IHS1L4-A2	Solid	02/26/13 10:45	02/28/13 13:10
160-1639-19	IHS1L4-A3	Solid	02/26/13 10:50	02/28/13 13:10
160-1639-20	IHS1L4-A4	Solid	02/26/13 10:55	02/28/13 13:10
160-1639-21	IHS1L4-B1	Solid	02/26/13 11:00	02/28/13 13:10
160-1639-23	IHS1L4-B3	Solid	02/26/13 11:10	02/28/13 13:10
160-1639-24	IHS1L4-B4	Solid	02/26/13 11:15	02/28/13 13:10
160-1639-25	IHS1L4-C2	Solid	02/26/13 11:20	02/28/13 13:10
160-1639-26	IHS1L4-C3	Solid	02/26/13 11:25	02/28/13 13:10
160-1639-27	IHS1L4-C4	Solid	02/26/13 11:30	02/28/13 13:10
160-1639-28	IHS1L4-D2	Solid	02/26/13 11:35	02/28/13 13:10
160-1639-29	IHS1L4-D3	Solid	02/26/13 11:40	02/28/13 13:10
160-1639-30	IHS1L4-D4	Solid	02/26/13 11:45	02/28/13 13:10
160-1639-31	IHS1L4-E2	Solid	02/26/13 11:55	02/28/13 13:10
160-1639-32	IHS1L4-E4	Solid	02/26/13 11:50	02/28/13 13:10

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L3-A1

Lab Sample ID: 160-1639-1

Date Collected: 02/25/13 08:15
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.938		0.237	0.255		0.372	pCi/g	03/12/13 10:32	03/15/13 15:18	1
Cesium-137	-0.0645	U	0.918	0.918	0.200	0.182	pCi/g	03/12/13 10:32	03/15/13 15:18	1
Thorium-232	0.938		0.237	0.255		0.372	pCi/g	03/12/13 10:32	03/15/13 15:18	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.21*		*0.259*	*0.288*		*0.165*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:18*	*1*
K-40	*4.92*		*1.39*	*1.48*		*1.09*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:18*	*1*
Pb-212	*1.04*		*0.213*	*0.252*		*0.199*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:18*	*1*
Pb-214	*1.38*		*0.208*	*0.252*		*0.203*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:18*	*1*
Tl-208	*0.383*		*0.100*	*0.108*		*0.0581*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:18*	*1*

Client Sample ID: IHS1L3-A2

Lab Sample ID: 160-1639-2

Date Collected: 02/25/13 08:20
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.514		0.219	0.226		0.282	pCi/g	03/12/13 10:32	03/15/13 15:21	1
Cesium-137	0.175		0.0586	0.0613	0.200	0.0419	pCi/g	03/12/13 10:32	03/15/13 15:21	1
Thorium-232	0.514		0.219	0.226		0.282	pCi/g	03/12/13 10:32	03/15/13 15:21	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.790*		*0.164*	*0.183*		*0.129*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*
K-40	*3.86*		*1.25*	*1.31*		*1.30*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*
Pb-212	*0.803*		*0.133*	*0.169*		*0.109*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*
Pb-214	*0.886*		*0.145*	*0.172*		*0.113*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*
Tl-208	*0.292*		*0.0605*	*0.0677*		*0.0357*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*

Client Sample ID: IHS1L3-A3

Lab Sample ID: 160-1639-3

Date Collected: 02/25/13 08:25
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.20		0.270	0.296		0.146	pCi/g	03/12/13 10:32	03/15/13 15:21	1
Cesium-137	0.0478	U	0.0712	0.0713	0.200	0.119	pCi/g	03/12/13 10:32	03/15/13 15:21	1
Thorium-232	1.20		0.270	0.296		0.146	pCi/g	03/12/13 10:32	03/15/13 15:21	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.04*		*0.219*	*0.244*		*0.171*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*

Client Sample ID: IHS1L3-A3

Lab Sample ID: 160-1639-3
Date Collected: 02/25/13 08:25
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
K-40	*4.84*		*1.52*	*1.60*		*1.80*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*
Pb-212	*1.16*		*0.206*	*0.255*		*0.202*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*
Pb-214	*1.18*		*0.193*	*0.228*		*0.175*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*
Tl-208	*0.471*		*0.113*	*0.123*		*0.0913*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:21*	*1*

Client Sample ID: IHS1L3-A4

Lab Sample ID: 160-1639-4
Date Collected: 02/25/13 08:30
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.36**		0.256	0.291		0.130	pCi/g	03/12/13 10:32	03/15/13 15:22	1
Cesium-137	-0.00242	U	0.0671	0.0671	0.200	0.123	pCi/g	03/12/13 10:32	03/15/13 15:22	1
Thorium-232	**1.36**		0.256	0.291		0.130	pCi/g	03/12/13 10:32	03/15/13 15:22	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.972*		*0.216*	*0.239*		*0.198*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:22*	*1*
K-40	*9.45*		*1.62*	*1.89*		*0.512*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:22*	*1*
Pb-212	*1.24*		*0.180*	*0.241*		*0.164*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:22*	*1*
Pb-214	*1.09*		*0.183*	*0.215*		*0.143*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:22*	*1*
Tl-208	*0.445*		*0.102*	*0.112*		*0.0884*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:22*	*1*

Client Sample ID: IHS1L3-B1

Lab Sample ID: 160-1639-5
Date Collected: 02/25/13 08:35
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.54**		0.318	0.355		0.125	pCi/g	03/12/13 10:32	03/15/13 15:23	1
Cesium-137	0.0351	U	0.0682	0.0683	0.200	0.117	pCi/g	03/12/13 10:32	03/15/13 15:23	1
Thorium-232	**1.54**		0.318	0.355		0.125	pCi/g	03/12/13 10:32	03/15/13 15:23	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.11*		*0.220*	*0.248*		*0.187*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
K-40	*5.27*		*1.40*	*1.50*		*1.53*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
Pb-212	*1.17*		*0.216*	*0.264*		*0.210*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
Pb-214	*1.24*		*0.239*	*0.272*		*0.209*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
Tl-208	*0.423*		*0.105*	*0.114*		*0.0957*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L3-B3

Lab Sample ID: 160-1639-7
Date Collected: 02/25/13 08:45
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.13		0.269	0.293		0.308	pCi/g	03/12/13 10:32	03/15/13 15:23	1
Cesium-137	0.0864	U	0.0631	0.0637	0.200	0.0914	pCi/g	03/12/13 10:32	03/15/13 15:23	1
Thorium-232	1.13		0.269	0.293		0.308	pCi/g	03/12/13 10:32	03/15/13 15:23	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.04*		*0.230*	*0.254*		*0.189*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
K-40	*5.28*		*1.44*	*1.54*		*1.28*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
Pb-212	*1.12*		*0.191*	*0.240*		*0.182*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
Pb-214	*0.953*		*0.194*	*0.218*		*0.200*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*
Tl-208	*0.384*		*0.0960*	*0.104*		*0.0837*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:23*	*1*

Client Sample ID: IHS1L3-B4

Lab Sample ID: 160-1639-8
Date Collected: 02/25/13 08:50
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.851		0.214	0.231		0.0996	pCi/g	03/12/13 10:32	03/15/13 15:24	1
Cesium-137	0.0396	U	0.0498	0.0499	0.200	0.0887	pCi/g	03/12/13 10:32	03/15/13 15:24	1
Thorium-232	0.851		0.214	0.231		0.0996	pCi/g	03/12/13 10:32	03/15/13 15:24	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.737*		*0.157*	*0.174*		*0.131*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:24*	*1*
K-40	*4.72*		*1.06*	*1.17*		*1.03*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:24*	*1*
Pb-212	*0.703*		*0.131*	*0.159*		*0.136*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:24*	*1*
Pb-214	*0.774*		*0.142*	*0.163*		*0.125*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:24*	*1*
Tl-208	*0.254*		*0.0753*	*0.0798*		*0.0722*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:24*	*1*

Client Sample ID: IHS1L3-C2

Lab Sample ID: 160-1639-9
Date Collected: 02/25/13 08:55
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	41.1		0.962	4.30		0.495	pCi/g	03/12/13 10:32	03/20/13 22:53	1
Cesium-137	0.0657	U	0.150	0.151	0.200	0.250	pCi/g	03/12/13 10:32	03/20/13 22:53	1
Thorium-232	41.1		0.962	4.30		0.495	pCi/g	03/12/13 10:32	03/20/13 22:53	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*45.2*		*3.09*	*5.61*		*2.36*	*pCi/g*	*03/12/13 10:32*	*03/20/13 22:53*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L3-C2

Lab Sample ID: 160-1639-9
Date Collected: 02/25/13 08:55
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.39*		*0.381*	*0.407*		*0.388*	*pCi/g*	*03/12/13 10:32*	*03/20/13 22:53*	*1*
K-40	*12.5*		*2.06*	*2.42*		*1.49*	*pCi/g*	*03/12/13 10:32*	*03/20/13 22:53*	*1*
Pb-212	*47.2*		*0.607*	*6.14*		*0.333*	*pCi/g*	*03/12/13 10:32*	*03/20/13 22:53*	*1*
Pb-214	*1.37*		*0.296*	*0.329*		*0.332*	*pCi/g*	*03/12/13 10:32*	*03/20/13 22:53*	*1*
Tl-208	*14.4*		*0.368*	*1.54*		*0.203*	*pCi/g*	*03/12/13 10:32*	*03/20/13 22:53*	*1*

Client Sample ID: IHS1L3-C3

Lab Sample ID: 160-1639-10
Date Collected: 02/25/13 09:00
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.03**		0.342	0.358		0.378	pCi/g	03/12/13 10:32	03/15/13 15:25	1
Cesium-137	-0.0375	U	1.50	1.50	0.200	0.168	pCi/g	03/12/13 10:32	03/15/13 15:25	1
Thorium-232	**1.03**		0.342	0.358		0.378	pCi/g	03/12/13 10:32	03/15/13 15:25	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.20*		*0.236*	*0.267*		*0.180*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:25*	*1*
K-40	*5.82*		*1.41*	*1.53*		*1.34*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:25*	*1*
Pb-212	*1.14*		*0.201*	*0.318*		*0.195*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:25*	*1*
Pb-214	*1.16*		*0.245*	*0.289*		*0.235*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:25*	*1*
Tl-208	*0.320*		*0.104*	*0.109*		*0.129*	*pCi/g*	*03/12/13 10:32*	*03/15/13 15:25*	*1*

Client Sample ID: IHS1L3-C4

Lab Sample ID: 160-1639-11
Date Collected: 02/25/13 09:05
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.42**		0.240	0.280		0.102	pCi/g	03/12/13 10:32	03/15/13 16:13	1
Cesium-137	0.0360	U	0.0564	0.0566	0.200	0.0949	pCi/g	03/12/13 10:32	03/15/13 16:13	1
Thorium-232	**1.42**		0.240	0.280		0.102	pCi/g	03/12/13 10:32	03/15/13 16:13	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.960*		*0.219*	*0.241*		*0.180*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
K-40	*5.26*		*1.21*	*1.33*		*1.21*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
Pb-212	*1.18*		*0.188*	*0.242*		*0.166*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
Pb-214	*1.09*		*0.235*	*0.260*		*0.202*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
Tl-208	*0.417*		*0.0899*	*0.0998*		*0.0697*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L3-D2

Lab Sample ID: 160-1639-12

Date Collected: 02/25/13 09:10
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.67		0.286	0.333		0.264	pCi/g	03/12/13 10:32	03/15/13 16:13	1
Cesium-137	0.0727	U	0.0672	0.0676	0.200	0.105	pCi/g	03/12/13 10:32	03/15/13 16:13	1
Thorium-232	1.67		0.286	0.333		0.264	pCi/g	03/12/13 10:32	03/15/13 16:13	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.07*		*0.217*	*0.244*		*0.164*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
K-40	*5.83*		*1.46*	*1.57*		*1.40*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
Pb-212	*1.68*		*0.216*	*0.307*		*0.187*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
Pb-214	*1.07*		*0.263*	*0.286*		*0.238*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*
Tl-208	*0.659*		*0.126*	*0.144*		*0.0954*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:13*	*1*

Client Sample ID: IHS1L3-D3

Lab Sample ID: 160-1639-13

Date Collected: 02/25/13 09:15
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.01		0.266	0.285		0.259	pCi/g	03/12/13 10:32	03/15/13 16:14	1
Cesium-137	0.0467	U	0.0643	0.0645	0.200	0.107	pCi/g	03/12/13 10:32	03/15/13 16:14	1
Thorium-232	1.01		0.266	0.285		0.259	pCi/g	03/12/13 10:32	03/15/13 16:14	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.00*		*0.216*	*0.240*		*0.199*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:14*	*1*
K-40	*7.98*		*1.50*	*1.71*		*0.521*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:14*	*1*
Pb-212	*0.890*		*0.175*	*0.210*		*0.188*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:14*	*1*
Pb-214	*1.15*		*0.209*	*0.241*		*0.230*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:14*	*1*
Tl-208	*0.395*		*0.0988*	*0.107*		*0.0890*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:14*	*1*

Client Sample ID: IHS1L3-D4

Lab Sample ID: 160-1639-14

Date Collected: 02/25/13 09:20
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.708		0.251	0.261		0.186	pCi/g	03/12/13 10:32	03/15/13 16:16	1
Cesium-137	0.0545	U	0.0715	0.0718	0.200	0.125	pCi/g	03/12/13 10:32	03/15/13 16:16	1
Thorium-232	0.708		0.251	0.261		0.186	pCi/g	03/12/13 10:32	03/15/13 16:16	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.794*		*0.186*	*0.204*		*0.156*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:16*	*1*

Client Sample ID: IHS1L3-D4

Lab Sample ID: 160-1639-14

Date Collected: 02/25/13 09:20

Matrix: Solid

Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
K-40	*7.11*		*1.41*	*1.59*		*1.15*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:16*	*1*
Pb-212	*0.798*		*0.165*	*0.238*		*0.179*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:16*	*1*
Pb-214	*0.921*		*0.181*	*0.218*		*0.182*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:16*	*1*
Tl-208	*0.348*		*0.104*	*0.110*		*0.0923*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:16*	*1*

Client Sample ID: IHS1L3-E3

Lab Sample ID: 160-1639-15

Date Collected: 02/25/13 09:25

Matrix: Solid

Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.16**		0.272	0.297		0.269	pCi/g	03/12/13 10:32	03/15/13 16:51	1
Cesium-137	**0.313**		0.0840	0.0901	0.200	0.0530	pCi/g	03/12/13 10:32	03/15/13 16:51	1
Thorium-232	**1.16**		0.272	0.297		0.269	pCi/g	03/12/13 10:32	03/15/13 16:51	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*1.18*		*0.658*	*0.669*		*0.549*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:51*	*1*
Bi-214	*1.09*		*0.217*	*0.245*		*0.188*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:51*	*1*
K-40	*7.40*		*1.53*	*1.70*		*1.54*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:51*	*1*
Pb-212	*1.24*		*0.179*	*0.240*		*0.159*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:51*	*1*
Pb-214	*1.19*		*0.218*	*0.251*		*0.180*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:51*	*1*
Tl-208	*0.385*		*0.0885*	*0.0971*		*0.0761*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:51*	*1*

Client Sample ID: IHS1L3-E4

Lab Sample ID: 160-1639-16

Date Collected: 02/25/13 09:30

Matrix: Solid

Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.733**		0.198	0.212		0.254	pCi/g	03/12/13 10:32	03/15/13 16:52	1
Cesium-137	0.0923	U	0.0636	0.0643	0.200	0.0948	pCi/g	03/12/13 10:32	03/15/13 16:52	1
Thorium-232	**0.733**		0.198	0.212		0.254	pCi/g	03/12/13 10:32	03/15/13 16:52	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.770*		*0.176*	*0.194*		*0.152*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:52*	*1*
K-40	*4.56*		*1.19*	*1.28*		*1.31*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:52*	*1*
Pb-212	*0.861*		*0.174*	*0.207*		*0.172*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:52*	*1*
Pb-214	*0.929*		*0.218*	*0.239*		*0.187*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:52*	*1*
Tl-208	*0.334*		*0.0706*	*0.0786*		*0.0498*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:52*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L4-A1

Lab Sample ID: 160-1639-17

Date Collected: 02/26/13 10:40
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.480	U	0.262	0.267		0.645	pCi/g	03/12/13 10:32	03/15/13 16:53	1
Cesium-137	0.0333	U	0.110	0.110	0.200	0.195	pCi/g	03/12/13 10:32	03/15/13 16:53	1
Thorium-232	0.480	U	0.262	0.267		0.645	pCi/g	03/12/13 10:32	03/15/13 16:53	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.938*		*0.236*	*0.256*		*0.110*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:53*	*1*
K-40	*3.39*		*1.80*	*1.83*		*2.48*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:53*	*1*
Pb-212	*0.995*		*0.222*	*0.257*		*0.225*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:53*	*1*
Pb-214	*1.18*		*0.282*	*0.307*		*0.252*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:53*	*1*
Tl-208	*0.270*		*0.116*	*0.119*		*0.145*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:53*	*1*

Client Sample ID: IHS1L4-A2

Lab Sample ID: 160-1639-18

Date Collected: 02/26/13 10:45
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.70**		0.218	0.278		0.0877	pCi/g	03/12/13 10:32	03/15/13 16:54	1
Cesium-137	**0.205**		0.0659	0.0692	0.200	0.0513	pCi/g	03/12/13 10:32	03/15/13 16:54	1
Thorium-232	**1.70**		0.218	0.278		0.0877	pCi/g	03/12/13 10:32	03/15/13 16:54	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*2.42*		*0.700*	*0.744*		*0.462*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:54*	*1*
Bi-214	*0.660*		*0.151*	*0.166*		*0.125*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:54*	*1*
K-40	*4.70*		*1.14*	*1.24*		*1.28*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:54*	*1*
Pb-212	*1.88*		*0.188*	*0.308*		*0.145*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:54*	*1*
Pb-214	*0.815*		*0.166*	*0.186*		*0.144*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:54*	*1*
Tl-208	*0.692*		*0.111*	*0.132*		*0.0775*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:54*	*1*

Client Sample ID: IHS1L4-A3

Lab Sample ID: 160-1639-19

Date Collected: 02/26/13 10:50
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**4.37**		0.559	0.715		0.132	pCi/g	03/12/13 10:32	03/15/13 16:55	1
Cesium-137	**0.331**		0.120	0.124	0.200	0.113	pCi/g	03/12/13 10:32	03/15/13 16:55	1
Thorium-232	**4.37**		0.559	0.715		0.132	pCi/g	03/12/13 10:32	03/15/13 16:55	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L4-A3

Lab Sample ID: 160-1639-19

Date Collected: 02/26/13 10:50
Matrix: Solid
Date Received: 02/28/13 13:10

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*4.65*		*1.31*	*1.40*		*1.16*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
Bi-214	*1.05*		*0.229*	*0.254*		*0.203*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
K-40	*5.96*		*1.35*	*1.48*		*1.02*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
Pb-212	*4.38*		*0.338*	*0.660*		*0.250*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
Pb-214	*1.19*		*0.256*	*0.285*		*0.238*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
Tl-208	*1.40*		*0.176*	*0.229*		*0.118*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*

Client Sample ID: IHS1L4-A4

Lab Sample ID: 160-1639-20

Date Collected: 02/26/13 10:55
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**13.0**		0.462	1.40		0.310	pCi/g	03/12/13 10:32	03/19/13 22:49	1
Cesium-137	0.0866	U	0.0862	0.0867	0.200	0.141	pCi/g	03/12/13 10:32	03/19/13 22:49	1
Thorium-232	**13.0**		0.462	1.40		0.310	pCi/g	03/12/13 10:32	03/19/13 22:49	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*14.7*		*1.59*	*2.21*		*1.32*	*pCi/g*	*03/12/13 10:32*	*03/19/13 22:49*	*1*
Bi-214	*0.942*		*0.185*	*0.210*		*0.199*	*pCi/g*	*03/12/13 10:32*	*03/19/13 22:49*	*1*
K-40	*8.05*		*1.13*	*1.39*		*0.942*	*pCi/g*	*03/12/13 10:32*	*03/19/13 22:49*	*1*
Pb-212	*13.2*		*0.358*	*1.74*		*0.239*	*pCi/g*	*03/12/13 10:32*	*03/19/13 22:49*	*1*
Pb-214	*0.768*		*0.177*	*0.194*		*0.237*	*pCi/g*	*03/12/13 10:32*	*03/19/13 22:49*	*1*
Tl-208	*4.69*		*0.217*	*0.533*		*0.133*	*pCi/g*	*03/12/13 10:32*	*03/19/13 22:49*	*1*

Client Sample ID: IHS1L4-B1

Lab Sample ID: 160-1639-21

Date Collected: 02/26/13 11:00
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.19**		0.258	0.286		0.193	pCi/g	03/12/13 10:32	03/15/13 16:55	1
Cesium-137	0.00111	U	0.0634	0.0634	0.200	0.125	pCi/g	03/12/13 10:32	03/15/13 16:55	1
Thorium-232	**1.19**		0.258	0.286		0.193	pCi/g	03/12/13 10:32	03/15/13 16:55	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.08*		*0.213*	*0.240*		*0.168*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
K-40	*7.95*		*1.67*	*1.86*		*1.41*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
Pb-212	*1.13*		*0.227*	*0.333*		*0.218*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
Pb-214	*1.17*		*0.204*	*0.256*		*0.198*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*
Tl-208	*0.324*		*0.0922*	*0.0981*		*0.111*	*pCi/g*	*03/12/13 10:32*	*03/15/13 16:55*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L4-B3

Lab Sample ID: 160-1639-23

Date Collected: 02/26/13 11:10
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**8.65**		0.659	1.11		0.295	pCi/g	03/12/13 12:26	03/19/13 21:56	1
Cesium-137	0.0632	U	0.101	0.101	0.200	0.175	pCi/g	03/12/13 12:26	03/19/13 21:56	1
Thorium-232	**8.65**		0.659	1.11		0.295	pCi/g	03/12/13 12:26	03/19/13 21:56	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*10.5*		*1.77*	*2.08*		*1.06*	*pCi/g*	*03/12/13 12:26*	*03/19/13 21:56*	*1*
Bi-214	*1.17*		*0.262*	*0.289*		*0.240*	*pCi/g*	*03/12/13 12:26*	*03/19/13 21:56*	*1*
K-40	*3.63*		*1.40*	*1.45*		*1.97*	*pCi/g*	*03/12/13 12:26*	*03/19/13 21:56*	*1*
Pb-212	*9.74*		*0.458*	*2.15*		*0.326*	*pCi/g*	*03/12/13 12:26*	*03/19/13 21:56*	*1*
Pb-214	*1.22*		*0.347*	*0.383*		*0.353*	*pCi/g*	*03/12/13 12:26*	*03/19/13 21:56*	*1*
Tl-208	*3.04*		*0.314*	*0.446*		*0.214*	*pCi/g*	*03/12/13 12:26*	*03/19/13 21:56*	*1*

Client Sample ID: IHS1L4-B4

Lab Sample ID: 160-1639-24

Date Collected: 02/26/13 11:15
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.51**		0.286	0.325		0.0994	pCi/g	03/12/13 12:26	03/15/13 17:44	1
Cesium-137	0.0122	U	0.0515	0.0515	0.200	0.0918	pCi/g	03/12/13 12:26	03/15/13 17:44	1
Thorium-232	**1.51**		0.286	0.325		0.0994	pCi/g	03/12/13 12:26	03/15/13 17:44	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.00*		*0.199*	*0.225*		*0.149*	*pCi/g*	*03/12/13 12:26*	*03/15/13 17:44*	*1*
K-40	*6.74*		*1.24*	*1.41*		*0.830*	*pCi/g*	*03/12/13 12:26*	*03/15/13 17:44*	*1*
Pb-212	*1.24*		*0.189*	*0.248*		*0.166*	*pCi/g*	*03/12/13 12:26*	*03/15/13 17:44*	*1*
Pb-214	*0.804*		*0.166*	*0.186*		*0.148*	*pCi/g*	*03/12/13 12:26*	*03/15/13 17:44*	*1*
Tl-208	*0.504*		*0.0889*	*0.103*		*0.0534*	*pCi/g*	*03/12/13 12:26*	*03/15/13 17:44*	*1*

Client Sample ID: IHS1L4-C2

Lab Sample ID: 160-1639-25

Date Collected: 02/26/13 11:20
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.915**		0.236	0.255		0.117	pCi/g	03/12/13 12:26	03/15/13 17:44	1
Cesium-137	-0.0142	U	0.170	0.170	0.200	0.126	pCi/g	03/12/13 12:26	03/15/13 17:44	1
Thorium-232	**0.915**		0.236	0.255		0.117	pCi/g	03/12/13 12:26	03/15/13 17:44	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L4-C2

Lab Sample ID: 160-1639-25

Date Collected: 02/26/13 11:20
Matrix: Solid
Date Received: 02/28/13 13:10

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Bi-214	0.837		0.174	0.195		0.133	pCi/g	03/12/13 12:26	03/15/13 17:44	1
K-40	5.35		1.33	1.44		1.45	pCi/g	03/12/13 12:26	03/15/13 17:44	1
Pb-212	0.878		0.185	0.265		0.186	pCi/g	03/12/13 12:26	03/15/13 17:44	1
Pb-214	0.782		0.158	0.188		0.133	pCi/g	03/12/13 12:26	03/15/13 17:44	1
Tl-208	0.348		0.0866	0.0938		0.0749	pCi/g	03/12/13 12:26	03/15/13 17:44	1

Client Sample ID: IHS1L4-C3

Lab Sample ID: 160-1639-26

Date Collected: 02/26/13 11:25
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.24		0.231	0.263		0.238	pCi/g	03/12/13 12:26	03/17/13 17:43	1
Cesium-137	0.0171	U	0.0641	0.0641	0.200	0.114	pCi/g	03/12/13 12:26	03/17/13 17:43	1
Thorium-232	1.24		0.231	0.263		0.238	pCi/g	03/12/13 12:26	03/17/13 17:43	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Bi-212	1.65		0.699	0.720		0.576	pCi/g	03/12/13 12:26	03/17/13 17:43	1
Bi-214	1.22		0.237	0.269		0.185	pCi/g	03/12/13 12:26	03/17/13 17:43	1
K-40	4.10		1.27	1.34		1.53	pCi/g	03/12/13 12:26	03/17/13 17:43	1
Pb-212	1.19		0.214	0.264		0.195	pCi/g	03/12/13 12:26	03/17/13 17:43	1
Pb-214	1.25		0.284	0.313		0.252	pCi/g	03/12/13 12:26	03/17/13 17:43	1
Tl-208	0.468		0.0904	0.103		0.0585	pCi/g	03/12/13 12:26	03/17/13 17:43	1

Client Sample ID: IHS1L4-C4

Lab Sample ID: 160-1639-27

Date Collected: 02/26/13 11:30
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.494	U	0.284	0.289		0.573	pCi/g	03/12/13 12:26	03/17/13 17:45	1
Cesium-137	-0.0154	U	0.0962	0.0963	0.200	0.178	pCi/g	03/12/13 12:26	03/17/13 17:45	1
Thorium-232	0.494	U	0.284	0.289		0.573	pCi/g	03/12/13 12:26	03/17/13 17:45	1

Other Detected Radionuclides	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Bi-214	0.853		0.288	0.302		0.249	pCi/g	03/12/13 12:26	03/17/13 17:45	1
K-40	5.78		1.96	2.04		1.90	pCi/g	03/12/13 12:26	03/17/13 17:45	1
Pb-212	0.947		0.219	0.251		0.206	pCi/g	03/12/13 12:26	03/17/13 17:45	1
Pb-214	0.774		0.248	0.261		0.208	pCi/g	03/12/13 12:26	03/17/13 17:45	1
Tl-208	0.359		0.111	0.117		0.0821	pCi/g	03/12/13 12:26	03/17/13 17:45	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L4-D2

Lab Sample ID: 160-1639-28

Date Collected: 02/26/13 11:35
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	2.70		0.405	0.490		0.322	pCi/g	03/12/13 12:26	03/17/13 17:44	1
Cesium-137	0.0603	U	0.0863	0.0865	0.200	0.144	pCi/g	03/12/13 12:26	03/17/13 17:44	1
Thorium-232	2.70		0.405	0.490		0.322	pCi/g	03/12/13 12:26	03/17/13 17:44	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*3.67*		*1.31*	*1.36*		*1.12*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:44*	*1*
Bi-214	*1.13*		*0.251*	*0.277*		*0.192*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:44*	*1*
K-40	*8.37*		*1.67*	*1.87*		*0.885*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:44*	*1*
Pb-212	*3.23*		*0.306*	*0.518*		*0.250*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:44*	*1*
Pb-214	*1.37*		*0.245*	*0.283*		*0.177*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:44*	*1*
Tl-208	*1.01*		*0.157*	*0.189*		*0.101*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:44*	*1*

Client Sample ID: IHS1L4-D3

Lab Sample ID: 160-1639-29

Date Collected: 02/26/13 11:40
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.16		0.303	0.325		0.418	pCi/g	03/12/13 12:26	03/17/13 17:45	1
Cesium-137	0.0333	U	0.0870	0.0871	0.200	0.171	pCi/g	03/12/13 12:26	03/17/13 17:45	1
Thorium-232	1.16		0.303	0.325		0.418	pCi/g	03/12/13 12:26	03/17/13 17:45	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*2.61*		*1.07*	*1.10*		*0.863*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:45*	*1*
Bi-214	*1.09*		*0.215*	*0.243*		*0.0787*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:45*	*1*
K-40	*6.01*		*1.57*	*1.69*		*1.16*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:45*	*1*
Pb-212	*1.55*		*0.246*	*0.317*		*0.222*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:45*	*1*
Pb-214	*1.26*		*0.259*	*0.290*		*0.212*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:45*	*1*
Tl-208	*0.595*		*0.124*	*0.138*		*0.0665*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:45*	*1*

Client Sample ID: IHS1L4-D4

Lab Sample ID: 160-1639-30

Date Collected: 02/26/13 11:45
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.35		0.220	0.259		0.173	pCi/g	03/12/13 12:26	03/17/13 17:47	1
Cesium-137	0.381		0.0838	0.0927	0.200	0.0474	pCi/g	03/12/13 12:26	03/17/13 17:47	1
Thorium-232	1.35		0.220	0.259		0.173	pCi/g	03/12/13 12:26	03/17/13 17:47	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Client Sample ID: IHS1L4-D4

Lab Sample ID: 160-1639-30

Date Collected: 02/26/13 11:45
Matrix: Solid
Date Received: 02/28/13 13:10

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.909*		*0.165*	*0.190*		*0.159*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:47*	*1*
K-40	*3.86*		*1.01*	*1.08*		*1.04*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:47*	*1*
Pb-212	*1.22*		*0.175*	*0.236*		*0.156*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:47*	*1*
Pb-214	*1.22*		*0.222*	*0.256*		*0.188*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:47*	*1*
Tl-208	*0.425*		*0.0973*	*0.107*		*0.0771*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:47*	*1*

Client Sample ID: IHS1L4-E2

Lab Sample ID: 160-1639-31

Date Collected: 02/26/13 11:55
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.878**		0.201	0.220		0.167	pCi/g	03/12/13 12:26	03/17/13 17:48	1
Cesium-137	0.00625	U	0.0542	0.0542	0.200	0.0993	pCi/g	03/12/13 12:26	03/17/13 17:48	1
Thorium-232	**0.878**		0.201	0.220		0.167	pCi/g	03/12/13 12:26	03/17/13 17:48	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.780*		*0.167*	*0.186*		*0.134*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:48*	*1*
K-40	*8.75*		*1.52*	*1.76*		*0.867*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:48*	*1*
Pb-212	*1.00*		*0.188*	*0.229*		*0.182*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:48*	*1*
Pb-214	*0.695*		*0.164*	*0.179*		*0.178*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:48*	*1*
Tl-208	*0.277*		*0.0872*	*0.0918*		*0.0900*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:48*	*1*

Client Sample ID: IHS1L4-E4

Lab Sample ID: 160-1639-32

Date Collected: 02/26/13 11:50
Matrix: Solid
Date Received: 02/28/13 13:10

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.573**		0.209	0.217		0.338	pCi/g	03/12/13 12:26	03/17/13 17:49	1
Cesium-137	**0.158**		0.0689	0.0709	0.200	0.0624	pCi/g	03/12/13 12:26	03/17/13 17:49	1
Thorium-232	**0.573**		0.209	0.217		0.338	pCi/g	03/12/13 12:26	03/17/13 17:49	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.774*		*0.203*	*0.218*		*0.198*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:49*	*1*
K-40	*5.62*		*1.26*	*1.38*		*0.854*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:49*	*1*
Pb-212	*0.919*		*0.136*	*0.181*		*0.117*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:49*	*1*
Pb-214	*0.890*		*0.192*	*0.213*		*0.176*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:49*	*1*
Tl-208	*0.371*		*0.0943*	*0.102*		*0.0818*	*pCi/g*	*03/12/13 12:26*	*03/17/13 17:49*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-39309/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40441 — **Prep Batch: 39309**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.08685	U	0.126	0.126		0.260	pCi/g	03/12/13 10:32	03/15/13 16:09	1
Cesium-137	-0.0004200	U	0.0347	0.0347	0.200	0.0674	pCi/g	03/12/13 10:32	03/15/13 16:09	1
Thorium-232	0.08685	U	0.126	0.126		0.260	pCi/g	03/12/13 10:32	03/15/13 16:09	1

Other Detected Radionuclides	*MB Result*	*MB Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Other Detected Radionuclide	*None*						*pCi/g*	*03/12/13 10:32*	*03/15/13 16:09*	*1*

Lab Sample ID: LCS 160-39309/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40442 — **Prep Batch: 39309**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	100.0		10.5		1.19	pCi/g	102	87 - 116
Cesium-137	31.9	32.35		3.45	0.200	0.327	pCi/g	101	87 - 120
Cobalt-60	26.2	25.38		2.60		0.208	pCi/g	97	87 - 115

Lab Sample ID: 160-1639-1 DU — **Client Sample ID: IHS1L3-A1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40440 — **Prep Batch: 39309**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium-228	0.938		0.6592	U	0.344		0.725	pCi/g	0.46	1
Cesium-137	-0.0645	U	0.002393	U	0.0949	0.200	0.184	pCi/g	0.07	1
Thorium-232	0.938		0.6592	U	0.344		0.725	pCi/g	0.46	1

Lab Sample ID: MB 160-39337/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40441 — **Prep Batch: 39337**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	-0.04751	U	0.913	0.913		0.309	pCi/g	03/12/13 12:26	03/15/13 17:41	1
Cesium-137	-0.002152	U	0.0483	0.0483	0.200	0.0895	pCi/g	03/12/13 12:26	03/15/13 17:41	1
Thorium-232	-0.04751	U	0.913	0.913		0.309	pCi/g	03/12/13 12:26	03/15/13 17:41	1

Other Detected Radionuclides	*MB Result*	*MB Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Other Detected Radionuclide	*None*						*pCi/g*	*03/12/13 12:26*	*03/15/13 17:41*	*1*

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-39337/2-A
Matrix: Solid
Analysis Batch: 40442

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 39337

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	97.83		10.3		1.22	pCi/g	100	87 - 116
Cesium-137	31.9	31.67		3.37	0.200	0.276	pCi/g	99	87 - 120
Cobalt-60	26.2	25.67		2.63		0.180	pCi/g	98	87 - 115

Lab Sample ID: 160-1639-23 DU
Matrix: Solid
Analysis Batch: 40381

Client Sample ID: IHS1L4-B3
Prep Type: Total/NA
Prep Batch: 39337

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium-228	8.65		9.602		1.22		0.373	pCi/g	0.41	1
Cesium-137	0.0632	U	0.02501	U	0.0797	0.200	0.138	pCi/g	0.21	1
Thorium-232	8.65		9.602		1.22		0.373	pCi/g	0.41	1

Rad

Leach Batch: 36867

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1639-1	IHS1L3-A1	Total/NA	Solid	Dry and Grind	
160-1639-1 DU	IHS1L3-A1	Total/NA	Solid	Dry and Grind	
160-1639-2	IHS1L3-A2	Total/NA	Solid	Dry and Grind	
160-1639-3	IHS1L3-A3	Total/NA	Solid	Dry and Grind	
160-1639-4	IHS1L3-A4	Total/NA	Solid	Dry and Grind	
160-1639-5	IHS1L3-B1	Total/NA	Solid	Dry and Grind	
160-1639-7	IHS1L3-B3	Total/NA	Solid	Dry and Grind	
160-1639-8	IHS1L3-B4	Total/NA	Solid	Dry and Grind	
160-1639-9	IHS1L3-C2	Total/NA	Solid	Dry and Grind	
160-1639-10	IHS1L3-C3	Total/NA	Solid	Dry and Grind	
160-1639-11	IHS1L3-C4	Total/NA	Solid	Dry and Grind	
160-1639-12	IHS1L3-D2	Total/NA	Solid	Dry and Grind	
160-1639-13	IHS1L3-D3	Total/NA	Solid	Dry and Grind	
160-1639-14	IHS1L3-D4	Total/NA	Solid	Dry and Grind	
160-1639-15	IHS1L3-E3	Total/NA	Solid	Dry and Grind	
160-1639-16	IHS1L3-E4	Total/NA	Solid	Dry and Grind	
160-1639-17	IHS1L4-A1	Total/NA	Solid	Dry and Grind	
160-1639-18	IHS1L4-A2	Total/NA	Solid	Dry and Grind	
160-1639-19	IHS1L4-A3	Total/NA	Solid	Dry and Grind	
160-1639-20	IHS1L4-A4	Total/NA	Solid	Dry and Grind	
160-1639-21	IHS1L4-B1	Total/NA	Solid	Dry and Grind	
160-1639-23	IHS1L4-B3	Total/NA	Solid	Dry and Grind	
160-1639-23 DU	IHS1L4-B3	Total/NA	Solid	Dry and Grind	
160-1639-24	IHS1L4-B4	Total/NA	Solid	Dry and Grind	
160-1639-25	IHS1L4-C2	Total/NA	Solid	Dry and Grind	
160-1639-26	IHS1L4-C3	Total/NA	Solid	Dry and Grind	
160-1639-27	IHS1L4-C4	Total/NA	Solid	Dry and Grind	
160-1639-28	IHS1L4-D2	Total/NA	Solid	Dry and Grind	
160-1639-29	IHS1L4-D3	Total/NA	Solid	Dry and Grind	
160-1639-30	IHS1L4-D4	Total/NA	Solid	Dry and Grind	
160-1639-31	IHS1L4-E2	Total/NA	Solid	Dry and Grind	
160-1639-32	IHS1L4-E4	Total/NA	Solid	Dry and Grind	

Prep Batch: 39309

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1639-1	IHS1L3-A1	Total/NA	Solid	Fill_Geo-0	36867
160-1639-1 DU	IHS1L3-A1	Total/NA	Solid	Fill_Geo-0	36867
160-1639-2	IHS1L3-A2	Total/NA	Solid	Fill_Geo-0	36867
160-1639-3	IHS1L3-A3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-4	IHS1L3-A4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-5	IHS1L3-B1	Total/NA	Solid	Fill_Geo-0	36867
160-1639-7	IHS1L3-B3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-8	IHS1L3-B4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-9	IHS1L3-C2	Total/NA	Solid	Fill_Geo-0	36867
160-1639-10	IHS1L3-C3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-11	IHS1L3-C4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-12	IHS1L3-D2	Total/NA	Solid	Fill_Geo-0	36867
160-1639-13	IHS1L3-D3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-14	IHS1L3-D4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-15	IHS1L3-E3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-16	IHS1L3-E4	Total/NA	Solid	Fill_Geo-0	36867

QC Association Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1639-1

Rad (Continued)

Prep Batch: 39309 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1639-17	IHS1L4-A1	Total/NA	Solid	Fill_Geo-0	36867
160-1639-18	IHS1L4-A2	Total/NA	Solid	Fill_Geo-0	36867
160-1639-19	IHS1L4-A3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-20	IHS1L4-A4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-21	IHS1L4-B1	Total/NA	Solid	Fill_Geo-0	36867
LCS 160-39309/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-39309/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Prep Batch: 39337

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1639-23	IHS1L4-B3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-23 DU	IHS1L4-B3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-24	IHS1L4-B4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-25	IHS1L4-C2	Total/NA	Solid	Fill_Geo-0	36867
160-1639-26	IHS1L4-C3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-27	IHS1L4-C4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-28	IHS1L4-D2	Total/NA	Solid	Fill_Geo-0	36867
160-1639-29	IHS1L4-D3	Total/NA	Solid	Fill_Geo-0	36867
160-1639-30	IHS1L4-D4	Total/NA	Solid	Fill_Geo-0	36867
160-1639-31	IHS1L4-E2	Total/NA	Solid	Fill_Geo-0	36867
160-1639-32	IHS1L4-E4	Total/NA	Solid	Fill_Geo-0	36867
LCS 160-39337/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-39337/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-1623-1
Client Project/Site: Waste Characterizations

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Daniel Spicuzza

Authorized for release by:
3/26/2013 9:41:48 AM

Erika Starman
Project Manager I
erika.starman@testamericainc.com

LINKS

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-1623-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Waste Characterizations

Report Number: 160-1623-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

Job ID: 160-1623-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

The samples were received on 2/26/2013 12:55 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 21.0º C.

CESIUM-137 & OTHER GAMMA EMITTERS (GS)

Samples IHS1L1-A1 (160-1623-1), IHS1L1-A2 (160-1623-2), IHS1L1-A3 (160-1623-3), IHS1L1-A4 (160-1623-4), IHS1L1-B1 (160-1623-5), IHS1L1-B2 (160-1623-6), IHS1L1-B3 (160-1623-7), IHS1L1-B4 (160-1623-8), IHS1L1-C1 (160-1623-9), IHS1L1-C2 (160-1623-10), IHS1L1-D3 (160-1623-11), IHS1L1-D4 (160-1623-12), IHS1L1-E3 (160-1623-13), IHS1L1-E4 (160-1623-14), IHS1L1-F3 (160-1623-15), IHS1L1-F4 (160-1623-16), IHS1L2-A1 (160-1623-17), IHS1L2-A2 (160-1623-18), IHS1L2-A3 (160-1623-19), IHS1L2-A4 (160-1623-20), IHS1L2-B1 (160-1623-21), IHS1L2-B2 (160-1623-22), IHS1L2-B3 (160-1623-23), IHS1L2-B4 (160-1623-24), IHS1L2-C2 (160-1623-25), IHS1L2-D3 (160-1623-26), IHS1L2-D4 (160-1623-27), IHS1L2-E2 (160-1623-28), IHS1L2-E3 (160-1623-29), IHS1L2-E4 (160-1623-30), IHS1L2-F3 (160-1623-31) and IHS1L2-F4 (160-1623-32) were analyzed for Cesium-137 & Other Gamma Emitters (GS) in accordance with DOE GA-01-R. The samples were leached on 02/27/2013, prepared on 03/07/2013 and 03/08/2013 and analyzed on 03/12/2013, 03/14/2013, 03/15/2013 and 03/18/2013.

No other difficulties were encountered during the Gamma spec analyses.

All other quality control parameters were within the acceptance limits.

St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

CR 323

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 2/21/2013	COC No: IH-1
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	1 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L1-A1	2/20/2013	1230	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-A2	2/20/2013	1235	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-A3	2/20/2013	1240	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-A4	2/20/2013	1245	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-B1	2/20/2013	1250	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-B2	2/20/2013	1255	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-B3	2/20/2013	1300	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-B4	2/20/2013	1305	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-C1	2/20/2013	1310	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-C2	2/20/2013	1315	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-D3	2/20/2013	1320	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-D4	2/20/2013	1325	Grab	S	1		X	Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments: QC Level IV

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	AWS	2/22/2013/1600	[signature]	TASTL	2.26.13 1255
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 2/21/2013	COC No: IH-I
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	1 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample (Y/N)	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L1-E3	2/20/2013	1330	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-E4	2/20/2013	1335	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-F3	2/20/2013	1340	Grab	S	1		X	Ac-228 for Th-232
IHS1L1-F4	2/20/2013	1345	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-A1	2/21/2013	1300	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-A2	2/21/2013	1305	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-A3	2/21/2013	1310	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-A4	2/21/2013	1315	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-B1	2/21/2013	1320	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-B2	2/21/2013	1325	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-B3	2/21/2013	1330	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-B4	2/21/2013	1335	Grab	S	1		X	Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments: QC Level IV

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Spicuzza	AWS	2/22/2013/1600	Gil Clark	TA STL	2-26-13 1255
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

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Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 2/21/2013	COC No: IH-1
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	3 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample	Gamma Spec (Ac-228 and Th-232)	Sample Specific Notes:
IHS1L2-C2	2/21/2013	1340	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-D3	2/21/2013	1345	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-D4	2/21/2013	1350	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-E2	2/21/2013	1355	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-E3	2/21/2013	1400	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-E4	2/21/2013	1405	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-F3	2/21/2013	1410	Grab	S	1		X	Ac-228 for Th-232
IHS1L2-F4	2/21/2013	1415	Grab	S	1		X	Ac-228 for Th-232

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* _____ *Months*

Special Instructions/QC Requirements & Comments: QC Level IV

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Dan Spicuzza	AWS	2/22/2013/1600	Jill Clarke	TA STL	2.26.13 1255
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-1623-1

Login Number: 1623

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Method	Method Description	Protocol	Laboratory
GA-01-R	Cesium-137 & Other Gamma Emitters (GS)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-1623-1	IHS1L1-A1	Solid	02/20/13 12:30	02/26/13 14:58
160-1623-2	IHS1L1-A2	Solid	02/20/13 12:35	02/26/13 14:58
160-1623-3	IHS1L1-A3	Solid	02/20/13 12:40	02/26/13 14:58
160-1623-4	IHS1L1-A4	Solid	02/20/13 12:45	02/26/13 14:58
160-1623-5	IHS1L1-B1	Solid	02/20/13 12:50	02/26/13 14:58
160-1623-6	IHS1L1-B2	Solid	02/20/13 12:55	02/26/13 14:58
160-1623-7	IHS1L1-B3	Solid	02/20/13 13:00	02/26/13 14:58
160-1623-8	IHS1L1-B4	Solid	02/20/13 13:05	02/26/13 14:58
160-1623-9	IHS1L1-C1	Solid	02/20/13 13:10	02/26/13 14:58
160-1623-10	IHS1L1-C2	Solid	02/20/13 13:15	02/26/13 14:58
160-1623-11	IHS1L1-D3	Solid	02/20/13 13:20	02/26/13 14:58
160-1623-12	IHS1L1-D4	Solid	02/20/13 13:25	02/26/13 14:58
160-1623-13	IHS1L1-E3	Solid	02/20/13 13:30	02/26/13 14:58
160-1623-14	IHS1L1-E4	Solid	02/20/13 13:35	02/26/13 14:58
160-1623-15	IHS1L1-F3	Solid	02/20/13 13:40	02/26/13 14:58
160-1623-16	IHS1L1-F4	Solid	02/20/13 13:45	02/26/13 14:58
160-1623-17	IHS1L2-A1	Solid	02/21/13 13:00	02/26/13 14:58
160-1623-18	IHS1L2-A2	Solid	02/21/13 13:05	02/26/13 14:58
160-1623-19	IHS1L2-A3	Solid	02/21/13 13:10	02/26/13 14:58
160-1623-20	IHS1L2-A4	Solid	02/21/13 13:15	02/26/13 14:58
160-1623-21	IHS1L2-B1	Solid	02/21/13 13:20	02/26/13 14:58
160-1623-22	IHS1L2-B2	Solid	02/21/13 13:25	02/26/13 14:58
160-1623-23	IHS1L2-B3	Solid	02/21/13 13:30	02/26/13 14:58
160-1623-24	IHS1L2-B4	Solid	02/21/13 13:35	02/26/13 14:58
160-1623-25	IHS1L2-C2	Solid	02/21/13 13:40	02/26/13 14:58
160-1623-26	IHS1L2-D3	Solid	02/21/13 13:45	02/26/13 14:58
160-1623-27	IHS1L2-D4	Solid	02/21/13 13:50	02/26/13 14:58
160-1623-28	IHS1L2-E2	Solid	02/21/13 13:55	02/26/13 14:58
160-1623-29	IHS1L2-E3	Solid	02/21/13 14:00	02/26/13 14:58
160-1623-30	IHS1L2-E4	Solid	02/21/13 14:05	02/26/13 14:58
160-1623-31	IHS1L2-F3	Solid	02/21/13 14:10	02/26/13 14:58
160-1623-32	IHS1L2-F4	Solid	02/21/13 14:15	02/26/13 14:58

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L1-A1

Lab Sample ID: 160-1623-1

Date Collected: 02/20/13 12:30
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.06**		0.253	0.275		0.249	pCi/g	03/07/13 14:39	03/12/13 10:31	1
Cesium-137	0.0720	U	0.0496	0.0502	0.200	0.0763	pCi/g	03/07/13 14:39	03/12/13 10:31	1
Thorium-232	**1.06**		0.253	0.275		0.249	pCi/g	03/07/13 14:39	03/12/13 10:31	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.829*		*0.190*	*0.208*		*0.161*	*pCi/g*	*03/07/13 14:39*	*03/12/13 10:31*	*1*
K-40	*4.05*		*1.17*	*1.24*		*1.34*	*pCi/g*	*03/07/13 14:39*	*03/12/13 10:31*	*1*
Pb-212	*1.01*		*0.165*	*0.273*		*0.148*	*pCi/g*	*03/07/13 14:39*	*03/12/13 10:31*	*1*
Pb-214	*0.831*		*0.208*	*0.235*		*0.204*	*pCi/g*	*03/07/13 14:39*	*03/12/13 10:31*	*1*
Tl-208	*0.318*		*0.0748*	*0.0818*		*0.0601*	*pCi/g*	*03/07/13 14:39*	*03/12/13 10:31*	*1*

Client Sample ID: IHS1L1-A2

Lab Sample ID: 160-1623-2

Date Collected: 02/20/13 12:35
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.446	U	0.234	0.238		0.460	pCi/g	03/07/13 14:39	03/12/13 11:27	1
Cesium-137	0.0894	U	0.0929	0.0934	0.200	0.146	pCi/g	03/07/13 14:39	03/12/13 11:27	1
Thorium-232	0.446	U	0.234	0.238		0.460	pCi/g	03/07/13 14:39	03/12/13 11:27	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.730*		*0.211*	*0.224*		*0.112*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:27*	*1*
Pb-212	*0.680*		*0.235*	*0.251*		*0.252*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:27*	*1*
Pb-214	*0.720*		*0.173*	*0.188*		*0.228*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:27*	*1*
Tl-208	*0.168*		*0.140*	*0.141*		*0.153*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:27*	*1*

Client Sample ID: IHS1L1-A3

Lab Sample ID: 160-1623-3

Date Collected: 02/20/13 12:40
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.591**		0.171	0.181		0.291	pCi/g	03/07/13 14:39	03/12/13 11:36	1
Cesium-137	0.0622	U	0.0588	0.0591	0.200	0.0922	pCi/g	03/07/13 14:39	03/12/13 11:36	1
Thorium-232	**0.591**		0.171	0.181		0.291	pCi/g	03/07/13 14:39	03/12/13 11:36	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.677*		*0.140*	*0.157*		*0.0536*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:36*	*1*
K-40	*5.09*		*1.34*	*1.44*		*1.30*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:36*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L1-A3

Lab Sample ID: 160-1623-3
Date Collected: 02/20/13 12:40
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Pb-212	*0.744*		*0.122*	*0.155*		*0.105*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:36*	*1*
Pb-214	*0.633*		*0.132*	*0.147*		*0.0909*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:36*	*1*
Tl-208	*0.321*		*0.0774*	*0.0843*		*0.0452*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:36*	*1*

Client Sample ID: IHS1L1-A4

Lab Sample ID: 160-1623-4
Date Collected: 02/20/13 12:45
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.837**		0.212	0.229		0.0994	pCi/g	03/07/13 14:39	03/12/13 11:38	1
Cesium-137	**0.0925**		0.0580	0.0588	0.200	0.0840	pCi/g	03/07/13 14:39	03/12/13 11:38	1
Thorium-232	**0.837**		0.212	0.229		0.0994	pCi/g	03/07/13 14:39	03/12/13 11:38	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.761*		*0.172*	*0.190*		*0.142*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:38*	*1*
K-40	*4.82*		*1.09*	*1.20*		*0.972*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:38*	*1*
Pb-212	*0.669*		*0.135*	*0.160*		*0.131*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:38*	*1*
Pb-214	*0.709*		*0.154*	*0.171*		*0.133*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:38*	*1*
Tl-208	*0.262*		*0.0637*	*0.0693*		*0.0482*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:38*	*1*

Client Sample ID: IHS1L1-B1

Lab Sample ID: 160-1623-5
Date Collected: 02/20/13 12:50
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.376**		0.159	0.163		0.289	pCi/g	03/07/13 14:39	03/12/13 11:40	1
Cesium-137	-0.00813	U	0.103	0.103	0.200	0.117	pCi/g	03/07/13 14:39	03/12/13 11:40	1
Thorium-232	**0.376**		0.159	0.163		0.289	pCi/g	03/07/13 14:39	03/12/13 11:40	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.726*		*0.177*	*0.193*		*0.146*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:40*	*1*
K-40	*4.96*		*1.16*	*1.27*		*1.09*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:40*	*1*
Pb-212	*0.665*		*0.156*	*0.212*		*0.165*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:40*	*1*
Pb-214	*0.844*		*0.197*	*0.226*		*0.179*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:40*	*1*
Tl-208	*0.238*		*0.0893*	*0.0927*		*0.0851*	*pCi/g*	*03/07/13 14:39*	*03/12/13 11:40*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L1-B2

Lab Sample ID: 160-1623-6
Matrix: Solid
Date Collected: 02/20/13 12:55
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	22.8		0.800	2.46		0.452	pCi/g	03/07/13 14:39	03/15/13 15:17	1
Cesium-137	0.0387	U	0.134	0.134	0.200	0.225	pCi/g	03/07/13 14:39	03/15/13 15:17	1
Thorium-232	22.8		0.800	2.46		0.452	pCi/g	03/07/13 14:39	03/15/13 15:17	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*25.3*		*3.03*	*4.01*		*2.44*	*pCi/g*	*03/07/13 14:39*	*03/15/13 15:17*	*1*
Bi-214	*1.23*		*0.377*	*0.398*		*0.348*	*pCi/g*	*03/07/13 14:39*	*03/15/13 15:17*	*1*
K-40	*11.0*		*1.61*	*1.97*		*1.02*	*pCi/g*	*03/07/13 14:39*	*03/15/13 15:17*	*1*
Pb-212	*26.2*		*0.485*	*3.43*		*0.269*	*pCi/g*	*03/07/13 14:39*	*03/15/13 15:17*	*1*
Pb-214	*1.26*		*0.272*	*0.302*		*0.342*	*pCi/g*	*03/07/13 14:39*	*03/15/13 15:17*	*1*
Tl-208	*8.14*		*0.324*	*0.905*		*0.190*	*pCi/g*	*03/07/13 14:39*	*03/15/13 15:17*	*1*

Client Sample ID: IHS1L1-B3

Lab Sample ID: 160-1623-7
Matrix: Solid
Date Collected: 02/20/13 13:00
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.744		0.420	0.427		0.489	pCi/g	03/07/13 14:39	03/12/13 12:17	1
Cesium-137	0.0285	U	0.0851	0.0851	0.200	0.157	pCi/g	03/07/13 14:39	03/12/13 12:17	1
Thorium-232	0.744		0.420	0.427		0.489	pCi/g	03/07/13 14:39	03/12/13 12:17	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.00*		*0.292*	*0.310*		*0.190*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
K-40	*3.45*		*1.98*	*2.01*		*2.76*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
Pb-212	*1.20*		*0.262*	*0.304*		*0.244*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
Pb-214	*1.03*		*0.250*	*0.272*		*0.207*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
Tl-208	*0.469*		*0.140*	*0.148*		*0.101*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*

Client Sample ID: IHS1L1-B4

Lab Sample ID: 160-1623-8
Matrix: Solid
Date Collected: 02/20/13 13:05
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.15		0.238	0.265		0.138	pCi/g	03/07/13 14:39	03/12/13 12:17	1
Cesium-137	0.0590	U	0.0613	0.0616	0.200	0.0975	pCi/g	03/07/13 14:39	03/12/13 12:17	1
Thorium-232	1.15		0.238	0.265		0.138	pCi/g	03/07/13 14:39	03/12/13 12:17	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L1-B4

Lab Sample ID: 160-1623-8
Matrix: Solid

Date Collected: 02/20/13 13:05
Date Received: 02/26/13 14:58

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.859*		*0.189*	*0.209*		*0.105*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
K-40	*4.46*		*1.38*	*1.45*		*1.47*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
Pb-212	*0.828*		*0.142*	*0.178*		*0.129*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
Pb-214	*1.11*		*0.183*	*0.216*		*0.0975*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*
Tl-208	*0.361*		*0.0894*	*0.0969*		*0.0609*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:17*	*1*

Client Sample ID: IHS1L1-C1

Lab Sample ID: 160-1623-9
Matrix: Solid

Date Collected: 02/20/13 13:10
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.468**		0.197	0.203		0.243	pCi/g	03/07/13 14:39	03/12/13 12:18	1
Cesium-137	0.0202	U	0.0430	0.0431	0.200	0.0744	pCi/g	03/07/13 14:39	03/12/13 12:18	1
Thorium-232	**0.468**		0.197	0.203		0.243	pCi/g	03/07/13 14:39	03/12/13 12:18	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.733*		*0.160*	*0.177*		*0.136*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:18*	*1*
K-40	*5.75*		*1.08*	*1.23*		*0.743*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:18*	*1*
Pb-212	*0.688*		*0.137*	*0.163*		*0.124*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:18*	*1*
Pb-214	*0.714*		*0.136*	*0.155*		*0.112*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:18*	*1*
Tl-208	*0.318*		*0.0745*	*0.0815*		*0.0602*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:18*	*1*

Client Sample ID: IHS1L1-C2

Lab Sample ID: 160-1623-10
Matrix: Solid

Date Collected: 02/20/13 13:15
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**2.13**		0.333	0.400		0.235	pCi/g	03/07/13 14:39	03/12/13 12:22	1
Cesium-137	0.0374	U	0.0800	0.0801	0.200	0.146	pCi/g	03/07/13 14:39	03/12/13 12:22	1
Thorium-232	**2.13**		0.333	0.400		0.235	pCi/g	03/07/13 14:39	03/12/13 12:22	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.05*		*0.234*	*0.258*		*0.190*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:22*	*1*
K-40	*8.39*		*1.68*	*1.89*		*1.39*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:22*	*1*
Pb-212	*2.17*		*0.261*	*0.536*		*0.232*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:22*	*1*
Pb-214	*1.19*		*0.233*	*0.281*		*0.268*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:22*	*1*
Tl-208	*0.771*		*0.149*	*0.169*		*0.118*	*pCi/g*	*03/07/13 14:39*	*03/12/13 12:22*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L1-D3

Lab Sample ID: 160-1623-11

Date Collected: 02/20/13 13:20
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.987		0.229	0.251		0.124	pCi/g	03/07/13 14:39	03/12/13 14:36	1
Cesium-137	0.0248	U	0.0573	0.0574	0.200	0.100	pCi/g	03/07/13 14:39	03/12/13 14:36	1
Thorium-232	0.987		0.229	0.251		0.124	pCi/g	03/07/13 14:39	03/12/13 14:36	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.811*		*0.184*	*0.202*		*0.164*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:36*	*1*
K-40	*5.33*		*1.35*	*1.45*		*1.39*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:36*	*1*
Pb-212	*1.01*		*0.175*	*0.218*		*0.167*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:36*	*1*
Pb-214	*1.05*		*0.188*	*0.217*		*0.159*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:36*	*1*
Tl-208	*0.463*		*0.101*	*0.112*		*0.0757*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:36*	*1*

Client Sample ID: IHS1L1-D4

Lab Sample ID: 160-1623-12

Date Collected: 02/20/13 13:25
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.713		0.337	0.345		0.605	pCi/g	03/07/13 14:39	03/12/13 14:37	1
Cesium-137	0.0387	U	0.113	0.113	0.200	0.201	pCi/g	03/07/13 14:39	03/12/13 14:37	1
Thorium-232	0.713		0.337	0.345		0.605	pCi/g	03/07/13 14:39	03/12/13 14:37	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.825*		*0.269*	*0.283*		*0.191*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:37*	*1*
K-40	*3.42*		*1.70*	*1.74*		*2.15*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:37*	*1*
Pb-212	*0.801*		*0.196*	*0.222*		*0.193*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:37*	*1*
Pb-214	*0.940*		*0.235*	*0.255*		*0.233*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:37*	*1*
Tl-208	*0.328*		*0.111*	*0.116*		*0.0896*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:37*	*1*

Client Sample ID: IHS1L1-E3

Lab Sample ID: 160-1623-13

Date Collected: 02/20/13 13:30
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.07		0.220	0.246		0.193	pCi/g	03/07/13 14:39	03/12/13 14:38	1
Cesium-137	0.0822		0.0565	0.0571	0.200	0.0792	pCi/g	03/07/13 14:39	03/12/13 14:38	1
Thorium-232	1.07		0.220	0.246		0.193	pCi/g	03/07/13 14:39	03/12/13 14:38	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.907*		*0.212*	*0.232*		*0.141*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:38*	*1*

Client Sample ID: IHS1L1-E3

Lab Sample ID: 160-1623-13

Date Collected: 02/20/13 13:30

Matrix: Solid

Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
K-40	*4.75*		*1.38*	*1.47*		*1.39*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:38*	*1*
Pb-212	*0.846*		*0.146*	*0.183*		*0.136*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:38*	*1*
Pb-214	*0.940*		*0.157*	*0.185*		*0.136*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:38*	*1*
Tl-208	*0.440*		*0.0872*	*0.0984*		*0.0318*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:38*	*1*

Client Sample ID: IHS1L1-E4

Lab Sample ID: 160-1623-14

Date Collected: 02/20/13 13:35

Matrix: Solid

Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.969**		0.206	0.229		0.0987	pCi/g	03/07/13 14:39	03/12/13 14:43	1
Cesium-137	0.0508	U	0.0493	0.0496	0.200	0.0777	pCi/g	03/07/13 14:39	03/12/13 14:43	1
Thorium-232	**0.969**		0.206	0.229		0.0987	pCi/g	03/07/13 14:39	03/12/13 14:43	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.822*		*0.158*	*0.180*		*0.119*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:43*	*1*
K-40	*7.70*		*1.31*	*1.53*		*0.824*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:43*	*1*
Pb-212	*0.678*		*0.119*	*0.148*		*0.109*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:43*	*1*
Pb-214	*0.893*		*0.150*	*0.177*		*0.104*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:43*	*1*
Tl-208	*0.276*		*0.0717*	*0.0772*		*0.0592*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:43*	*1*

Client Sample ID: IHS1L1-F3

Lab Sample ID: 160-1623-15

Date Collected: 02/20/13 13:40

Matrix: Solid

Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.900**		0.228	0.246		0.379	pCi/g	03/07/13 14:39	03/12/13 14:50	1
Cesium-137	0.0120	U	0.0768	0.0768	0.200	0.145	pCi/g	03/07/13 14:39	03/12/13 14:50	1
Thorium-232	**0.900**		0.228	0.246		0.379	pCi/g	03/07/13 14:39	03/12/13 14:50	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.873*		*0.203*	*0.222*		*0.173*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:50*	*1*
K-40	*3.87*		*1.28*	*1.34*		*1.60*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:50*	*1*
Pb-212	*0.871*		*0.177*	*0.258*		*0.177*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:50*	*1*
Pb-214	*0.821*		*0.217*	*0.243*		*0.204*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:50*	*1*
Tl-208	*0.344*		*0.0894*	*0.0963*		*0.0797*	*pCi/g*	*03/07/13 14:39*	*03/12/13 14:50*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L1-F4

Lab Sample ID: 160-1623-16

Date Collected: 02/20/13 13:45
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.560	U	0.389	0.393		0.695	pCi/g	03/07/13 14:39	03/12/13 20:42	1
Cesium-137	0.0673	U	0.0900	0.0902	0.200	0.148	pCi/g	03/07/13 14:39	03/12/13 20:42	1
Thorium-232	0.560	U	0.389	0.393		0.695	pCi/g	03/07/13 14:39	03/12/13 20:42	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.776*		*0.261*	*0.273*		*0.182*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
K-40	*5.35*		*2.14*	*2.21*		*2.44*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
Pb-212	*1.02*		*0.234*	*0.268*		*0.228*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
Pb-214	*0.969*		*0.206*	*0.229*		*0.185*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
Tl-208	*0.170*		*0.121*	*0.123*		*0.164*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*

Client Sample ID: IHS1L2-A1

Lab Sample ID: 160-1623-17

Date Collected: 02/21/13 13:00
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.872**		0.231	0.248		0.113	pCi/g	03/07/13 14:39	03/12/13 20:42	1
Cesium-137	0.0542	U	0.0551	0.0554	0.200	0.0877	pCi/g	03/07/13 14:39	03/12/13 20:42	1
Thorium-232	**0.872**		0.231	0.248		0.113	pCi/g	03/07/13 14:39	03/12/13 20:42	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.627*		*0.137*	*0.152*		*0.0710*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
K-40	*6.38*		*1.30*	*1.45*		*0.701*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
Pb-212	*0.688*		*0.136*	*0.162*		*0.130*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
Pb-214	*0.756*		*0.153*	*0.172*		*0.101*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*
Tl-208	*0.186*		*0.0599*	*0.0630*		*0.0608*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:42*	*1*

Client Sample ID: IHS1L2-A2

Lab Sample ID: 160-1623-18

Date Collected: 02/21/13 13:05
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.464**		0.208	0.213		0.350	pCi/g	03/07/13 14:39	03/12/13 20:43	1
Cesium-137	**0.187**		0.0719	0.0745	0.200	0.100	pCi/g	03/07/13 14:39	03/12/13 20:43	1
Thorium-232	**0.464**		0.208	0.213		0.350	pCi/g	03/07/13 14:39	03/12/13 20:43	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*1.34*		*0.585*	*0.602*		*0.458*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:43*	*1*

Client Sample ID: IHS1L2-A2

Lab Sample ID: 160-1623-18

Date Collected: 02/21/13 13:05

Matrix: Solid

Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.717*		*0.168*	*0.184*		*0.0967*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:43*	*1*
Pb-212	*0.644*		*0.172*	*0.191*		*0.170*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:43*	*1*
Pb-214	*0.821*		*0.195*	*0.213*		*0.164*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:43*	*1*
Tl-208	*0.222*		*0.0970*	*0.0997*		*0.0839*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:43*	*1*

Client Sample ID: IHS1L2-A3

Lab Sample ID: 160-1623-19

Date Collected: 02/21/13 13:10

Matrix: Solid

Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.01**		0.233	0.255		0.258	pCi/g	03/07/13 14:39	03/12/13 20:44	1
Cesium-137	**0.0880**		0.0520	0.0528	0.200	0.0716	pCi/g	03/07/13 14:39	03/12/13 20:44	1
Thorium-232	**1.01**		0.233	0.255		0.258	pCi/g	03/07/13 14:39	03/12/13 20:44	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.960*		*0.178*	*0.204*		*0.128*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
K-40	*5.32*		*1.17*	*1.29*		*1.05*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
Pb-212	*1.00*		*0.168*	*0.212*		*0.152*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
Pb-214	*0.969*		*0.163*	*0.192*		*0.169*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
Tl-208	*0.240*		*0.0676*	*0.0720*		*0.0740*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*

Client Sample ID: IHS1L2-A4

Lab Sample ID: 160-1623-20

Date Collected: 02/21/13 13:15

Matrix: Solid

Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.911**		0.197	0.219		0.258	pCi/g	03/07/13 14:39	03/12/13 20:44	1
Cesium-137	0.0703	U	0.0745	0.0748	0.200	0.127	pCi/g	03/07/13 14:39	03/12/13 20:44	1
Thorium-232	**0.911**		0.197	0.219		0.258	pCi/g	03/07/13 14:39	03/12/13 20:44	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.603*		*0.180*	*0.190*		*0.178*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
K-40	*5.91*		*1.29*	*1.42*		*1.13*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
Pb-212	*0.782*		*0.148*	*0.225*		*0.145*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
Pb-214	*0.797*		*0.196*	*0.222*		*0.200*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*
Tl-208	*0.205*		*0.0809*	*0.0836*		*0.110*	*pCi/g*	*03/07/13 14:39*	*03/12/13 20:44*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L2-B1

Lab Sample ID: 160-1623-21

Date Collected: 02/21/13 13:20
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.471**		0.169	0.176		0.265	pCi/g	03/08/13 15:28	03/14/13 15:09	1
Cesium-137	0.0351	U	0.0499	0.0500	0.200	0.0831	pCi/g	03/08/13 15:28	03/14/13 15:09	1
Thorium-232	**0.471**		0.169	0.176		0.265	pCi/g	03/08/13 15:28	03/14/13 15:09	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.796*		*0.142*	*0.164*		*0.0964*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
K-40	*4.91*		*1.10*	*1.21*		*1.03*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
Pb-212	*0.740*		*0.126*	*0.158*		*0.114*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
Pb-214	*0.774*		*0.142*	*0.163*		*0.120*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
Tl-208	*0.250*		*0.0644*	*0.0695*		*0.0545*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*

Client Sample ID: IHS1L2-B2

Lab Sample ID: 160-1623-22

Date Collected: 02/21/13 13:25
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**9.16**		0.699	1.17		0.256	pCi/g	03/08/13 15:28	03/14/13 15:09	1
Cesium-137	0.0453	U	0.102	0.102	0.200	0.173	pCi/g	03/08/13 15:28	03/14/13 15:09	1
Thorium-232	**9.16**		0.699	1.17		0.256	pCi/g	03/08/13 15:28	03/14/13 15:09	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*11.2*		*2.39*	*2.66*		*1.79*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
Bi-214	*0.995*		*0.280*	*0.299*		*0.286*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
K-40	*9.71*		*1.65*	*1.92*		*0.515*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
Pb-212	*10.4*		*0.454*	*1.42*		*0.258*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
Pb-214	*0.773*		*0.249*	*0.262*		*0.360*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*
Tl-208	*3.03*		*0.246*	*0.399*		*0.130*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:09*	*1*

Client Sample ID: IHS1L2-B3

Lab Sample ID: 160-1623-23

Date Collected: 02/21/13 13:30
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.30**		0.268	0.299		0.194	pCi/g	03/08/13 15:28	03/14/13 15:10	1
Cesium-137	0.00299	U	0.0608	0.0608	0.200	0.112	pCi/g	03/08/13 15:28	03/14/13 15:10	1
Thorium-232	**1.30**		0.268	0.299		0.194	pCi/g	03/08/13 15:28	03/14/13 15:10	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L2-B3

Lab Sample ID: 160-1623-23

Date Collected: 02/21/13 13:30
Matrix: Solid
Date Received: 02/26/13 14:58

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.07*		*0.206*	*0.234*		*0.179*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
K-40	*6.00*		*1.33*	*1.47*		*0.977*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
Pb-212	*1.06*		*0.207*	*0.248*		*0.208*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
Pb-214	*1.32*		*0.272*	*0.304*		*0.227*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
Tl-208	*0.503*		*0.108*	*0.120*		*0.0903*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*

Client Sample ID: IHS1L2-B4

Lab Sample ID: 160-1623-24

Date Collected: 02/21/13 13:35
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.852**		0.184	0.204		0.110	pCi/g	03/08/13 15:28	03/14/13 15:10	1
Cesium-137	0.0720	U	0.0535	0.0541	0.200	0.0790	pCi/g	03/08/13 15:28	03/14/13 15:10	1
Thorium-232	**0.852**		0.184	0.204		0.110	pCi/g	03/08/13 15:28	03/14/13 15:10	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.694*		*0.159*	*0.174*		*0.137*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
K-40	*6.29*		*1.25*	*1.40*		*0.839*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
Pb-212	*0.590*		*0.130*	*0.151*		*0.134*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
Pb-214	*0.710*		*0.166*	*0.182*		*0.136*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*
Tl-208	*0.332*		*0.0756*	*0.0831*		*0.0469*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:10*	*1*

Client Sample ID: IHS1L2-C2

Lab Sample ID: 160-1623-25

Date Collected: 02/21/13 13:40
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**2.80**		0.457	0.541		0.149	pCi/g	03/08/13 15:28	03/14/13 15:12	1
Cesium-137	**0.0967**		0.0639	0.0647	0.200	0.0944	pCi/g	03/08/13 15:28	03/14/13 15:12	1
Thorium-232	**2.80**		0.457	0.541		0.149	pCi/g	03/08/13 15:28	03/14/13 15:12	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.38*		*0.266*	*0.302*		*0.198*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:12*	*1*
K-40	*8.27*		*1.70*	*1.90*		*1.43*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:12*	*1*
Pb-212	*2.46*		*0.311*	*0.615*		*0.274*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:12*	*1*
Pb-214	*1.11*		*0.235*	*0.277*		*0.261*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:12*	*1*
Tl-208	*0.848*		*0.159*	*0.182*		*0.118*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:12*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L2-D3

Lab Sample ID: 160-1623-26

Date Collected: 02/21/13 13:45
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	1.26		0.344	0.367		0.172	pCi/g	03/08/13 15:28	03/14/13 15:07	1
Cesium-137	-0.0133	U	0.110	0.110	0.200	0.169	pCi/g	03/08/13 15:28	03/14/13 15:07	1
Thorium-232	1.26		0.344	0.367		0.172	pCi/g	03/08/13 15:28	03/14/13 15:07	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*1.71*		*0.713*	*0.735*		*0.548*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:07*	*1*
Bi-214	*1.12*		*0.236*	*0.263*		*0.142*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:07*	*1*
K-40	*6.49*		*1.62*	*1.75*		*1.14*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:07*	*1*
Pb-212	*1.07*		*0.183*	*0.229*		*0.168*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:07*	*1*
Pb-214	*1.22*		*0.203*	*0.239*		*0.178*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:07*	*1*
Tl-208	*0.396*		*0.114*	*0.121*		*0.0848*	*pCi/g*	*03/08/13 15:28*	*03/14/13 15:07*	*1*

Client Sample ID: IHS1L2-D4

Lab Sample ID: 160-1623-27

Date Collected: 02/21/13 13:50
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.491		0.227	0.233		0.329	pCi/g	03/08/13 15:28	03/14/13 20:00	1
Cesium-137	0.0452	U	0.0576	0.0578	0.200	0.0946	pCi/g	03/08/13 15:28	03/14/13 20:00	1
Thorium-232	0.491		0.227	0.233		0.329	pCi/g	03/08/13 15:28	03/14/13 20:00	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.716*		*0.178*	*0.192*		*0.201*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
K-40	*7.09*		*1.38*	*1.56*		*0.963*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Pb-212	*0.853*		*0.168*	*0.201*		*0.164*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Pb-214	*0.744*		*0.157*	*0.175*		*0.145*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Tl-208	*0.259*		*0.0794*	*0.0838*		*0.0769*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*

Client Sample ID: IHS1L2-E2

Lab Sample ID: 160-1623-28

Date Collected: 02/21/13 13:55
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	7.47		0.502	0.912		0.219	pCi/g	03/08/13 15:28	03/18/13 21:31	1
Cesium-137	0.199		0.103	0.105	0.200	0.102	pCi/g	03/08/13 15:28	03/18/13 21:31	1
Thorium-232	7.47		0.502	0.912		0.219	pCi/g	03/08/13 15:28	03/18/13 21:31	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L2-E2

Lab Sample ID: 160-1623-28

Date Collected: 02/21/13 13:55
Matrix: Solid
Date Received: 02/26/13 14:58

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-212	*7.51*		*1.32*	*1.54*		*1.14*	*pCi/g*	*03/08/13 15:28*	*03/18/13 21:31*	*1*
Bi-214	*0.945*		*0.245*	*0.264*		*0.234*	*pCi/g*	*03/08/13 15:28*	*03/18/13 21:31*	*1*
K-40	*7.34*		*1.10*	*1.33*		*0.790*	*pCi/g*	*03/08/13 15:28*	*03/18/13 21:31*	*1*
Pb-212	*7.92*		*0.322*	*1.07*		*0.229*	*pCi/g*	*03/08/13 15:28*	*03/18/13 21:31*	*1*
Pb-214	*0.973*		*0.181*	*0.207*		*0.213*	*pCi/g*	*03/08/13 15:28*	*03/18/13 21:31*	*1*
Tl-208	*2.56*		*0.170*	*0.315*		*0.104*	*pCi/g*	*03/08/13 15:28*	*03/18/13 21:31*	*1*

Client Sample ID: IHS1L2-E3

Lab Sample ID: 160-1623-29

Date Collected: 02/21/13 14:00
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**1.14**		0.279	0.302		0.134	pCi/g	03/08/13 15:28	03/14/13 20:00	1
Cesium-137	0.0817	U	0.0640	0.0645	0.200	0.0962	pCi/g	03/08/13 15:28	03/14/13 20:00	1
Thorium-232	**1.14**		0.279	0.302		0.134	pCi/g	03/08/13 15:28	03/14/13 20:00	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.961*		*0.200*	*0.224*		*0.125*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
K-40	*4.57*		*1.36*	*1.44*		*1.42*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Pb-212	*1.08*		*0.171*	*0.221*		*0.148*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Pb-214	*1.00*		*0.192*	*0.218*		*0.143*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Tl-208	*0.284*		*0.0826*	*0.0877*		*0.0683*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*

Client Sample ID: IHS1L2-E4

Lab Sample ID: 160-1623-30

Date Collected: 02/21/13 14:05
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	**0.878**		0.293	0.306		0.361	pCi/g	03/08/13 15:28	03/14/13 20:00	1
Cesium-137	0.0741	U	0.0826	0.0830	0.200	0.136	pCi/g	03/08/13 15:28	03/14/13 20:00	1
Thorium-232	**0.878**		0.293	0.306		0.361	pCi/g	03/08/13 15:28	03/14/13 20:00	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*1.21*		*0.238*	*0.269*		*0.119*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
K-40	*6.57*		*1.75*	*1.88*		*1.72*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Pb-212	*0.987*		*0.188*	*0.227*		*0.183*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Pb-214	*1.16*		*0.210*	*0.242*		*0.183*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*
Tl-208	*0.410*		*0.108*	*0.116*		*0.0678*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:00*	*1*

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Client Sample ID: IHS1L2-F3

Lab Sample ID: 160-1623-31

Date Collected: 02/21/13 14:10
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.813		0.189	0.206		0.310	pCi/g	03/08/13 15:28	03/14/13 20:03	1
Cesium-137	0.0876		0.0566	0.0573	0.200	0.0816	pCi/g	03/08/13 15:28	03/14/13 20:03	1
Thorium-232	0.813		0.189	0.206		0.310	pCi/g	03/08/13 15:28	03/14/13 20:03	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.771*		*0.162*	*0.181*		*0.134*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:03*	*1*
K-40	*5.78*		*1.26*	*1.39*		*1.02*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:03*	*1*
Pb-212	*0.826*		*0.133*	*0.171*		*0.110*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:03*	*1*
Pb-214	*1.13*		*0.195*	*0.228*		*0.142*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:03*	*1*
Tl-208	*0.300*		*0.0755*	*0.0817*		*0.0603*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:03*	*1*

Client Sample ID: IHS1L2-F4

Lab Sample ID: 160-1623-32

Date Collected: 02/21/13 14:15
Matrix: Solid
Date Received: 02/26/13 14:58

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.773		0.228	0.241		0.325	pCi/g	03/08/13 15:28	03/14/13 20:02	1
Cesium-137	0.0774	U	0.0602	0.0607	0.200	0.0908	pCi/g	03/08/13 15:28	03/14/13 20:02	1
Thorium-232	0.773		0.228	0.241		0.325	pCi/g	03/08/13 15:28	03/14/13 20:02	1

Other Detected Radionuclides	*Result*	*Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Bi-214	*0.660*		*0.178*	*0.191*		*0.186*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:02*	*1*
K-40	*5.96*		*1.33*	*1.47*		*1.07*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:02*	*1*
Pb-212	*0.809*		*0.146*	*0.180*		*0.151*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:02*	*1*
Pb-214	*0.956*		*0.180*	*0.206*		*0.139*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:02*	*1*
Tl-208	*0.292*		*0.0791*	*0.0847*		*0.0719*	*pCi/g*	*03/08/13 15:28*	*03/14/13 20:02*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1623-1

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS)

Lab Sample ID: MB 160-38190/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 39387 — **Prep Batch: 38190**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.002903	U	0.0844	0.0844		0.177	pCi/g	03/07/13 14:39	03/12/13 10:29	1
Cesium-137	-0.007951	U	0.0896	0.0896	0.200	0.104	pCi/g	03/07/13 14:39	03/12/13 10:29	1
Thorium-232	0.002903	U	0.0844	0.0844		0.177	pCi/g	03/07/13 14:39	03/12/13 10:29	1

Other Detected Radionuclides	*MB Result*	*MB Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Other Detected Radionuclide	*None*						*pCi/g*	*03/07/13 14:39*	*03/12/13 10:29*	*1*

Lab Sample ID: LCS 160-38190/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 39384 — **Prep Batch: 38190**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	95.76		10.1		1.14	pCi/g	98	87 - 116
Cesium-137	32.0	31.38		3.33	0.200	0.234	pCi/g	98	87 - 120
Cobalt-60	26.3	24.93		2.55		0.119	pCi/g	95	87 - 115

Lab Sample ID: 160-1623-1 DU — **Client Sample ID: IHS1L1-A1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 39378 — **Prep Batch: 38190**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium-228	1.06		0.8665		0.248		0.114	pCi/g	0.36	1
Cesium-137	0.0720	U	0.03185	U	0.0695	0.200	0.119	pCi/g	0.34	1
Thorium-232	1.06		0.8665		0.248		0.114	pCi/g	0.36	1

Lab Sample ID: MB 160-38316/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 40089 — **Prep Batch: 38316**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Actinium-228	0.0000	U	0.0688	0.0688		0.253	pCi/g	03/08/13 15:28	03/14/13 15:13	1
Cesium-137	0.05512	U	0.0698	0.0701	0.200	0.113	pCi/g	03/08/13 15:28	03/14/13 15:13	1
Thorium-232	0.0000	U	0.0688	0.0688		0.253	pCi/g	03/08/13 15:28	03/14/13 15:13	1

Other Detected Radionuclides	*MB Result*	*MB Qualifier*	*Count Uncert. (2σ+/-)*	*Total Uncert. (2σ+/-)*	*RL*	*MDC*	*Unit*	*Prepared*	*Analyzed*	*Dil Fac*
Other Detected Radionuclide	*None*						*pCi/g*	*03/08/13 15:28*	*03/14/13 15:13*	*1*

Method: GA-01-R - Cesium-137 & Other Gamma Emitters (GS) (Continued)

Lab Sample ID: LCS 160-38316/2-A
Matrix: Solid
Analysis Batch: 40090

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 38316

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Americium-241	97.6	94.95		9.96		1.02	pCi/g	97	87 - 116
Cesium-137	32.0	30.35		3.24	0.200	0.279	pCi/g	95	87 - 120
Cobalt-60	26.2	24.66		2.53		0.141	pCi/g	94	87 - 115

Lab Sample ID: 160-1623-21 DU
Matrix: Solid
Analysis Batch: 40087

Client Sample ID: IHS1L2-B1
Prep Type: Total/NA
Prep Batch: 38316

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Actinium-228	0.471		0.5496		0.177		0.305	pCi/g	0.22	1
Cesium-137	0.0351	U	0.01418	U	0.0551	0.200	0.0979	pCi/g	0.20	1
Thorium-232	0.471		0.5496		0.177		0.305	pCi/g	0.22	1

Rad

Leach Batch: 36523

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1623-1	IHS1L1-A1	Total/NA	Solid	Dry and Grind	
160-1623-1 DU	IHS1L1-A1	Total/NA	Solid	Dry and Grind	
160-1623-2	IHS1L1-A2	Total/NA	Solid	Dry and Grind	
160-1623-3	IHS1L1-A3	Total/NA	Solid	Dry and Grind	
160-1623-4	IHS1L1-A4	Total/NA	Solid	Dry and Grind	
160-1623-5	IHS1L1-B1	Total/NA	Solid	Dry and Grind	
160-1623-6	IHS1L1-B2	Total/NA	Solid	Dry and Grind	
160-1623-7	IHS1L1-B3	Total/NA	Solid	Dry and Grind	
160-1623-8	IHS1L1-B4	Total/NA	Solid	Dry and Grind	
160-1623-9	IHS1L1-C1	Total/NA	Solid	Dry and Grind	
160-1623-10	IHS1L1-C2	Total/NA	Solid	Dry and Grind	
160-1623-11	IHS1L1-D3	Total/NA	Solid	Dry and Grind	
160-1623-12	IHS1L1-D4	Total/NA	Solid	Dry and Grind	
160-1623-13	IHS1L1-E3	Total/NA	Solid	Dry and Grind	
160-1623-14	IHS1L1-E4	Total/NA	Solid	Dry and Grind	
160-1623-15	IHS1L1-F3	Total/NA	Solid	Dry and Grind	
160-1623-16	IHS1L1-F4	Total/NA	Solid	Dry and Grind	
160-1623-17	IHS1L2-A1	Total/NA	Solid	Dry and Grind	
160-1623-18	IHS1L2-A2	Total/NA	Solid	Dry and Grind	
160-1623-19	IHS1L2-A3	Total/NA	Solid	Dry and Grind	
160-1623-20	IHS1L2-A4	Total/NA	Solid	Dry and Grind	
160-1623-21	IHS1L2-B1	Total/NA	Solid	Dry and Grind	
160-1623-21 DU	IHS1L2-B1	Total/NA	Solid	Dry and Grind	
160-1623-22	IHS1L2-B2	Total/NA	Solid	Dry and Grind	
160-1623-23	IHS1L2-B3	Total/NA	Solid	Dry and Grind	
160-1623-24	IHS1L2-B4	Total/NA	Solid	Dry and Grind	
160-1623-25	IHS1L2-C2	Total/NA	Solid	Dry and Grind	
160-1623-26	IHS1L2-D3	Total/NA	Solid	Dry and Grind	
160-1623-27	IHS1L2-D4	Total/NA	Solid	Dry and Grind	
160-1623-28	IHS1L2-E2	Total/NA	Solid	Dry and Grind	
160-1623-29	IHS1L2-E3	Total/NA	Solid	Dry and Grind	
160-1623-30	IHS1L2-E4	Total/NA	Solid	Dry and Grind	
160-1623-31	IHS1L2-F3	Total/NA	Solid	Dry and Grind	
160-1623-32	IHS1L2-F4	Total/NA	Solid	Dry and Grind	

Prep Batch: 38190

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1623-1	IHS1L1-A1	Total/NA	Solid	Fill_Geo-0	36523
160-1623-1 DU	IHS1L1-A1	Total/NA	Solid	Fill_Geo-0	36523
160-1623-2	IHS1L1-A2	Total/NA	Solid	Fill_Geo-0	36523
160-1623-3	IHS1L1-A3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-4	IHS1L1-A4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-5	IHS1L1-B1	Total/NA	Solid	Fill_Geo-0	36523
160-1623-6	IHS1L1-B2	Total/NA	Solid	Fill_Geo-0	36523
160-1623-7	IHS1L1-B3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-8	IHS1L1-B4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-9	IHS1L1-C1	Total/NA	Solid	Fill_Geo-0	36523
160-1623-10	IHS1L1-C2	Total/NA	Solid	Fill_Geo-0	36523
160-1623-11	IHS1L1-D3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-12	IHS1L1-D4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-13	IHS1L1-E3	Total/NA	Solid	Fill_Geo-0	36523

Rad (Continued)

Prep Batch: 38190 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1623-14	IHS1L1-E4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-15	IHS1L1-F3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-16	IHS1L1-F4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-17	IHS1L2-A1	Total/NA	Solid	Fill_Geo-0	36523
160-1623-18	IHS1L2-A2	Total/NA	Solid	Fill_Geo-0	36523
160-1623-19	IHS1L2-A3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-20	IHS1L2-A4	Total/NA	Solid	Fill_Geo-0	36523
LCS 160-38190/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-38190/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Prep Batch: 38316

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1623-21	IHS1L2-B1	Total/NA	Solid	Fill_Geo-0	36523
160-1623-21 DU	IHS1L2-B1	Total/NA	Solid	Fill_Geo-0	36523
160-1623-22	IHS1L2-B2	Total/NA	Solid	Fill_Geo-0	36523
160-1623-23	IHS1L2-B3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-24	IHS1L2-B4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-25	IHS1L2-C2	Total/NA	Solid	Fill_Geo-0	36523
160-1623-26	IHS1L2-D3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-27	IHS1L2-D4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-28	IHS1L2-E2	Total/NA	Solid	Fill_Geo-0	36523
160-1623-29	IHS1L2-E3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-30	IHS1L2-E4	Total/NA	Solid	Fill_Geo-0	36523
160-1623-31	IHS1L2-F3	Total/NA	Solid	Fill_Geo-0	36523
160-1623-32	IHS1L2-F4	Total/NA	Solid	Fill_Geo-0	36523
LCS 160-38316/2-A	Lab Control Sample	Total/NA	Solid	Fill_Geo-0	
MB 160-38316/1-A	Method Blank	Total/NA	Solid	Fill_Geo-0	

Appendix I
Concrete Slab Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
3/1/2013	10:15	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-009	2360	184949	7/11/2013	α 35.1%	α 8.8%	α 82.0	α 34.2
		43-93	268605		βγ 28.1%	βγ 7.0%	βγ 610.0	βγ 2249.1
LOCATION:	NSF Indian Head, IR Site 1	2929	118419	9/4/2013	α 67.2%	α 16.8%	α 17.8	α 6.0
					βγ 46.9%	βγ 11.7%	βγ 119.0	βγ 360.8
SURVEYOR:	James C. Young Jr.							
DATE: 3/1/2013	TIME: 14:50 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Release Survey Of Concrete Debirs

This is a release survey of concrete debris pieces.

Comments:

Accessible areas of the concrete debris was 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 160-180 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT Page 2 of 2

SURVEY NUMBER: IHS1-009

SURVEYOR: James C. Young Jr. LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1				-22.8	42.7	-2.0	17.3	Concrete Debris
2				-28.5	99.6	0.0	6.0	Concrete Debris
3				-28.5	177.9	0.0	23.0	Concrete Debris
4				-17.1	142.3	2.0	37.2	Concrete Debris
5				-11.4	270.5	-2.0	40.1	Concrete Debris
6				-17.1	199.3	0.0	25.9	Concrete Debris
7				-17.1	42.7	-2.0	14.5	Concrete Debris
8				-22.8	-85.4	0.0	8.8	Concrete Debris
9				-17.1	-28.5	-2.0	-2.6	Concrete Debris
10				-28.5	-71.2	-2.0	31.6	Concrete Debris
11				-17.1	-113.9	0.0	28.7	Concrete Debris
12				-22.8	-99.6	2.0	40.1	Concrete Debris
13				-22.8	-78.3	0.0	3.1	Concrete Debris
14				-22.8	-28.5	0.0	-5.4	Concrete Debris
15				-11.4	-35.6	-2.0	17.3	Concrete Debris
16				-17.1	21.4	0.0	23.0	Concrete Debris
17				-11.4	78.3	2.0	-2.6	Concrete Debris
18				-17.1	-64.1	-2.0	6.0	Concrete Debris
19				-11.4	-49.8	-6.0	37.2	Concrete Debris
20				-17.1	-35.6	-4.0	42.9	Concrete Debris
21				-22.8	-28.5	-2.0	31.6	Concrete Debris
22				-5.7	-14.2	0.0	20.2	Concrete Debris
23				-11.4	35.6	2.0	17.3	Concrete Debris
24				-11.4	42.7	-2.0	3.1	Concrete Debris
25				-17.1	-71.2	-2.0	25.9	Concrete Debris
26				-11.4	-49.8	-2.0	23.0	Concrete Debris
27				0.0	-14.2	0.0	17.3	Concrete Debris
28				-5.7	56.9	-2.0	11.7	Concrete Debris
29				-22.8	28.5	-4.0	37.2	Concrete Debris
30				-17.1	14.2	0.0	45.8	Concrete Debris
31				5.7	-7.1	-4.0	48.6	Concrete Debris
32				-17.1	71.2	-2.0	28.7	Concrete Debris
33				-11.4	85.4	-4.0	0.3	Concrete Debris
34				-22.8	-42.7	-4.0	6.0	Concrete Debris
35				-17.1	14.2	-6.0	-2.6	Concrete Debris
36				-11.4	0.0	-4.0	-5.4	Concrete Debris
37				-5.7	-28.5	-4.0	31.6	Concrete Debris
38				-11.4	28.5	-2.0	17.3	Concrete Debris
39				-17.1	35.6	-2.0	28.7	Concrete Debris
40				-11.4	121.0	-4.0	40.1	Concrete Debris
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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N/A								
N/A								

Reviewer
Daniel Spicuzza

Date: 3/1/2013

Time: 14:50

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-009	Date : 3/1/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Of Concrete Debirs	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118419	9/4/2013	α	16.80%	α	5.95
			β	11.73%	β	360.77
2360 43-93	184949	7/11/2013	α	8.78%	α	34.19
			β	7.03%	β	2249.11

Contamination Levels:

5.7	dpm / 100cm^2	α	**Maximum Fixed**
270.5	dpm / 100cm^2	β	
2.0	dpm / 100cm^2	α	**Maximum Removable**
48.6	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: James C. Young Jr.	Date: 3/1/2013
	Time: 1015
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 3/1/2013 2:50:00 PM

Appendix J
Air Sample Data

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-01	RWP Number:	NSFIH-2013-01	AWS Number:	N/A
Date Start:	2/20/2013	Date Stop:	2/20/2013		
Time Start:	14:00	Time Stop:	14:30	Total Time:	30 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: James C. Young Jr. 2/20/2013
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003511		Counter I.D.:	118419	
Cal. Date:	1/28/2013		Probe I.D.:	121393	
Cal. Due Date:	1/28/2014		Cal. Date:	9/4/2012	
Flow Rate Start:	5	CFM	Cal. Due Date:	9/4/2013	
		LPM			
Flow Rate Stop:	5	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	5	CFM			
		LPM	Alpha Eff:	67.2	%
			Beta/Gamma Eff:	46.9	%
			Alpha Background:	1	CPM
	118419		Beta/Gamma Background:	46	CPM

Technician Performing Count: James C. Young Jr. 2/20/2013
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 2.7E-13 µCi/ml Beta/Gamma MDA= 2.3E-12 µCi/ml

Technician Performing Calculation: James C. Young Jr. 2/20/2013
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1430	1904	10	190.4	1	189.4	0.67	0.672	2.22E+06	1.89E-04
βγ	1430	4228	10	422.8	46	376.8	0.95	0.469	2.22E+06	3.81E-04

Technician Performing Initial Count: William Wylie 2/20/2013
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
30	min	5	CFM	4.2E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 2/20/2013
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity	
α	1.9E-04	µCi	4.2E+06	milliliters	4.5E-11	µCi/ml α
βγ	3.8E-04	µCi	4.2E+06	milliliters	9.0E-11	µCi/ml βγ

Technician Performing Calculation: William Wylie 2/20/2013
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1630	212	10	21.2	1	20.2	0.67	0.672	2.22E+06	2.02E-05
βγ	1630	839	10	83.9	46	37.9	0.95	0.469	2.22E+06	3.83E-05

Technician Performing Decay Count: William Wylie 2/20/2013
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity	
α	2.0E-05	µCi	4244999.999	milliliters	4.8E-12	µCi/ml α
βγ	3.8E-05	µCi	4244999.999	milliliters	9.0E-12	µCi/ml βγ

Technician Performing Calculation: William Wylie 2/20/2013
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	37.2	Minutes
T 1/2 βγ =	36.2	Minutes

Technician Performing Calculation: William Wylie 2/20/2013
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1030	12	10	1.2	1	0.2	0.67	0.672	2.22E+06	2.00E-07
βγ	1030	470	10	47	46	1	0.95	0.469	2.22E+06	1.01E-06

Technician Performing Decay Count: Daniel Spicuzza 2/21/2013
Date

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity	
α	2.00E-07	mCi	4245000	milliliters	4.7E-14	mCi/ml α
βγ	1.01E-06	mCi	4245000	milliliters	2.4E-13	mCi/ml βγ

Technician Performing Calculation: Daniel Spicuzza 2/21/2013
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 2/21/2013

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-02	RWP Number:	NSFIH-2013-01	AWS Number:	N/A
Date Start:	2/21/2013	Date Stop:	2/21/2013		
Time Start:	9:00	Time Stop:	9:40	Total Time:	40 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: James C. Young Jr. 2/21/2013
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003511		Counter I.D.:	118419	
Cal. Date:	1/28/2013		Probe I.D.:	121393	
Cal. Due Date:	1/28/2014		Cal. Date:	9/4/2012	
Flow Rate Start:	5	CFM	Cal. Due Date:	9/4/2013	
		LPM			
Flow Rate Stop:	5	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	5	CFM			
		LPM	Alpha Eff:	67.2	%
			Beta/Gamma Eff:	46.9	%
			Alpha Background:	1	CPM
	118419		Beta/Gamma Background:	42.3	CPM

Technician Performing Count: James C. Young Jr. 2/21/2013
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 2.1E-13 µCi/ml Beta/Gamma MDA= 1.7E-12 µCi/ml

Technician Performing Calculation: James C. Young Jr. 2/21/2013
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O945	1542	10	154.2	1	153.2	0.67	0.672	2.22E+06	1.53E-04
βγ	O945	3821	10	382.1	42.3	339.8	0.95	0.469	2.22E+06	3.44E-04

Technician Performing Initial Count: William Wylie 2/21/2013
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
40	min	5	CFM	5.7E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: William Wylie 2/21/2013
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity	
α	1.5E-04	µCi	5.7E+06	milliliters	2.7E-11	µCi/ml α
βγ	3.4E-04	µCi	5.7E+06	milliliters	6.1E-11	µCi/ml βγ

Technician Performing Calculation: William Wylie 2/21/2013
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1145	159	10	15.9	1	14.9	0.67	0.672	2.22E+06	1.49E-05
βγ	1145	761	10	76.1	42.3	33.8	0.95	0.469	2.22E+06	3.42E-05

Technician Performing Decay Count: William Wylie 2/21/2013
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity	
α	1.5E-05	µCi	5660000.001	milliliters	2.6E-12	µCi/ml α
βγ	3.4E-05	µCi	5660000.001	milliliters	6.0E-12	µCi/ml βγ

Technician Performing Calculation: William Wylie 2/21/2013
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	35.7	Minutes
T 1/2 βγ =	36.0	Minutes

Technician Performing Calculation: William Wylie 2/21/2013
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 24 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 24 hours (if feasible) and then recount the sample:**

24hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O945	12	10	1.2	1	0.2	0.67	0.672	2.22E+06	2.00E-07
βγ	O945	388	10	38.8	42.3	0	0.95	0.469	2.22E+06	0.00E+00

Technician Performing Decay Count: Daniel Spicuzza 2/22/2013
Date

24 hr. Decayed Activity			Volume		24 hr. Decayed Activity	
α	2.00E-07	mCi	5660000	milliliters	3.5E-14	mCi/ml α
βγ	0.00E+00	mCi	5660000	milliliters	0.0E+00	mCi/ml βγ

Technician Performing Calculation: Daniel Spicuzza 2/22/2013
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.83 / 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 / 2.83

Technician Performing Calculation: N/A | N/A
Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A
Date

HP Supervisor Review: Daniel Spicuzza | 2/22/2013
Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-03	RWP Number:	NSFIH-2013-01	AWS Number:	N/A
Date Start:	2/25/2013	Date Stop:	2/25/2013		
Time Start:	13:05	Time Stop:	13:50	Total Time:	45 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: James C. Young Jr. 2/25/2013
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003511		Counter I.D.:	118419	
Cal. Date:	1/28/2013		Probe I.D.:	121393	
Cal. Due Date:	1/28/2014		Cal. Date:	9/4/2012	
Flow Rate Start:	5	CFM	Cal. Due Date:	9/4/2013	
		LPM			
Flow Rate Stop:	5	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	5	CFM			
		LPM	Alpha Eff:	67.2	%
			Beta/Gamma Eff:	46.9	%
			Alpha Background:	1	CPM
	118419		Beta/Gamma Background:	41.9	CPM

Technician Performing Count: James C. Young Jr. 2/25/2013
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.8E-13 µCi/ml Beta/Gamma MDA= 1.5E-12 µCi/ml

Technician Performing Calculation: James C. Young Jr. 2/25/2013
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1355	2112	10	211.2	1	210.2	0.67	0.672	2.22E+06	2.10E-04
βγ	1355	4796	10	479.6	41.9	437.7	0.95	0.469	2.22E+06	4.43E-04

Technician Performing Initial Count: James C. Young Jr. 2/25/2013
Date

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
45	min	5	CFM	6.4E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: James C. Young Jr. 2/25/2013
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity	
α	2.1E-04	µCi	6.4E+06	milliliters	3.3E-11	µCi/ml α
βγ	4.4E-04	µCi	6.4E+06	milliliters	6.9E-11	µCi/ml βγ

Technician Performing Calculation: James C. Young Jr. 2/25/2013
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1555	243	10	24.3	1	23.3	0.67	0.672	2.22E+06	2.33E-05
βγ	1555	865	10	86.5	41.9	44.6	0.95	0.469	2.22E+06	4.51E-05

Technician Performing Decay Count: William Wylie 2/25/2013
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity	
α	2.3E-05	µCi	6367500	milliliters	3.7E-12	µCi/ml α
βγ	4.5E-05	µCi	6367500	milliliters	7.1E-12	µCi/ml βγ

Technician Performing Calculation: William Wylie 2/25/2013
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	37.8	Minutes
T 1/2 βγ =	36.4	Minutes

Technician Performing Calculation: William Wylie 2/25/2013
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O955	13	10	1.3	1	0.3	0.67	0.672	2.22E+06	3.00E-07
βγ	O955	320	10	32	41.9	0	0.95	0.469	2.22E+06	0.00E+00

Technician Performing Decay Count: Daniel Spicuzza 2/26/2013

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity	
α	3.00E-07	mCi	6367500	milliliters	4.7E-14	mCi/ml α
βγ	0.00E+00	mCi	6367500	milliliters	0.0E+00	mCi/ml βγ

Technician Performing Calculation: Daniel Spicuzza 2/26/2013
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\,(e^{-0.0655\,(hrs)})}{1 - e^{-0.0655\,(hrs)}}$$

$$= \frac{mCi - \quad mCi\,(e^{-0.0655\,(-\_\_\_\_hrs)})}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 2/26/2013

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-04	RWP Number:	NSFIH-2013-01	AWS Number:	N/A
Date Start:	2/26/2013	Date Stop:	2/26/2013		
Time Start:	8:05	Time Stop:	8:50	Total Time:	45 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: James C. Young Jr. — 2/26/2013 (Date)

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003511		Counter I.D.:	118419	
Cal. Date:	1/28/2013		Probe I.D.:	121393	
Cal. Due Date:	1/28/2014		Cal. Date:	9/4/2012	
Flow Rate Start:	5	CFM	Cal. Due Date:	9/4/2013	
		LPM			
Flow Rate Stop:	5	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	5	CFM			
		LPM	Alpha Eff:	67.2	%
			Beta/Gamma Eff:	46.9	%
			Alpha Background:	1	CPM
			Beta/Gamma Background:	42.4	CPM

Technician Performing Count: James C. Young Jr. — 2/26/2013 (Date)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.8E-13 µCi/ml Beta/Gamma MDA= 1.5E-12 µCi/ml

Technician Performing Calculation: James C. Young Jr. 2/26/2013
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O855	1956	10	195.6	1	194.6	0.67	0.672	2.22E+06	1.95E-04
βγ	O855	4567	10	456.7	42.4	414.3	0.95	0.469	2.22E+06	4.19E-04

Technician Performing Initial Count: James C. Young Jr. 2/26/2013

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
45	min	5	CFM	6.4E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: James C. Young Jr. 2/26/2013
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity	
α	1.9E-04	µCi	6.4E+06	milliliters	3.1E-11	µCi/ml α
βγ	4.2E-04	µCi	6.4E+06	milliliters	6.6E-11	µCi/ml βγ

Technician Performing Calculation: James C. Young Jr. 2/26/2013
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1055	201	10	20.1	1	19.1	0.67	0.672	2.22E+06	1.91E-05
βγ	1055	656	10	65.6	42.4	23.2	0.95	0.469	2.22E+06	2.35E-05

Technician Performing Decay Count: William Wylie 2/26/2013
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity	
α	1.9E-05	µCi	6367500	milliliters	3.0E-12	µCi/ml α
βγ	2.3E-05	µCi	6367500	milliliters	3.7E-12	µCi/ml βγ

Technician Performing Calculation: William Wylie 2/26/2013
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	35.8	Minutes
T 1/2 βγ =	28.9	Minutes

Technician Performing Calculation: William Wylie 2/26/2013
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 24 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 24 hours (if feasible) and then recount the sample:**

24hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O855	15	10	1.5	1	0.5	0.67	0.672	2.22E+06	5.00E-07
βγ	O855	379	10	37.9	42.4	0	0.95	0.469	2.22E+06	0.00E+00

Technician Performing Decay Count: Daniel Spicuzza 2/27/2013

24 hr. Decayed Activity			Volume		24 hr. Decayed Activity	
α	5.00E-07	mCi	6367500	milliliters	7.9E-14	mCi/ml α
βγ	0.00E+00	mCi	6367500	milliliters	0.0E+00	mCi/ml βγ

Technician Performing Calculation: Daniel Spicuzza 2/27/2013
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\ \ hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 2/27/2013

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-05	RWP Number:	NSFIH-2013-01	AWS Number:	N/A
Date Start:	2/28/2013	Date Stop:	2/28/2013		
Time Start:	9:05	Time Stop:	9:55	Total Time:	50 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003511		Counter I.D.:	118419	
Cal. Date:	1/28/2013		Probe I.D.:	121393	
Cal. Due Date:	1/28/2014		Cal. Date:	9/4/2012	
Flow Rate Start:	5	CFM	Cal. Due Date:	9/4/2013	
		LPM			
Flow Rate Stop:	5	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	5	CFM			
		LPM	Alpha Eff:	67.2	%
			Beta/Gamma Eff:	46.9	%
			Alpha Background:	0.9	CPM
			Beta/Gamma Background:	42.3	CPM

Technician Performing Count: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V * T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.6E-13 µCi/ml Beta/Gamma MDA= 1.3E-12 µCi/ml

Technician Performing Calculation: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1000	2154	10	215.4	0.9	214.5	0.67	0.672	2.22E+06	2.15E-04
βγ	1000	4634	10	463.4	42.3	421.1	0.95	0.469	2.22E+06	4.26E-04

Technician Performing Initial Count: James C. Young Jr. 2/28/2013

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
50	min	5	CFM	7.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity	
α	2.1E-04	µCi	7.1E+06	milliliters	3.0E-11	µCi/ml α
βγ	4.3E-04	µCi	7.1E+06	milliliters	6.0E-11	µCi/ml βγ

Technician Performing Calculation: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1200	232	10	23.2	0.9	22.3	0.67	0.672	2.22E+06	2.23E-05
βγ	1200	732	10	73.2	42.3	30.9	0.95	0.469	2.22E+06	3.12E-05

Technician Performing Decay Count: William Wylie 3/1/2013
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity	
α	2.2E-05	µCi	7075000.001	milliliters	3.2E-12	µCi/ml α
βγ	3.1E-05	µCi	7075000.001	milliliters	4.4E-12	µCi/ml βγ

Technician Performing Calculation: William Wylie 3/1/2013
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	36.7	Minutes
T 1/2 βγ =	31.8	Minutes

Technician Performing Calculation: William Wylie 3/1/2013
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O600	13	10	1.3	0.9	0.4	0.67	0.672	2.22E+06	4.00E-07
βγ	O600	389	10	38.9	42.3	0	0.95	0.469	2.22E+06	0.00E+00

Technician Performing Decay Count: Daniel Spicuzza 3/1/2013

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity	
α	4.00E-07	mCi	7075000.001	milliliters	5.7E-14	mCi/ml α
βγ	0.00E+00	mCi	7075000.001	milliliters	0.0E+00	mCi/ml βγ

Technician Performing Calculation: Daniel Spicuzza 3/1/2013
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - \quad mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 3/1/2013

Date

AIR SAMPLE DATA AND ANALYSIS

INSTRUCTION 1: Complete the following information concerning the sample:

Project/Location:	NSF Indian Head, IR Site 1				
A/S ID Number:	AS-06	RWP Number:	NSFIH-2013-01	AWS Number:	N/A
Date Start:	2/28/2013	Date Stop:	2/28/2013		
Time Start:	12:25	Time Stop:	13:15	Total Time:	50 Minutes
Sample Location:	Downwind During Excavation of Soils				

Sample Type:

Breathing Zone		General Area	X	Other	
High Volume	X	Low Volume		Lapel/Personal	

Comments:

Technician Performing Sample: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 2: Complete the following information concerning sampling equipment and counting equipment:

Type Sampler:	HiVol		Type Counter:	Model-2929	
Sampler I.D.:	003511		Counter I.D.:	118419	
Cal. Date:	1/28/2013		Probe I.D.:	121393	
Cal. Due Date:	1/28/2014		Cal. Date:	9/4/2012	
Flow Rate Start:	5	CFM	Cal. Due Date:	9/4/2013	
		LPM			
Flow Rate Stop:	5	CFM	Count Time:	10	Minutes
		LPM			
Average Flow Rate:	5	CFM			
		LPM	Alpha Eff:	67.2	%
			Beta/Gamma Eff:	46.9	%
			Alpha Background:	0.9	CPM
			Beta/Gamma Background:	42.3	CPM

Technician Performing Count: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA in } \mu\text{Ci/ml} = \frac{2.71 + 4.65\sqrt{(R_B * T)}}{2.22\text{ E+6} * E * V*T}$$

where: V = Sample Volume in Milliliters
T = Sample Count Time in Minutes
R_B = Background Count Rate in CPM
E = Instrument Efficiency Expressed as a Decimal

Alpha MDA = 1.6E-13 µCi/ml Beta/Gamma MDA= 1.3E-12 µCi/ml

Technician Performing Calculation: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 (if feasible) minutes:

Initial Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	1320	1832	10	183.2	0.9	182.3	0.67	0.672	2.22E+06	1.82E-04
βγ	1320	4452	10	445.2	42.3	402.9	0.95	0.469	2.22E+06	4.07E-04

Technician Performing Initial Count: James C. Young Jr. 2/28/2013

INSTRUCTION 5: Calculate the Total Sample Volume:

Total Sample Run Time		Sample Average Flow Rate		Total Volume	
50	min	5	CFM	7.1E+06	milliliters
		0	LPM	0	milliliters

Technician Performing Calculation: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 6: Determine the Initial Airborne Concentration

Initial Activity			Volume		Initial Activity	
α	1.8E-04	µCi	7.1E+06	milliliters	2.6E-11	µCi/ml α
βγ	4.1E-04	µCi	7.1E+06	milliliters	5.8E-11	µCi/ml βγ

Technician Performing Calculation: James C. Young Jr. 2/28/2013
Date

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 2 hour decay period (if feasible) to allow the short lived Radon daughters to decay.

2 hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity µCi
α	1520	194	10	19.4	0.9	18.5	0.67	0.672	2.22E+06	1.85E-05
βγ	1520	756	10	75.6	42.3	33.3	0.95	0.469	2.22E+06	3.37E-05

Technician Performing Decay Count: William Wylie 2/28/2013
Date

INSTRUCTION 8: Determine the airborne concentration following 2 Hr. decay and utilizing volume data in Instruction 5:

2 hr. Decayed Activity			Volume		2 hr. Decayed Activity	
α	1.9E-05	µCi	7075000.001	milliliters	2.6E-12	µCi/ml α
βγ	3.4E-05	µCi	7075000.001	milliliters	4.8E-12	µCi/ml βγ

Technician Performing Calculation: William Wylie 2/28/2013
Date

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T1/2\ (Min) = \frac{-.693(t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t =	120	elapsed time between counts in minutes.
T 1/2 α =	36.3	Minutes
T 1/2 βγ =	33.4	Minutes

Technician Performing Calculation: William Wylie 2/28/2013
Date

INSTRUCTION 10: **If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 2 hour decay, then a 20 hour (if feasible) decay count of the sample is required to remove the Thoron component of the sample.**

INSTRUCTION 11: **Decay sample for 20 hours (if feasible) and then recount the sample:**

20hr. Decay Count	Time Counted	Gross Counts	Count Period (Min)	Gross Count Rate	Background Count Rate	Net Count Rate	CF	EFF CPM/DPM	DPM/mCi	Activity
α	O820	12	10	1.2	0.9	0.3	0.67	0.672	2.22E+06	3.00E-07
βγ	O820	434	10	43.4	42.3	1.1	0.95	0.469	2.22E+06	1.11E-06

Technician Performing Decay Count: Daniel Spicuzza 3/1/2013

20 hr. Decayed Activity			Volume		20 hr. Decayed Activity	
α	3.00E-07	mCi	7075000.001	milliliters	4.2E-14	mCi/ml α
βγ	1.11E-06	mCi	7075000.001	milliliters	1.6E-13	mCi/ml βγ

Technician Performing Calculation: Daniel Spicuzza 3/1/2013
Date

INSTRUCTION 12: **Using the 2 hour and the 20 hour activity, determine the long-lived activity due to alpha:**

$$A_{LL} = \frac{A_{20} - A_1 \left(e^{-0.0655(T)}\right)}{1 - e^{-0.0655(T)}}$$

where:
- A_{LL} = long-lived activity which emits alpha
- A_{20} = 20 hour decayed activity due to alpha
- A_1 = 2 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- T = elapsed time between the 2 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$A_{LL}\mu Ci = \frac{A_{20}mCi - A_1mCi\left(e^{-0.0655(hrs)}\right)}{1 - e^{-0.0655(hrs)}}$$

$$= \frac{mCi - \quad mCi\left(e^{-0.0655(-\_\_\_hrs)}\right)}{1 - e^{-0.0655(\quad hrs)}}$$

$$= \underline{\qquad\qquad} mCi$$

Technician Performing Calculation: N/A N/A
Date

INSTRUCTION 13: **Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:**

_____ $A_{LL}\mu Ci$ = ($A_{LL}\mu Ci$) (0.67)

where 0.67 is:

Nuclide	T½	Ci		Emission		Yield	Energy
Th-232	1.4E+10 y	1		Alpha		100%	4.01 Mev
Ra-228	5.75 yr.	0.9446		Beta		100%	0.05 Mev
Ac-228	6.13 hr.	0.9446		Beta		100%	2.11 Mev
Th-228	1.91 yr.	0.9171		Alpha		100%	5.4 Mev
Ra-224	3.62 day	0.9169		Alpha		100%	5.5 Mev
Rn-220	55 sec.	0.9169		Alpha		100%	6.3 Mev
Po-216	0.15 sec.	0.9169		Alpha		100%	6.8 Mev
Pb-212	10.6 hr.	0.9169		Beta		100%	0.6 Mev
Bi-212	60.6 min	0.9169		Beta		100%	2.25 Mev

Total long-lived alpha activity= 1 + .917 + .917 = 2.8 1.89 = .67

Total long-lived beta activity= .945 + .945 = 1.89 2.83

Technician Performing Calculation: N/A | N/A

Date

INSTRUCTION 14: **Calculate the long-lived activity concentrations from the values determined in Instructions 12 and 13:**

_____ A_{LL} µCi = µCi/ml [A_{LL}]a
volume

_____ A_{LL} µCi = µCi/ml [A_{LL}]bg
volume

If: [A_{LL}] > 1E-13 µCi/ml α
[A_{LL}] > 2E-10 µCi/ml βγ

Then:
- Report this to the HP Supervisor Immediately
- Post the area as Airborne Radioactivity Area
- Calculate and record DAC Hours for the affected individuals
- Send the sample out for an isotopic analysis

Technician Performing Calculation: N/A | N/A

Date

HP Supervisor Review: Daniel Spicuzza | 3/1/2013

Date

Appendix Z

Aleut World Solutions, LLC (AWS), 2013. Final Survey Report Site 1 Removal Action, Naval Support Facility Indian Head, Indian Head, MD, Rev. 0 December 20, 2013.

Appendix K
Background Reference Area Data

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	126197	
Last Calibration Date:	4/20/2012				
Detector Model:	44-10		Detector Serial No.:	192598	
Today's Date:	2/12/2013		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Surface Background				
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	6160	252.87		63941.55
2	5867	-40.13		1610.68
3	5298	-609.13		371043.42
4	6012	104.87		10997.02
5	6219	311.87		97260.82
6	6123	215.87		46598.42
7	6072	164.87		27181.02
8	5698	-209.13		43736.75
9	5789	-118.13		13955.48
10	5598	-309.13		95563.42
11	5498	-409.13		167390.08
12	6070	162.87		26525.55
13	6123	215.87		46598.42
14	6021	113.87		12965.62
15	5892	-15.13		229.02
16	5684	-223.13		49788.48
17	6021	113.87		12965.62
18	5578	-329.13		108328.75
19	5986	78.87		6219.95
20	6233	325.87		106189.08
21	5876	-31.13		969.28
22	5589	-318.13		101208.82
23	6032	124.87		15591.68
24	6123	215.87		46598.42
25	5916	8.87		78.62
26	5843	-64.13		4113.08
27	6310	402.87		162301.55
28	5921	13.87		192.28
29	5765	-142.13		20201.88
30	5897	-10.13		102.68
Mean Count: $\bar{x}$	5907.13		SUM	1660447.47
Standard Deviation (σ)	239.28		Variance:	57256.81
Background Count Rate:		5907.13	CPM + -	717.85 CPM

Action Level
6624.99

Calculations Completed by:	William Wylie	Date:	2/12/2013
Reviewed by:	Daniel Spicuzza	Date:	2/12/2013

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	120633	
Last Calibration Date:	8/15/2012				
Detector Model:	44-10		Detector Serial No.:	316939	
Today's Date:	2/12/2013		Data Collected by:	William Wylie	

	Alpha		Beta-Gamma	X	Gamma	

Remarks: Instrument Surface Background

Type of Surface:	Soil		Count Time:	1	Minutes
Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$	
1	6052	-165.87		27511.75	
2	6198	-19.87		394.68	
3	6432	214.13		45853.08	
4	5984	-233.87		54693.62	
5	6321	103.13		10636.48	
6	5987	-230.87		53299.42	
7	6216	-1.87		3.48	
8	6345	127.13		16162.88	
9	6432	214.13		45853.08	
10	5923	-294.87		86946.35	
11	6423	205.13		42079.68	
12	6023	-194.87		37973.02	
13	6213	-4.87		23.68	
14	6143	-74.87		5605.02	
15	6321	103.13		10636.48	
16	6180	-37.87		1433.88	
17	6298	80.13		6421.35	
18	6410	192.13		36915.22	
19	6234	16.13		260.28	
20	5890	-327.87		107496.55	
21	6034	-183.87		33806.95	
22	6289	71.13		5059.95	
23	6190	-27.87		776.55	
24	6423	205.13		42079.68	
25	5892	-325.87		106189.08	
26	6321	103.13		10636.48	
27	6456	238.13		56707.48	
28	6324	106.13		11264.28	
29	6209	-8.87		78.62	
30	6373	155.13		24066.35	
Mean Count: $\bar{x}$	6217.87		SUM	880865.47	
Standard Deviation (σ)	174.28		Variance:	30374.67	
Background Count Rate:		6217.87	CPM + -	522.85	CPM

Action Level
6740.72

Calculations Completed by:	William Wylie	Date:	2/12/2013
Reviewed by:	Daniel Spicuzza	Date:	2/12/2013

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	79037	
Last Calibration Date:	8/15/2012				
Detector Model:	44-10		Detector Serial No.:	316936	
Today's Date:	2/12/2013		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Surface Background				
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	5546	-53.80		2894.44
2	5239	-360.80		130176.64
3	5478	-121.80		14835.24
4	6012	412.20		169908.84
5	5569	-30.80		948.64
6	5721	121.20		14689.44
7	5321	-278.80		77729.44
8	5239	-360.80		130176.64
9	5356	-243.80		59438.44
10	5689	89.20		7956.64
11	5198	-401.80		161443.24
12	5346	-253.80		64414.44
13	5269	-330.80		109428.64
14	5589	-10.80		116.64
15	5475	-124.80		15575.04
16	5387	-212.80		45283.84
17	5872	272.20		74092.84
18	6032	432.20		186796.84
19	5478	-121.80		14835.24
20	5689	89.20		7956.64
21	5876	276.20		76286.44
22	5342	-257.80		66460.84
23	5890	290.20		84216.04
24	5943	343.20		117786.24
25	6016	416.20		173222.44
26	5688	88.20		7779.24
27	5634	34.20		1169.64
28	5715	115.20		13271.04
29	5806	206.20		42518.44
30	5579	-20.80		432.64
Mean Count: $\bar{x}$	5599.80		SUM	1871840.80
Standard Deviation (σ)	254.06		Variance:	64546.23
Background Count Rate:		5599.80	CPM + -	762.18 CPM

Action Level			
6361.98			
Calculations Completed by:	William Wylie	Date:	2/12/2013
Reviewed by:	Daniel Spicuzza	Date:	2/12/2013

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian head				
Instrument Model:	2350-1		Instrument Serial No.	117014	
Last Calibration Date:	6/27/2013				
Detector Model:	44-10		Detector Serial No.:	316939	
Today's Date:	8/19/2013		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background				
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	5574	-156.30		24429.69
2	5389	-341.30		116485.69
3	5678	-52.30		2735.29
4	6043	312.70		97781.29
5	5985	254.70		64872.09
6	5863	132.70		17609.29
7	5698	-32.30		1043.29
8	5789	58.70		3445.69
9	5457	-273.30		74692.89
10	5681	-49.30		2430.49
11	6389	658.70		433885.69
12	5490	-240.30		57744.09
13	5574	-156.30		24429.69
14	5876	145.70		21228.49
15	5493	-237.30		56311.29
16	5779	48.70		2371.69
17	5864	133.70		17875.69
18	5651	-79.30		6288.49
19	5856	125.70		15800.49
20	5789	58.70		3445.69
21	5785	54.70		2992.09
22	5876	145.70		21228.49
23	5962	231.70		53684.89
24	5451	-279.30		78008.49
25	5567	-163.30		26666.89
26	5790	59.70		3564.09
27	5645	-85.30		7276.09
28	5489	-241.30		58225.69
29	5742	11.70		136.89
30	5684	-46.30		2143.69
Mean Count: $\bar{x}$	5730.30		SUM	1298834.30
Standard Deviation (σ)	211.63		Variance:	44787.39
Background Count Rate:		5730.30	CPM + -	423.26 CPM

Action Level
6365.19

Calculations Completed by:	William Wylie	Date:	8/19/2013
Reviewed by:	Daniel Spicuzza	Date:	8/19/2013

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	98639	
Last Calibration Date:	6/27/2013				
Detector Model:	44-10		Detector Serial No.:	316936	
Today's Date:	8/19/2013		Data Collected by:	Harry Obregon	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background				
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	5897	226.47		51287.15
2	5562	-108.53		11779.48
3	5238	-432.53		187085.08
4	5349	-321.53		103383.68
5	5572	-98.53		9708.82
6	5690	19.47		378.95
7	5892	221.47		49047.48
8	5578	-92.53		8562.42
9	5731	60.47		3656.22
10	5647	-23.53		553.82
11	5729	58.47		3418.35
12	5833	162.47		26395.42
13	5942	271.47		73694.15
14	5736	65.47		4285.88
15	5827	156.47		24481.82
16	5922	251.47		63235.48
17	5411	-259.53		67357.55
18	5598	-72.53		5261.08
19	5369	-301.53		90922.35
20	5836	165.47		27379.22
21	5739	68.47		4687.68
22	5661	-9.53		90.88
23	5753	82.47		6800.75
24	5483	-187.53		35168.75
25	5819	148.47		22042.35
26	5742	71.47		5107.48
27	5401	-269.53		72648.22
28	5387	-283.53		80391.15
29	5926	255.47		65263.22
30	5846	175.47		30788.55
Mean Count: $\bar{x}$	5670.53		SUM	1134863.47
Standard Deviation (σ)	197.82		Variance:	39133.22
Background Count Rate:		5670.53	CPM + -	395.64 CPM

Action Level
6264.00

Calculations Completed by:	Harry Obregon	Date:	8/19/2013
Reviewed by:	Daniel Spicuzza	Date:	8/19/2013

Appendix L
Instrument Calibration Data

SEO # 00-004

CERTIFICATE OF CALIBRATION

CUSTOM ALPHA STANDARD[1]

Radionuclide Th-230 Activity 2.585 nCi Serial Number B403

Reference Date Feb. 1, 1994 Half-Life[2] $(7.54 \pm 0.03) \times 10^4$ years

Alpha Flux Rate (2 pi emission rate) 2869.4 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
alpha	4621.1	23.4
	4687.6	76.3

SOURCE DESCRIPTION
The activity is homogenously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and alpha flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

ORIGINAL

Systematic uncertainty	± 1.56%
Random uncertainty	± 0.97%
Total uncertainty	± 2.53%

Calibration Laboratory

2-24-94
Date

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

SEG# 045410

CERTIFICATE OF CALIBRATION

CUSTOM BETA STANDARD[1]

Radionuclide Tc-99 Activity 9.504 nCi Serial Number B399

Reference Date April 1, 1994 Half-Life[2] $(2.13 \pm 0.05) \times 10^5$ years

Beta Flux Rate (2 pi emission rate) 12131.9 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
beta	E_{max} = 294 E_{avg} = 85	100

SOURCE DESCRIPTION
The activity is homogeneously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and beta flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

Systematic uncertainty	± 3.08%
Weighing uncertainty	± 0.72%
Total uncertainty	± 3.80%

ORIGINAL

Daniel Oh
Calibration Laboratory

4-8-94
Date

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

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North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

119701

14 October 1997 Men/wo

Amersham Buchler
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D-38110 Braunschweig
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D-38001 Braunschweig

Tel. (05307) 930-0
Fax (05307) 930-293
Fax-Zentrale 930-237

Amersham
The Health Science Group

CERTIFICATE

No. 363229

for a Sealed Radioactive Source

Source Type: Alpha Wide Area Reference Source

Product Code	TZRX1922
Drawing	VZ-1368
Dimensions of Active Surface	Ø 36 mm
Overall Dimensions	Ø 47 mm x 3 mm
Source No.	FS 437
Nuclide	Thorium-230

Measurement Data

Activity	318 Bq 19080 DPM
Overall Uncertainty*	± 10 %
Alpha Surface Emission Rate	148 s^{-1} ± 5 % in 2 π steradian 8.59 E-3 µCi
Reference Date	30 September 1997
Traceability*	Defined on page 2

Leakage and Contamination Test(s)

Test Method(s)*	I
Test(s) passed on	13 October 1997

Additional Information

ISO Classification*	C.34645
Recommended Working Life*	10 years
Remark	

* see page 2 for explanation

Amersham Buchler

i. A. [signature]
(Production Manager)

Quality Assurance System

The quality assurance system of Amersham Buchler GmbH & Co KG was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 1994.

Amersham
The Health Science Group

Overall Uncertainty

The declared uncertainty U is an expanded uncertainty $U = k * u_c$ with a coverage factor of $k = 3$. The combined uncertainty u_c is the sum of all uncertainties which can be evaluated by statistical means (uncertainty type A, u_A) and all other uncertainties (uncertainty type B, u_B) whereby $u_B^2 = u_A^2 + u_B^2$ is.
(Ref.: NIST Technical Note 1297 / WECC-Doc. 19-1990)

Traceability

This certificate documents the traceability of measurement results to national standards, standard measuring equipment and methods for the realisation of physical units of measurement according to the International System of Units (SI).

Traceability is defined as 'the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.'

Amersham Buchler GmbH & Co KG has been accredited as DKD (Deutscher Kalibrierdienst) calibration laboratory by the Physikalisch-Technische Bundesanstalt (PTB) and is authorized to issue reference sources which are traceable to national standards held at the PTB in Germany.

Because of the European Cooperation for Accreditation of Laboratories (EAL) mutual recognition agreement the certificates are also accepted by all EAL-members (e.g. NAMAS, UK).

This product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)".

As a requirement of the ANSI N42.22-1995 Amersham participates in the NEI/NIST Measurements Assurance Program of the Nuclear Power Industry.

Leakage and Contamination Tests

Stringent tests for leakage are an essential feature of radioactive sources production. They are based on ISO 9978. Some standard methods used for sealing radiation sources are listed below.

Wipe Test I

The source is wiped with a swab or tissue, moistened with ethanol or water; the activity removed is measured.
Limit: 185 Bq.

Immersion Test II

The source is immersed in a suitable liquid at 50 °C for 4 hours and the activity removed is measured.
Limit: 185 Bq.

Bubble Test III

The source is immersed in water or a suitable liquid and the pressure in the vessel reduced to 13 kPa (100 mm Hg). No bubbles must be observed.
(This test conforms to ISO 9978 except that for some sources, the 100 mm³ free volume requirement is not met.)

Emanation Test IV

The source is placed in a gas tight enclosure with activated carbon as absorber and is left there for at least 3 h. The source is considered leak tight when not more than 185 Bq Radon related to a collection time of 12 h can be measured afterwards.

ISO Classification

The International Organisation for Standardization (ISO) has proposed a system of classification of sealed radioactive sources based on safety requirements for typical uses (see ISO 2919). This system provides a manufacturer of sealed radioactive sources with a set of tests to evaluate the safety of his products. It also assists a user of such sealed sources to select types which suit the application he has in mind. The tests to which specimen sources are subjected are listed in the following table.

Classification of sealed source performance standards according to ISO 2919

Test	Class 1	2	3	4	5	6
Temperature	No test	+ 40 °C (20 min) + 80 °C (1 h)	+ 40 °C (20min) + 180 °C (1 h)	+ 40 °C (20 min) + 400 °C (1 h) and thermal shock 400° C to 20° C	+ 40 °C (20 min) + 600 °C (1 h) and thermal shock 600 °C to 20 °C	+ 40 °C (20 min) + 800 °C (1 h) and thermal shock 800 °C to 20 °C
External Pressure	No test	25 kPa absolute	25 kPa absolute to 2 MPa absolute	25 kPa absolute to 7 MPa absolute	25 kPa absolute to 70 MPa absolute	25 kPa absolute to 170 MPa absolute
Impact	No test	50 g from 1 m	200 g from 1 m	2 kg from 1 m	5 kg from 1 m	20 kg from 1 m
Vibration	No test	3 x 10 min 25 Hz to 100 Hz at 5 g peak amplitude	3 x 10 min 25 Hz to 50 Hz at 5 g peak amplitude and 50 Hz to 90 Hz at 0.635 mm amplitude peak to peak and 90 Hz to 100 Hz at 10 g peak amplitude	3 x 30 min 25 Hz to 80 Hz at 1.5 mm amplitude peak to peak and 80 Hz to 2000 Hz at 20 g peak amplitude		
Puncture	No test	1 g from 1 m	10 g from 1 m	50 g from 1 m	300 g from 1 m	1 kg from 1 m

Special Applications

No test programme can cover all possible combinations of environments to which a source may be exposed.

Users should therefore consult our experts before using sources in potentially adverse environments.

IAEA Special Form

'Special Form' is a test specification for sealed sources given in the IAEA transport regulations.
(IAEA Safety Series No. 6, 1985 revised edition)

It is used in determining the maximum acceptable activities for various types of transport containers.

Recommended Working Life

The 'recommended working life' is our recommendation of the period within which the source should be replaced. The period given has been assessed on the basis of such factors as, toxicity of nuclide, total initial activity, source construction (e.g. capsule design, source insert type, etc.), typical application environment, operational experience, test performance data, etc.

The usage of a source is, however, quite often limited by the half-life of the nuclide.
Adverse environments could affect the appearance and integrity of a source. It is the user's responsibility to regularly inspect and test the source in order to assess at what point during the 'recommended working life' the source should be replaced.

01. 08. 98 12:45 PM *AMERSHAM CORP G. S. A. P02

#019419

CERTIFICATE OF CALIBRATION

MODEL CAL2703 BETA STANDARD

Radionuclide Tc-99 Activity 10.89 nCi Serial Number A414

Reference Date October 1, 1992 Half-Life[1] $(2.13 \pm 0.05) \times 10^5$ years

PRINCIPAL EMISSIONS[1]

Type	Energy (keV)	Intensity (%)
beta	E_{max} = 294 E_{avg} = 85	100

SOURCE DESCRIPTION

The activity is deposited in a 33 mm active diameter on an aluminum backing disc. The active area is sealed beneath 0.9 mg/cm² aluminized mylar stretched on an aluminum support ring. This active element was then epoxied into an aluminum outer support ring 47 mm in diameter by 2 mm thick.

METHOD OF CALIBRATION

The source was calibrated by dispensing a gravimetric aliquot of a solution calibrated by liquid scintillation using an efficiency established through ongoing intercomparisons with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

Systematic uncertainty	± 1.71%
Weighing uncertainty	± 0.54%
Total uncertainty	± 2.25%

ORIGINAL

Calibration Laboratory

10-8-92
Date

REFERENCES

(1) Table of Radioactive Isotopes, 7th edition, 1986.

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North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

010102

DEUTSCHER KALIBRIERDIENST DKD

Kalibrierlaboratorium für Meßgrößen der Radioaktivität
Calibration laboratory for measurements of radioactivity

AKKREDITIERT DURCH DIE
PHYSIKALISCH-TECHNISCHE BUNDESANSTALT (PTB)

AEA Technology QSA GmbH
Postfach 58 42 — Gieselweg 1
D-38049 Braunschweig — D-38110 Braunschweig

Tel. +49 (0) 5307 932-0
Fax +49 (0) 5307 932-194

Source no. HP 709

08518
DKD-K-06501
01-01

Kalibrierzeichen
Calibration mark

Kalibrierschein
Calibration Certificate

Gegenstand *Object*	**Beta Wide Area Reference Source**
Hersteller *Manufacturer*	**AEA Technology QSA GmbH**
Typ *Type*	**TCR03022**
Strahler-Nr. *Source number*	**HP 709**
Auftraggeber *Customer*	**AEA TECHNOLOGY QSA, INC. USA-BURLINGTON MA 01803**
Auftragsnummer *Order No.*	**CO 33657**
Anzahl der Seiten des Kalibrierscheines *Number of pages of the certificate*	**2**
Referenzdatum *Reference date*	**15 December 2000**

Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).

Der Deutsche Kalibrierdienst ist Unterzeichner des multilateralen Übereinkommens der European co-operation for Accreditation (EA) zur gegenseitigen Anerkennung der Kalibrierscheine.

Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).

The Deutscher Kalibrierdienst is signatory to the multilateral agreement of the European co-operation for Accreditation (EA) for the mutual recognition of calibration certificates.

The user is obliged to have the object recalibrated at appropriate intervals.

Dieser Kalibrierschein darf nur vollständig und unverändert weiterverbreitet werden. Auszüge oder Änderungen bedürfen der Genehmigung sowohl der Physikalisch-Technischen Bundesanstalt als auch des ausstellenden Kalibrierlaboratoriums. Kalibrierscheine ohne Unterschrift und Stempel haben keine Gültigkeit.

This calibration certificate may not be reproduced other than in full except with the permission of both the Physikalisch-Technische Bundesanstalt and the issuing laboratory. Calibration certificates without signature and seal are not valid.

Stempel *Seal*	Datum *Date*	Leiter des Kalibrierlaboratoriums *Head of the calibration laboratory*	Stellvertreter *Deputy*	Bearbeiter *Person in charge*
Deutscher DKD-K-06501 Kalibrierdienst	6 January 2001	Dr. Thieme	Schott	Linke / Schott / Schüler

Beta Wide Area Reference Source

Source no.	HP 709
Drawing	VZ-1368
Nuclide	Technetium-99
Activity	914 Bq
Beta surface emission rate	444 s^{-1} in 2 π steradian
Reference date	15 December 2000 at 12.00 GMT
Dimensions of active surface	Ø 36 mm
Overall dimensions	Ø 47 mm x 3 mm
Leakage and contamination test	The amount of the removable activity is less than 0.1 % of the total activity but does not exceed 200 Bq. (Wipe test according to ISO 9978, no. 5.3.1)
Date of wipe test	22 December 2000
Construction	Tc-99 is incorporated into the surface of an anodized aluminium foil of 0.3 mm thickness. The thickness of the activated layer is approx. 6 µm. The activated foil is mounted into a holder.
Measuring method	The activity was determined by comparison with a reference source of the same construction. The beta surface emission rate was measured using a windowless proportional counter.
Traceability	Additional to the direct traceability to the PTB through the DKD this product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)". As a requirement of the ANSI N42.22-1995 AEA Technology QSA GmbH participates in the NEI/NIST Measurements Assurance Program of the Nuclear Power Industry.
Uncertainty	The relative uncertainty of the activity is 5 %, the relative uncertainty of the beta surface emission rate is 3 %. The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %. (Ref. NIST Technical Note 1297/"Guide to the Expression of Uncertainty in Measurement" ISO Guide, 1995)
Radioactive impurities	Related to Tc-99 (equal 100 %) the following radioactive impurities were detected: none
Quality assurance system	The quality assurance system of AEA Technology QSA GmbH was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, issue 1994. Isotrak products meet the requirements of 10CFR50 Appendix B in the USA.
Uniformity	The uniformity of the surface emission rate is better than 10 %.
Remark	This is a Class 2 equivalent reference source which fulfills all requirements of a Class 2 source except that the active area is smaller than 100 cm^2.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 126197
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%) Before Calibration	Instrument Response (±10%) After Calibration	Comments: Calibrated in accordance with CP-IN-WI-239	
400	400	395	395	Pulser: 120935	Cal Due: 09/29/2012
4,000	4,000	3,951	3,951	DVM: 94710023	Cal Due: 11/11/2012
40,000	40,000	39,528	39,528	Temp/Press: 3590	Cal Due: 09/21/2012
400,000	400,000	395,751	395,751	Humidity: 958670	Cal Due: 06/07/2012
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N21 I/O Firmware Version: 37123N04	
500	(490-510)	500	500		
1,500	(1,498-1,502)	1,501	1,501		
2,000	(1,940-2,060)	1,996	1,996	Temp: 23.7 °C Pressure: 739 mmHg Humidity: 45%	
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	11.8	10.4	BAT > 4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	50.9	47.1	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	100	90	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	11	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10 mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: [signature]	Date: 4/20/12	
Calibration Date: 04/20/2012	*Certification Due (6mo): 10/20/2012 *Certification Due (12mo): 04/20/2013		

* Calibration due date is dependant on users regulatory requirements.

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CALIBRATION CERTIFICATE

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1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 192598
Customer Purchase Order Number: N/A	Work Order Number: 2012-12192	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Cs^{137}	Serial Number: 090240	Activity: 10µCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 08/31/2012

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#126197	Count 1	2.01
Due Date	04/20/13	Count 2	2.01
Threshold	T=100 (10mV)	Count 3	2.03
Cable Length	5ft.	Average	2.016
Temp/Press: 3590	Cal Due: 09/21/12	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 06/07/2012	Pass/Fail	PASS
Temp: 21.8 °C		Humidity: 38.7%	Press: 736mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 68,899	High Sample Activity (2mR/hr) Using Source #2 = 257,428	Dead Time (DT): 1.472673E-05	Calibration Constant (CC): 5.6447714E+10

ATTACHMENTS		DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	YES	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	YES	0.400	0.360 - 0.440	0.411	0.411
Voltage Plateau:	YES	1.0	0.900 – 1.10	1.06	1.06
High Voltage:	1000V	2	1.8 - 2.2	2.01	2.01

COMMENTS

****Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector****

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By:	Reviewed By:	Date: 4/26/12
Certification Date: 04/26/2012	*Certification Due (6mo): 10/26/2012	
	*Certification Due (12mo): 04/26/2013	

* Calibration due date is dependant on users regulatory requirements.

background plateau 44-10 #192598 4/26/2012 5ft cable

700	504
750	816
800	1023
850	1073
900	1161
950	1163
1000	1206
1050	1258
1100	1194
1150	1141
1200	1201
1250	1230
1300	1146
1350	1164

source plateau Cs137 #090240 10uCi button

700	3420
750	3750
800	4302
850	4583
900	4806
950	4949
1000	4970
1050	4962
1100	4741
1150	4872
1200	4870
1250	4696
1300	4883
1350	5349

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 04/26/2012.
The current time of day is: 08:38:45.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: _____

Comments:

Model 2350 Serial # =	126197.
User I.D. =	
High Voltage =	1000 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.472673E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	192598.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.6 volts.

det1 Generated: 04/26/2012 08:40:21.

Model 2350 Serial #126197

H1000$E
Set High Voltage: 1000

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

*SL1.472673E-05$ *
Set Dead Time: 1.472673E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N192598$A
Set Detector Serial #: 192598

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 04/26/2012.
The current time of day is: 08:39:03.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: R

Comments:

Model 2350 Serial # =	126197.
User I.D. =	
High Voltage =	1000 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.472673E-05.
Detector Calibration Constant =	5.644712E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	192598.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.6 volts.

det2 Generated: 04/26/2012 08:41:03.

Model 2350 Serial #126197

H1000$E
Set High Voltage: 1000

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

*SL1.472673E-05$ *
Set Dead Time: 1.472673E-05

SC5.644712E+10$T
Set Calibration Constant: 5.644712E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N192598$A
Set Detector Serial #: 192598

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 120633
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-239	
400	400	399	399	Pulser: 120935	Cal Due: 09/29/2012
4,000	4,000	3,965	3,965	DVM: 94710023	Cal Due: 11/11/2012
40,000	40,000	39,672	39,672	Temp/Press: 3590	Cal Due: 09/21/2012
400,000	400,000	397,425	397,425	Humidity: 992290	Cal Due: 05/31/2013
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N28 I/O Firmware Version: 37123N05	
500	(490-510)	499	499		
1,500	(1,498-1,502)	1,500	1,500		
2,000	(1,940-2,060)	1,996	1,996	Temp: 23.5 °C Pressure: 739 mmHg Humidity: 39%	
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	11.2	10.1	BAT >4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	50.1	46.4	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	100	100	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	11	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: J. Dikerson	Date: 8/15/12
Calibration Date: 08/15/2012	*Certification Due (6mo): 02/15/2013 *Certification Due (12mo): 08/15/2013	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 316939
Customer Purchase Order Number: N/A	Work Order Number: N/A	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Cs^{137}	Serial Number: 019457	Activity: 5µCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 08/31/2012

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#120633	Count 1	2.01
Due Date	08/15/2013	Count 2	1.98
Threshold	T=100 (10mV)	Count 3	1.99
Cable Length	5ft.	Average	1.99
Temp/Press: 3590	Cal Due: 09/21/2012	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 992290	Cal Due: 05/31/2013	Pass/Fail	PASS
Temp: 23.5 °C		Humidity: 39%	Press: 739 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 70,864	High Sample Activity (2mR/hr) Using Source #2 = 261,445	Dead Time (DT): 1.503884E-05	Calibration Constant (CC): 5.832809E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.398	0.398
Voltage Plateau:	√YES	NO	1.0	0.900-1.10	1.02	1.02
High Voltage: 1050V			2	1.8-2.2	1.99	1.99

COMMENTS

Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	Reviewed By: [signature]	Date: 8/16/12
Certification Date: 08/15/2012	*Certification Due (6mo): 02/15/2013	
	*certification Due (12mo): 08/15/2013	

* Calibration due date is dependant on users regulatory requirements.

background plateau 44-10#316939

700	185
750	325
800	544
850	774
900	996
950	1021
1000	1102
1050	1061
1100	1129
1150	1138
1200	1105
1250	1126
1300	1078
1350	1138

source plateau Cs-137#019457

700	1744
750	2621
800	3491
850	4136
900	4633
950	4681
1000	4898
1050	4990
1100	5015
1150	4973
1200	4981
1250	4992
1300	5026
1350	5000

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 08/15/2012.
The current time of day is: 14:18:45.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	120633.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.503884E-05.
Detector Calibration Constant =	5.832809E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	316939.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.4 volts.

det1 Generated: 08/15/2012 14:21:44.

Model 2350 Serial #120633

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.503884E-05$.
Set Dead Time: 1.503884E-05

SC5.832809E+10$Z
Set Calibration Constant: 5.832809E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N316939$7
Set Detector Serial #: 316939

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 08/15/2012.
The current time of day is: 14:19:45.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	120633.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.500000E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	316939.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.4 volts.

det2 Generated: 08/15/2012 14:22:18.

Model 2350 Serial #120633

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.500000E-05$E
Set Dead Time: 1.500000E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N316939$7
Set Detector Serial #: 316939

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
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Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 79037
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-239	
400	400	399	399	Pulser: 120935	Cal Due: 09/29/2012
4,000	4,000	3,998	3,998	DVM: 94710023	Cal Due: 11/11/2012
40,000	40,000	39,966	39,966	Temp/Press: 3590	Cal Due: 09/21/2012
400,000	400,000	399,558	399,558	Humidity: 992290	Cal Due: 05/31/2013
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N29 I/O Firmware Version: 37123N05	
500	(490-510)	500	500		
1,500	(1,498-1,502)	1,501	1,501		
2,000	(1,940-2,060)	1,996	1,996	Temp: 23.5 °C Pressure: 739 mmHg Humidity: 39%	
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	10.3	10.3	BAT >4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	49.2	49.2	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	98	98	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Pauli	Reviewed By: Jeff Dickenson	Date: 8/15/12
Calibration Date: 08/15/2012	*Certification Due (6mo): 02/15/2013 *Certification Due (12mo): 08/15/2013	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 316936
Customer Purchase Order Number: N/A	Work Order Number: N/A	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION			
1) Source Nuclide: Cs^{137}	Serial Number: 019457	Activity: 5μCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 08/31/2012

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#79037	Count 1	2.02
Due Date	08/15/2013	Count 2	2.03
Threshold	T=100 (10mV)	Count 3	1.97
Cable Length	5ft.	Average	2.01
Temp/Press: 3590	Cal Due: 09/21/2012	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 992290	Cal Due: 05/31/2013	Pass/Fail	PASS
Temp: 23.5 °C		Humidity: 39%	Press: 739 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 72,243	High Sample Activity (2mR/hr) Using Source #2 = 262,611	Dead Time (DT): 1.559220E-05	Calibration Constant (CC): 5.979517E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.402	0.402
Voltage Plateau:	√YES	NO	1.0	0.900-1.10	1.04	1.04
High Voltage: 1050V			2	1.8-2.2	2.00	2.00

COMMENTS

Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	Reviewed By: [signature]	Date: 8/16/12
Certification Date: 08/15/2012	*Certification Due (6mo): 02/15/2013	
	*certification Due (12mo): 08/15/2013	

* Calibration due date is dependant on users regulatory requirements.

background plateau 44-10#316936

700	242
750	396
800	619
850	888
900	1142
950	1205
1000	1224
1050	1226
1100	1212
1150	1294
1200	1263
1250	1321
1300	1240
1350	1330

source plateau Cs-137#019457

700	1415
750	2143
800	2911
850	3635
900	4088
950	4177
1000	4170
1050	4344
1100	4337
1150	4431
1200	4371
1250	4341
1300	4451
1350	4681

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 08/16/2012.
The current time of day is: 19:49:57.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	79037.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.560000E-05.
Detector Calibration Constant =	5.979515E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	316936.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.3 volts.

DET1 Generated: 08/16/2012 19:50:57.

Model 2350 Serial #79037

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.560000E-05$K
Set Dead Time: 1.560000E-05

SC5.979515E+10$+
Set Calibration Constant: 5.979515E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N316936$4
Set Detector Serial #: 316936

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 08/16/2012.
The current time of day is: 19:50:19.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: Mp

Comments:

Model 2350 Serial # =	79037.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.560000E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	316936.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.3 volts.

DET2 Generated: 08/16/2012 19:51:35.

Model 2350 Serial #79037

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.560000E-05$K
Set Dead Time: 1.560000E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N316936$4
Set Detector Serial #: 316936

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 163904
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: N/A	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%) Before Calibration	Instrument Response (± 10%) After Calibration	Comments: Calibrated in accordance with CP-IN-WI-219	
X 0.1	100	N/A **	95	Pulser: 100272	Cal Due: 12/13/12
X 0.1	300	N/A **	300	DVM: 92260808	Cal Due: 02/21/13
X 0.1	500	N/A **	500	Temp/Press: 3590	Cal Due: 09/21/12
X 1	1,000	N/A **	950	Humidity: 992290	Cal Due: 05/31/13
X 1	3,000	N/A **	3,000	Temp: 24.0 °C Humidity: 35.7 % Pressure: 739 mmHg	
X 1	5,000	N/A **	5,000		
X 10	10,000	N/A **	9,500		
X 10	30,000	N/A **	30,000	Reset: SAT	Sensitivity: SAT
X 10	50,000	N/A **	50,000	Audio: SAT	Geotropism: SAT
X 100	100,000	N/A **	95,000	F/S Resp: SAT	BAT: SAT
X 100	300,000	N/A **	300,000	Limited Use: X100 scale for information use only. Calibrated in CPM. Use with pancake GM probe.	
X 100	500,000	N/A **	500,000		
Mech. Zero	0	N/A **	0		
HV Verification				** Meter movement faulty, no As Found readings taken; movement replaced.	
HV Adjustable from 450 to 1,500		☒ SAT ☐ UNSAT			
				Precision (CPM) Reading 1 = 36,500 Reading 2 = 36,000 Reading 3 = 35,500 Mean = 36,000 ☒ SAT ☐ UNSAT	
See additional detector sheet for detector calibration information					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: Mike Yoner	Reviewed By: Jeff Dakenso	Date: 6/12/12
Certification Date: 06/12/2012	*Certification Due (6 mo.): 12/12/2012	
	*Certification Due (12 mo.): 06/12/2013	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 44-9
Contact Name: Tony Riggs		Serial Number: 014742
Customer Purchase Order Number: N/A	Work Order Number: N/A	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	Serial Number: 119720	Original Activity (dpm): 2,562	Certification Date: 10/14/97
2) Source Nuclide: Tc-99	Serial Number: 119718	Original Activity (dpm): 20,520	Certification Date: 10/14/97
3) Source Nuclide: Tc-99	Serial Number: 069507	Original Activity (dpm): 237,960	Certification Date: 04/01/95

Efficiency determined using 180-2 jig @ 1/8" geometry

Source #	Gross CPM	Net CPM	Efficiency (%)				
Source 1	330	300	11.7				
Source 2	2,550	2,520	12.3				
Source 3	36,000	35,970	15.1				

INSTRUMENT INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background (CPM)	Operating Voltage	Threshold
3	163904	06/12/2013	30	900 Volts	39 mV

COMMENTS

Detectors calibrated with a Model 3 or 12 and may be used with any Model 3 or 12 provided that the instrument is in calibration and the Instrument was previously set up to be used with a GM detector (operating voltage 900 Volts).

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: Mike Yonce	Reviewed By: Jeff Dikenso Date: 6/12/12
Certification Date: 06/12/2012	Certification Due (6 mo.): 12/12/2012 Certification Due (12 mo.): 06/12/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 164070
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: 2012-12261	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%) Before Calibration	Instrument Response (± 10%) After Calibration	Comments: Calibrated in accordance with CP-IN-WI-219	
X0.1	100	100	100	Pulser: 246163	Cal Due: 12/23/12
X0.1	300	300	300	DVM: 88020324	Cal Due: 01/05/13
X0.1	500	500	500	Temp/Press: 3590	Cal Due: 09/21/12
X 1	1,000	1,000	1,000	Humidity: 958670	Cal Due: 06/07/12
X 1	3,000	3,000	3,000	Temp: 22.9 ° C Humidity: 40.7% Pressure: 737 mmHg	
X 1	5,000	4,900	5,000		
X 10	10,000	10,000	10,000		
X 10	30,000	30,000	30,000	Reset: SAT	Sensitivity: SAT
X 10	50,000	50,000	50,000	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT: SAT
X 100	300,000	300,000	300,000	Limited Use: X100 scale for info only. Use with GM Detector.	
X 100	500,000	490,000	500,000		
Mech. Zero	0	0	0		
HV Verification					
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT			
				Precision Test Reading 1 = 2,500 Reading 2 = 2,550 Reading 3 = 2,550 Mean = 2,533 ☒ SAT ☐ UNSAT	
See additional detector sheet for detector calibration information					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By:	Date: 5/30/12
Certification Date: 05/30/2012	*Certification Due (6 mo.): 11/30/2012	
	*Certification Due (12 mo.): 05/30/2013	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37831
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 44-9
Contact Name: Tony Riggs		Serial Number: 150446
Customer Purchase Order Number: N/A	Work Order Number: N/A	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	Serial Number: 119720	Original Activity (dpm): 2,562	Certification Date: 10/14/97
2) Source Nuclide: Tc-99	Serial Number: 119718	Original Activity (dpm): 20,520	Certification Date: 10/14/97
3) Source Nuclide: Tc-99	Serial Number: 069507	Original Activity (dpm): 237,960	Certification Date: 04/01/95

Efficiency determined using 180-2 jig @1/8" geometry

Source #	Gross CPM	Net CPM	Efficiency (%)				
Source 1	340	290	11.3%				
Source 2	2,700	2,650	12.9%				
Source 3	35,500	35,450	14.9%				

INSTRUMENT USED TO DETERMINE EFFICIENCY			DETECTOR INFORMATION	
Model	Serial Number	Due Date	Background (cpm)	Operating Voltage
3	269098	04/24/2013	50	900V

COMMENTS

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	Reviewed By: Jeff Pikinson Date: 4/25/12
Certification Date: 04/24/2012	Certification Due: 04/24/2013

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37831		Model: 19	Serial Number: 167121
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2012-12418	Calibration Method: Electronic And Source	

INSTRUMENT CALIBRATION INFORMATION

Range (µR/hr)	Calibration Standard Value	Tolerances (µR/hr)	Instrument Response		Comments	
			As Found (µR/hr)	As Left (µR/hr)	Calibrated in accordance with CP-IN-WI-211	
5000 Black	4,000 µR/hr	3,600 - 4,400	4,400	3,900	Pulser: 246163	Cal Due: 12/23/2012
	2,500 µR/hr	2,250 - 2,750	2,700	2,500	DVM: 88020324	Cal Due: 01/15/2013
	1,000 µR/hr	900 - 1,100	1,100	1,000	Temp/Press: 3590	Cal Due: 09/21/2012
500 Black	400 µR/hr	360 - 440	390	390	Humidity: 992290	Cal Due: 05/31/2013
	250 µR/hr	225 - 275	250	250	Temp: 23.5 °C Humidity: 43 % Pressure: 739 mmHg	
	Input cpm = 18,000	90 - 110	100	100		
250 Red	Input cpm = 36,000	180 - 220	198	198		
	Input cpm = 21,600	108 - 132	120	120	Geotropism: SAT	Over Range: SAT
	Input cpm = 9,000	45 - 55	50	50	Batteries: SAT	Mech. Zero: SAT
50 Black	Input cpm = 7,200	36 - 44	39.5	39.5	F/S Response: SAT	Audio: SAT
	Input cpm = 4,500	22.5 - 27.5	25	25	Light: SAT	
	Input cpm = 1,800	9 - 11	10	10		
25 Red	Input cpm = 3,600	18 - 22	19.8	19.8	Source: Cs-137#049711 Due Date: 08/31/2012	
	Input cpm = 2,160	10.8 - 13.2	12	12	High Voltage As Found: 700V	As Left: 700V
	Input cpm = 900	4.5 - 5.5	5	5	cpm/µR/hr: As Found: 180	As Left: 180

Precision Test—Reading 1: 250µR/hr 2: 250µR/hr 3: 250µR/hr Mean: 250µR/hr Precision Test: SAT

COMMENTS

Special Remarks: High Voltage: 700Volts cpm/µR/hr: 180

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By:	Date: 8/15/12
Certification Date: 08/14/2012	*Certification Due (6 mo.): 02/14/2013	
	*Certification Due (12 mo.): 08/14/2013	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

Customer Information		Instrument Information	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2929	Serial Number: 118419
Contact Name: Tony Riggs		Probe: 43-10-1	Serial Number: 121393
Customer Purchase Order Number: N/A	Work Order Number: 2012-12460	Calibration Method: Electronic And Source	

Instrument Calibration Information

M&TE	ID Number	Calibration Due Date	Environmental Conditions	
Thermometer	3590	09/21/2012	Temperature (°C)	23.6
Barometer	3590	09/21/2012	Pressure (mmHg)	745
Hygrometer	992290	05/13/2013	Humidity (%)	36.5
Pulse Generator	246163	12/23/2012	Calibrated in accordance with CP-IN-WI-235	
DVM	94710023	01/05/2013		

Isotope	Source ID Number	Decayed Activity (dpm)	2Pi Emissions (EPM)	Source Cert. Date
Pu^{239}	070201	20,574	10,390/min	05/01/2012
Tc^{99}	099608	21,312	10,500/ min	08/08/1996
Th^{230}	119738	18,600	8,640/ min	10/20/1997
Sry^{90}	129676	12,687	8,936/min	05/12/2003

Frequency Calibration

Desired (cpm)	Tolerances (cpm)	Alpha As Found (cpm)	Alpha As Left (cpm)	Beta As Found (cpm)	Beta As Left (cpm)
40	40	40	40	40	40
400	(392-408)	401	401	402	402
4,000	(3,920-4,080)	4.012	4.012	4,021	4,021
40,000	(39.2K-40.8K)	40,116	40,116	40,239	40,239
400,000	(392K-408K)	401,239	401,239	400,307	400,307

Background Determination	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Counts, C_b	8	8	917	917
Time, T_b (min)	20	20	20	20
Rate, R_b (cpm)	0.40	0.40	45.9	45.9

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By:	Reviewed By:	Date: 9/4/12
Calibration Date: 09/04/2012	*Calibration Due (6mo): 03/04/2013	
	*Calibration Due (12mo): 09/04/2013	

* Calibration due date is dependant on users regulatory requirements.

CROSS TALK & EFFICIENCY SHEET

Instrument ID: 118419

As Found Alpha Threshold (mv)	As Left Alpha Threshold (mv)
175	175

Alpha Source: Cross Talk – Performed using Pu^{239} 070201

Paramter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	34,901	34,901	793	793
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s\|\alpha\|} = 6{,}980.2$	$R_{s\|\alpha\|} = 6{,}980.2$	$R_{s\|\beta\|} = 158.6$	$R_{s\|\beta\|} = 158.6$
EFF (% c/d) (>25%)	34.0%	34.0%	N/A	N/A
2π EFF (% Net cpm/emmisions)	67.2%	67.2%	N/A	N/A
%Crosstalk |α to β| (< 10%)	$\frac{R_{s\|\beta\|} - R_{b\|\beta\|}}{R_{s\|\alpha\|} - R_{b\|\alpha\|}} = \frac{158.6 - 45.9}{6{,}980.2 - 0.40} = 1.60\%$			

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
4.1 mV	4.0 mV	49.4 mV	50 mV

Beta Source: Cross Talk Performed Using Tc^{99} #099608

Paramter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	5	5	24,854	24,854
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s\|\alpha\|} = 1$	$R_{s\|\alpha\|} = 1$	$R_{s\|\beta\|} = 4{,}970.8$	$R_{s\|\beta\|} = 4{,}970.8$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	23.1%	23.1%
2π EFF (% Net cpm/emmisions)	N/A	N/A	46.9%	46.9%
%Crosstalk |β to α| (< 1%)	$\frac{R_{s\|\alpha\|} - R_{b\|\alpha\|}}{R_{s\|\beta\|} - R_{b\|\beta\|}} = \frac{1.0 - 0.4}{4970.8 - 45.9} = 0.012\%$			

High Voltage Power Supply Calibratiou

Desired Voltage	Tolerance	DVM As Found	DVM As Left	2929 Meter As Found	2929 Meter As Left
600	540 – 660	599	599	600	600
800	720 – 880	794	794	800	800
1,000	900 – 1,100	1,000	1,000	1,000	1,000
1,200	1,080 – 1,320	1,200	1,200	1,200	1,200
1,300	1,170 – 1,430	1,297	1,297	1,300	1,300

High Voltage	As Found	Vern Dial Reading	As Left	Vern Dial Reading
	750V	3.00	750V	3.00

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: [signature] Reviewed By: J. Woolding Date: 9/4/12

Calibration Date: 09/04/2012 *Calibration Due (6mo): 03/04/2013

*Calibration Due (12mo): 09/04/2013

* Calibration due date is dependant on users regulatory requirements.

EFFICIENCY SHEET

Instrument ID: 118419

As Found Alpha Threshold (mv)	As Left Alpha Threshold (mv)
175	175

Alpha Source: Efficiency determined using Th^{230} #119738

Paramter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	31,125	31,125	2,549	2,549
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]}$ = 6,225	$R_{s[\alpha]}$ = 6,225	$R_{s[\beta]}$ = 509.8	$R_{s[\beta]}$ = 509.8
4π EFF (% Net cpm/dpm) (>25%)	33.5%	33.5%	N/A	N/A
2π EFF (% Net cpm/emmisions)	72.0%	72.0%	N/A	N/A

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
4.1 mV	4.1 mV	49.4 mV	49.4 mV

Beta Source: Efficiency determined using Sry^{90} #129676

Paramter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	19	19	21,646	21,646
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]}$ =	$R_{s[\alpha]}$ =	$R_{s[\beta]}$ = 4,329.2	$R_{s[\beta]}$ = 4,329.2
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	34.1%	34.1%
2π EFF (% Net cpm/emmisions)	N/A	N/A	48.5%	48.5%

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: [signature] Reviewed By: [signature] Date: 9/4/12

Calibration Date: 09/04/2012

*Calibration Due (6mo): 03/04/2013

*Calibration Due (12mo): 09/04/2013

* Calibration due date is dependant on users regulatory requirements.

Instrument ID: 118419

Source and Background Plateau Worksheet								
High Voltage	Background		Alpha Source		Beta Source		Cross Talk	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α
600								
650								
700								
750								
800								
850		Plateau not required—All As Founds within tolerance						
900								
950			As Found HV = As Left HV					
1000								
1050								
1100								
1150								

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	**Reviewed By:** J Woodring	**Date:** 9/4/12
Calibration Date: 09/04/2012		***Calibration Due (6mo):** 03/04/2013 ***Calibration Due (12mo):** 09/04/2013

* Calibration due date is dependant on users regulatory requirements.

Computer Equivalent of Form IN-WI-235-F1 (Page 4 of 6)

Alpha Source Chi-Square Test

Ludlum Model 2929	Serial Number:	118419	Source Nuclide Th230	Source ID 119738

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	6080	-4.10	16.81
2	6118	33.90	1149.21
3	6081	-3.10	9.61
4	5934	-150.10	22530.01
5	6159	74.90	5610.01
6	6021	-63.10	3981.61
7	6112	27.90	778.41
8	5974	-110.10	12122.01
9	6132	47.90	2294.41
10	6002	-82.10	6740.41
11	6071	-13.10	171.61
12	6095	10.90	118.81
13	5912	-172.10	29618.41
14	6185	100.90	10180.81
15	6142	57.90	3352.41
16	6206	121.90	14859.61
17	6114	29.90	894.01
18	6120	35.90	1288.81
19	6097	12.90	166.41
20	6127	42.90	1840.41
Σ=	121682	(x-Mean)² =	117723.80

Mean = 6084.10

Chi² = 19.35

σ = 78.71

2σ= 157.4292155

Reduce Chi Square= 1.01839

3σ= 236.14

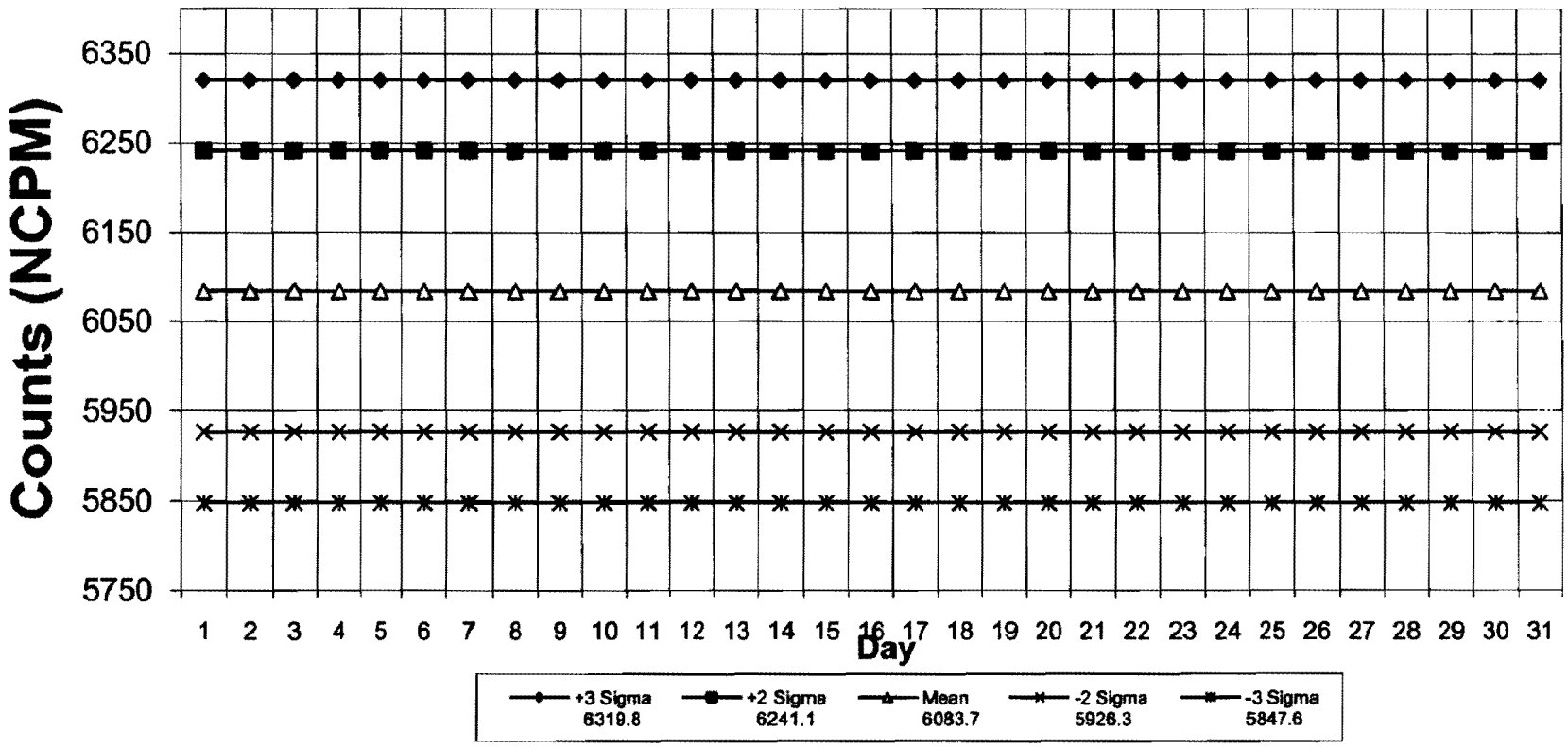
Reduced Chi Pass/Fail= PASS

Performed By/Date _____ / 9/4/12

Reviewed By/Date _____ / 9/4/12

Control Chart **Month Of_____20_____**

Instrument_____, Source#_____, Isotope_____



Reviewed By_____Date_____

Computer Equivalent of Form IN-WI-235-F1 (Page 4 of 6)

Beta Source Chi-Square Test

Ludlum Model 2929 Serial Number: 118419 Tc99 99608

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	4979	42.65	1819.02
2	5003	66.65	4442.22
3	4907	-29.35	861.42
4	4860	-76.35	5829.32
5	4996	59.65	3558.12
6	4957	20.65	426.42
7	4851	-85.35	7284.62
8	4922	-14.35	205.92
9	4932	-4.35	18.92
10	4871	-65.35	4270.62
11	4890	-46.35	2148.32
12	5012	75.65	5722.92
13	4961	24.65	607.62
14	4901	-35.35	1249.62
15	4877	-59.35	3522.42
16	4985	48.65	2366.82
17	4972	35.65	1270.92
18	4881	-55.35	3063.62
19	4963	26.65	710.22
20	5007	70.65	4991.42
Σ=	98727	(x-Mean)² =	54370.55

Mean = 4936.35 Chi² = 11.01

σ = 53.49 2σ= 106.988

Reduce Chi Square= 0.579701 3σ= 160.48

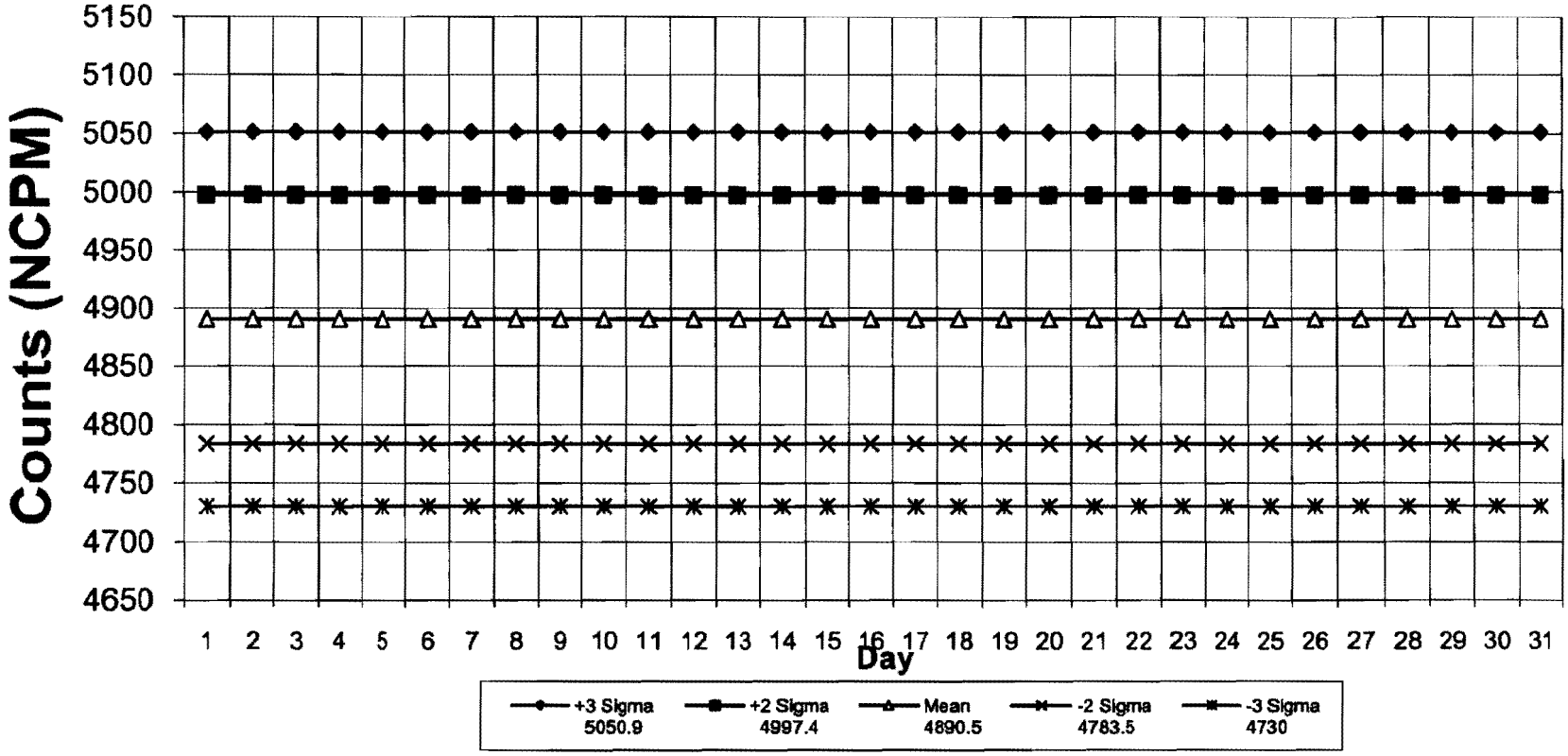
Reduced Chi Pass/Fail= PASS

Performed By/Date _____ / 9/4/12

Reviewed By/Date _____ / 9/4/12

Control Chart **Month Of_____20_____**

Instrument_____, Source#_____, Isotope_____



Reviewed By_____Date_____

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2360	Serial Number: 202410
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2012-12231	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value	Ratemeter Response (± 10% of Standard Values)		Calibration Standard Value CPM	Time Base (minutes)	Tolerances (cpm) ± 2%	Scaler Response	
		As Found	As Left				As Found	As Left
X 1	100	100	100	1,000 CPM	0.1	90 – 110	98	98
X 1	250	250	250	1,000 CPM	0.5	450 – 550	494	494
X 1	400	400	400	1,000 CPM	1	900 – 1,100	985	985
X 10	1,000	1,000	1,000	1,000 CPM	2	1.8K–2.2K	1,975	1,975
X 10	2,500	2,500	2,500	1,000 CPM	5	4.5K-5.5K	4,938	4,938
X 10	4,000	4,000	4,000	1,000 CPM	10	9K-11K	9,875	9,875
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: [signature] Date: 5/17/12
Calibration Date: 05/17/2012	*Calibration Due (6mo): 11/17/2012 *Calibration Due (12mo): 05/17/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 202410

M&TE					Environmental Conditions		
Volt Meter	ID#	94710023	Cal Due:	11/11/2012	Barometer	ID# 3590	Cal Due: 09/21/12
Pulser	ID#	120935	Cal Due:	09/29/2012	Thermometer	ID# 3590	Cal Due: 09/21/12
Humidity	ID#	958670	Cal Due:	06/07/2012	Temp: 23.1 °C	Pressure: 740 mmHg	Humidity: 38%

Special Test

BAT Check	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
Mechanical Zero	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)							
Voltage	Tolerance	As Found	As Left	Alpha Sensitivity =	140 mv	Alpha Sensitivity =	120 mv
				Beta Sensitivity =	3.6 mv	Beta Sensitivity =	3.5 mv
500	450-550	494	494	Beta Window =	32.7 mv	Beta Window =	30 mv
1000	900-1100	991	991	Beta Setpoints—Pulser counts detected at 3.5mv ± 1mv and shut off at 30mv for beta. For Alpha channel counts detected at 120mv and above.			
1500	1350-1650	1,496	1,496				
H.V. Set With Detector Not Connected				Overload to be set with detector to be used			

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5ft cable

Instrument Calibrated By: M. Paul	Reviewed By: [signature] Date: 5/19/12
Calibration Date: 05/17/2012	*Calibration Due (6mo): 11/17/2012
	*Calibration Due (12mo): 05/17/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 299649
Customer Purchase: Order Number: N/A	Work Order Number: 2012-12231	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	119738	18,600	8,640 dpm	3,607	19.4%	41.7%
Pu-239	019442	13,607	N/A	3,333	24.5%	N/A
Tc-99	099608	21,312	10,500 dpm	3,730	17.5%	35.5%
SrY-90	129676	12,790	9,008 dpm	3,770	29.5%	41.9%

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	202410	05/17/2013	0.6	775V	Alpha (120mV)
2360	202410	05/17/2013	213.8	775V	Beta (3.5-30mV)

ATTACHMENTS

Voltage Plateau: √YES NO

MDA/Cross Talk Evaluation: √YES NO

COMMENTS

Calibrated with 5ft cable

Linearity test performed with Tc-99#099608.

Calibrated in accordance with original equipment technical manual.

LINEARITY TEST (Gross Counts)

Count 1 (Toe)	3,701
Count 2 (Mid)	4,052
Count 3 (Heel)	4,078
Average	3,944
Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul

Reviewed By: [signature]

Date: 5/17/12

Certification Date: 05/17/2012

*Certification Due (6mo): 11/17/2012

*Certification Due (12mo): 05/17/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	Energy Solutions			Manufacturer:			
Address:	1570 Bear Creek Road Oak Ridge, TN 37830			Model:	2360	S.N.	202410
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	299649
Customer PO No.:	N/A	Work Order Number:	2012-12231	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	019442	6/1/92	13,607
β Source	Tc-99	099608	8/8/96	21,311

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating	High	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
Voltage	Voltage	Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	750	0.0	150.0	3,158.0	307.0	1.0	3,035.0	5.22%	0.03%	23.21%	13.54%
SET	**775**	**1.0**	**193.0**	**3,218.0**	**523.0**	**1.0**	**3,830.0**	**10.91%**	**0.00%**	**23.64%**	**17.07%**
	800	0.0	248.0	3,362.0	1,286.0	2.0	4,221.0	33.33%	0.05%	24.71%	18.64%
	825	3.0	338.0	3,176.0	4,563.0	0.0	4,777.0	148.87%	0.00	23.32%	20.83%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: M. Paul Reviewed By: Date:

Calibration Date: 5/17/12 Calibration Due: 5/17/13

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2360	Serial Number: 185775
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value	Ratemeter Response (± 10% of Standard Values)		Calibration Standard Value CPM	Time Base (minutes)	Tolerances (cpm) ± 2%	Scaler Response	
		As Found	As Left				As Found	As Left
X 1	100	100	100	1,000 CPM	0.1	90 – 110	99	99
X 1	250	250	250	1,000 CPM	0.5	450 – 550	494	494
X 1	400	400	400	1,000 CPM	1	900 – 1,100	989	989
X 10	1,000	1,000	1,000	1,000 CPM	2	1.8K–2.2K	1,978	1,978
X 10	2,500	2,500	2,500	1,000 CPM	5	4.5K-5.5K	4,945	4,945
X 10	4,000	4,000	4,000	1,000 CPM	10	9K-11K	9,890	9,890
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument	
Calibrated By: M. Paul	Reviewed By: [illegible] Date: 4/13/12
Calibration Date: 04/13/2012	*Calibration Due (6mo): 10/13/2012
	*Calibration Due (12mo): 04/13/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 185775

M&TE					Environmental Conditions		
Volt Meter	ID#	94710023	Cal Due:	11/11/2012	Barometer	ID# 3590	Cal Due: 09/21/12
Pulser	ID#	120935	Cal Due:	09/29/2012	Thermometer	ID# 3590	Cal Due: 09/21/12
Humidity	ID#	958670	Cal Due:	06/07/2012	Temp: 22.6°C	Pressure: 745 mmHg	Humidity: 31%

Special Test

BAT Check	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
Mechanical Zero	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)				Alpha Sensitivity = 144 mv	Alpha Sensitivity = 120 mv
Voltage	Tolerance	As Found	As Left	Beta Sensitivity = 3.8 mv	Beta Sensitivity = 3.5 mv
500	450-550	489	489	Beta Window = 33.1 mv	Beta Window = 30 mv
1000	900-1100	998	998	Beta Setpoints--Pulser counts detected at 3.5mv ± 1mv and shut off at 30mv for beta. For Alpha channel counts detected at 120mv and above.	
1500	1350-1650	1,503	1,503		
H.V. Set With Detector Not Connected				Overload to be set with detector to be used	

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5ft cable

Instrument Calibrated By: M. Paul	Reviewed By: Jeff Ouberiso Date: 4/13/12
Calibration Date: 04/13/2012	*Calibration Due (6mo): 10/13/2012 *Calibration Due (12mo): 04/13/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 238098
Customer Purchase: Order Number: N/A	Work Order Number: N/A	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	119738	18,600	8,640 dpm	3,303	17.8%	38.3%
Pu-239	019442	13,607	N/A	3,104	22.8%	N/A
Tc-99	099608	21,312	10,500 dpm	3,239	15.2%	30.8%
SrY-90	129676	12,820	9,027 dpm	3,806	29.7%	42.2%

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	185775	04/13/2013	2.2	800V	Alpha (120mV)
2360	185775	04/13/2013	215.0	800V	Beta (3.5-30mV)

ATTACHMENTS

Voltage Plateau: √ YES NO

MDA/Cross Talk Evaluation: √ YES NO

COMMENTS

Calibrated with 5ft cable

Linearity test performed with Tc-99#099608.

Calibrated in accordance with original equipment technical manual.

LINEARITY TEST (Gross Counts)

Count 1 (Toe)	3,501
Count 2 (Mid)	3,470
Count 3 (Heel)	3,392
Average	3,454
Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector

Certified By: M. Paul

Reviewed By: J. Robinson

Date: 4/13/12

Certification Date: 04/13/2012

*Certification Due (6mo): 10/13/2012

*Certification Due (12mo): 04/13/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd Oak Ridge, TN 37830			Model:	2360	S.N.	185775
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	238098
Customer PO No.:	N/A	Work Order Number:	N/A	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	019442	6/1/92	13,607
β Source	Tc-99	099608	8/8/96	21,311

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	750	3.0	98.0	3,019.0	232.0	1.0	2,076.0	4.59%	0.00	22.17%	9.28%
	775	4.0	176.0	3,006.0	364.0	4.0	2,727.0	6.64%	0.00%	22.06%	11.97%
SET	**800**	**5.0**	**229.0**	**3,046.0**	**422.0**	**1.0**	**3,267.0**	**6.85%**	**0.00**	**22.35%**	**14.26%**
	825	2.0	227.0	3,111.0	601.0	3.0	3,921.0	12.97%	0.03%	22.85%	17.33%
	850	4.0	262.0	3,172.0	1,339.0	4.0	4,534.0	37.01%	0.00%	23.28%	20.05%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: M. Pauli Reviewed By: Jeff Dickinson Date: 4/13/12

Calibration Date: 4/13/12 Calibration Due: 4/13/13

2800 Solway Road
Knoxville, TN 37931

Calibration Certificate

Calibration Certificate for HV-1,Serial # 003511, Bar Code # ,Property # SEC-7278

Date: 01/28/13 **Date Last Cal. Expires:** 11/22/12 **Technician:** Jeffrey Knight

Location: 9999, **Reason For Calibration:** Due for Calibration

EQUIPMENT USED DURING CALIBRATION

MODEL: D-814 **SERIAL #:** 3114 **CAL. DUE:** 09/21/13

MODEL: **SERIAL #:** **CAL DUE:**

AS FOUND DATA **AF Physical Condition** SAT **AS LEFT DATA**

As Found Instrument Flow Indication: 9 **CFM** **As Left Instrument Flow Indication:** 8 **CFM**

As Found Calibrator Flow Indication: 8 **CFM** **As Left Calibrator Flow Indication:** 8 **CFM**

Unit of Measure: ○ **LPM** ◉ **CFM**

Reproducibility 8 **CFM** 8 **CFM** 8 **CFM** **Average:** 8.00 **CFM**

☑ **Are the Individual Counts Within 10% of the Average?**

CALIBRATION DATA	TARGET VALUE	AIR SAMPLER READING	CALIBRATOR READING	ERROR %
	3.00 CFM	3.00 CFM	3.10 CFM	3.33% CFM
	5.00 CFM	5.00 CFM	5.08 CFM	1.60% CFM
	8.00 CFM	8.00 CFM	8.12 CFM	1.50% CFM

Air Sampler Setting 8.00 ☑ **Is Error Within 10%?**

Reproducibility 8 **CFM** 8 **CFM** 8 **CFM** **Average:** 8.00 **CFM**

☑ **Are the Individual Counts Within 10% of the Average?**

Air Sampler rotometer reading: ○ Use Manufacturers Indication ◉ Use Corrected Marking ○ N/A

Comments: **Married as a set with:** **Model** **Bar Code #:**

Calibrated using F&J filter media (model #FP-47M).

☑ **Does Instrument Meet Final Acceptance Criteria?** ☑ **Calibration Sticker Attached?**

Date Instrument is Due For Next Calibration: **01/28/14**

Performed by: _____ **Reviewed by:** _____ **Date:** 1/30/13

Printed Name: Jeffrey Knight

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 268605
Customer Purchase: Order Number: N/A	Work Order Number: 2012-12344	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	119738	18,600	8,640 dpm	3,032.4	16.3%	35.1%
Tc-99	099604	21,667	10,680 dpm	2,996.6	13.8%	28.1%
Pu^{239}	071201	20,574	10,390/min	4,523.4	22.0%	43.5%
SrY-90	129676	12,734	8,969/ min	3,337.6	26.2%	37.2%

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	184949	07/11/2013	0.6	850V	Alpha (120mV)
2360	184949	07/11/2013	206.4	850V	Beta (3.5-30mV)

ATTACHMENTS

Voltage Plateau: √YES NO MDA/Cross Talk Evaluation: √YES NO

COMMENTS	LINEARITY TEST (Gross Counts)	
Calibrated with 5ft cable Linearity test performed with Tc-99#099604. Calibrated in accordance with original equipment technical manual.	Count 1 (Toe)	2,956
	Count 2 (Mid)	3,203
	Count 3 (Heel)	3,428
	Average	3,195.7
	Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector		
Certified By:	Reviewed By:	Date: 7/11/12
Certification Date: 07/11/2012	*Certification Due (6mo): 01/11/2013	
	*Certification Due (12mo): 07/11/2013	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd Oak Ridge, TN 37830			Model:	2360	S.N.	184949
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	268605
Customer PO No.:	N/A	Work Order Number:	N/A	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,574
β Source	Tc-99	099604	8/8/96	21,667

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	825	2.0	169.0	4,436.0	357.0	2.0	2,883.0	4.41%	0.00%	21.55%	12.53%
SET	**850**	**1.0**	**200.0**	**4,358.0**	**453.0**	**3.0**	**3,193.0**	**6.08%**	**0.07%**	**21.18%**	**13.81%**
	875	2.0	220.0	4,629.0	637.0	7.0	3,736.0	9.46%	0.14%	22.49%	16.23%
	900	3.0	195.0	4,692.0	1,082.0	2.0	4,071.0	19.72%	0.00	22.79%	17.89%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: _____ Reviewed By: _____ Date: 7/11/12

Calibration Date: 7/11/12 Calibration Due: 7/11/13

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2360	Serial Number: 184949
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2012-12344	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value	Ratemeter Response (± 10% of Standard Values)		Calibration Standard Value CPM	Time Base (minutes)	Tolerances (cpm) ± 2%	Scaler Response	
		As Found	As Left				As Found	As Left
X 1	100	100	100	1,000 CPM	0.1	90 – 110	100	100
X 1	250	250	250	1,000 CPM	0.5	450 – 550	498	498
X 1	400	400	400	1,000 CPM	1	900 – 1,100	994	994
X 10	1,000	1,000	1,000	1,000 CPM	2	1.8K–2.2K	1,987	1,987
X 10	2,500	2,500	2,500	1,000 CPM	5	4.5K-5.5K	4,983	4,983
X 10	4,000	4,000	4,000	1,000 CPM	10	9K-11K	9,971	9,971
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordauce with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By: Date: 7/11/12
Calibration Date: 07/11/2012	*Calibration Due (6mo): 01/11/2013
	*Calibration Due (12mo): 07/11/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 184949

M&TE					Environmental Conditions		
Volt Meter	ID#	88020324	Cal Due:	01/15/2013	Barometer	ID# 3590	Cal Due: 09/21/12
Pulser	ID#	246163	Cal Due:	12/23/2012	Thermometer	ID# 3590	Cal Due: 09/21/12
Humidity	ID#	992290	Cal Due:	05/31/2013	Temp: 24.0 °C	Pressure: 741 mmHg	Humidity: 38%

Special Test

BAT Check	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
Mechanical Zero	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)							
Voltage	Tolerance	As Found	As Left	Alpha Sensitivity =	120 mv	Alpha Sensitivity =	120 mv
				Beta Sensitivity =	3.5 mv	Beta Sensitivity =	3.5 mv
500	450-550	494	494	Beta Window =	26 mv	Beta Window =	30 mv
1000	900-1100	1,002	1,002	Beta Setpoints--Pulser counts detected at 3.5mv ± 1mv and shut off at 30mv for beta. For Alpha channel counts detected at 120mv and above.			
1500	1350-1650	1,509	1,509				
H.V. Set With Detector Not Connected				Overload to be set with detector to be used			

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5ft cable

Instrument Calibrated By:	Reviewed By: Date: 7/11/12
Calibration Date: 07/11/2012	*Calibration Due (6mo): 01/11/2013
	*Calibration Due (12mo): 07/11/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 150306
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: N/A	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (cpm) (Tolerance ±10% of Calibration Standard Values)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-219	
X 0.1	100	100	100	Pulser: 120935	Cal Due: 10/02/13
X 0.1	250	240	250	DVM: 20800044	Cal Due: 08/10/13
X 0.1	400	390	395	Temp/Press: 3590	Cal Due: 10/08/13
X 1	1,000	1,000	1,000	Humidity: 992290	Cal Due: 05/31/13
X 1	2,500	2,450	2,500	Temp: 21.1 °C Humidity: 31% Pressure: 749 mmHg	
X 1	4,000	3,900	3,950		
X 10	10,000	10,000	10,000		
X 10	25,000	24,000	25,000	Reset: SAT	Sensitivity: SAT
X 10	40,000	38,000	39,500	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT:
X 100	250,000	245,000	250,000	Limited Use: X100 scale for info only. Use with pancake GM.	
X 100	400,000	390,000	395,000		
Mech. Zero	0	0	0		
HV Verification					
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT			
				Precision (cpm) Reading 1 = 29,000 Reading 2 = 29,000 Reading 3 = 29,500 Mean = 29,167 ☒ SAT ☐ UNSAT	
See additional detector sheet for detector calibration information					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: Jeff Robinson	Date: 11/15/12
Certification Date: 11/15/2012	* Certification Due (6 mo.): 05/15/2013 * Certification Due (12 mo.): 11/15/2013	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

Energy*Solutions* Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISEStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: Energy*Solutions* Services, Inc.		**Manufacturer: Ludlum**
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		**Detector Model: 44-9**
Contact Name: Tony Riggs		**Serial Number: 128751**
Customer Purchase Order Number: N/A	**Work Order Number: N/A**	**Evaluation Method: Source**

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	**Serial Number: 119720**	**Original Activity (dpm): 2,562**	**Certification Date: 10/14/97**
2) Source Nuclide: Tc-99	**Serial Number: 119718**	**Original Activity (dpm): 20,520**	**Certification Date: 10/14/97**
3) Source Nuclide: Tc-99	**Serial Number: 069507**	**Original Activity (dpm): 237,960**	**Certification Date: 04/01/95**

Efficiency determined using 180-2 jig @ 1/8" geometry

Source #	Gross CPM	Net CPM	Efficiency				
Source 1	330	290	11.3%				
Source 2	2,550	2,510	12.2%				
Source 3	29,000	28,960	12.2%				

INSTRUMENT INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
3	150306	11/15/2013	40	900 Volts	35 mV

COMMENTS

Detectors calibrated with a Model 3 or 12 and may be used with any Model 3 or 12 provided that the instrument is in calibration and the Instrument was previously set up to be used with a GM detector (operating voltage 900Volts)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	**Reviewed By:** Jeff Dickinson **Date:** 11/15/12
Certification Date: 11/15/2012	*** Certification Due (6 mo.): 05/15/2013** *** Certification Due (12 mo.): 11/15/2013**

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 269098
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: 2013-12912	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%) Before Calibration	Instrument Response (± 10%) After Calibration	Comments: Calibrated in accordance with CP-IN-WI-219	
X0.1	100	100	100	Pulser: 151067	Cal Due: 12/11/13
X0.1	250	250	250	DVM: 20380178	Cal Due: 08/10/13
X0.1	400	400	400	Temp/Press: 3590	Cal Due: 10/08/13
X 1	1,000	1,000	1,000	Humidity: 992290	Cal Due: 05/31/13
X 1	2,500	2,500	2,500	Temp: 21.5 ° C Humidity: 38% Pressure: 747 mmHg	
X 1	4,000	4,000	4,000		
X 10	10,000	10,000	10,000		
X 10	25,000	25,000	25,000	Reset: SAT	Sensitivity: SAT
X 10	40,000	40,000	40,000	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT: SAT
X 100	250,000	250,000	250,000	Limited Use: X100 scale for info only. Use with GM Detector.	
X 100	400,000	390,000	390,000		
Mech. Zero	0	0	0		
HV Verification					
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT			
				Precision Test Reading 1 = 2,500 Reading 2 = 2,500 Reading 3 = 2,450 Mean = 2,483 ☒ SAT ☐ UNSAT	
See additional detector sheet for detector calibration information					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By:	Date: 5/14/13
Certification Date: 05/14/2013	*Certification Due (6 mo.): 11/14/2013	
	*Certification Due (12 mo.): 05/14/2014	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		**Manufacturer: Ludlum**
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		**Detector Model: 44-9**
Contact Name: Tony Riggs		**Serial Number: 094812**
Customer Purchase Order Number: N/A	**Work Order Number: 2013-12912**	**Evaluation Method: Source**

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION			
1) Source Nuclide: Tc-99	**Serial Number: 119720**	**Original Activity (dpm): 2,562**	**Certification Date: 10/14/97**
2) Source Nuclide: Tc-99	**Serial Number: 119718**	**Original Activity (dpm): 20,520**	**Certification Date: 10/14/97**
3) Source Nuclide: Tc-99	**Serial Number: 069507**	**Original Activity (dpm): 237,960**	**Certification Date: 04/01/95**

Efficiency determined using 180-2 jig @ 1/8" geometry

Source #	Gross CPM	Net CPM	Efficiency (%)				
Source 1	340	300	11.7				
Source 2	2,500	2,460	12.0				
Source 3	35,000	34,960	14.7				

INSTRUMENT INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
3	269098	05/14/2014	40	900 Volts	31 mV

COMMENTS

Detectors calibrated with a Model 3 and may be used with any Model 3 provided that the instrument is in calibration and the Instrument was previously set up to be used with a GM detector (operating voltage 900Volts)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By:	**Reviewed By:** Jeff Dickerson **Date:** 5/14/13
Certification Date: 05/14/2013	**Certification Due (6 mo.): 11/14/2013** **Certification Due (12 mo.): 05/14/2014**

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Rd Oak Ridge, TN 37830		Model: 19	Serial Number: 115870
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2013-12864	Calibration Method: Electronic And Source	

INSTRUMENT CALIBRATION INFORMATION

Range (µR/hr)	Calibration Standard Value	Tolerances (µR/hr)	Instrument Response		Comments
			As Found (µR/hr)	As Left (µR/hr)	Calibrated in accordance with CP-IN-WI-211
5000 Black	4000 µR/hr	3600 - 4400	3,700	3,850	Pulser: 120935 Cal Due: 10/02/2013
	2500 µR/hr	2250 - 2750	2,350	2,500	DVM: 20800044 Cal Due: 08/10/2013
	1000 µR/hr	900 - 1100	1,000	1,000	Temp/Press: 3590 Cal Due: 10/08/2013
500 Black	400 µR/hr	360 - 440	380	385	Humidity: 992290 Cal Due: 05/31/2013
	250 µR/hr	225 - 275	240	250	Temp: 24.1 °C Humidity: 40% Pressure: 745 mmHg
	Input cpm = 18,500	90 – 110	100	100	
250 Red	Input cpm = 37,000	180 – 220	198	198	
	Input cpm = 22,200	108 - 132	120	120	Geotropism: SAT Over Range: SAT
	Input cpm = 9,250	45 - 55	50	50	Batteries: SAT Mech. Zero: SAT
50 Black	Input cpm = 7,500	36 - 44	39.5	39.5	F/S Response: SAT Audio: SAT
	Input cpm = 4,630	22.5 – 27.5	25	25	Light: SAT
	Input cpm = 1,850	9 - 11	10	10	
25 Red	Input cpm = 3,700	18 – 22	19.8	19.8	Source: Cs137# 049711 Due: 08/31/2012
	Input cpm = 2,220	10.8 – 13.2	12	12	High Voltage As Found: 850V As Left: 850V
	Input cpm = 925	4.5 – 5.5	5	5	cpm/µR/hr: As Found: 186 As Left: 185

Precision Test---Reading 1: 250 µR/hr 2: 250 µR/hr 3: 250 µR/hr Mean: 250 µR/hr Precision Test: SAT

COMMENTS

Special Remarks: High Voltage: 850Volts cpm/µR/hr: 185

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: Jeff Dickinson	Date: 4/17/13
Certification Date: 04/17/2013	*Certification Due (6mo): 10/17/2013	
	*certification Due (12mo): 04/17/2014	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2360	Serial Number: 297779
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2012-12596	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value	Ratemeter Response (± 10% of Standard Values)		Calibration Standard Value CPM	Time Base (minutes)	Tolerances (cpm) ± 2%	Scaler Response	
		As Found	As Left				As Found	As Left
X 1	100	100	100	40,000 CPM	0.1	3,920-4,080	3,945	3,945
X 1	250	250	250	40,000 CPM	0.5	19.6K-20.4K	19,740	19,740
X 1	400	400	400	40,000 CPM	1	39.2K-40.8K	39,506	39,506
X 10	1,000	1,000	1,000	40,000 CPM	2	78.4K–81.6K	79,012	79,012
X 10	2,500	2,500	2,500					
X 10	4,000	4,000	4,000					
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: J. Dickinson Date: 11/9/12
Calibration Date: 11/09/2012	*Calibration Due (6mo): 05/09/2013
	*Calibration Due (12mo): 11/09/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 297779

M&TE					Environmental Conditions		
Volt Meter	ID#	94710023	Cal Due:	11/11/2012	Barometer	ID# 2551	Cal Due: 11/16/12
Pulser	ID#	120935	Cal Due:	10/02/2013	Thermometer	ID# 2551	Cal Due: 11/16/12
Humidity	ID#	992290	Cal Due:	05/31/2013	Temp: 21.4°C	Pressure: 747 mmHg	Humidity: 29%

Special Test			
Mechanical Zero	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
BAT Check	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)							
Voltage	Tolerance	As Found	As Left	Alpha Sensitivity =	143 mv	Alpha Sensitivity =	120 mv
				Beta Sensitivity =	4.0 mv	Beta Sensitivity =	3.5 mv
500	450-550	510	510	Beta Window =	35 mv	Beta Window =	30 mv
1000	900-1100	1,016	1,016	Beta Setpoints--Pulser counts detected at 3.5mv ± 1mv and shut off at 30mv for beta. For Alpha channel counts detected at 120mv and above.			
1500	1350-1650	1,503	1,503				
H.V. Set With Detector Not Connected				Overload to be set with detector to be used			

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5ft cable

Instrument	
Calibrated By: M. Paul	Reviewed By: Jeff Dickerson Date: 11/9/12
Calibration Date: 11/09/2012	*Calibration Due (6mo): 05/09/2013
	*Calibration Due (12mo): 11/09/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 323064
Customer Purchase: Order Number: N/A	Work Order Number: 2012-12596	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	071203	16,590	8,379/min	3,413	20.6%	40.7%
Tc-99	099608	21,312	10,500/min	2,719	12.8%	25.9%
Pu^{239}	071201	20,574	10,390/min	4,456	21.7%	42.9%
SrY-90	129676	12,634	8,899/min	3,384	26.8%	38.0%

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	297779	11/09/2013	0.8	775V	Alpha (120mV)
2360	297779	11/09/2013	185.2	775V	Beta (3.5-30mV)

ATTACHMENTS

Voltage Plateau: √ YES NO

MDA/Cross Talk Evaluation: √ YES NO

COMMENTS

Calibrated with 5ft cable

Linearity test performed with Tc-99 #099608.

Calibrated in accordance with original equipment technical manual.

LINEARITY TEST (Gross Counts)

Count 1 (Toe)	2,742
Count 2 (Mid)	2,924
Count 3 (Heel)	3,046
Average	2,904
Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul

Reviewed By: [signature] Date: 11/9/12

Certification Date: 11/09/2012

*Certification Due (6mo): 05/09/2013

*Certification Due (12mo): 11/09/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: Isfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd Oak Ridge, TN 37830			Model:	2360	S.N.	297779
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	323064
Customer PO No.:	N/A	Work Order Number:	12-12596	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,574
β Source	Tc-99	099608	8/8/96	21,312

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	725	0.0	88.0	4,149.0	221.0	0.0	1,917.0	3.28%	0.00%	20.17%	8.58%
	750	2.0	163.0	4,275.0	244.0	2.0	2,480.0	1.97%	0.00%	20.77%	10.87%
SET	**775**	**2.0**	**200.0**	**4,422.0**	**301.0**	**2.0**	**3,060.0**	**2.39%**	**0.00%**	**21.48%**	**13.42%**
	800	4.0	217.0	4,736.0	348.0	1.0	3,478.0	2.90%	0.00	23.00%	15.30%
	825	2.0	247.0	4,743.0	376.0	1.0	3,744.0	2.87%	0.00	23.04%	16.41%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: M. Paul Reviewed By: Jeff Atkinson Date: 11/9/12

Calibration Date: 11/9/12 Calibration Due: 11/9/13

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2360	Serial Number: 297848
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2012-12516	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value	Ratemeter Response (± 10% of Standard Values)		Calibration Standard Value CPM	Time Base (minutes)	Tolerances (cpm) ± 2%	Scaler Response	
		As Found	As Left				As Found	As Left
X 1	100	100	100	40,000 CPM	0.1	3,920-4,080	3,978	3,978
X 1	250	250	250	40,000 CPM	0.5	19.6K-20.4K	19,891	19,891
X 1	400	400	400	40,000 CPM	1	39.2K-40.8K	39,781	39,781
X 10	1,000	1,000	1,000	40,000 CPM	2	78.4K–81.6K	79,562	79,562
X 10	2,500	2,500	2,500					
X 10	4,000	4,000	4,000					
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	40,000	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	400,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: Jeff Robinson Date: 11/9/12
Calibration Date: 11/08/2012	*Calibration Due (6mo): 05/08/2013
	*Calibration Due (12mo): 11/08/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 297848

M&TE					Environmental Conditions		
Volt Meter	ID#	94710023	Cal Due:	11/11/2012	Barometer	ID# 2551	Cal Due: 11/16/12
Pulser	ID#	120935	Cal Due:	10/02/2013	Thermometer	ID# 2551	Cal Due: 11/16/12
Humidity	ID#	992290	Cal Due:	05/31/2013	Temp: 21.3°C	Pressure: 744 mmHg	Humidity: 31%

Special Test			
Mechanical Zero	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
BAT Check	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)							
Voltage	Tolerance	As Found	As Left	Alpha Sensitivity =	136 mv	Alpha Sensitivity =	120 mv
500	450-550	504	504	Beta Sensitivity =	3.7 mv	Beta Sensitivity =	3.5 mv
1000	900-1100	995	995	Beta Window =	31.6 mv	Beta Window =	30 mv
1500	1350-1650	1,494	1,494	Beta Setpoints--Pulser counts detected at 3.5mv ± 1mv and shut off at 30mv for beta. For Alpha channel counts detected at 120mv and above.			
H.V. Set With Detector Not Connected				Overload to be set with detector to be used			

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5ft cable

Instrument Calibrated By: M. Paul	Reviewed By: J. Dickerson Date: 11/9/12
Calibration Date: 11/08/2012	*Calibration Due (6mo): 05/08/2013 *Calibration Due (12mo): 11/08/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 323069
Customer Purchase Order Number: N/A	Work Order Number: 2012-12516	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	119738	18,600	8,640/min	3,535	19.0%	40.9%
Tc-99	099608	21,312	10,500/min	3,399	15.9%	32.4%
Pu^{239}	071201	20,574	10,390/min	4,821	23.4%	46.4%
SrY-90	129676	12,634	8,899/min	3,737	29.6%	42.0%

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	297848	11/08/2013	2.2	775V	Alpha (120mV)
2360	297848	11/08/2013	188.2	775V	Beta (3.5-30mV)

ATTACHMENTS

Voltage Plateau: √ YES NO

MDA/Cross Talk Evaluation: √ YES NO

COMMENTS

Calibrated with 5ft cable

Linearity test performed with Tc-99 #099608.

Calibrated in accordance with original equipment technical manual.

LINEARITY TEST (Gross Counts)

Count 1 (Toe)	3,427
Count 2 (Mid)	3,622
Count 3 (Heel)	3,713
Average	3,587
Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector

Certified By: M. Paul

Reviewed By: [signature] Date: 11/9/12

Certification Date: 11/08/2012

*Certification Due (6mo): 05/08/2013

*Certification Due (12mo): 11/08/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 323069
Customer Purchase Order Number: N/A	Work Order Number: 2012-12516	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	119738	18,600	8,640/min	3,535	19.0%	40.9%
Tc-99	099608	21,312	10,500/min	3,399	15.9%	32.4%
Pu^{239}	071201	20,574	10,390/min	4,821	23.4%	46.4%
SrY-90	129676	12,634	8,899/min	3,737	29.6%	42.0%

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	297848	11/08/2013	2.2	775V	Alpha (120mV)
2360	297848	11/08/2013	188.2	775V	Beta (3.5-30mV)

ATTACHMENTS

Voltage Plateau: √ YES NO

MDA/Cross Talk Evaluation: √ YES NO

COMMENTS

Calibrated with 5ft cable

Linearity test performed with Tc-99 #099608.

Calibrated in accordance with original equipment technical manual.

LINEARITY TEST (Gross Counts)

Count 1 (Toe)	3,427
Count 2 (Mid)	3,622
Count 3 (Heel)	3,713
Average	3,587
Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector

Certified By: M. Paul

Reviewed By: [signature] Date: 11/9/12

Certification Date: 11/08/2012

*Certification Due (6mo): 05/08/2013

*Certification Due (12mo): 11/08/2013

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd Oak Ridge, TN 37830			Model:	2360	S.N.	297848
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	323069
Customer PO No.:	N/A	Work Order Number:	2012-12516	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,574
β Source	Tc-99	099608	8/8/96	21,312

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	725	1.0	106.0	4,606.0	247.0	1.0	2,511.0	3.13%	0.00%	22.38%	11.28%
	750	2.0	176.0	4,706.0	262.0	4.0	3,094.0	1.90%	0.07%	22.86%	13.69%
SET	**775**	**3.0**	**201.0**	**4,797.0**	**309.0**	**1.0**	**3,519.0**	**2.35%**	**0.00**	**23.30%**	**15.57%**
	800	3.0	205.0	4,803.0	384.0	2.0	3,867.0	3.89%	0.00	23.33%	17.18%
	825	5.0	226.0	4,983.0	545.0	2.0	4,265.0	6.71%	0.00	24.20%	18.95%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: M. Paul Reviewed By: Jeff Dukinson Date: 11/9/12

Calibration Date: 11/8/12 Calibration Due: 11/8/13

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

Energy*Solutions* Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: Energy*Solutions* Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 98639
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-239	
400	400	397	397	Pulser: 120935	Cal Due: 10/02/2013
4,000	4,000	3,963	3,963	DVM: 94710023	Cal Due: 12/03/2013
40,000	40,000	39,607	39,607	Temp/Press: 3590	Cal Due: 10/08/2013
400,000	400,000	396,467	396,467	Humidity: 958670	Cal Due: 04/26/2014
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N21 I/O Firmware Version: 37123N04	
500	(490-510)	500	500		
1,500	(1,498-1,502)	1,500	1,500	Temp: 24.3 °C Pressure: 739 mmHg Humidity: 36 %	
2,000	(1,940-2,060)	1,997	1,997		
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	11.2	10.0	BAT > 4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	50.6	46.8	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	103	96	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10 mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: Jeff Delsanto	Date: 6/27/13
Calibration Date: 06/27/2013	*Certification Due (6mo): 12/27/2013 *Certification Due (12mo): 06/27/2014	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 316936
Customer Purchase Order Number: N/A	Work Order Number: 2013-13054	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION			
1) Source Nuclide: Cs^{137}	Serial Number: 019456	Activity: 5μCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 08/30/2013

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#98639	Count 1	2.02
Due Date	06/27/2014	Count 2	2.01
Threshold	T=100 (10mV)	Count 3	1.97
Cable Length	5ft.	Average	2.00
Temp/Press: 3590	Cal Due: 10/08/2013	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 04/26/2014	Pass/Fail	PASS
Temp: 23.0 °C		Humidity: 39%	Press: 741 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 71,146	High Sample Activity (2mR/hr) Using Source #2 = 255,964	Dead Time (DT): 1.643518E-05	Calibration Constant (CC): 5.912029E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.407	0.407
Voltage Plateau:	√YES	NO	1.0	0.900-1.10	1.00	1.00
High Voltage: 1050V			2	1.8-2.2	2.00	2.00

COMMENTS

****Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector****

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	Reviewed By:	Date: 8/8/13
Certification Date: 08/08/2013	*Certification Due (6mo): 02/08/2014	
	*certification Due (12mo): 08/08/2014	

* Calibration due date is dependant on users regulatory requirements.

BACKGROUND PLATEAU 44-10#316936 08/08/2013

700	186
750	363
800	583
850	877
900	1099
950	1119
1000	1139
1050	1186
1100	1267
1150	1272
1200	1180
1250	1224
1300	1223
1350	1203

SOURCE PLATEAU Cs-137#019456

700	1647
750	2159
800	3051
850	3736
900	4186
950	4148
1000	4081
1050	4303
1100	4357
1150	4383
1200	4420
1250	4582
1300	4408
1350	4470

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 08/08/2013.
The current time of day is: 10:35:06.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	98639.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.643518E-05.
Detector Calibration Constant =	5.912029E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	316936.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.4 volts.

DET1 Generated: 08/08/2013 10:36:05.

Model 2350 Serial #98639

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.643518E-05$-
Set Dead Time: 1.643518E-05

SC5.912029E+10$S
Set Calibration Constant: 5.912029E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N316936$4
Set Detector Serial #: 316936

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 08/08/2013.
The current time of day is: 10:35:29.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	98639.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.640000E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	316936.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.4 volts.

DET2 Generated: 08/08/2013 10:36:40.

Model 2350 Serial #98639

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.640000E-05$J
Set Dead Time: 1.640000E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N316936$4
Set Detector Serial #: 316936

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 117014
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-239	
400	400	398	398	Pulser: 120935	Cal Due: 10/02/2013
4,000	4,000	3,980	3,980	DVM: 94710023	Cal Due: 12/03/2013
40,000	40,000	39,810	39,810	Temp/Press: 3590	Cal Due: 10/08/2013
400,000	400,000	398,640	398,640	Humidity: 958670	Cal Due: 04/26/2014
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N21 I/O Firmware Version: 37123N04	
500	(490-510)	497	497		
1,500	(1,498-1,502)	1,499	1,499	Temp: 24.3 °C Pressure: 739 mmHg Humidity: 36 %	
2,000	(1,940-2,060)	1,996	1,996		
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	10.6	10.6	BAT > 4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	48.1	48.1	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	98	98	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10 mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: [signature]	Date: 6/27/13
Calibration Date: 06/27/2013	*Certification Due (6mo): 12/27/2013 *Certification Due (12mo): 06/27/2014	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 316939
Customer Purchase Order Number: N/A	Work Order Number: 2013-13054	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION			
1) Source Nuclide: Cs^{137}	Serial Number: 019456	Activity: 5µCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 08/30/2013

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#117014	Count 1	1.97
Due Date	06/27/2014	Count 2	2.03
Threshold	T=100 (10mV)	Count 3	2.07
Cable Length	5ft.	Average	2.02
Temp/Press: 3590	Cal Due: 10/08/2013	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 04/26/2014	Pass/Fail	PASS
Temp: 23.0 °C		Humidity: 39%	Press: 741 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 69,829	High Sample Activity (2mR/hr) Using Source #2 = 253,087	Dead Time (DT): 1.630605E-05	Calibration Constant (CC): 5.786211E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.398	0.398
Voltage Plateau:	√YES	NO	1.0	0.900-1.10	0.997	0.997
High Voltage: 1050V			2	1.8-2.2	2.02	2.02

COMMENTS

Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	Reviewed By:	Date: 8/8/13
Certification Date: 08/08/2013	*Certification Due (6mo): 02/08/2014	
	*certification Due (12mo): 08/08/2014	

* Calibration due date is dependant on users regulatory requirements.

BACKGROUND PLATEAU 44-10#316939 08/08/2013

700	171
750	298
800	539
850	751
900	1006
950	1127
1000	1130
1050	1178
1100	1173
1150	1197
1200	1223
1250	1225
1300	1197
1350	1124

SOURCE PLATEAU Cs-137#019456

700	1378
750	2066
800	2757
850	3539
900	4042
950	4120
1000	4258
1050	4508
1100	4330
1150	4336
1200	4353
1250	4510
1300	4514
1350	4567

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 08/08/2013.
The current time of day is: 10:17:36.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	117014.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.630605E-05.
Detector Calibration Constant =	5.786211E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	316939.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.2 volts.

DET1 Generated: 08/08/2013 10:18:38.

Model 2350 Serial #117014

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.630605E-05$T
Set Dead Time: 1.630605E-05

SC5.786211E+10$U
Set Calibration Constant: 5.786211E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N316939$7
Set Detector Serial #: 316939

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 08/08/2013.
The current time of day is: 10:17:58.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: MP

Comments:

Model 2350 Serial # =	117014.
User I.D. =	
High Voltage =	1050 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.629999E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	316939.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.2 volts.

DET2 Generated: 08/08/2013 10:19:14.

Model 2350 Serial #117014

H1050$J
Set High Voltage: 1050

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.629999E-05$A
Set Dead Time: 1.629999E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N316939$7
Set Detector Serial #: 316939

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

119701

14 October 1997 Men/wo
Page 1 of 2 pages, Issue 07/95

Amersham Buchler
GmbH & Co KG
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D-38001 Braunschweig
Tel. (05307) 930-0
Fax (05307) 930-293
Fax-Zentrale 930-237

Amersham
The Health Science Group

CERTIFICATE

No. 363229

for a Sealed Radioactive Source

Source Type: Alpha Wide Area Reference Source

Product Code	TZRX1922
Drawing	VZ-1368
Dimensions of Active Surface	Ø 36 mm
Overall Dimensions	Ø 47 mm x 3 mm
Source No.	FS 437
Nuclide	Thorium-230

Measurement Data

Activity	318 Bq 19,080 DPM
Overall Uncertainty*	± 10 %
Alpha Surface Emission Rate	148 s^{-1} ± 5 % in 2 π steradian 8.59 E-3 μCi
Reference Date	30 September 1997
Traceability*	Defined on page 2

Leakage and Contamination Test(s)

Test Method(s)*	1
Test(s) passed on	13 October 1997

Additional Information

ISO Classification*	C.34645
Recommended Working Life*	10 years
Remark	

* see page 2 for explanation

Amersham Buchler

i. A. Pet

(Production Manager)

Quality Assurance System

The quality assurance system of Amersham Buchler GmbH & Co KG was certified by Lloyd's Register Quality Assurance (LRQA) according to ISO 9001, Issue 1994.

Amersham
The Health Science Group

Overall Uncertainty

The declared uncertainty U is an expanded uncertainty $U = k * u_c$ with a coverage factor of $k = 3$. The combined uncertainty u_c is the sum of all uncertainties which can be evaluated by statistical means (uncertainty type A, u_A) and all other uncertainties (uncertainty type B, u_B) whereby $u_c^2 = u_A^2 + u_B^2$ is.
(Ref.: NIST Technical Note 1297 / WECC-Doc. 19-1990)

Traceability

This certificate documents the traceability of measurement results to national standards, standard measuring equipment and methods for the realisation of physical units of measurement according to the International System of Units (SI).

Traceability is defined as 'the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.'

Amersham Buchler GmbH & Co KG has been accredited at DKD (Deutscher Kalibrierdienst) calibration laboratory by the Physikalisch-Technische Bundesanstalt (PTB) and is authorized to issue reference sources which are traceable to national standards held at the PTB in Germany.

Because of the European Cooperation for Accreditation of Laboratories (EAL) mutual recognition agreement the certificates are also accepted by all EAL-members (e.g. NAMAS, UK).

This product complies with the requirements for traceability to NIST specified in the American National Standard "Traceability of Radioactive Sources to the NIST and Associated Instrument Quality Control (ANSI N42.22-1995)".

As a requirement of the ANSI N42.22-1995 Amersham participates in the NEI/NIST Measurements Assurance Program of the Nuclear Power Industry.

Leakage and Contamination Tests

Stringent tests for leakage are an essential feature of radioactive sources production. They are based on ISO 9978. Some standard methods used for testing radiation sources are listed below.

Wipe Test I

The source is wiped with a swab or tissue, moistened with ethanol or water; the activity removed is measured.
Limit: 185 Bq.

Immersion Test II

The source is immersed in a suitable liquid at 50 °C for 4 hours and the activity removed is measured.
Limit: 185 Bq.

Bubble Test III

The source is immersed in water or a suitable liquid and the pressure in the vessel reduced to 13 kPa (100 mm Hg). No bubbles must be observed.
(This test conforms to ISO 9978 except that for some sources, the 100 mm³ free volume requirement is not met.)

Emanation Test IV

The source is placed in a gas tight enclosure with activated carbon as absorber and is left there for at least 3 h. The source is considered leak tight when not more than 185 Bq Radon related to a collection time of 12 h can be measured afterwards.

ISO Classification

The International Organization for Standardization (ISO) has proposed a system of classification of sealed radioactive sources based on safety requirements for typical uses (see ISO 2919). This system provides a manufacturer of sealed radioactive sources with a set of tests to evaluate the safety of his products. It also assists a user of such sealed sources to select types which suit the application he has in mind. The tests to which specimen sources are subjected are listed in the following table.

Classification of sealed source performance standards according to ISO 2919

Test	Class 1	2	3	4	5	6
Temperature	No test	- 40 °C (20 min) + 80 °C (1 h)	- 40 °C (20 min) + 180 °C (1 h)	- 40 °C (20 min) + 400 °C (1 h) and thermal shock 400° C to 20° C	- 40 °C (20 min) + 600 °C (1 h) and thermal shock 600 °C to 20 °C	- 40 °C (20 min) + 800 °C (1 h) and thermal shock 800 °C to 20 °C
External Pressure	No test	25 kPa absolute	25 kPa absolute to 2 MPa absolute	25 kPa absolute to 7 MPa absolute	25 kPa absolute to 70 MPa absolute	25 kPa absolute to 170 MPa absolute
Impact	No test	50 g from 1 m	200 g from 1 m	2 kg from 1 m	5 kg from 1 m	20 kg from 1 m
Vibration	No test	3 x 10 min 25 Hz to 500 Hz at 5 g peak amplitude	3 x 10 min 25 Hz to 50 Hz at 5 g peak amplitude and 50 Hz to 90 Hz at 0.635 mm amplitude peak to peak and 90 Hz to 500 Hz at 10 g peak amplitude	3 x 30 min 25 Hz to 80 Hz at 1.5 mm amplitude peak to peak and 80 Hz to 2000 Hz at 20 g peak amplitude		
Puncture	No test	1 g from 1 m	10 g from 1 m	50 g from 1 m	500 g from 1 m	1 kg from 1 m

Special Applications

No test programme can cover all possible combinations of environments to which a source may be exposed.

Users should therefore consult our experts before using sources in potentially adverse environments.

IAEA Special Form

'Special Form' is a test specification for sealed sources given in the IAEA transport regulations.
(IAEA Safety Series No. 6, 1985 revised edition)

It is used in determining the maximum acceptable activities for various types of transport containers.

Recommended Working Life

The 'recommended working life' is our recommendation of the period within which the source should be replaced. The period given has been assessed on the basis of such factors as, toxicity of nuclide, total initial activity, source construction (e.g. capsule design, source insert type, etc.), typical application environments, operational experience, test performance data, etc.

The usage of a source is, however, quite often limited by the half-life of the nuclide.
Adverse environments could affect the appearance and integrity of a source. It is the user's responsibility to regularly inspect and test the source in order to assess at what point during the 'recommended working life' the source should be replaced.

01. 08. 96 12:45 PM *AMERSHAM CORP G. S. A. P02

SEG # 035404

CERTIFICATE OF CALIBRATION

CUSTOM ALPHA STANDARD[1]

Radionuclide Th-230 Activity 2.585 nCi Serial Number B403

Reference Date Feb. 1, 1994 Half-Life[2] $(7.54 \pm 0.03) \times 10^4$ years

Alpha Flux Rate (2 pi emission rate) 2869.4 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
alpha	4621.1	23.4
	4687.6	76.3

SOURCE DESCRIPTION
The activity is homogenously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and alpha flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

ORIGINAL

Systematic uncertainty	± 1.56%
Random uncertainty	± 0.97%
Total uncertainty	± 2.53%

Calibration Laboratory

2-24-94
Date

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

11971 5

Amersham Buchler
GmbH & Co KG
Giesweg 1
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D-38001 Braunschweig
Tel. (05307) 930-0
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Fax Zentrale 930-237

Amersham
The Health Science Group

CERTIFICATE

No. 363235

for a Sealed Radioactive Source

Source Type: Beta Wide Area Reference Source

Product Code	TCRX1896
Drawing	VZ-1368
Dimensions of Active Surface	Ø 36 mm
Overall Dimensions	Ø 47 mm x 3 mm
Source No.	FS 450
Nuclide	Technetium-99

Measurement Data

Activity	365 Bq
Overall Uncertainty*	± 10 %
Beta Surface Emission Rate	180 s^{-1} ± 10 % in 2 π steradian
Reference Date	30 September 1997
Traceability*	Defined on page 2

Leakage and Contamination Test(s)

Test Method(s)*	1
Test(s) passed on	13 October 1997

Additional Information

ISO Classification*	C34645
Recommended Working Life*	10 years
Remark	

* see page 2 for explanation

Amersham Buchler

i. A. Pat

(Production Manager)

SEG# 049410

CERTIFICATE OF CALIBRATION

CUSTOM BETA STANDARD[1]

Radionuclide Tc-99 Activity 9.504 nCi Serial Number B399

Reference Date April 1, 1994 Half-Life[2] $(2.13 \pm 0.05) \times 10^5$ years

Beta Flux Rate (2 pi emission rate) 12131.9 particles/minute

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
beta	E_{max} = 294 E_{avg} = 85	100

SOURCE DESCRIPTION
The activity is homogeneously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and beta flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

Systematic uncertainty	± 3.08%
Weighing uncertainty	± 0.72%
Total uncertainty	± 3.80%

ORIGINAL

Daniel Kh
Calibration Laboratory

4-8-94
Date

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

Customer Information		Instrument Information	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2929	Serial Number: 118407
Contact Name: Tony Riggs		Probe: 43-10-1	Serial Number: 092751
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic And Source	

Instrument Calibration Information

M&TE	ID Number	Calibration Due Date	Environmental Conditions	
Thermometer	2551	11/16/12	Temperature (°C)	24.3
Barometer	2551	11/16/12	Pressure (mmHg)	741
Humidity	992290	05/31/13	Humidity (%)	43.0
Pulse Generator	43855	02/22/13	Calibrated in accordance with CP-IN-WI-235	
DVM	92260808	02/21/13		

Isotope	Source ID Number	Decayed Activity (dpm)	2Pi Emissions (EPM)	Source Cert. Date
Pu^{239}	071201	20,574	10,390 / min	05/01/12
Tc^{99}	099608	21,311	10,500 / min	08/08/96
Th^{230}	071203	16,590	8,379 / min	05/01/12
SrY^{90}	129676	12,820	9,027 / min	05/12/03

Frequency Calibration

Desired (cpm)	Tolerances (cpm)	Alpha As Found (cpm)	Alpha As Left (cpm)	Beta As Found (cpm)	Beta As Left (cpm)
40	40	40	40	40	40
400	(392 - 408)	396	396	396	396
4,000	(3,920 - 4,080)	3,962	3,962	3,961	3,961
40,000	(39.2K - 40.8K)	39,628	39,628	39,634	39,634
400,000	(392K - 408K)	396,326	396,326	396,301	396,301

Background Determination	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Counts, C_b	12	10	923	849
Time, T_b (min)	20	20	20	20
Rate, R_b (cpm)	0.60	0.50	46.15	42.45

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: Mike Yonce	Reviewed By: Jeff Nilsson	Date: 10/26/12
Calibration Date: 10/26/2012	* Calibration Due (6 mo.): 04/26/2013	
	* Calibration Due (12 mo.): 10/26/2013	

* Calibration due date is dependent on users regulatory requirements.

CROSS TALK & EFFICIENCY SHEET

Instrument ID: 118407

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
155	175

Alpha Source: Cross Talk – Performed using Pu^{239} #071201

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	35,864	35,048	827	651
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 7{,}172.8$	$R_{s[\alpha]} = 7{,}009.6$	$R_{s[\beta]} = 165.4$	$R_{s[\beta]} = 130.2$
4π EFF (% Net cpm/dpm) (>25%)	34.9 %	34.1 %	N/A	N/A
2π EFF (% Net cpm/emissions)	69.0 %	67.5 %	N/A	N/A
%Crosstalk [α to β] (< 10%)	$\frac{R_{s[\beta]} - R_{b[\beta]}}{R_{s[\alpha]} - R_{b[\alpha]}} = \frac{130.2 - 42.45}{7{,}009.6 - 0.5} = 1.3\ \%$			

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
3.4 mV	4.0 mV	60 mV	50 mV

Beta Source: Cross Talk Performed Using Tc^{99} #099608

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	4	3	25,599	23,893
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 0.8$	$R_{s[\alpha]} = 0.6$	$R_{s[\beta]} = 5{,}119.8$	$R_{s[\beta]} = 4{,}778.6$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	23.8 %	22.2 %
2π EFF (% Net cpm/emissions)	N/A	N/A	48.3 %	45.1 %
%Crosstalk [β to α] (< 1%)	$\frac{R_{s[\alpha]} - R_{b[\alpha]}}{R_{s[\beta]} - R_{b[\beta]}} = \frac{0.6 - 0.5}{4{,}778.6 - 42.45} = 0.002\ \%$			

High Voltage Power Supply Calibration

Desired Voltage	Tolerance	DVM As Found	DVM As Left	2929 Meter As Found	2929 Meter As Left
600	540 - 660	582	582	600	600
800	720 - 880	800	800	800	800
1,000	900 - 1,100	1,004	1,004	1,000	1,000
1,200	1,080 - 1,320	1,210	1,210	1,200	1,200
1,300	1,170 - 1,430	1,310	1,310	1,300	1,300

High Voltage	As Found	Vern Dial Reading	As Left	Vern Dial Reading
	735	3.00	725	2.97

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: Mike Yoder **Reviewed By:** [illegible] **Date:** 10/26/12

Calibration Date: 10/26/2012

*** Calibration Due (6 mo.): 04/26/2013**

*** Calibration Due (12 mo.): 10/26/2013**

* Calibration due date is dependent on users regulatory requirements.

EFFICIENCY SHEET

Instrument ID: 118407

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
155	175

Alpha Source: Efficiency determined using Th^{230} #071203				
Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	28,579	28,282	2,135	1,593
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 5{,}715.8$	$R_{s[\alpha]} = 5{,}656.4$	$R_{s[\beta]} = 427.0$	$R_{s[\beta]} = 318.6$
4π EFF (% Net cpm/dpm) (>25%)	34.4 %	34.1 %	N/A	N/A
2π EFF (% Net cpm/emissions)	68.2 %	67.5 %	N/A	N/A

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
3.4 mV	4.0 mV	60 mV	50 mV

Beta Source: Efficiency determined using Sr^{90} #129676				
Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	26	24	22,327	20,427
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 5.2$	$R_{s[\alpha]} = 4.8$	$R_{s[\beta]} = 4{,}465.4$	$R_{s[\beta]} = 4{,}085.4$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	34.5 %	31.5 %
2π EFF (% Net cpm/emissions)	N/A	N/A	49.0 %	44.8 %

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: Mike Yoss Reviewed By: Jeff Dubrino Date: 10/26/12

Calibration Date: 10/26/2012

* Calibration Due (6 mo.): 04/26/2013

* Calibration Due (12 mo.): 10/26/2013

* Calibration due date is dependent on users regulatory requirements.

Instrument ID: 118407

Source and Background Plateau Worksheet								
High Voltage	Background		Alpha Source		Beta Source		Cross Talk	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α
600								
650								
700								
750								
800								
850		See attached sheet for background and source plateaus						
900								
950								
1000								
1050								
1100								
1150								

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument

Calibrated By: Mike Yonce **Reviewed By:** Jeff Nelson **Date:** 10/26/12

Calibration Date: 10/26/2012

*** Calibration Due (6 mo.): 04/26/2013**

*** Calibration Due (12 mo.): 10/26/2013**

* Calibration due date is dependent on users regulatory requirements.

Computer Equivalent of Form IN-WI-235-F1 (Page 4 of 6)

Beta Source Chi-Square Test

Ludlum Model 2929 Serial Number: 118407 Tc-99 099608

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	4799	70.30	4942.09
2	4701	-27.70	767.29
3	4744	15.30	234.09
4	4661	-67.70	4583.29
5	4798	69.30	4802.49
6	4634	-94.70	8968.09
7	4718	-10.70	114.49
8	4852	123.30	15202.89
9	4687	-41.70	1738.89
10	4719	-9.70	94.09
11	4743	14.30	204.49
12	4718	-10.70	114.49
13	4732	3.30	10.89
14	4761	32.30	1043.29
15	4649	-79.70	6352.09
16	4736	7.30	53.29
17	4618	-110.70	12254.49
18	4805	76.30	5821.69
19	4706	-22.70	515.29
20	4793	64.30	4134.49
Σ=	94574	(x-Mean)² =	71952.20

Mean = 4728.70 Chi² = 15.22

σ = 61.54 2σ= 123.0765

Reduce Chi Square= 0.800845 3σ= 184.61

Reduced Chi Pass/Fail= PASS

Performed By/Date Mike Yonce / 10-26-12

Reviewed By/Date Jeff Dulemio / 10-26-12

Computer Equivalent of Form IN-WI-235-F1 (Page 4 of 6)

Alpha Source Chi-Square Test

Ludlum Model 2929	Serial Number: 118407	Source Nuclide Th-230	Source ID 071203

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	5712	66.25	4389.06
2	5632	-13.75	189.06
3	5610	-35.75	1278.06
4	5591	-54.75	2997.56
5	5638	-7.75	60.06
6	5671	25.25	637.56
7	5646	0.25	0.06
8	5538	-107.75	11610.06
9	5623	-22.75	517.56
10	5634	-11.75	138.06
11	5794	148.25	21978.06
12	5549	-96.75	9360.56
13	5649	3.25	10.56
14	5671	25.25	637.56
15	5716	70.25	4935.06
16	5791	145.25	21097.56
17	5718	72.25	5220.06
18	5578	-67.75	4590.06
19	5449	-196.75	38710.56
20	5705	59.25	3510.56
Σ=	112915	(x-Mean)² =	131867.75

Mean = 5645.75

Chi² = 23.36

σ = 83.31

2σ= 166.618221

Reduce Chi Square= 1.229315

3σ= 249.93

Reduced Chi Pass/Fail= PASS

Performed By/Date Mike Yoss / 10-26-12

Reviewed By/Date Jeff Dickinson / 10-26-12

2800 Solway Road
Knoxville, TN 37931

Calibration Certificate

Calibration Certificate for LV-1, Serial # 003695, Bar Code # ,Property # SEC-7227

Date: 08/06/13 Date Last Cal. Expires: 05/08/14 Technician: Jeffrey Knight

Location: 9999. Reason For Calibration: Other (See Comments)

EQUIPMENT USED DURING CALIBRATION

MODEL: D-812 V.2 SERIAL #: 3531 CAL. DUE: 11/20/13

MODEL: SERIAL #: CAL DUE:

AS FOUND DATA AF Physical Condition UNSAT **AS LEFT DATA**

As Found Instrument Flow Indication: 60 LPM As Left Instrument Flow Indication: 60 LPM

As Found Calibrator Flow Indication: 60 LPM As Left Calibrator Flow Indication: 60 LPM

Unit of Measure: (•) LPM ( ) CFM

Reproducibility 60 LPM 60 LPM 60 LPM Average: 60.00 LPM

☑ Are the Individual Counts Within 10% of the Average?

CALIBRATION DATA	TARGET VALUE	AIR SAMPLER READING	CALIBRATOR READING	ERROR %
	30.00 LPM	30.00 LPM	31.00 LPM	3.33% LPM
	50.00 LPM	50.00 LPM	50.60 LPM	1.20% LPM
	70.00 LPM	70.00 LPM	72.00 LPM	2.86% LPM

Air Sampler Setting 60.00 ☑ Is Error Within 10%?

Reproducibility 60 LPM 60 LPM 60 LPM Average: 60.00 LPM

☑ Are the Individual Counts Within 10% of the Average?

Air Sampler rotometer reading: ( ) Use Manufacturers Indication (•) Use Corrected Marking ( ) N/A

Comments: Married as a set with: Model Bar Code #:

Calibrated for new customer. Replaced broken vacuum gauge - calibrated using F&J model FP-47M filter media.

☑ Does Instrument Meet Final Acceptance Criteria? ☑ Calibration Sticker Attached?

Date Instrument is Due For Next Calibration: 08/06/14

Performed by: Reviewed by: Date: 8/6/13

Printed Name: Jeffrey Knight

Appendix M
Daily Instrument Response Checks

Chi Square Tests

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2350-1			Instrument Serial No.	126197	
Last Calibration Date:		4/20/2012			Background Count Rate:	4993	C_B
Detector Model:		44-10			Detector Serial No.:	192598	
Today's Date:		2/12/2013			Data Collected by:	William Wylie	
Source ID:	119313	Activity	6,670,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**219783**	214790		-390.05	152139.00	
2		**219672**	214679		-501.05	251051.10	
3		**220606**	215613		432.95	187445.70	
4		**219789**	214796		-384.05	147494.40	
5		**219123**	214130		-1050.05	1102605.00	
6		**219456**	214463		-717.05	514160.70	
7		**220121**	215128		-52.05	2709.20	
8		**220043**	215050		-130.05	16913.00	
9		**220145**	215152		-28.05	786.80	
10		**220174**	215181		0.95	0.90	
11		**220212**	215219		38.95	1517.10	
12		**220255**	215262		81.95	6715.80	
13		**220343**	215350		169.95	28883.00	
14		**220432**	215439		258.95	67055.10	
15		**220589**	215596		415.95	173014.40	
16		**220389**	215396		215.95	46634.40	
17		**220841**	215848		667.95	446157.20	
18		**220587**	215594		413.95	171354.60	
19		**220126**	215133		-47.05	2213.70	
20		**220775**	215782		601.95	362343.80	
Total		4403461	4303601		SUM	3681194.95	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			215180				
Chi Squared Value (C^2):		17.11	10.11 - 30.14	Standard Deviation:	440		
+ 20% Value:	258216	- 20% Value:	172144				
Calculations Completed by:			William Wylie			Date:	2/12/2013
Reviewed by:			Daniel Spicuzza			Date:	2/12/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2350-1			Instrument Serial No.	120633	
Last Calibration Date:		8/15/2012			Background Count Rate:	5428	C_B
Detector Model:		44-10			Detector Serial No.:	316939	
Today's Date:		2/12/2013			Data Collected by:	William Wylie	
Source ID:	119313	Activity	6,670,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**218235**	212807		-95.15	9053.52	
2		**217983**	212555		-347.15	120513.12	
3		**218109**	212681		-221.15	48907.32	
4		**218093**	212665		-237.15	56240.12	
5		**217856**	212428		-474.15	224818.22	
6		**217643**	212215		-687.15	472175.12	
7		**218094**	212666		-236.15	55766.82	
8		**218034**	212606		-296.15	87704.82	
9		**217894**	212466		-436.15	190226.82	
10		**218432**	213004		101.85	10373.42	
11		**218120**	212692		-210.15	44163.02	
12		**218032**	212604		-298.15	88893.42	
13		**219234**	213806		903.85	816944.82	
14		**219002**	213574		671.85	451382.42	
15		**218368**	212940		37.85	1432.62	
16		**218803**	213375		472.85	223587.12	
17		**219035**	213607		704.85	496813.52	
18		**218025**	212597		-305.15	93116.52	
19		**219045**	213617		714.85	511010.52	
20		**218566**	213138		235.85	55625.22	
Total		4366603	4258043		SUM	4058748.55	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			212902				
Chi Squared Value (C^2):		19.06	10.11 - 30.14	Standard Deviation:	462		
+ 20% Value:	255483	- 20% Value:	170322				
Calculations Completed by:			William Wylie			Date:	2/12/2013
Reviewed by:			Daniel Spicuzza			Date:	2/12/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2350-1			Instrument Serial No.	79037	
Last Calibration Date:		8/15/2012			Background Count Rate:	4687	C_B
Detector Model:		44-10			Detector Serial No.:	316936	
Today's Date:		2/12/2013			Data Collected by:	Daniel Spicuzza	
Source ID:	119313	Activity	6,670,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**200785**	196098		276.20	76286.44	
2		**200123**	195436		-385.80	148841.64	
3		**200026**	195339		-482.80	233095.84	
4		**199137**	194450		-1371.80	1881835.24	
5		**200652**	195965		143.20	20506.24	
6		**200930**	196243		421.20	177409.44	
7		**201123**	196436		614.20	377241.64	
8		**201234**	196547		725.20	525915.04	
9		**200674**	195987		165.20	27291.04	
10		**200634**	195947		125.20	15675.04	
11		**200621**	195934		112.20	12588.84	
12		**200921**	196234		412.20	169908.84	
13		**200156**	195469		-352.80	124467.84	
14		**200567**	195880		58.20	3387.24	
15		**200554**	195867		45.20	2043.04	
16		**200501**	195814		-7.80	60.84	
17		**200598**	195911		89.20	7956.64	
18		**200276**	195589		-232.80	54195.84	
19		**200563**	195876		54.20	2937.64	
20		**200101**	195414		-407.80	166300.84	
Total		4010176	3916436		SUM	4027945.2	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			195822				
Chi Squared Value (C^2):		20.57	10.11 - 30.14	Standard Deviation:	460		
+ 20% Value:	234986	- 20% Value:	156657				
Calculations Completed by:			Daniel Spicuzza			Date:	2/12/2013
Reviewed by:			William Haney			Date:	2/12/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	202410	
Last Calibration Date:		5/17/2012			Background Count Rate:	0.6	C_B
Detector Model:		43-93			Detector Serial No.:	299649	
Today's Date:		2/12/2013			Data Collected by:	William Wylie	
Source ID:	039404	Activity	2,869	alphas/min	Efficiency:	41.7 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**840**	838.9		7.68	58.91	
2		**876**	875.4		44.18	1951.43	
3		**854**	852.9		21.68	469.81	
4		**844**	843.4		12.18	148.23	
5		**858**	856.9		25.68	659.21	
6		**814**	812.9		-18.32	335.81	
7		**804**	802.9		-28.32	802.31	
8		**795**	794.4		-36.82	1356.08	
9		**809**	807.9		-23.32	544.06	
10		**788**	787.4		-43.82	1920.63	
11		**773**	771.9		-59.32	3519.46	
12		**784**	782.9		-48.32	2335.31	
13		**853**	851.9		20.68	427.46	
14		**860**	858.9		27.68	765.91	
15		**835**	833.9		2.68	7.16	
16		**836**	835.4		4.18	17.43	
17		**861**	859.9		28.68	822.26	
18		**858**	857.4		26.18	685.13	
19		**854**	853.4		22.18	491.73	
20		**847**	845.9		14.68	215.36	
Total		16636.5	16624.5		SUM	17533.6375	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			831				
Chi Squared Value (C^2):		21.09	10.11 - 30.14	Standard Deviation:	30		
+ 20% Value:	997	- 20% Value:	665				
Calculations Completed by:			William Wylie			Date:	2/12/2013
Reviewed by:			Daniel Spicuzza			Date:	2/12/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	202410	
Last Calibration Date:		5/17/2012			Background Count Rate:	146	C_B
Detector Model:		43-93			Detector Serial No.:	299649	
Today's Date:		2/12/2013			Data Collected by:	William Wylie	
Source ID:	049410	Activity	12,131	betas/min	Efficiency:	35.5 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**3083**	2937		54.45	2964.80	
2		**3032**	2885.5		2.95	8.70	
3		**2946**	2800		-82.55	6814.50	
4		**3008**	2862		-20.55	422.30	
5		**3048**	2901.5		18.95	359.10	
6		**3124**	2977.5		94.95	9015.50	
7		**3029**	2883		0.45	0.20	
8		**3122**	2975.5		92.95	8639.70	
9		**2994**	2848		-34.55	1193.70	
10		**2949**	2802.5		-80.05	6408.00	
11		**3008**	2862		-20.55	422.30	
12		**2998**	2851.5		-31.05	964.10	
13		**3038**	2891.5		8.95	80.10	
14		**3021**	2875		-7.55	57.00	
15		**3025**	2878.5		-4.05	16.40	
16		**3046**	2900		17.45	304.50	
17		**2984**	2837.5		-45.05	2029.50	
18		**3041**	2895		12.45	155.00	
19		**3039**	2893		10.45	109.20	
20		**3041**	2894.5		11.95	142.80	
Total		60571	57651		SUM	40107.45	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			2883				
Chi Squared Value (C^2):		13.91	10.11 - 30.14	Standard Deviation:	46		
+ 20% Value:	3459	- 20% Value:	2306				
Calculations Completed by:			William Wylie			Date:	2/12/2013
Reviewed by:			Daniel Spicuzza			Date:	2/12/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	184949	
Last Calibration Date:		7/11/2012			Background Count Rate:	0.3	C_B
Detector Model:		43-93			Detector Serial No.:	268605	
Today's Date:		2/25/2013			Data Collected by:	William Wylie	
Source ID:	039404	Activity	2,869	alphas/min	Efficiency:	35.1 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**771**	770.7		-35.95	1292.40	
2		**827**	826.7		20.05	402.00	
3		**796**	795.7		-10.95	119.90	
4		**814**	813.7		7.05	49.70	
5		**825**	824.7		18.05	325.80	
6		**798**	797.7		-8.95	80.10	
7		**845**	844.7		38.05	1447.80	
8		**790**	789.7		-16.95	287.30	
9		**814**	813.7		7.05	49.70	
10		**833**	832.7		26.05	678.60	
11		**811**	810.7		4.05	16.40	
12		**823**	822.7		16.05	257.60	
13		**840**	839.7		33.05	1092.30	
14		**801**	800.7		-5.95	35.40	
15		**796**	795.7		-10.95	119.90	
16		**832**	831.7		25.05	627.50	
17		**763**	762.7		-43.95	1931.60	
18		**765**	764.7		-41.95	1759.80	
19		**788**	787.7		-18.95	359.10	
20		**807**	806.7		0.05	0.00	
Total		16139	16133		SUM	10932.95	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			807				
Chi Squared Value (C^2):		13.55	10.11 - 30.14	Standard Deviation:	24		
+ 20% Value:	968	- 20% Value:	645				
Calculations Completed by:			William Wylie			Date:	2/25/2013
Reviewed by:			Daniel Spicuzza			Date:	2/25/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	184949	
Last Calibration Date:		7/11/2012			Background Count Rate:	165	C_B
Detector Model:		43-93			Detector Serial No.:	268605	
Today's Date:		2/25/2013			Data Collected by:	William Wylie	
Source ID:	049410	Activity	12,131	betas/min	Efficiency:	28.1 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**3256**	3091		-92.10	8482.41	
2		**3312**	3147		-36.10	1303.21	
3		**3321**	3156		-27.10	734.41	
4		**3345**	3180		-3.10	9.61	
5		**3364**	3199		15.90	252.81	
6		**3381**	3216		32.90	1082.41	
7		**3402**	3237		53.90	2905.21	
8		**3352**	3187		3.90	15.21	
9		**3425**	3260		76.90	5913.61	
10		**3378**	3213		29.90	894.01	
11		**3421**	3256		72.90	5314.41	
12		**3387**	3222		38.90	1513.21	
13		**3401**	3236		52.90	2798.41	
14		**3326**	3161		-22.10	488.41	
15		**3383**	3218		34.90	1218.01	
16		**3420**	3255		71.90	5169.61	
17		**3280**	3115		-68.10	4637.61	
18		**3247**	3082		-101.10	10221.21	
19		**3310**	3145		-38.10	1451.61	
20		**3251**	3086		-97.10	9428.41	
Total		66962	63662		SUM	63833.8	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			3183				
Chi Squared Value (C^2):		20.05	10.11 - 30.14	Standard Deviation:	58		
+ 20% Value:	3820	- 20% Value:	2546				
Calculations Completed by:			William Wylie			Date:	2/25/2013
Reviewed by:			Daniel Spicuzza			Date:	2/25/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2929			Instrument Serial No.	118417	
Last Calibration Date:		10/26/2012			Background Count Rate:	0.77	C_B
Detector Model:		43-10-1			Detector Serial No.:	092751	
Today's Date:		2/12/2013			Data Collected by:	Daniel Spicuzza	
Source ID:	119701	Activity	8,880	alphas/min	Efficiency:	72.0 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**5357**	5356.23		105.60	11151.36	
2		**5196**	5195.23		-55.40	3069.16	
3		**5246**	5245.23		-5.40	29.16	
4		**5210**	5209.23		-41.40	1713.96	
5		**5198**	5197.23		-53.40	2851.56	
6		**5214**	5213.23		-37.40	1398.76	
7		**5373**	5372.23		121.60	14786.56	
8		**5209**	5208.23		-42.40	1797.76	
9		**5261**	5260.23		9.60	92.16	
10		**5246**	5245.23		-5.40	29.16	
11		**5257**	5256.23		5.60	31.36	
12		**5198**	5197.23		-53.40	2851.56	
13		**5255**	5254.23		3.60	12.96	
14		**5309**	5308.23		57.60	3317.76	
15		**5240**	5239.23		-11.40	129.96	
16		**5208**	5207.23		-43.40	1883.56	
17		**5339**	5338.23		87.60	7673.76	
18		**5189**	5188.23		-62.40	3893.76	
19		**5362**	5361.23		110.60	12232.36	
20		**5161**	5160.23		-90.40	8172.16	
Total		105028	105012.6		SUM	77118.8	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			5251				
Chi Squared Value (C^2):		14.69	10.11 - 30.14	Standard Deviation:	64		
+ 20% Value:	6301	- 20% Value:	4201				
Calculations Completed by:			Daniel Spicuzza			Date:	2/12/2013
Reviewed by:			William Haney			Date:	2/12/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2929			Instrument Serial No.	118417	
Last Calibration Date:		10/26/2012			Background Count Rate:	41.8	C_B
Detector Model:		43-10-1			Detector Serial No.:	092751	
Today's Date:		2/12/2013			Data Collected by:	Daniel Spicuzza	
Source ID:	119715	Activity	10,800	betas/min	Efficiency:	48.5 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**13189**	13147.2		84.50	7140.25	
2		**13116**	13074.2		11.50	132.25	
3		**13233**	13191.2		128.50	16512.25	
4		**13021**	12979.2		-83.50	6972.25	
5		**13145**	13103.2		40.50	1640.25	
6		**13210**	13168.2		105.50	11130.25	
7		**13185**	13143.2		80.50	6480.25	
8		**13174**	13132.2		69.50	4830.25	
9		**13166**	13124.2		61.50	3782.25	
10		**13120**	13078.2		15.50	240.25	
11		**13006**	12964.2		-98.50	9702.25	
12		**13298**	13256.2		193.50	37442.25	
13		**13021**	12979.2		-83.50	6972.25	
14		**13065**	13023.2		-39.50	1560.25	
15		**13047**	13005.2		-57.50	3306.25	
16		**13013**	12971.2		-91.50	8372.25	
17		**13105**	13063.2		0.50	0.25	
18		**12889**	12847.2		-215.50	46440.25	
19		**12954**	12912.2		-150.50	22650.25	
20		**13133**	13091.2		28.50	812.25	
Total		262090	261254		SUM	196119	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			13063				
Chi Squared Value (C^2):		15.01	10.11 - 30.14	Standard Deviation:	102		
+ 20% Value:	15675	- 20% Value:	10450				
Calculations Completed by:			Daniel Spicuzza			Date:	2/12/2013
Reviewed by:			William Haney			Date:	2/12/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2350-1			Instrument Serial No.	117014	
Last Calibration Date:		6/27/2013			Background Count Rate:	4438	C_B
Detector Model:		44-10			Detector Serial No.:	316939	
Today's Date:		8/19/2013			Data Collected by:	William Wylie	
Source ID:	O19456	Activity	6,670,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**230632**	226194		63.40	4019.56	
2		**229960**	225522		-608.60	370393.96	
3		**231230**	226792		661.40	437449.96	
4		**230526**	226088		-42.60	1814.76	
5		**230180**	225742		-388.60	151009.96	
6		**230148**	225710		-420.60	176904.36	
7		**230767**	226329		198.40	39362.56	
8		**230482**	226044		-86.60	7499.56	
9		**230675**	226237		106.40	11320.96	
10		**229836**	225398		-732.60	536702.76	
11		**230094**	225656		-474.60	225245.16	
12		**230432**	225994		-136.60	18659.56	
13		**231019**	226581		450.40	202860.16	
14		**230622**	226184		53.40	2851.56	
15		**230984**	226546		415.40	172557.16	
16		**231649**	227211		1080.40	1167264.16	
17		**230291**	225853		-277.60	77061.76	
18		**230710**	226272		141.40	19993.96	
19		**230678**	226240		109.40	11968.36	
20		**230457**	226019		-111.60	12454.56	
Total		4611372	4522612		SUM	3647394.8	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			226131				
Chi Squared Value (C^2):		16.13	10.11 - 30.14	Standard Deviation:	438		
+ 20% Value:	271357	- 20% Value:	180904				
Calculations Completed by:			William Wylie			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2350-1			Instrument Serial No.	98639	
Last Calibration Date:		6/27/2013			Background Count Rate:	4613	C_B
Detector Model:		44-10			Detector Serial No.:	316936	
Today's Date:		8/19/2013			Data Collected by:	Harry Obregon	
Source ID:	O19456	Activity	6,670,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**215598**	210985		273.75	74939.06	
2		**215502**	210889		177.75	31595.06	
3		**215506**	210893		181.75	33033.06	
4		**215714**	211101		389.75	151905.06	
5		**214518**	209905		-806.25	650039.06	
6		**216221**	211608		896.75	804160.56	
7		**216247**	211634		922.75	851467.56	
8		**214301**	209688		-1023.25	1047040.56	
9		**215721**	211108		396.75	157410.56	
10		**215621**	211008		296.75	88060.56	
11		**215137**	210524		-187.25	35062.56	
12		**215365**	210752		40.75	1660.56	
13		**214980**	210367		-344.25	118508.06	
14		**214517**	209904		-807.25	651652.56	
15		**215347**	210734		22.75	517.56	
16		**215290**	210677		-34.25	1173.06	
17		**215555**	210942		230.75	53245.56	
18		**214793**	210180		-531.25	282226.56	
19		**215173**	210560		-151.25	22876.56	
20		**215379**	210766		54.75	2997.56	
Total		4306485	4214225		SUM	5059571.75	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			210711				
Chi Squared Value (C^2):		24.01	10.11 - 30.14	Standard Deviation:	516		
+ 20% Value:	252854	- 20% Value:	168569				
Calculations Completed by:			Harry Obregon			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	297848	
Last Calibration Date:		11/8/2012			Background Count Rate:	0.2	C_B
Detector Model:		43-93			Detector Serial No.:	323069	
Today's Date:		8/19/2013			Data Collected by:	Harry Obregon	
Source ID:	039404	Activity	2,869	alphas/min	Efficiency:	40.9 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**781**	780.8		-35.60	1267.36	
2		**818**	817.8		1.40	1.96	
3		**844**	843.8		27.40	750.76	
4		**862**	861.8		45.40	2061.16	
5		**808**	807.8		-8.60	73.96	
6		**838**	837.8		21.40	457.96	
7		**825**	824.8		8.40	70.56	
8		**845**	844.8		28.40	806.56	
9		**839**	838.8		22.40	501.76	
10		**803**	802.8		-13.60	184.96	
11		**800**	799.8		-16.60	275.56	
12		**817**	816.8		0.40	0.16	
13		**805**	804.8		-11.60	134.56	
14		**798**	797.8		-18.60	345.96	
15		**793**	792.8		-23.60	556.96	
16		**812**	811.8		-4.60	21.16	
17		**823**	822.8		6.40	40.96	
18		**816**	815.8		-0.60	0.36	
19		**855**	854.8		38.40	1474.56	
20		**750**	749.8		-66.60	4435.56	
Total		16332	16328		SUM	13462.8	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			816				
Chi Squared Value (C^2):		16.49	10.11 - 30.14	Standard Deviation:	27		
+ 20% Value:	980	- 20% Value:	653				
Calculations Completed by:			Harry Obregon			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	297848	
Last Calibration Date:		11/8/2012			Background Count Rate:	157	C_B
Detector Model:		43-93			Detector Serial No.:	323069	
Today's Date:		8/19/2013			Data Collected by:	Harry Obregon	
Source ID:	049410	Activity	12,131	betas/min	Efficiency:	32.4 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**3456**	3299		60.10	3612.01	
2		**3431**	3274		35.10	1232.01	
3		**3398**	3241		2.10	4.41	
4		**3412**	3255		16.10	259.21	
5		**3455**	3298		59.10	3492.81	
6		**3325**	3168		-70.90	5026.81	
7		**3373**	3216		-22.90	524.41	
8		**3402**	3245		6.10	37.21	
9		**3472**	3315		76.10	5791.21	
10		**3351**	3194		-44.90	2016.01	
11		**3434**	3277		38.10	1451.61	
12		**3425**	3268		29.10	846.81	
13		**3351**	3194		-44.90	2016.01	
14		**3379**	3222		-16.90	285.61	
15		**3379**	3222		-16.90	285.61	
16		**3480**	3323		84.10	7072.81	
17		**3358**	3201		-37.90	1436.41	
18		**3281**	3124		-114.90	13202.01	
19		**3333**	3176		-62.90	3956.41	
20		**3423**	3266		27.10	734.41	
Total		67918	64778		SUM	53283.8	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			3239				
Chi Squared Value (C^2):		16.45	10.11 - 30.14	Standard Deviation:	53		
+ 20% Value:	3887	- 20% Value:	2591				
Calculations Completed by:			Harry Obregon			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	297779	
Last Calibration Date:		11/9/2012			Background Count Rate:	0.2	C_B
Detector Model:		43-93			Detector Serial No.:	323064	
Today's Date:		8/19/2013			Data Collected by:	Adolfo Matus Jr.	
Source ID:	039404	Activity	2,869	alphas/min	Efficiency:	40.7 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**858**	857.8		15.10	228.01	
2		**850**	849.8		7.10	50.41	
3		**868**	867.8		25.10	630.01	
4		**819**	818.8		-23.90	571.21	
5		**849**	848.8		6.10	37.21	
6		**815**	814.8		-27.90	778.41	
7		**854**	853.8		11.10	123.21	
8		**865**	864.8		22.10	488.41	
9		**833**	832.8		-9.90	98.01	
10		**859**	858.8		16.10	259.21	
11		**804**	803.8		-38.90	1513.21	
12		**810**	809.8		-32.90	1082.41	
13		**815**	814.8		-27.90	778.41	
14		**889**	888.8		46.10	2125.21	
15		**808**	807.8		-34.90	1218.01	
16		**857**	856.8		14.10	198.81	
17		**877**	876.8		34.10	1162.81	
18		**877**	876.8		34.10	1162.81	
19		**805**	804.8		-37.90	1436.41	
20		**846**	845.8		3.10	9.61	
Total		16858	16854		SUM	13951.8	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			843				
Chi Squared Value (C^2):		16.56	10.11 - 30.14	Standard Deviation:	27		
+ 20% Value:	1011	- 20% Value:	674				
Calculations Completed by:			Adolfo Matus Jr.			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	297779	
Last Calibration Date:		11/9/2012			Background Count Rate:	140	C_B
Detector Model:		43-93			Detector Serial No.:	323064	
Today's Date:		8/19/2013			Data Collected by:	Adoldo Matus Jr.	
Source ID:	049410	Activity	12,131	betas/min	Efficiency:	25.9 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**2245**	2105		-39.30	1544.49	
2		**2346**	2206		61.70	3806.89	
3		**2296**	2156		11.70	136.89	
4		**2245**	2105		-39.30	1544.49	
5		**2300**	2160		15.70	246.49	
6		**2303**	2163		18.70	349.69	
7		**2279**	2139		-5.30	28.09	
8		**2317**	2177		32.70	1069.29	
9		**2334**	2194		49.70	2470.09	
10		**2293**	2153		8.70	75.69	
11		**2287**	2147		2.70	7.29	
12		**2320**	2180		35.70	1274.49	
13		**2371**	2231		86.70	7516.89	
14		**2322**	2182		37.70	1421.29	
15		**2284**	2144		-0.30	0.09	
16		**2134**	1994		-150.30	22590.09	
17		**2272**	2132		-12.30	151.29	
18		**2216**	2076		-68.30	4664.89	
19		**2210**	2070		-74.30	5520.49	
20		**2312**	2172		27.70	767.29	
Total		45686	42886		SUM	55186.2	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			2144				
Chi Squared Value (C^2):		25.74	10.11 - 30.14	Standard Deviation:	54		
+ 20% Value:	2573	- 20% Value:	1715				
Calculations Completed by:			Adolfo Matus Jr.			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2929			Instrument Serial No.	118407	
Last Calibration Date:		10/26/2012			Background Count Rate:	0.3	C_B
Detector Model:		43-10-1			Detector Serial No.:	092751	
Today's Date:		8/19/2013			Data Collected by:	Adolfo Matus Jr.	
Source ID:	119701	Activity	8,880	alphas/min	Efficiency:	67.5 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**5415**	5414.7		-32.70	1069.29	
2		**5472**	5471.7		24.30	590.49	
3		**5488**	5487.7		40.30	1624.09	
4		**5329**	5328.7		-118.70	14089.69	
5		**5331**	5330.7		-116.70	13618.89	
6		**5521**	5520.7		73.30	5372.89	
7		**5521**	5520.7		73.30	5372.89	
8		**5392**	5391.7		-55.70	3102.49	
9		**5572**	5571.7		124.30	15450.49	
10		**5482**	5481.7		34.30	1176.49	
11		**5437**	5436.7		-10.70	114.49	
12		**5510**	5509.7		62.30	3881.29	
13		**5368**	5367.7		-79.70	6352.09	
14		**5401**	5400.7		-46.70	2180.89	
15		**5407**	5406.7		-40.70	1656.49	
16		**5469**	5468.7		21.30	453.69	
17		**5478**	5477.7		30.30	918.09	
18		**5437**	5436.7		-10.70	114.49	
19		**5416**	5415.7		-31.70	1004.89	
20		**5508**	5507.7		60.30	3636.09	
Total		108954	108948		SUM	81780.2	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			5447				
Chi Squared Value (C^2):		15.01	10.11 - 30.14	Standard Deviation:	66		
+ 20% Value:	6537	- 20% Value:	4358				
Calculations Completed by:			Adolfo Matus Jr.			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2929			Instrument Serial No.	118407	
Last Calibration Date:		10/26/2012			Background Count Rate:	44.9	C_B
Detector Model:		43-10-1			Detector Serial No.:	092751	
Today's Date:		8/19/2013			Data Collected by:	Adolfo Matus Jr.	
Source ID:	119715	Activity	10,800	betas/min	Efficiency:	45.1 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**4901**	4856.1		60.00	3600.00	
2		**4840**	4795.1		-1.00	1.00	
3		**4892**	4847.1		51.00	2601.00	
4		**4769**	4724.1		-72.00	5184.00	
5		**4760**	4715.1		-81.00	6561.00	
6		**4735**	4690.1		-106.00	11236.00	
7		**4932**	4887.1		91.00	8281.00	
8		**4831**	4786.1		-10.00	100.00	
9		**4759**	4714.1		-82.00	6724.00	
10		**4847**	4802.1		6.00	36.00	
11		**4769**	4724.1		-72.00	5184.00	
12		**4786**	4741.1		-55.00	3025.00	
13		**4856**	4811.1		15.00	225.00	
14		**4922**	4877.1		81.00	6561.00	
15		**4928**	4883.1		87.00	7569.00	
16		**4865**	4820.1		24.00	576.00	
17		**4938**	4893.1		97.00	9409.00	
18		**4821**	4776.1		-20.00	400.00	
19		**4872**	4827.1		31.00	961.00	
20		**4797**	4752.1		-44.00	1936.00	
Total		96820	95922		SUM	80170	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			4796				
Chi Squared Value (C^2):		16.72	10.11 - 30.14	Standard Deviation:	65		
+ 20% Value:	5755	- 20% Value:	3837				
Calculations Completed by:			Adolfo Matus Jr.			Date:	8/19/2013
Reviewed by:			Daniel Spicuzza			Date:	8/19/2013

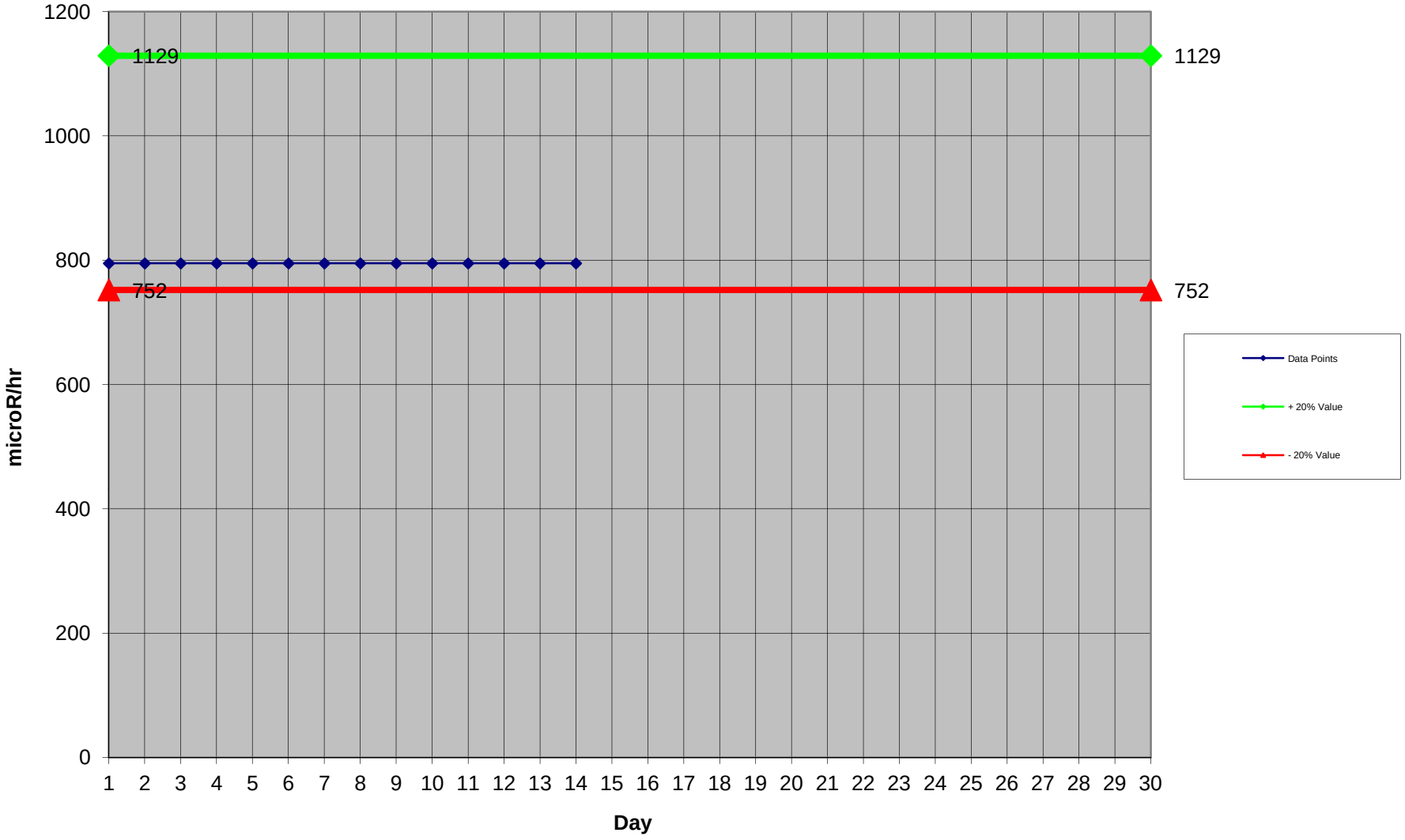
Daily Instrument Response Checks

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY dpm	BACKGROUND microR/hr	READING microR/hr	Net microR/hr 636-954	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/13/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	WW
2/14/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	WW
2/15/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	WW
2/19/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
2/20/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
2/21/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
2/22/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
2/25/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
2/26/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
2/27/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
2/28/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
3/1/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
3/4/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS
3/5/2013	19	167121	N	8/14/2013	119313	6,670,000	5	800	795	N/A	P	DS

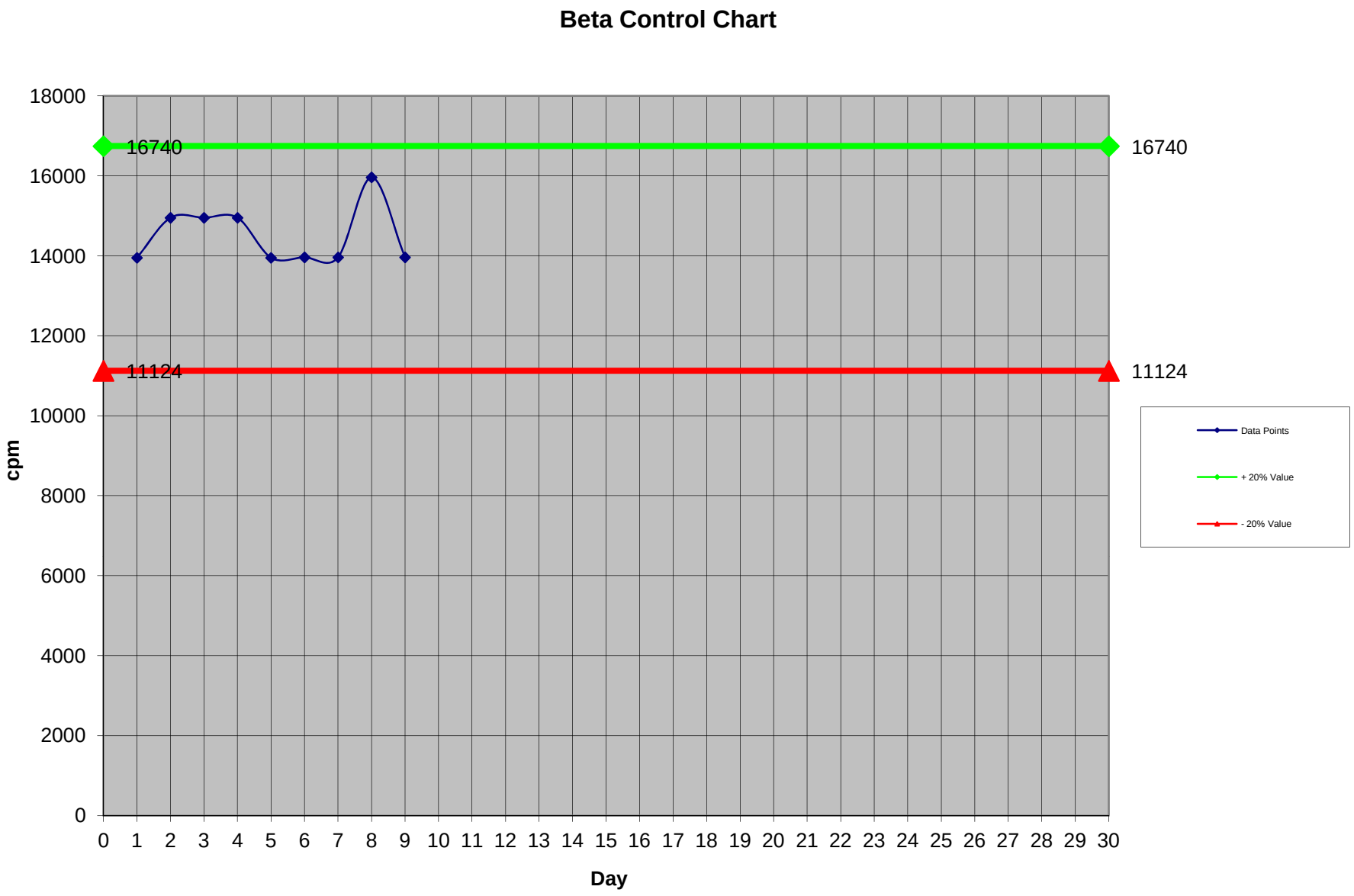
Gamma Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

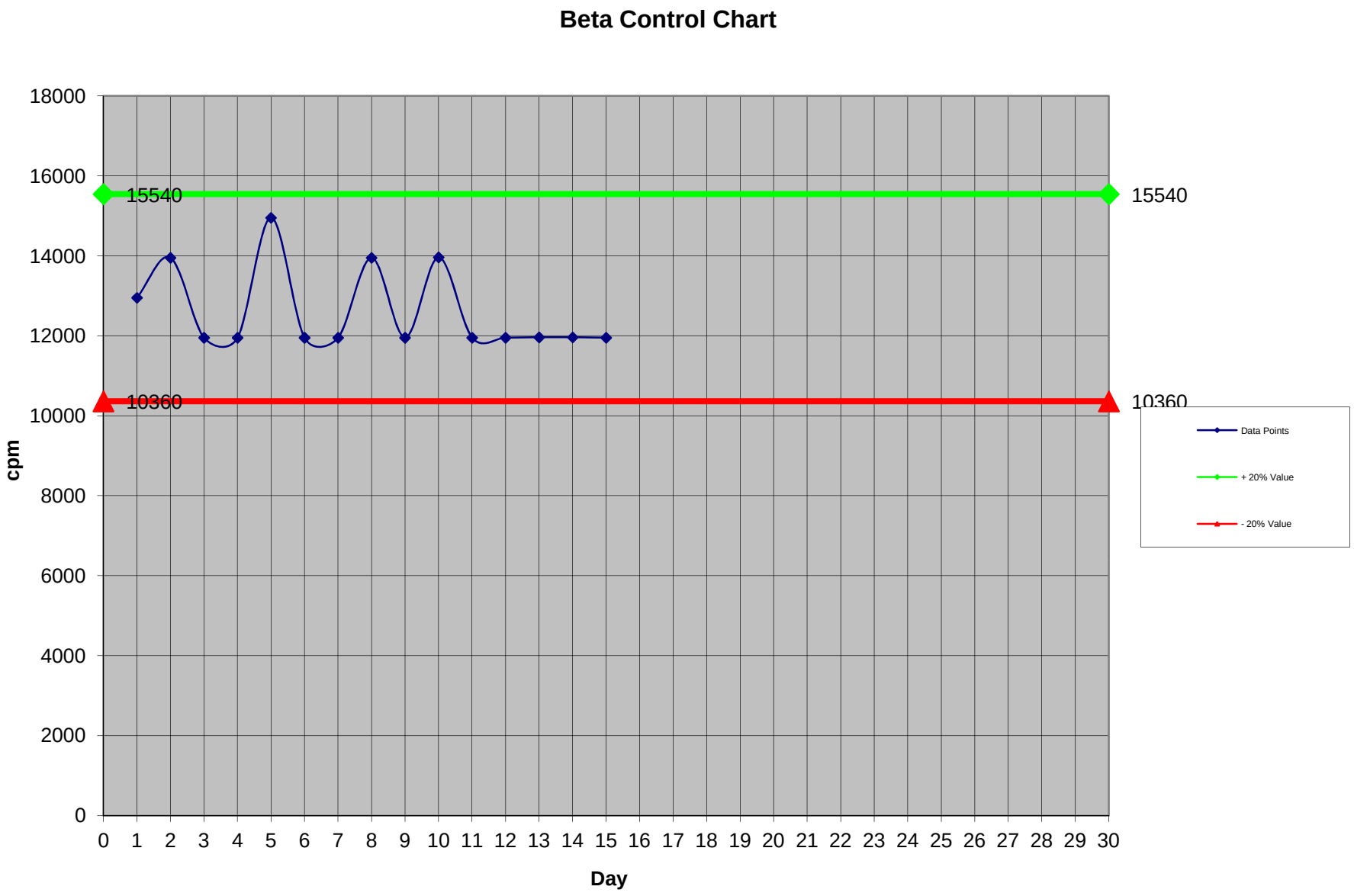
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 11124-16740	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/12/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	50	14000	13950	52	P	DS
2/13/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	50	15000	14950	56	P	WW
2/14/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	50	15000	14950	56	P	WW
2/15/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	50	15000	14950	56	P	WW
2/19/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	50	14000	13950	52	P	DS
2/20/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	40	14000	13960	52	P	WW
2/21/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	40	14000	13960	52	P	WW
2/22/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	40	16000	15960	60	P	WW
2/25/2013	3/44-9	164070/150446	N	4/24/2013	010102	26,640	40	14000	13960	52	P	WW


Beta Control Chart
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
cpm
16740
11124
16740
11124
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 10360-15540	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.	
2/12/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	13000	12950	49	P	DS	
2/12/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	14000	13950	52	P	WW	
2/14/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	
2/15/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	15540
2/19/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	15000	14950	56	P	DS	10360
2/20/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	
2/21/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	
2/22/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	14000	13950	52	P	WW	
2/25/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	
2/26/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	40	14000	13960	52	P	WW	
2/27/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	
2/28/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	
3/1/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	40	12000	11960	45	P	DS	
3/4/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	40	12000	11960	45	P	WW	
3/5/2013	3/44-9	163904/01472	N	6/12/2013	010102	26,640	50	12000	11950	45	P	WW	


Beta Control Chart
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
cpm
15540
15540
10360
10360
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

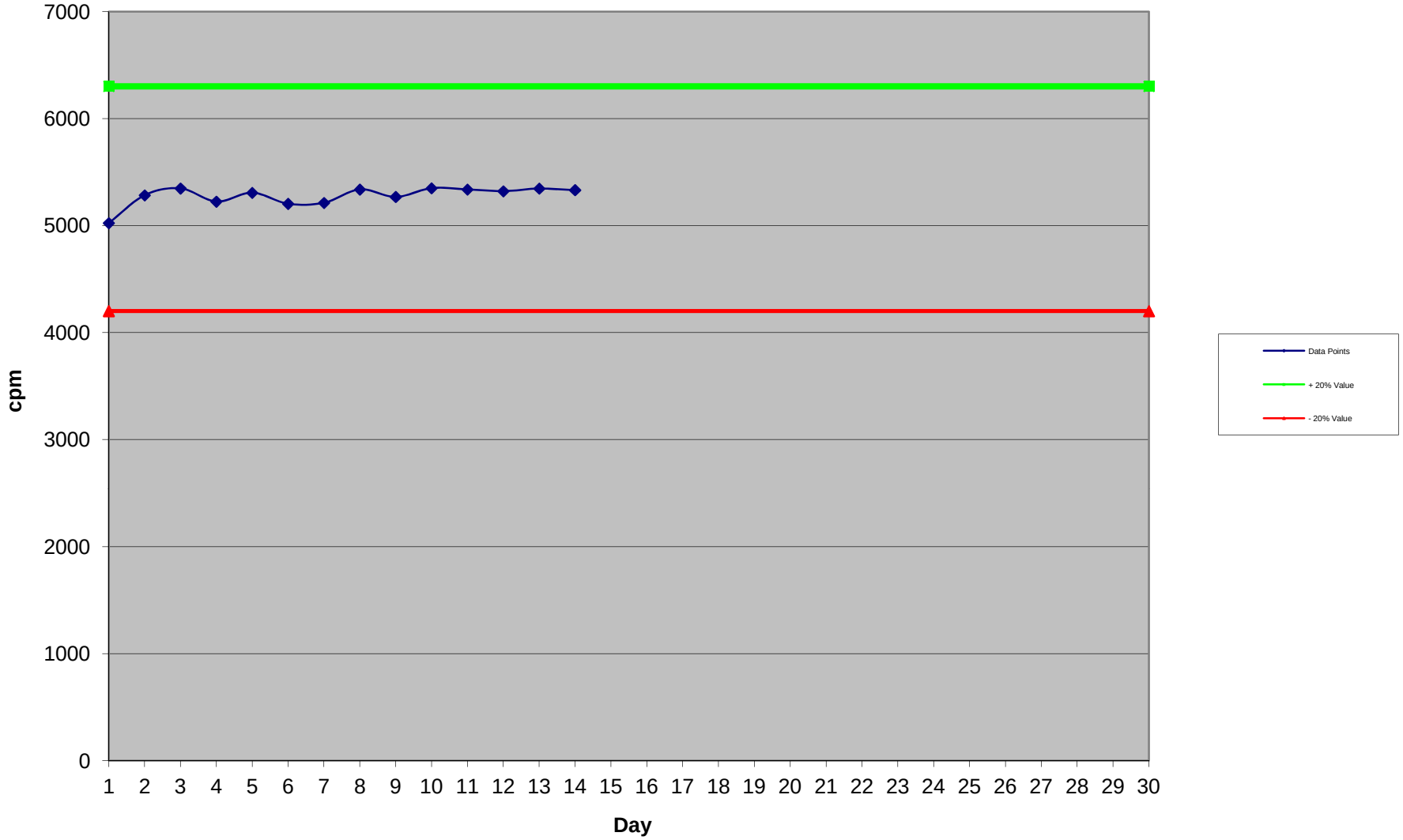
LUDLUM MODEL 2929
DAILY 30 MINUTE BACKGROUND AND EFFICIENCY

For:	February, March 2013 NSF Indian Head							
Instrument ID:	118419				Detector ID:	121393		
Cal Due Date:	9/4/2013							
Sources Used:			Alpha S/N:	Th-230/119701		Activity:	8,880	alphas/min
			Beta S/N:	Tc-99/010102		Activity:	26,640	betas/min
			Acceptable Range of Background:		0	CPM to	2.2	CPM α
Background Count Time:	30	Minutes			31	CPM to	52	CPM βγ

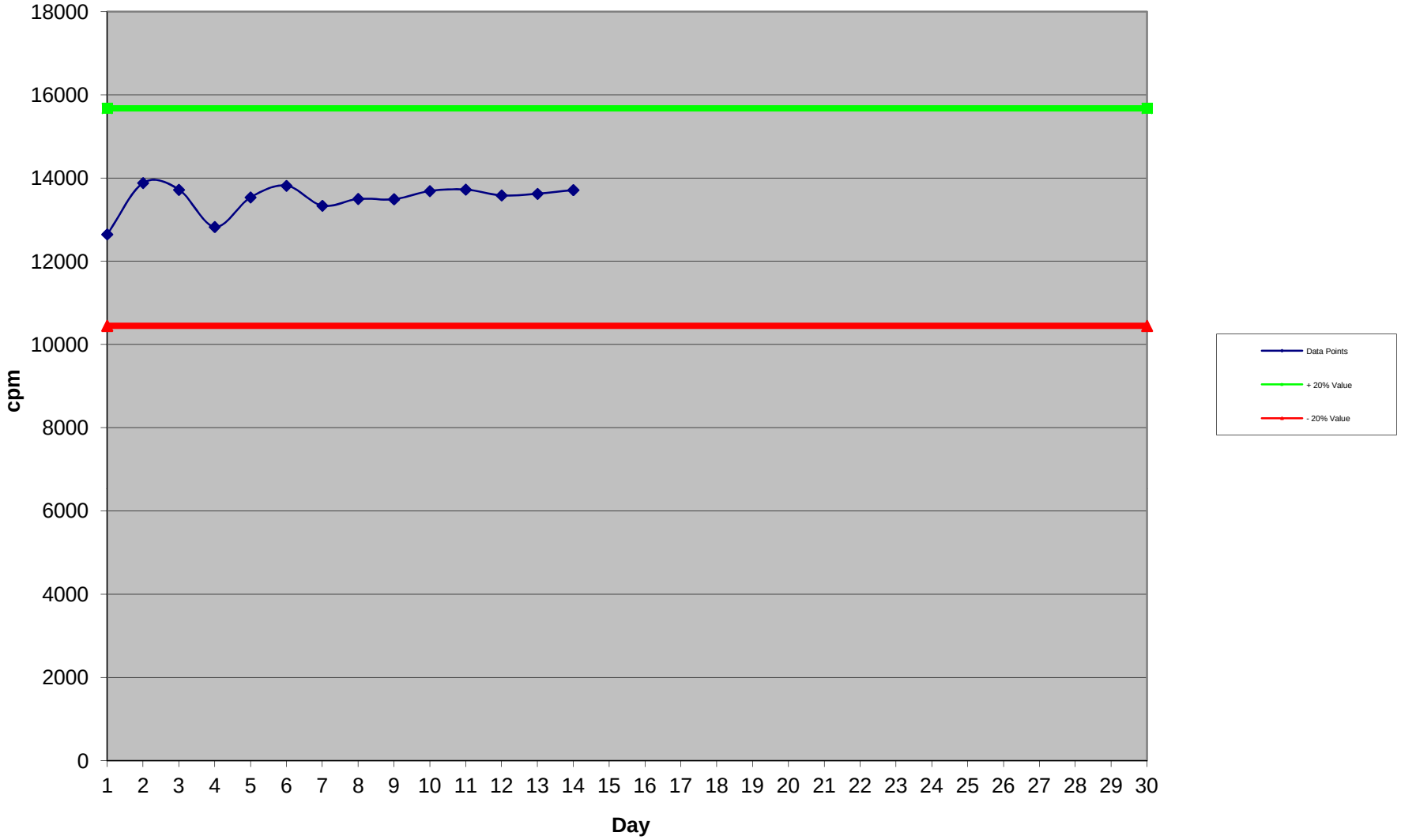
Date	Total Counts α	Total Counts βγ	30-Minute Background (CPM) α	30-Minute Background (CPM) βγ	1-min α Source Counts 4201-6301	Eff. α	1- min βγ Source Counts 10450-15675	Eff. βγ	Initials
2/13/2013	28	1248	0.9	41.6	5023	67.2	12645	46.9	DS
2/14/2013	31	1332	1.0	44.4	5283	67.2	13879	46.9	DS
2/15/2013	26	1286	0.9	42.9	5347	67.2	13717	46.9	DS
2/19/2013	30	1326	1.0	44.2	5224	67.2	12825	46.9	DS
2/20/2013	30	1379	1.0	46.0	5306	67.2	13535	46.9	DS
2/21/2013	30	1268	1.0	42.3	5203	67.2	13815	46.9	DS
2/22/2013	24	1220	0.8	40.7	5212	67.2	13335	46.9	DS
2/25/2013	29	1257	1.0	41.9	5337	67.2	13497	46.9	DS
2/26/2013	30	1271	1.0	42.4	5267	67.2	13489	46.9	DS
2/27/2013	30	1289	1.0	43.0	5349	67.2	13685	46.9	DS
2/28/2013	26	1269	0.9	42.3	5337	67.2	13720	46.9	DS
3/1/2013	29	1288	1.0	42.9	5321	67.2	13580	46.9	DS
3/4/2013	26	1262	0.9	42.1	5345	67.2	13621	46.9	DS
3/5/2013	30	1270	1.0	42.3	5331	67.2	13709	46.9	DS

Reviewed by:	*Daniel Spicuzza*	Date:	3/6/2013

Model 2929 Alpha Control Chart



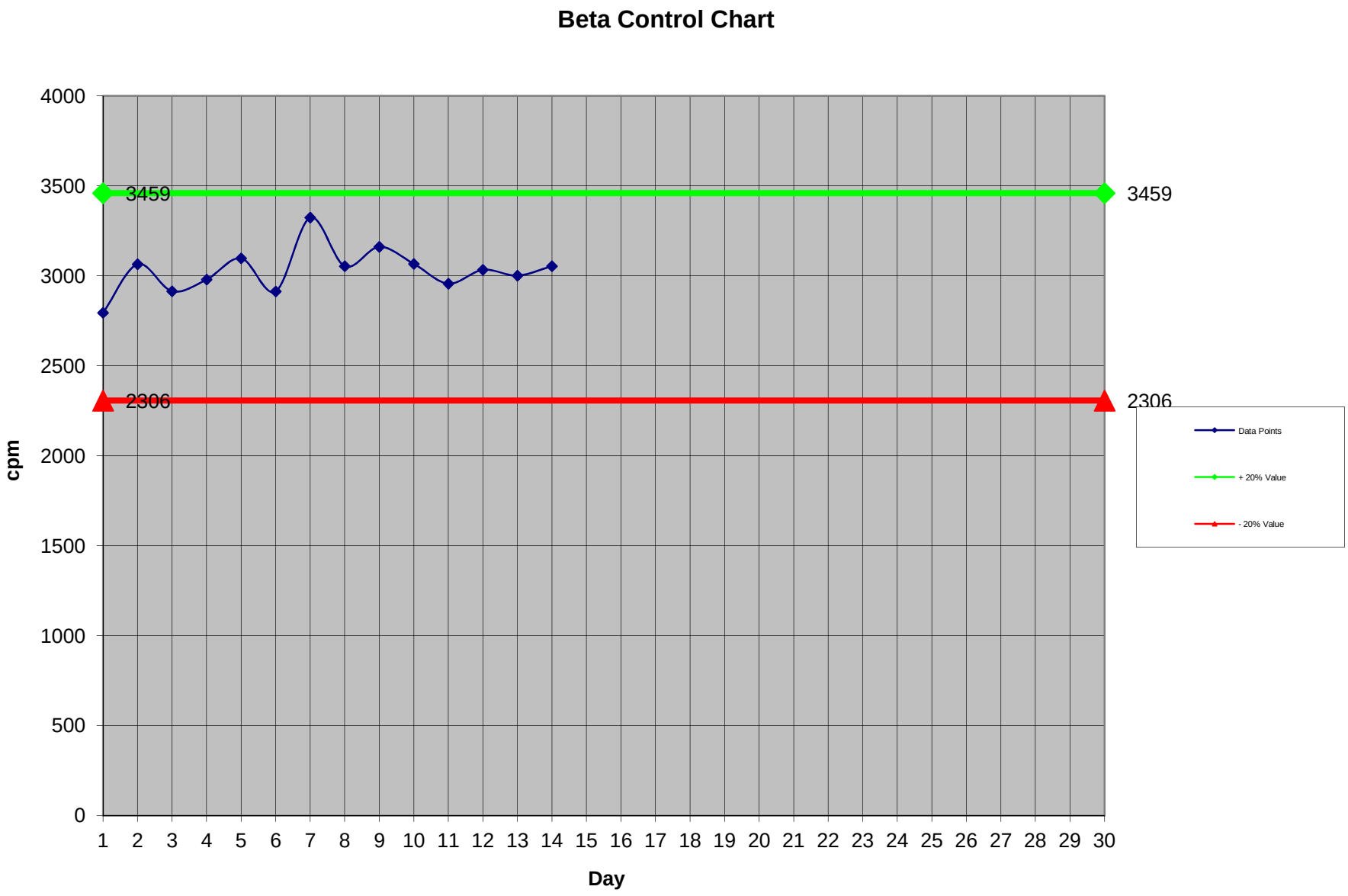
Model 2929 Beta Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

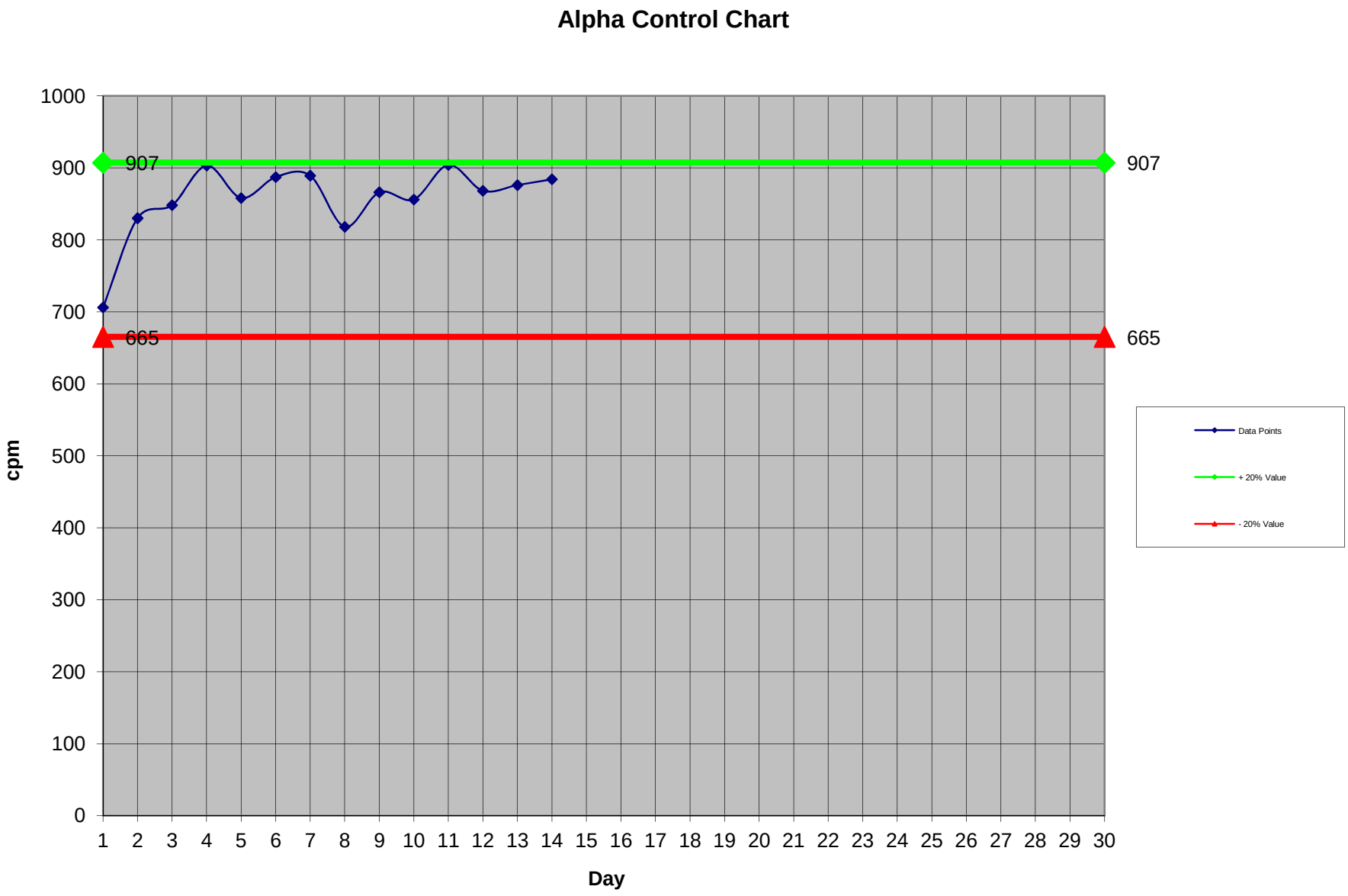
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2306-3459	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/13/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	138	2932	2794	35.5	P	WW
2/14/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	176	3240	3064	35.5	P	WW
2/15/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	142	3056	2914	35.5	P	WW
2/19/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	136	3115	2979	35.5	P	DS
2/20/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	137	3234	3097	35.5	P	WW
2/21/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	132	3045	2913	35.5	P	WW
2/22/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	141	3464	3323	35.5	P	WW
2/25/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	136	3189	3053	35.5	P	WW
2/26/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	130	3291	3161	35.5	P	WW
2/27/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	136	3202	3066	35.5	P	WW
2/28/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	148	3104	2956	35.5	P	WW
3/1/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	143	3176	3033	35.5	P	DS
3/4/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	167	3168	3001	35.5	P	DS
3/5/2013	2360/43-93	202410/299649	N	5/17/2013	049410	12,131	170	3223	3053	35.5	P	DS


Beta Control Chart
4000
3500
3000
2500
2000
1500
1000
500
0
cpm
3459
2306
3459
2306
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND CPM	READING CPM	Net CPM 665-907	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/13/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	0	706	706	41.7	P	WW
2/14/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	0	830	830	41.7	P	WW
2/15/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	2	850	848	41.7	P	WW
2/19/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	0	933	903	41.7	P	DS
2/20/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	0	858	858	41.7	P	WW
2/21/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	0	887	887	41.7	P	WW
2/22/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	1	890	889	41.7	P	WW
2/25/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	1	819	818	41.7	P	WW
2/26/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	0	866	866	41.7	P	WW
2/27/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	1	857	856	41.7	P	WW
2/28/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	1	905	904	41.7	P	WW
3/1/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	1	869	868	41.7	P	DS
3/4/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	0	876	876	41.7	P	DS
3/5/2013	2360/43-93	202410/299649	N	5/17/2013	039404	2,869	1	885	884	41.7	P	DS

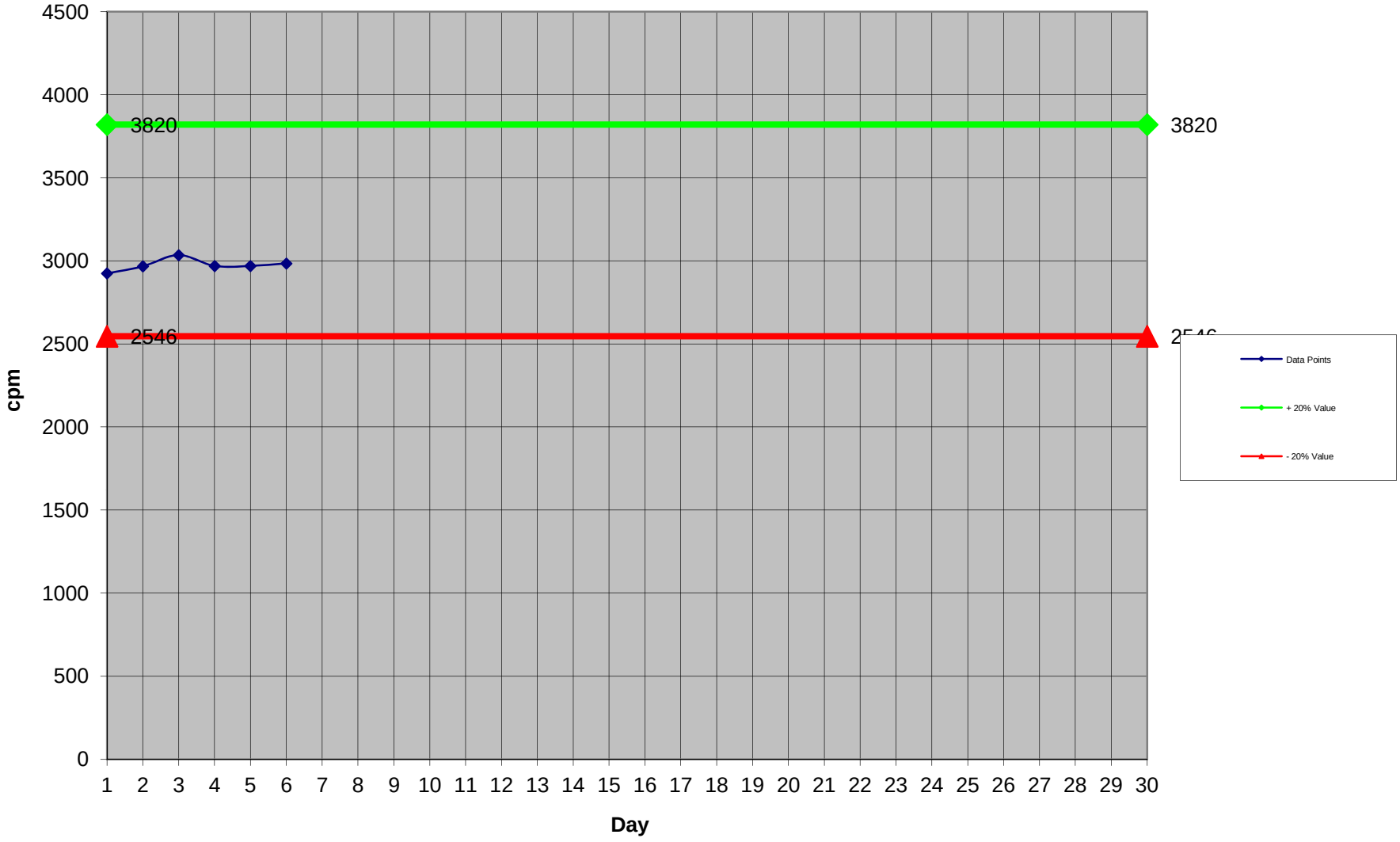

Alpha Control Chart
1000
900
800
700
600
500
400
300
200
100
0
cpm
907
665
907
665
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2546-3820	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/26/2013	2360/43-93	184949/268605	N	7/11/2013	049410	12,131	164	3088	2924	28.2	P	WW
2/27/2013	2360/43-93	184949/268605	N	7/11/2013	049410	12,131	158	3125	2967	28.2	P	WW
2/28/2013	2360/43-93	184949/268605	N	7/11/2013	049410	12,131	170	3204	3034	28.2	P	WW
3/1/2013	2360/43-93	184949/268605	N	7/11/2013	049410	12,131	164	3133	2969	28.2	P	WW
3/4/2013	2360/43-93	184949/268605	N	7/11/2013	049410	12,131	181	3150	2969	28.2	P	WW
3/5/2013	2360/43-93	184949/268605	N	7/11/2013	049410	12,131	177	3161	2984	28.2	P	WW

Beta Control Chart

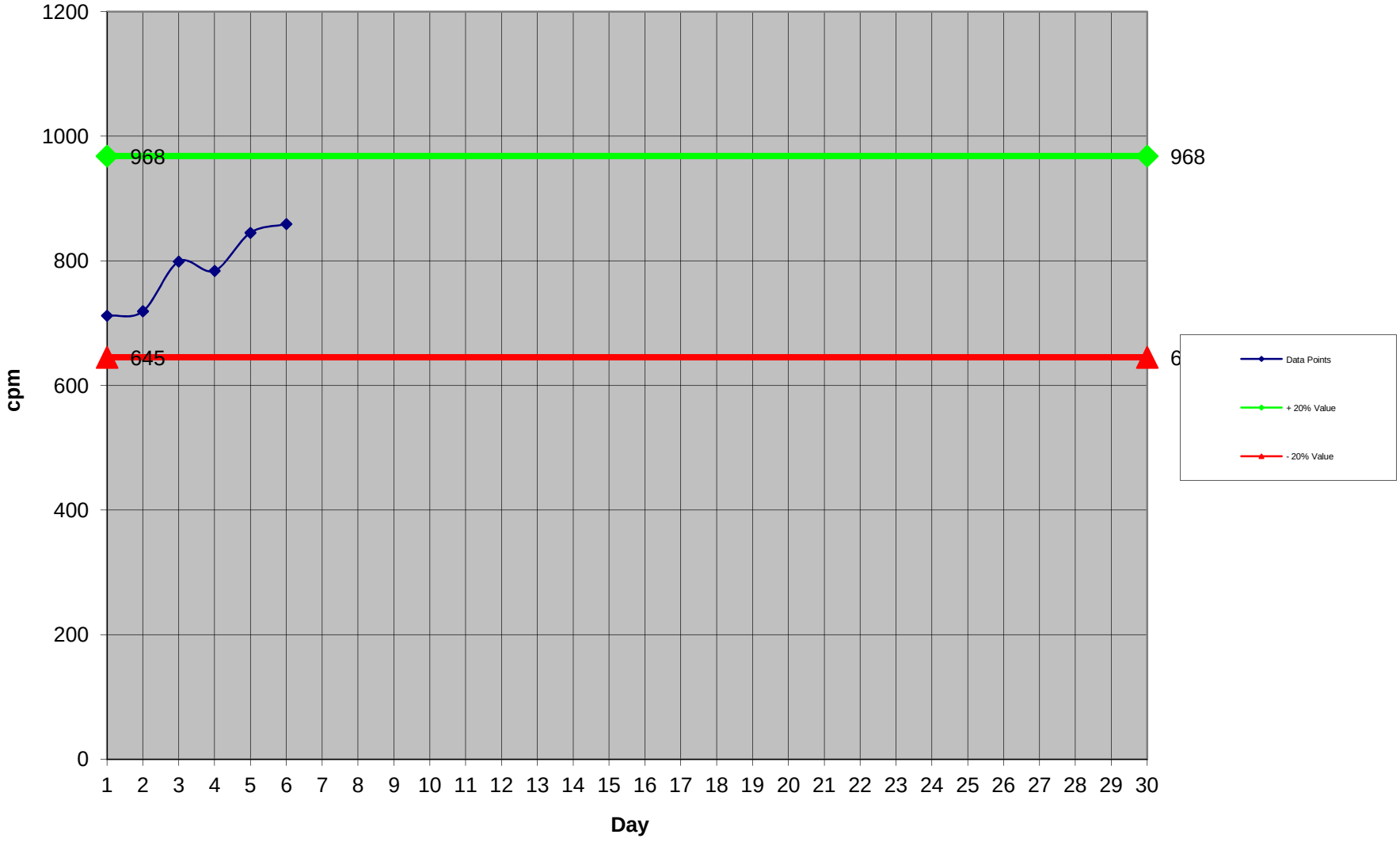


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND CPM	READING CPM	Net CPM 645-968	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/26/2013	2360/43-93	184949/268605	N	7/11/2013	039404	2,869	1	713	712	34.5	P	WW
2/27/2013	2360/43-93	184949/268605	N	7/11/2013	039404	2,869	0	719	719	34.5	P	WW
2/28/2013	2360/43-93	184949/268605	N	7/11/2013	039404	2,869	1	800	799	34.5	P	WW
3/1/2013	2360/43-93	184949/268605	N	7/11/2013	039404	2,869	1	785	784	34.5	P	WW
3/4/2013	2360/43-93	184949/268605	N	7/11/2013	039404	2,869	0	845	845	34.5	P	WW
3/5/2013	2360/43-93	184949/268605	N	7/11/2013	039404	2,869	1	860	859	34.5	P	WW

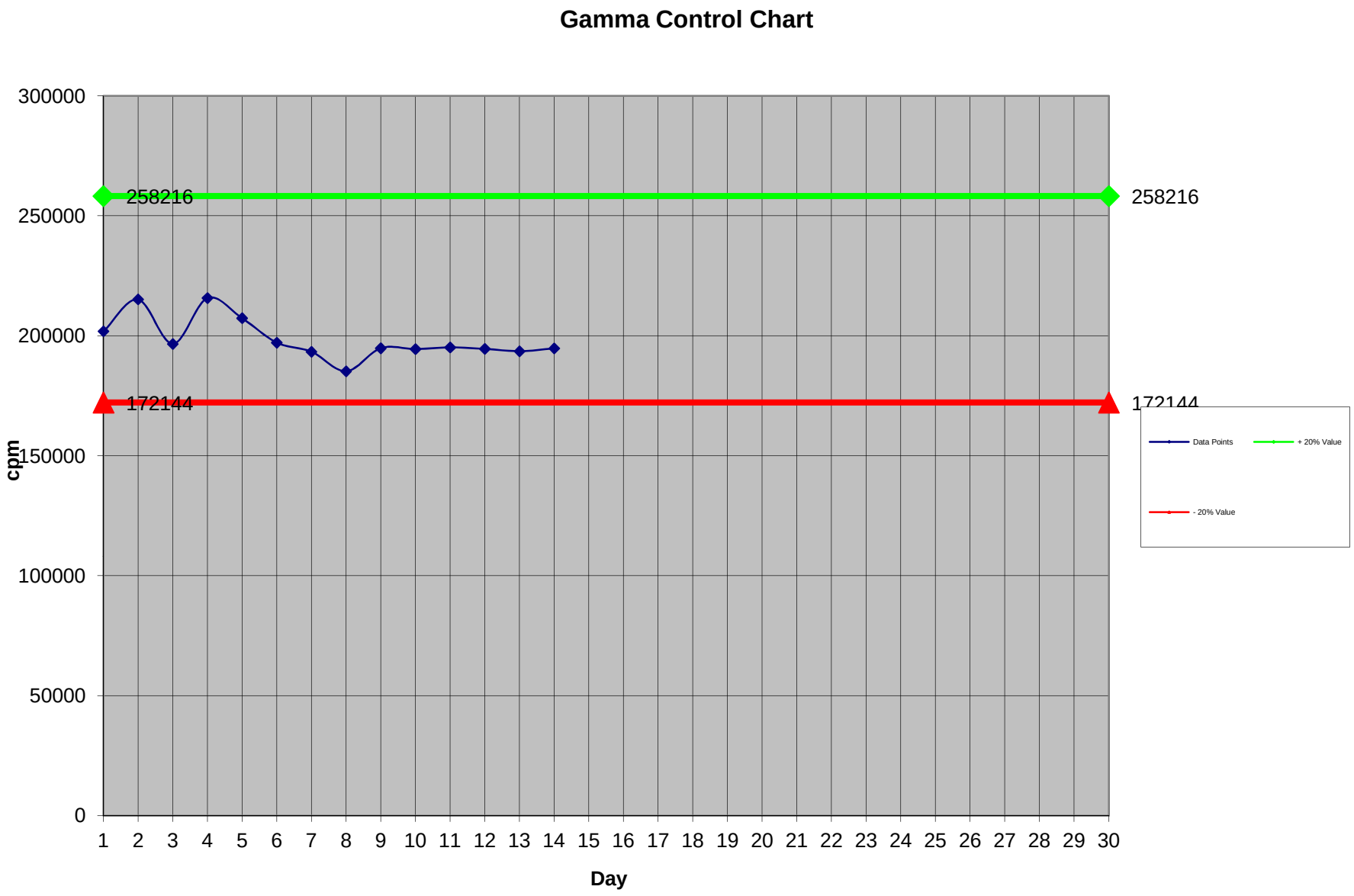
Alpha Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY DPM	BACKGROUND CPM	READING CPM	Net CPM 172144-258216	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/13/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4754	206644	201890	N/A	P	DS
2/14/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4740	219887	215147	N/A	P	DS
2/15/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4595	201185	196590	N/A	P	DS
2/19/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4458	220196	215738	N/A	P	DS
2/20/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4341	211652	207311	N/A	P	DS
2/21/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4233	201355	197122	N/A	P	DS
2/22/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4667	197985	193318	N/A	P	DS
2/25/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4807	189974	185167	N/A	P	DS
2/26/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4725	199518	194793	N/A	P	DS
2/27/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4843	199286	194443	N/A	P	DS
2/28/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	5000	200120	195120	N/A	P	DS
3/1/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4976	199522	194546	N/A	P	DS
3/4/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4876	198421	193545	N/A	P	DS
3/5/2013	2350-1/44-10	126197/192598	N	4/20/2013	119313	6,670,000	4931	199673	194742	N/A	P	DS

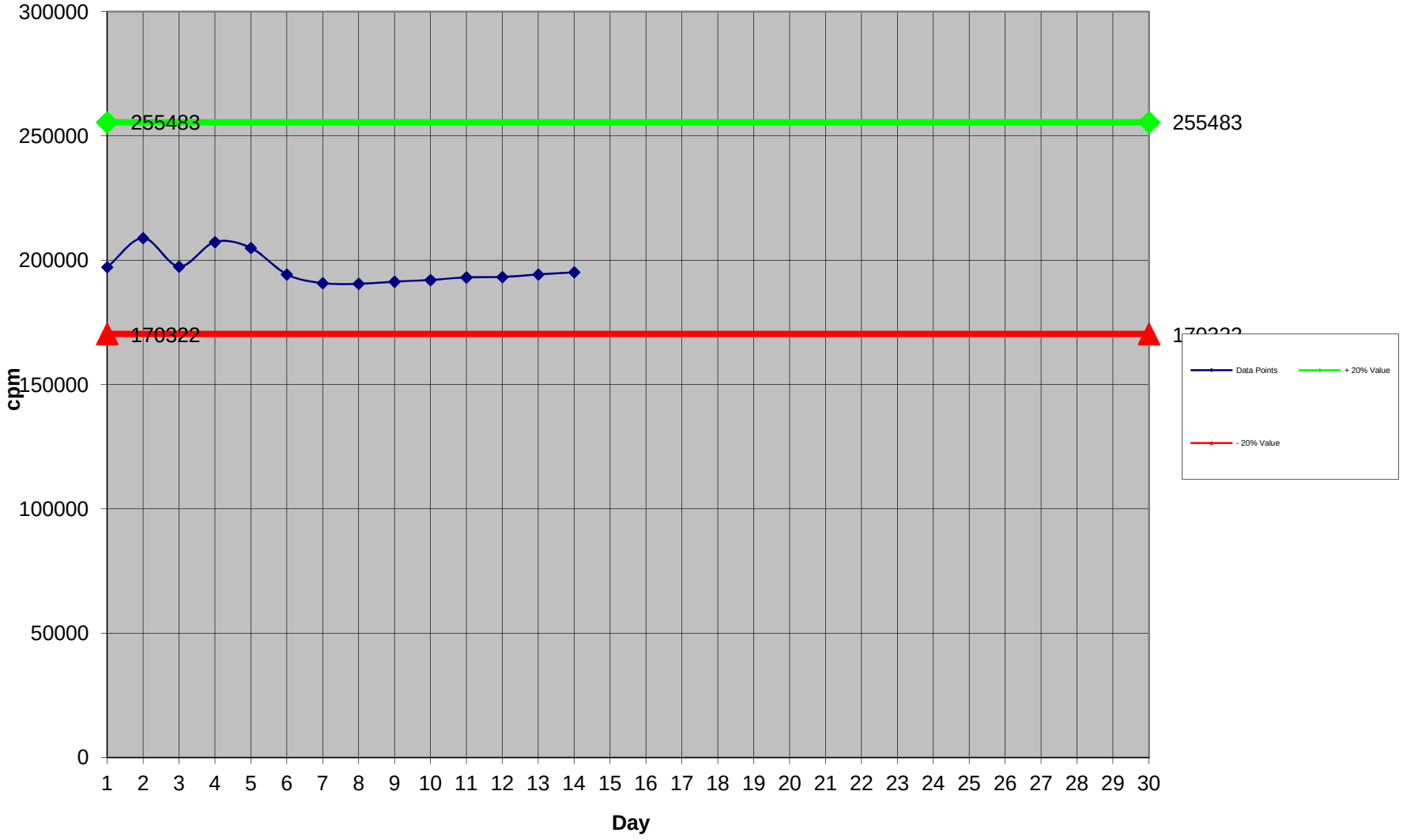

Gamma Control Chart
300000
250000
200000
150000
100000
50000
0
cpm
258216
258216
172144
172144
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY DPM	BACKGROUND CPM	READING CPM	Net CPM 170322-255483	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/13/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4821	201982	197161	N/A	P	AM
2/14/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4537	213382	208845	N/A	P	AM
2/15/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4682	202113	197431	N/A	P	AM
2/19/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4192	211488	207296	N/A	P	AM
2/20/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4279	209147	204868	N/A	P	AM
2/21/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4259	198534	194275	N/A	P	AM
2/22/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4676	195413	190737	N/A	P	AM
2/25/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4695	195217	190522	N/A	P	AM
2/26/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4893	196227	191334	N/A	P	AM
2/27/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4892	196927	192035	N/A	P	AM
2/28/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4987	198058	193071	N/A	P	AM
3/1/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4867	198104	193237	N/A	P	AM
3/4/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4851	199091	194240	N/A	P	AM
3/5/2013	2350-1/44-10	120633/316939	N	8/15/2013	119313	6,670,000	4987	200120	195133	N/A	P	AM

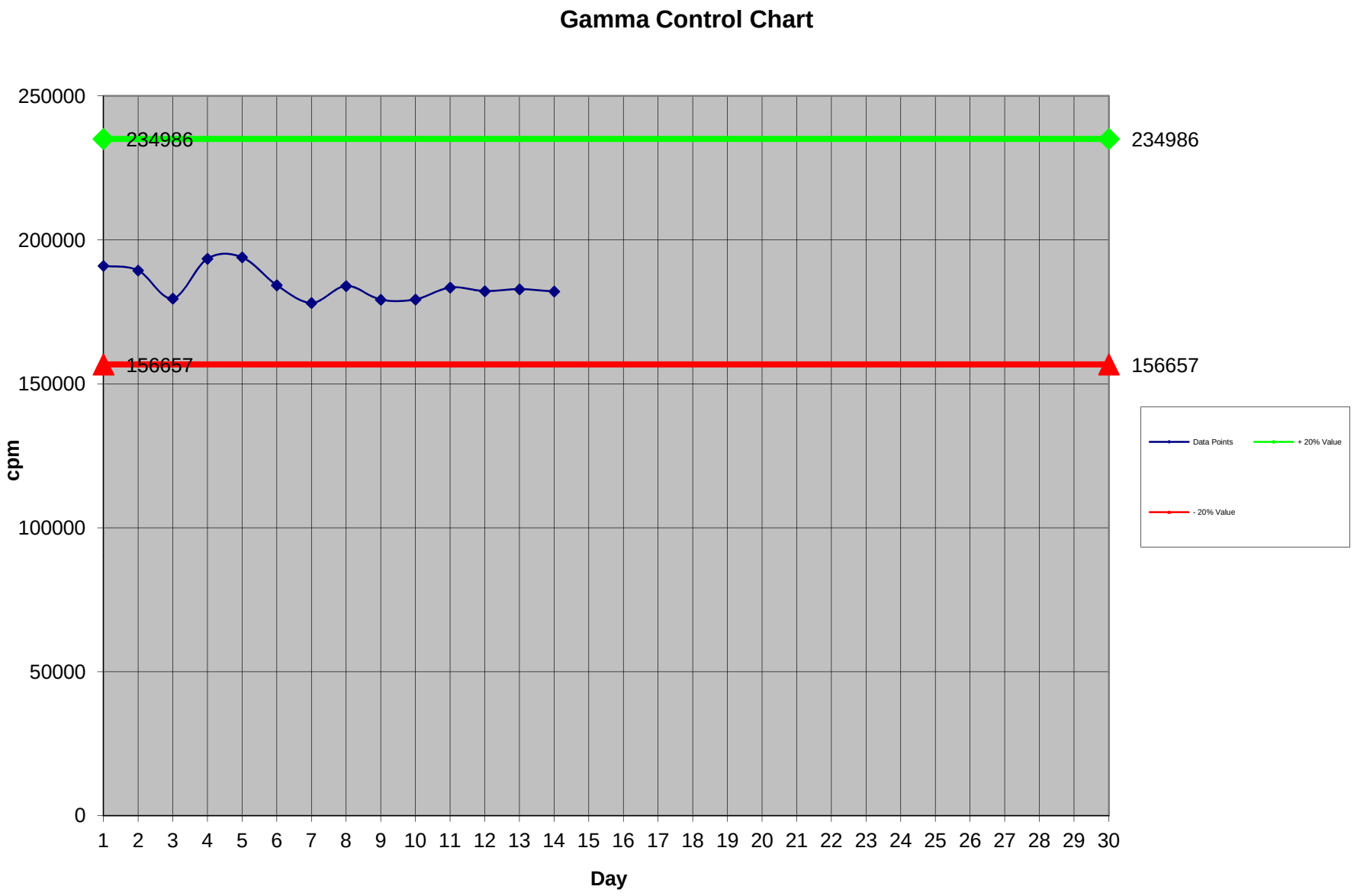
Gamma Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

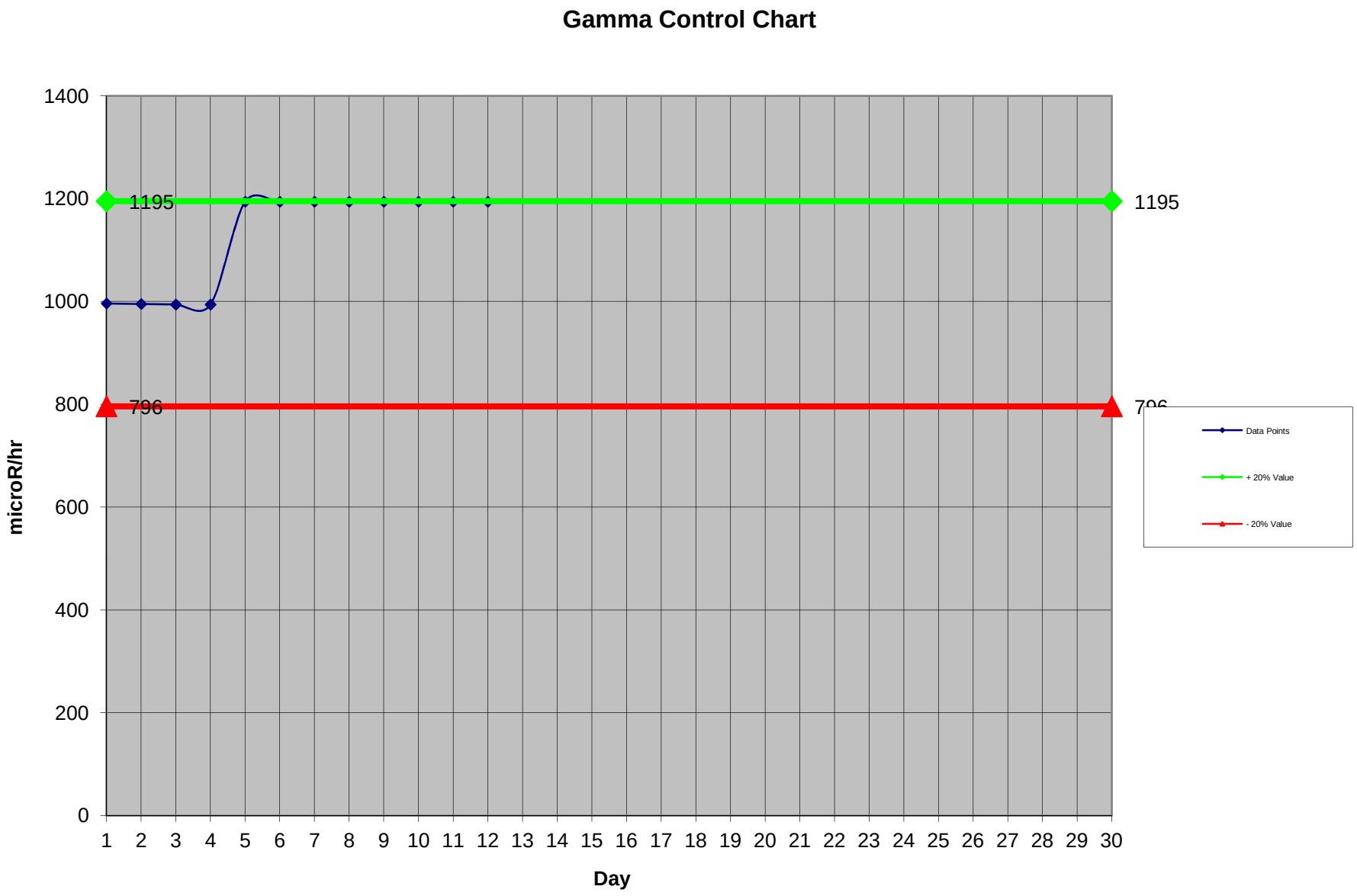
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY DPM	BACKGROUND CPM	READING CPM	Net CPM 156657-234986	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
2/13/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4496	195432	190936	N/A	P	DS
2/14/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4372	193689	189317	N/A	P	DS
2/15/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4452	183994	179542	N/A	P	DS
2/19/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4084	197503	193419	N/A	P	DS
2/20/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4247	198136	193889	N/A	P	WW
2/21/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4153	188345	184192	N/A	P	WW
2/22/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4364	182378	178014	N/A	P	WW
2/25/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4516	188451	183935	N/A	P	WW
2/26/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4698	183874	179176	N/A	P	WW
2/27/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4802	184053	179251	N/A	P	WW
2/28/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4913	188282	183369	N/A	P	WW
3/1/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4851	186991	182140	N/A	P	WW
3/4/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4769	187569	182800	N/A	P	WW
3/5/2013	2350-1/44-10	79037/316936	N	8/15/2013	119313	6,670,000	4890	186904	182014	N/A	P	WW


Gamma Control Chart
250000
200000
150000
100000
50000
0
cpm
234986
234986
156657
156657
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY dpm	BACKGROUND microR/hr	READING microR/hr	Net microR/hr 796-1195	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/20/2013	19	115870	N	4/17/2014	O19456	6,670,000	4	1000	996	N/A	P	AM
8/21/2013	19	115870	N	4/17/2014	O19456	6,670,000	5	1000	995	N/A	P	AM
8/22/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1000	994	N/A	P	AM
8/23/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1000	994	N/A	P	AM
8/26/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM
8/27/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM
8/28/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM
8/29/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM
8/30/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM
9/3/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM
9/4/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM
9/5/2013	19	115870	N	4/17/2014	O19456	6,670,000	6	1200	1194	N/A	P	AM

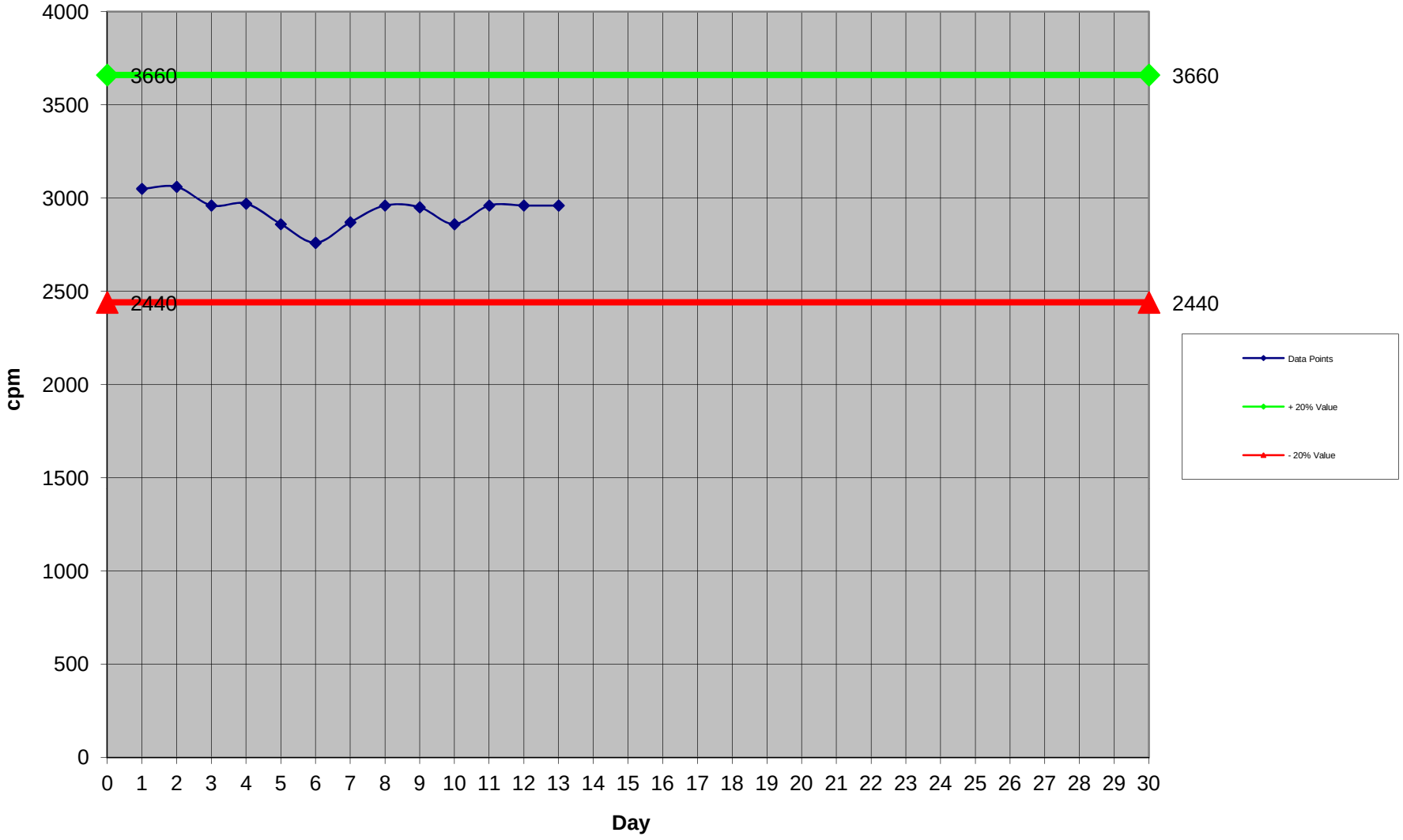

Gamma Control Chart
1400
1200
1000
800
600
400
200
0
microR/hr
1195
796
1195
796
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2440-3660	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/19/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	50	3100	3050	28	P	DS
8/20/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	3100	3060	28	P	DS
8/21/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	3000	2960	27	P	DS
8/22/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	30	3000	2970	28	P	DS
8/23/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	2900	2860	26	P	DS
8/26/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	2800	2760	26	P	DS
8/27/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	30	2900	2870	27	P	DS
8/28/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	3000	2960	27	P	DS
8/29/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	50	3000	2950	27	P	DS
8/30/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	2900	2860	26	P	DS
9/3/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	3000	2960	27	P	DS
9/4/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	3000	2960	27	P	DS
9/5/2013	3/44-9	269098/094812	N	5/14/2014	119715	10,800	40	3000	2960	27	P	DS

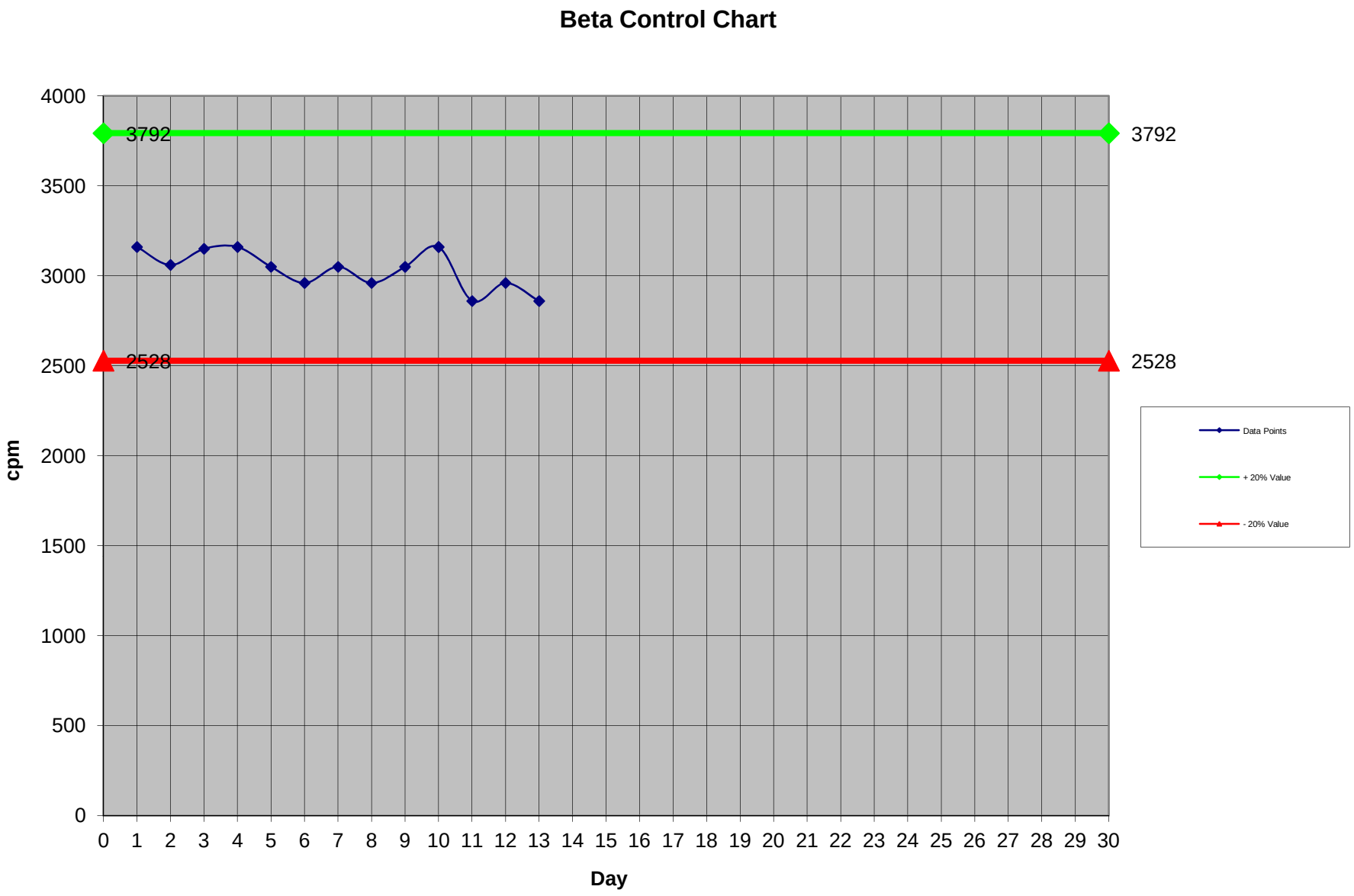
Beta Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2528-3792	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/19/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	3200	3160	29	P	DS
8/20/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	3100	3060	28	P	DS
8/21/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	50	3200	3150	29	P	DS
8/22/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	3200	3160	29	P	DS
8/23/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	50	3100	3050	28	P	DS
8/26/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	3000	2960	27	P	DS
8/27/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	50	3100	3050	28	P	DS
8/28/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	3000	2960	27	P	DS
8/29/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	50	3100	3050	28	P	DS
8/30/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	3200	3160	29	P	DS
9/3/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	2900	2860	26	P	DS
9/4/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	3000	2960	27	P	DS
9/5/2013	3/44-9	150306/128751	N	11/15/2013	119715	10,800	40	2900	2860	26	P	DS


Beta Control Chart
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3000
2500
2000
1500
1000
500
0
cpm
3792
2528
3792
2528
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

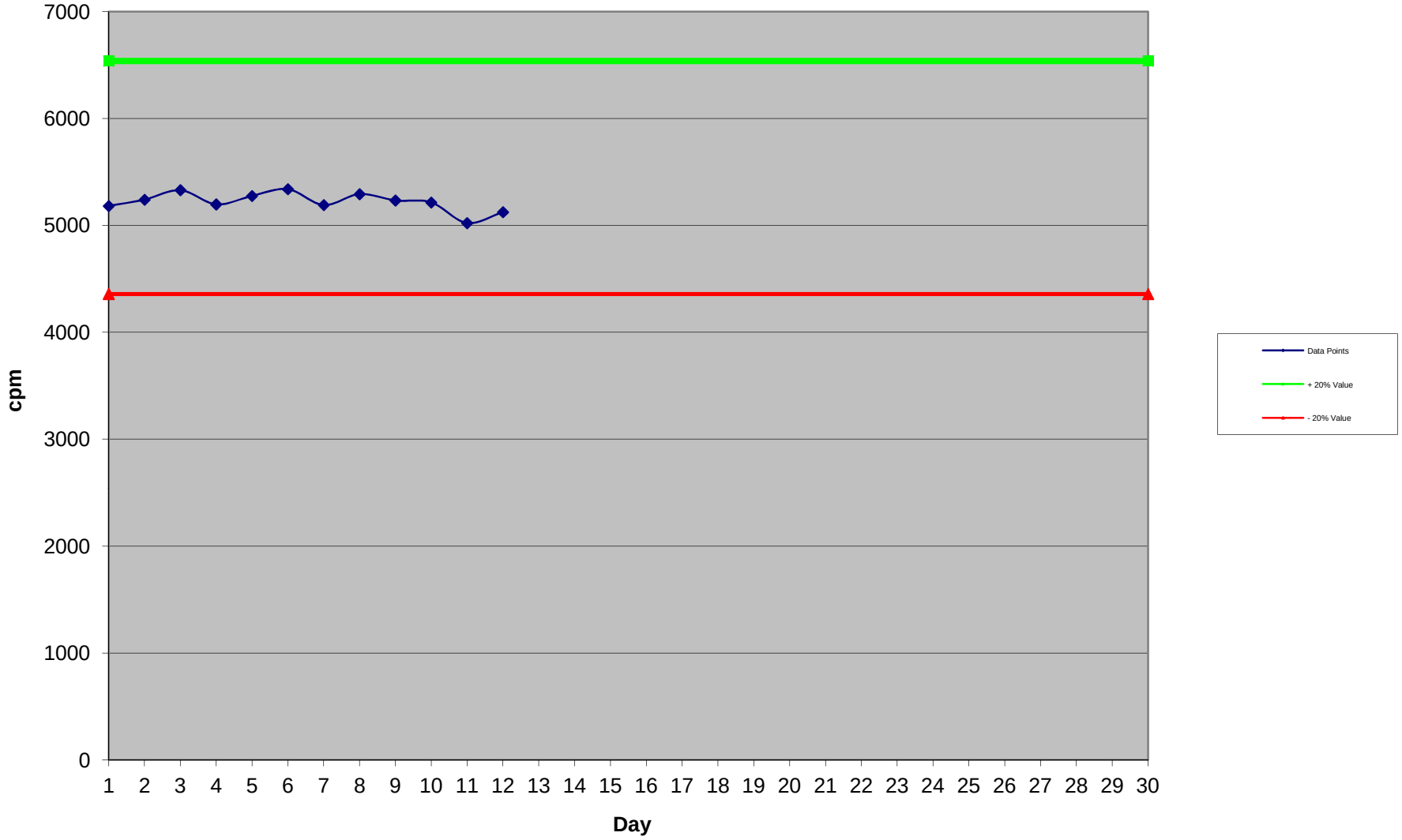
LUDLUM MODEL 2929
DAILY 30 MINUTE BACKGROUND AND EFFICIENCY

For:	August, September 2013 NSF Indian Head								
Instrument ID:	118407					Detector ID:	O92751		
Cal Due Date:	10/26/2013								
Sources Used:				Alpha S/N:	Th-230/119701		Activity:	8,880	alphas/min
				Beta S/N:	Tc-99/119715		Activity:	10,800	betas/min
				Acceptable Range of Background:		0	CPM to	2.2	CPM α
Background Count Time:		30	Minutes			31	CPM to	52	CPM βγ

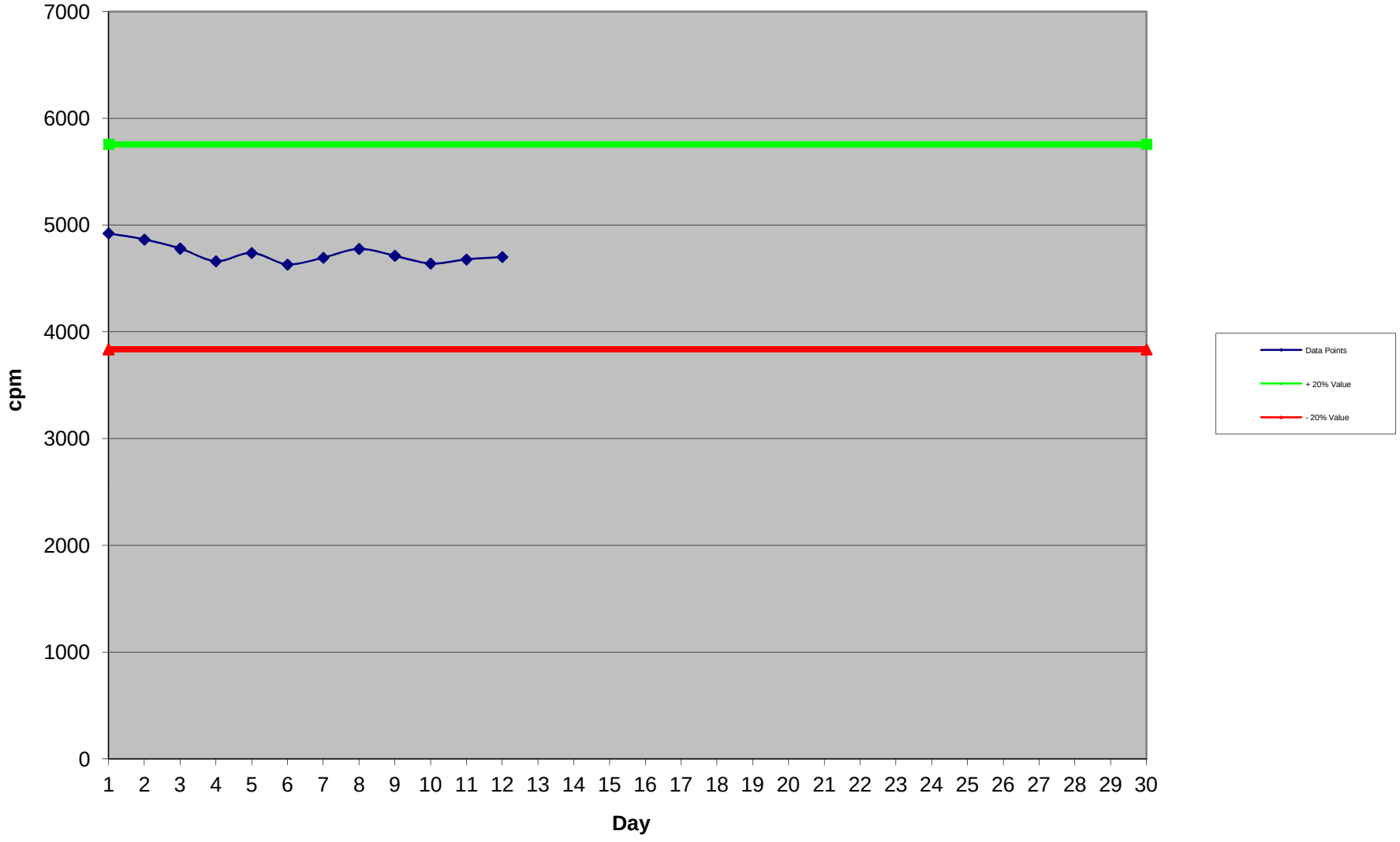
Date	Total Counts α	Total Counts βγ	30-Minute Background (CPM) α	30-Minute Background (CPM) βγ	1-min α Source Counts 4358-6537	Eff. α	1- min βγ Source Counts 3837-5755	Eff. βγ	Initials
8/20/2013	5	1326	0.2	44.2	5181	67.5	4922	45.1	DS
8/21/2013	10	1245	0.3	41.5	5240	67.5	4865	45.1	DS
8/22/2013	8	1286	0.3	42.9	5329	67.5	4780	45.1	DS
8/23/2013	12	1302	0.4	43.4	5196	67.5	4661	45.1	DS
8/26/2013	7	1316	0.2	43.9	5275	67.5	4739	45.1	DS
8/27/2013	2	1304	0.1	43.5	5338	67.5	4631	45.1	DS
8/28/2013	5	1361	0.2	45.4	5190	67.5	4694	45.1	DS
8/29/2013	8	1352	0.3	45.1	5292	67.5	4776	45.1	DS
8/30/2013	10	1249	0.3	41.6	5233	67.5	4712	45.1	DS
9/3/2013	16	1321	0.5	44.0	5214	67.5	4639	45.1	DS
9/4/2013	8	1276	0.3	42.5	5021	67.5	4678	45.1	DS
9/5/2013	12	1331	0.4	44.4	5123	67.5	4701	45.1	DS

Reviewed by:	*Daniel Spicuzza*	Date:	9/5/2013

Model 2929 Alpha Control Chart



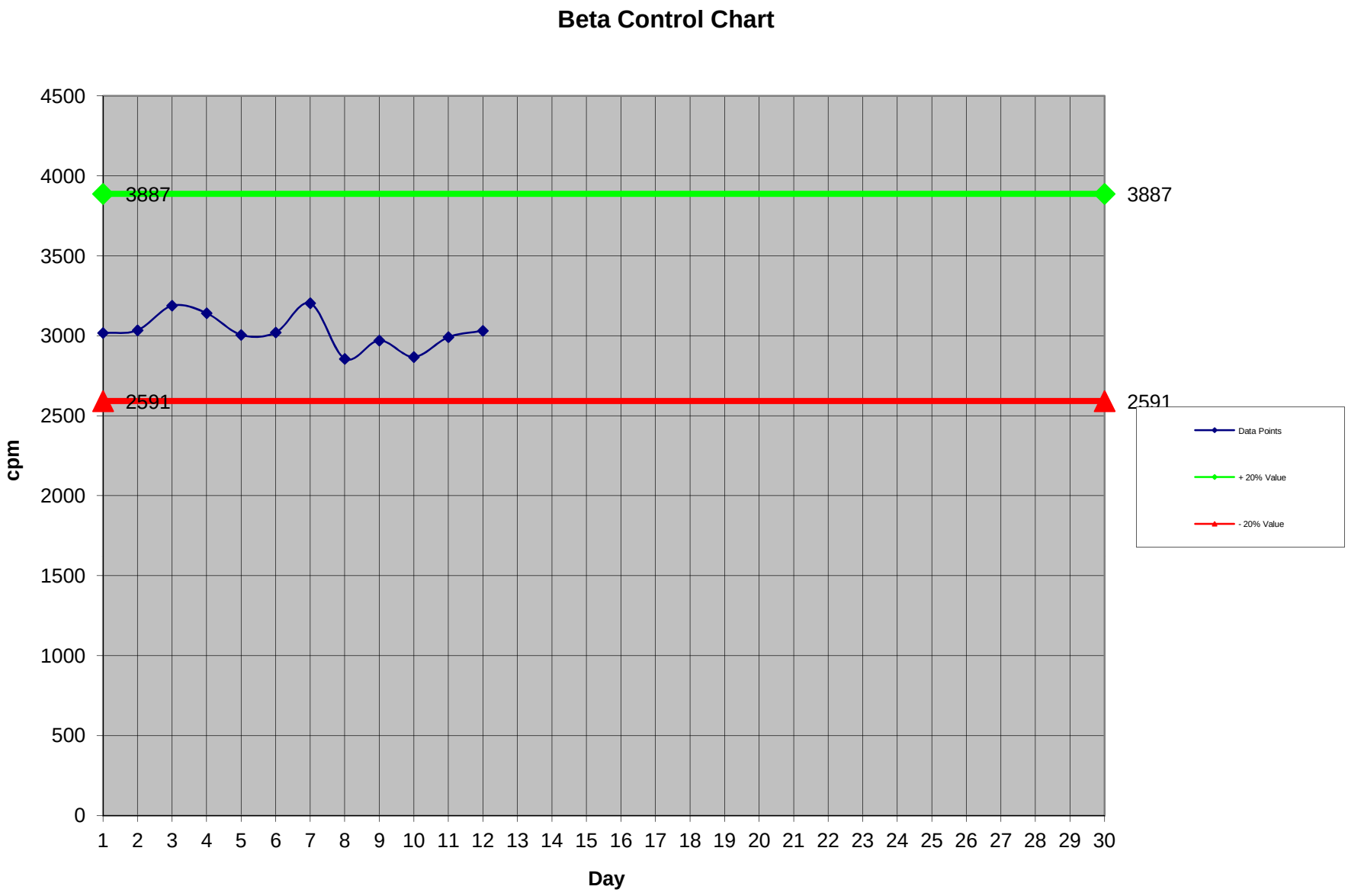
Model 2929 Beta Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

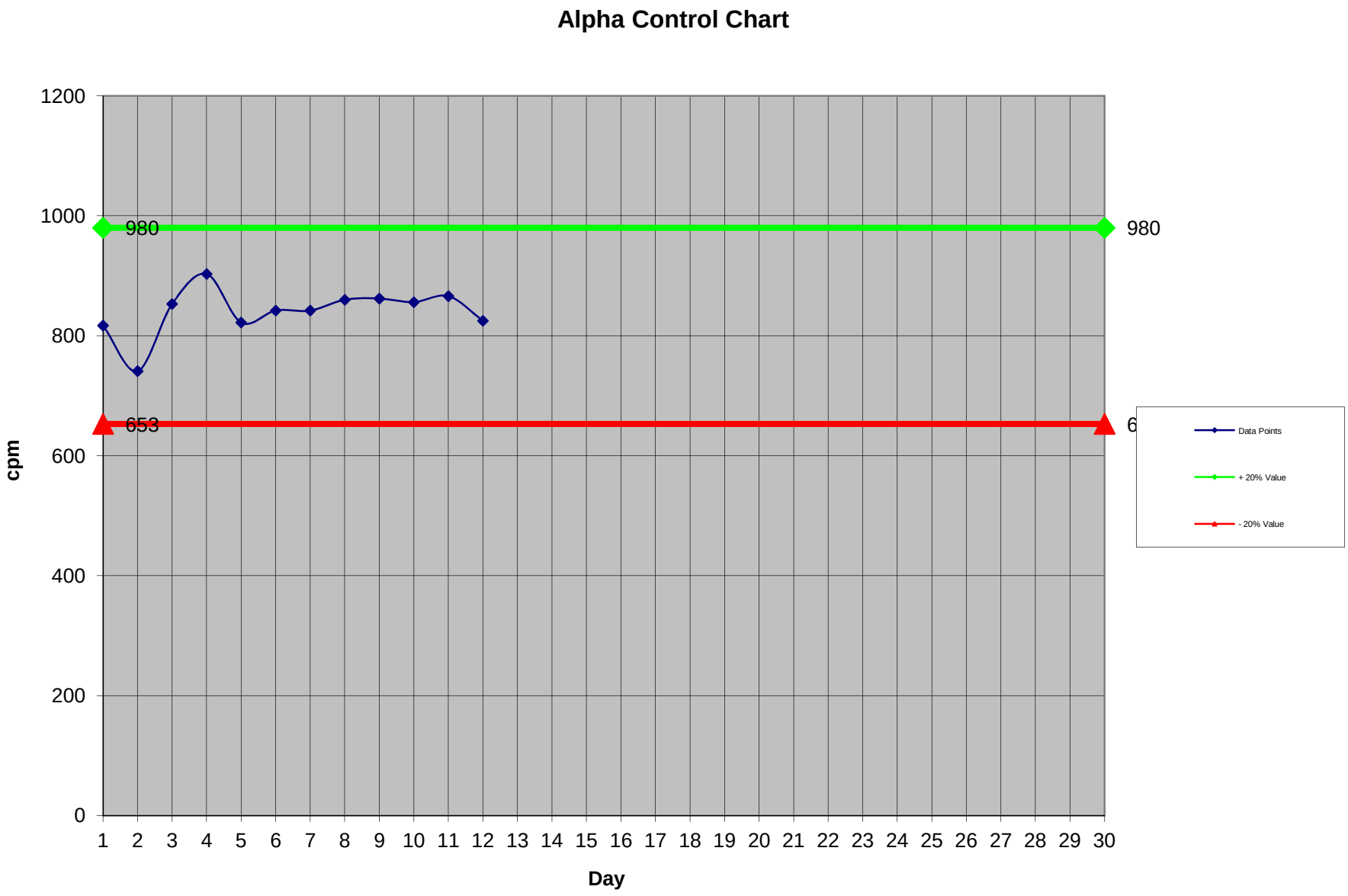
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2591-3887	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/20/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	162	3179	3017	32.4	P	WW
8/21/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	175	3209	3034	32.4	P	WW
8/22/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	182	3370	3188	32.4	P	WW
8/23/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	157	3298	3141	32.4	P	WW
8/26/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	175	3180	3005	32.4	P	WW
8/27/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	169	3189	3020	32.4	P	WW
8/28/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	170	3373	3203	32.4	P	WW
8/29/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	156	3011	2855	32.4	P	WW
8/30/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	162	3132	2970	32.4	P	WW
9/3/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	154	3021	2867	32.4	P	WW
9/4/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	134	3125	2991	32.4	P	WW
9/5/2013	2360/43-93	297848/323069	N	11/8/2013	049410	12,131	147	3178	3031	32.4	P	WW


Beta Control Chart
4500
4000
3500
3000
2500
2000
1500
1000
500
0
cpm
3887
3887
2591
2591
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND CPM	READING CPM	Net CPM 653-980	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/20/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	733	817	40.9	P	WW
8/21/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	741	741	40.9	P	WW
8/22/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	853	853	40.9	P	WW
8/23/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	903	903	40.9	P	WW
8/26/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	822	822	40.9	P	WW
8/27/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	842	842	40.9	P	WW
8/28/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	1	843	842	40.9	P	WW
8/29/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	860	860	40.9	P	WW
8/30/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	862	862	40.9	P	WW
9/3/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	856	856	40.9	P	WW
9/4/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	1	867	866	40.9	P	WW
9/5/2013	2360/43-93	297848/323069	N	11/8/2013	039404	2,869	0	825	825	40.9	P	WW

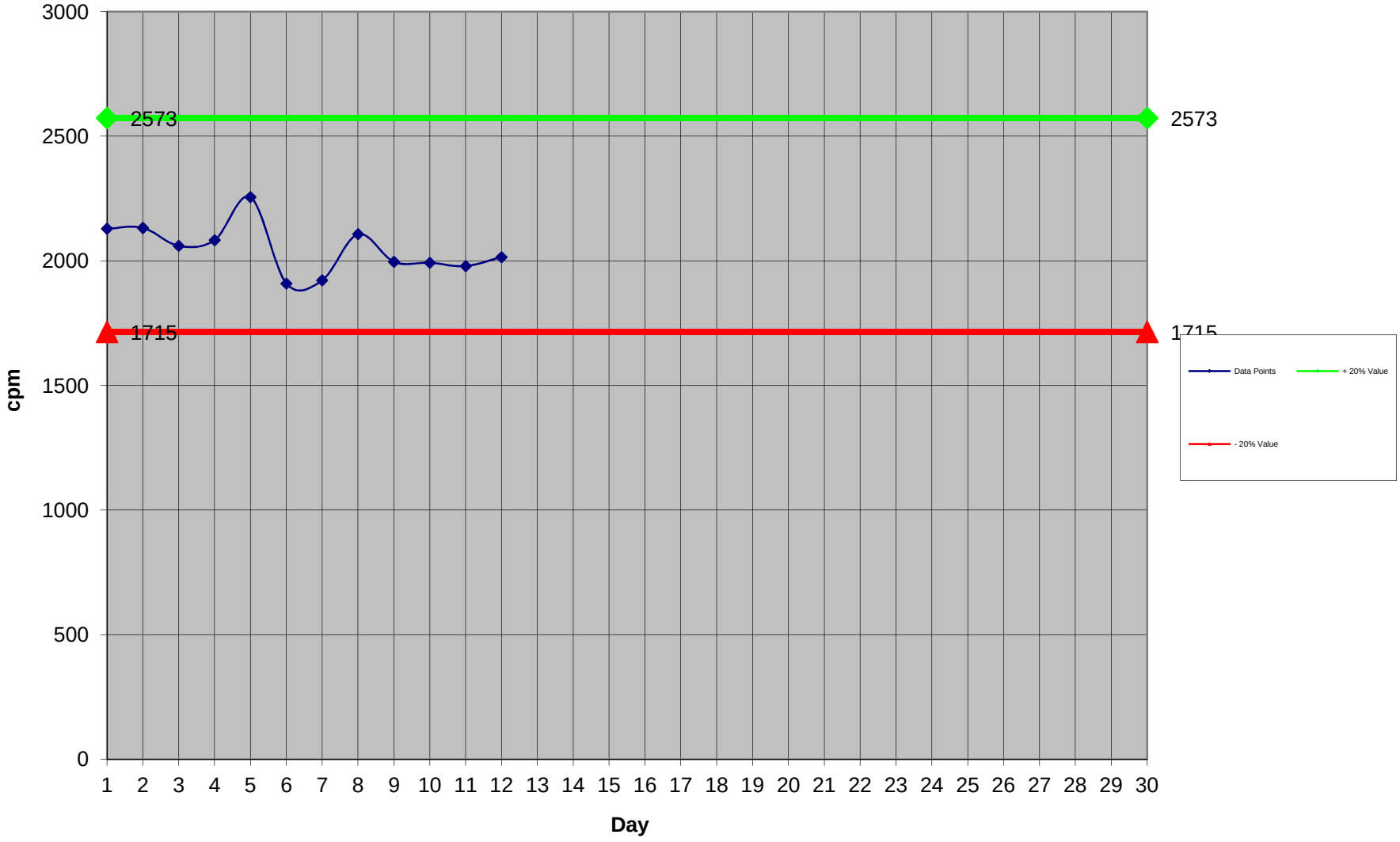

Alpha Control Chart
1200
1000
800
600
400
200
0
cpm
980
980
653
6
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 1715-2573	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/20/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	102	2231	2129	25.9	P	WW
8/21/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	153	2285	2132	25.9	P	WW
8/22/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	123	2183	2060	25.9	P	WW
8/23/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	126	2209	2083	25.9	P	WW
8/26/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	136	2392	2256	25.9	P	WW
8/27/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	113	2022	1909	25.9	P	WW
8/28/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	153	2075	1922	25.9	P	WW
8/29/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	123	2230	2107	25.9	P	WW
8/30/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	111	2107	1996	25.9	P	WW
9/3/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	111	2103	1992	25.9	P	WW
9/4/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	123	2102	1979	25.9	P	WW
9/5/2013	2360/43-93	297779/323064	N	11/9/2013	049410	12,131	119	2134	2015	25.9	P	WW

Beta Control Chart

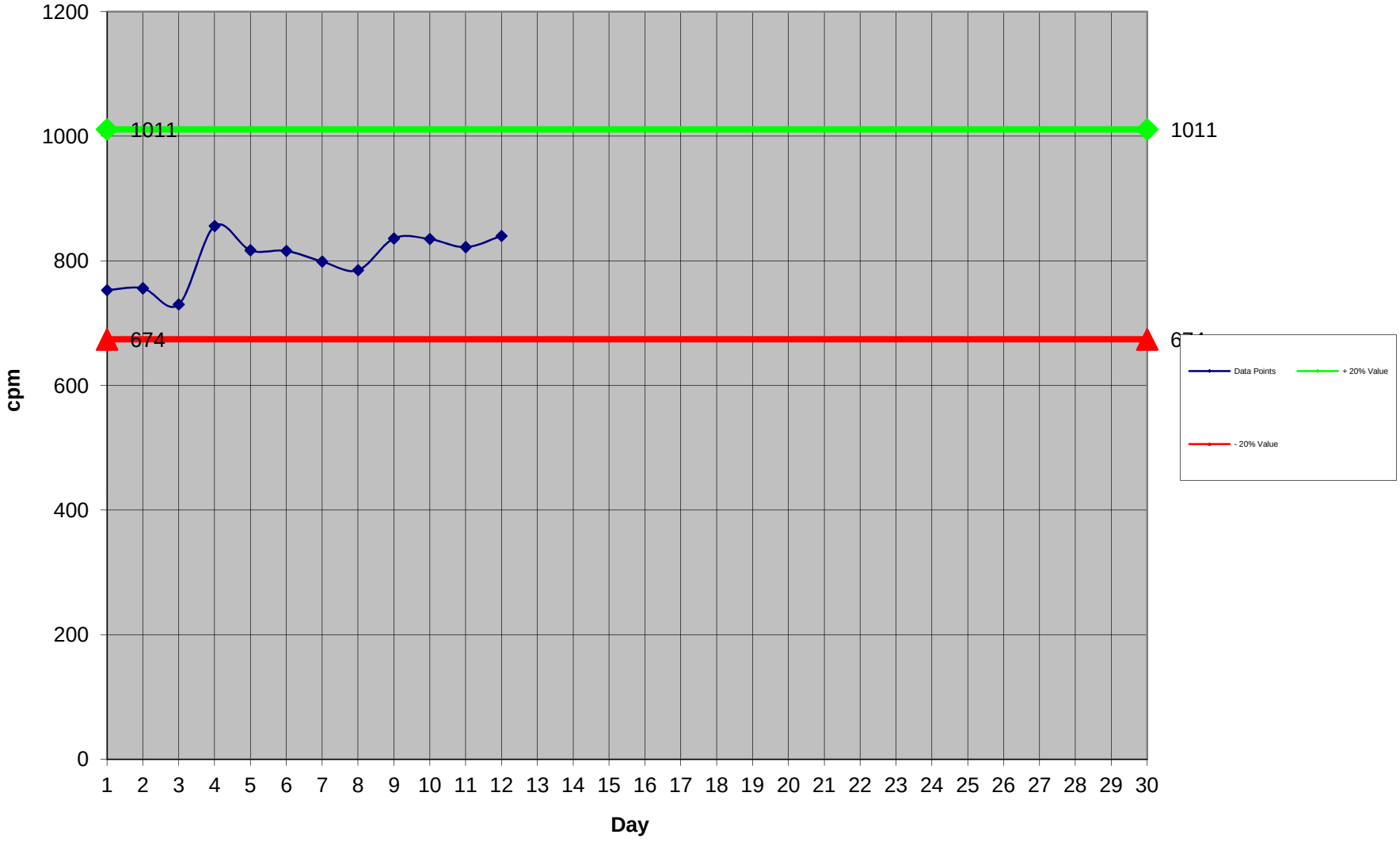


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND CPM	READING CPM	Net CPM 674-1011	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/20/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	753	753	40.7	P	WW
8/21/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	756	756	40.7	P	WW
8/22/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	1	731	730	40.7	P	WW
8/23/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	2	858	856	40.7	P	WW
8/26/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	817	817	40.7	P	WW
8/27/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	816	816	40.7	P	WW
8/28/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	799	799	40.7	P	WW
8/29/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	785	785	40.7	P	WW
8/30/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	836	836	40.7	P	WW
9/3/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	835	835	40.7	P	WW
9/4/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	1	823	822	40.7	P	WW
9/5/2013	2360/43-93	297779/323064	N	11/9/2013	039404	2,869	0	840	840	40.7	P	WW

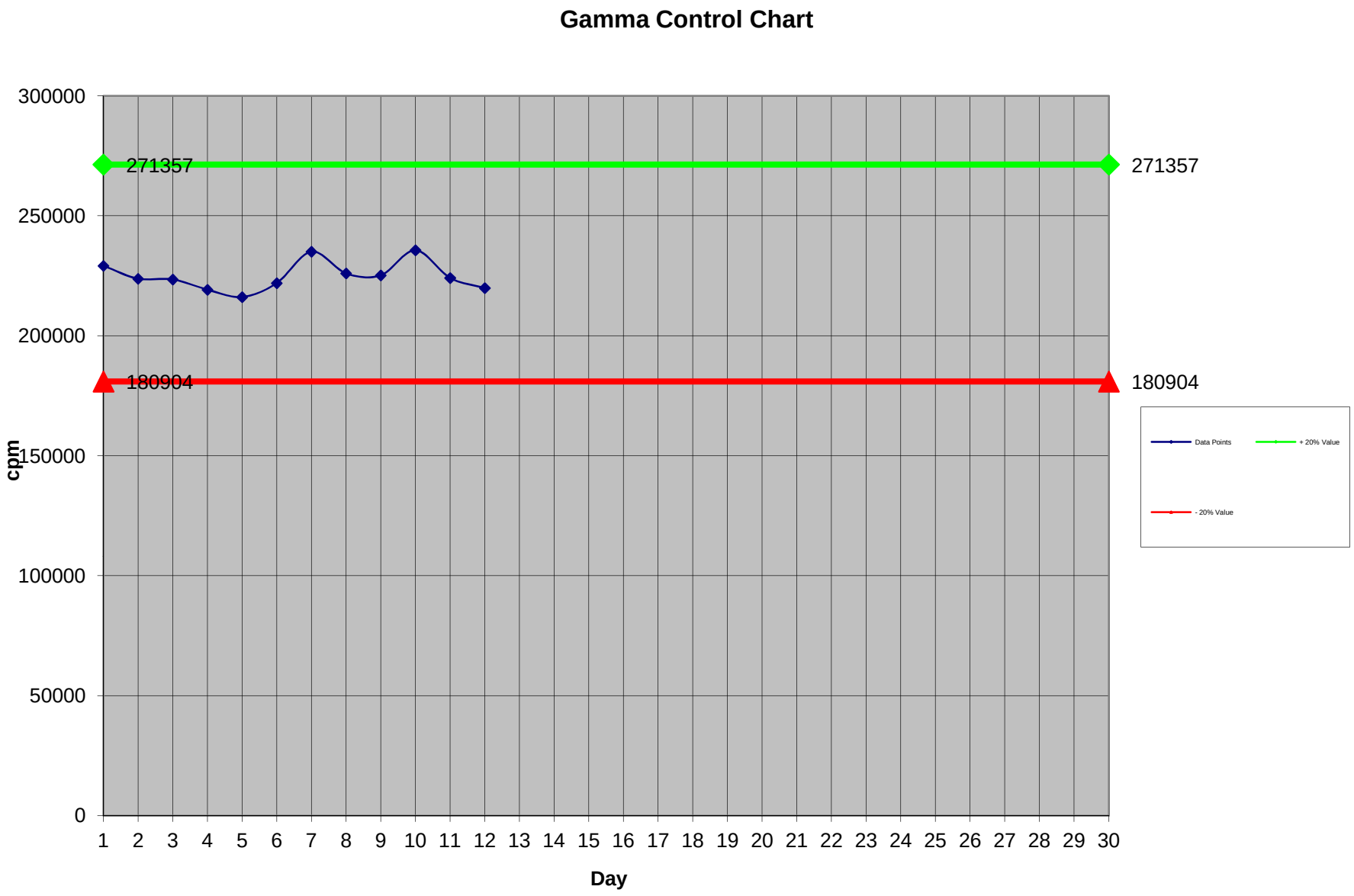
Alpha Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY DPM	BACKGROUND CPM	READING CPM	Net CPM 180904-271357	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/20/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	5017	234130	229113	N/A	P	HO
8/21/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	5016	228760	223744	N/A	P	HO
8/22/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	6725	230163	223438	N/A	P	HO
8/23/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	6262	225412	219150	N/A	P	HO
8/26/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	5166	221230	216064	N/A	P	AM
8/27/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	5705	227620	221915	N/A	P	AM
8/28/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	4450	239476	235026	N/A	P	AM
8/29/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	4416	230385	225969	N/A	P	AM
8/30/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	4333	229486	225153	N/A	P	AM
9/3/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	4609	240205	235596	N/A	P	AM
9/4/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	4689	228763	224074	N/A	P	AM
9/5/2013	2350-1/44-10	117014/316939	N	6/27/2014	O19456	6,670,000	4732	224567	219835	N/A	P	AM

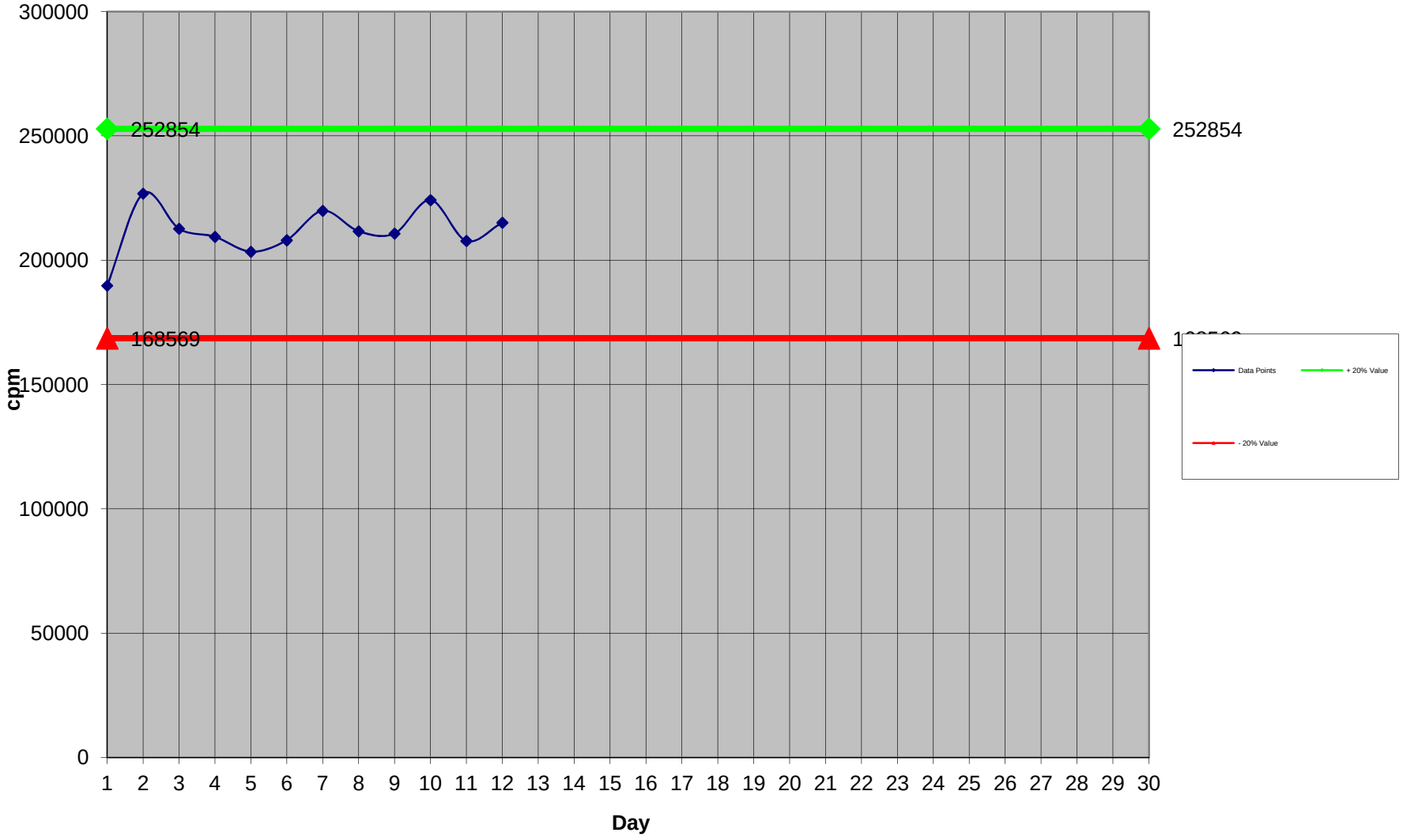

Gamma Control Chart
300000
250000
200000
150000
100000
50000
0
cpm
271357
271357
180904
180904
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY DPM	BACKGROUND CPM	READING CPM	Net CPM 168569-252854	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
8/20/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4999	194778	189779	N/A	P	HO
8/21/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	5499	232267	226768	N/A	P	HO
8/22/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4500	217118	212618	N/A	P	HO
8/23/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4554	213917	209363	N/A	P	HO
8/26/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	5295	208710	203415	N/A	P	AM
8/27/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	6116	214135	208019	N/A	P	AM
8/28/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	5005	224856	219851	N/A	P	AM
8/29/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4407	216022	211615	N/A	P	AM
8/30/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4519	215214	210695	N/A	P	AM
9/3/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4855	229030	224175	N/A	P	AM
9/4/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4843	212567	207724	N/A	P	AM
9/5/2013	2350-1/44-10	98639/316936	N	6/27/2014	O19456	6,670,000	4798	219876	215078	N/A	P	AM

Gamma Control Chart



Appendix N
Characterization Sample Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-3592-1
TestAmerica Sample Delivery Group: NSF Indian Head
Client Project/Site: Waste Characterizations

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Daniel Spicuzza

Authorized for release by:
9/27/2013 5:32:35 PM

Erika Gish, Project Manager I
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Receipt Checklists 7
Definitions/Glossary 8
Method Summary 9
Sample Summary 10
Client Sample Results 11
QC Sample Results 18
QC Association Summary 20
Tracer Carrier Summary 22

Job ID: 160-3592-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Waste Characterizations

Report Number: 160-3592-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 9/3/2013 12:45 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 21.0º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHS1CS-1 (160-3592-1), IHS1CS-2 (160-3592-2), IHS1CS-3 (160-3592-3), IHS1CS-4 (160-3592-4), IHS1CS-5 (160-3592-5), IHS1CS-6 (160-3592-6), IHS1CS-7 (160-3592-7), IHS1CS-8 (160-3592-8), IHS1CS-9 (160-3592-9), IHS1CS-10 (160-3592-10), IHS1CS-11 (160-3592-11), IHS1CS-12 (160-3592-12), IHS1CS-13 (160-3592-13), IHS1CS-14 (160-3592-14), IHS1CS-15 (160-3592-15), IHS1CS-16 (160-3592-16), IHS1CS-17 (160-3592-17), IHS1CS-18 (160-3592-18), IHS1CS-19 (160-3592-19), IHS1CS-20 (160-3592-20), IHS1CS-21 (160-3592-21), IHS1CS-22 (160-3592-22) and IHS1CS-23 (160-3592-23) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 09/03/2013, prepared on 09/09/2013 and analyzed on 09/17/2013, 09/18/2013 and 09/19/2013.

No other difficulties were encountered during the Isotopic Thorium analysis.

Job ID: 160-3592-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

All other quality control parameters were within the acceptance limits.

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:8/20/2103	COC No: IH-5
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	2 of 2 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2011-008
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHS1CS-13	8/20/2013	1425	G	S	1	N	N	X	
IHS1CS-14	8/20/2013	1435	G	S	1	N	N	X	
IHS1CS-15	8/20/2013	1442	G	S	1	N	N	X	
IHS1CS-16	8/20/2013	1450	G	S	1	N	N	X	
IHS1CS-17	8/20/2013	1458	G	S	1	N	N	X	
IHS1CS-18	8/20/2013	1512	G	S	1	N	N	X	
IHS1CS-19	8/20/2013	1518	G	S	1	N	N	X	
IHS1CS-20	8/20/2013	1528	G	S	1	N	N	X	
IHS1CS-21	8/20/2013	1535	G	S	1	N	N	X	
IHS1CS-22	8/20/2013	1543	G	S	1	N	Y	X	
IHS1CS-23	8/20/2013	1555	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: QC Level IV

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	AWS	8/29/13/1500			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by: [signature]	Company: TA STL	Date/Time: 9-3-13 1245

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/203

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

ar 439

TestAmerica
THE LEADER IN ENVIRONMENTAL TESING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:8/20/2103	COC No: IH-5
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 1 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			Lab Sampling:
(907) 278-2350 FAX	☐ 2 weeks			
Project Name: NSF Indian Head	☐ 1 week			Job / SDG No.:USN 2011-008
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHS1CS-1	8/20/2013	1100	G	S	1	N	N	X	
IHS1CS-2	8/20/2013	1114	G	S	1	N	N	X	
IHS1CS-3	8/20/2013	1120	G	S	1	N	N	X	
IHS1CS-4	8/20/2013	1245	G	S	1	N	N	X	
IHS1CS-5	8/20/2013	1255	G	S	1	N	N	X	
IHS1CS-6	8/20/2013	1305	G	S	1	N	N	X	
IHS1CS-7	8/20/2013	1315	G	S	1	N	Y	X	
IHS1CS-8	8/20/2013	1326	G	S	1	N	N	X	
IHS1CS-9	8/20/2013	1340	G	S	1	N	N	X	
IHS1CS-10	8/20/2013	1402	G	S	1	N	N	X	
IHS1CS-11	8/20/2013	1408	G	S	1	N	N	X	
IHS1CS-12	8/20/2013	1415	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: QC Level IV

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	AWS	8/29/13/1500			
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:
			Gil Clarke	TA STL	9-3-13 1245

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-3592-1
SDG Number: NSF Indian Head

Login Number: 3592
List Number: 1
Creator: Clarke, Jill C

List Source: TestAmerica St. Louis

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Thermal preservation not required.
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-3592-1	IHS1CS-1	Solid	08/20/13 11:00	09/03/13 12:45
160-3592-2	IHS1CS-2	Solid	08/20/13 11:14	09/03/13 12:45
160-3592-3	IHS1CS-3	Solid	08/20/13 11:20	09/03/13 12:45
160-3592-4	IHS1CS-4	Solid	08/20/13 12:45	09/03/13 12:45
160-3592-5	IHS1CS-5	Solid	08/20/13 12:55	09/03/13 12:45
160-3592-6	IHS1CS-6	Solid	08/20/13 13:05	09/03/13 12:45
160-3592-7	IHS1CS-7	Solid	08/20/13 13:15	09/03/13 12:45
160-3592-8	IHS1CS-8	Solid	08/20/13 13:26	09/03/13 12:45
160-3592-9	IHS1CS-9	Solid	08/20/13 13:40	09/03/13 12:45
160-3592-10	IHS1CS-10	Solid	08/20/13 14:02	09/03/13 12:45
160-3592-11	IHS1CS-11	Solid	08/20/13 14:08	09/03/13 12:45
160-3592-12	IHS1CS-12	Solid	08/20/13 14:15	09/03/13 12:45
160-3592-13	IHS1CS-13	Solid	08/20/13 14:25	09/03/13 12:45
160-3592-14	IHS1CS-14	Solid	08/20/13 14:35	09/03/13 12:45
160-3592-15	IHS1CS-15	Solid	08/20/13 14:42	09/03/13 12:45
160-3592-16	IHS1CS-16	Solid	08/20/13 14:50	09/03/13 12:45
160-3592-17	IHS1CS-17	Solid	08/20/13 14:58	09/03/13 12:45
160-3592-18	IHS1CS-18	Solid	08/20/13 15:12	09/03/13 12:45
160-3592-19	IHS1CS-19	Solid	08/20/13 15:18	09/03/13 12:45
160-3592-20	IHS1CS-20	Solid	08/20/13 15:28	09/03/13 12:45
160-3592-21	IHS1CS-21	Solid	08/20/13 15:35	09/03/13 12:45
160-3592-22	IHS1CS-22	Solid	08/20/13 15:43	09/03/13 12:45
160-3592-23	IHS1CS-23	Solid	08/20/13 15:55	09/03/13 12:45

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Client Sample ID: IHS1CS-1

Lab Sample ID: 160-3592-1
Matrix: Solid

Date Collected: 08/20/13 11:00
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.466		0.280	0.290	1.00	0.0598	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.634		0.334	0.350	1.00	0.0969	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.528		0.299	0.312	1.00	0.0724	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.1*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-2

Lab Sample ID: 160-3592-2
Matrix: Solid

Date Collected: 08/20/13 11:14
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.620		0.331	0.347	1.00	0.0962	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.895		0.387	0.415	1.00	0.0560	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.517		0.296	0.308	1.00	0.0638	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.0*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-3

Lab Sample ID: 160-3592-3
Matrix: Solid

Date Collected: 08/20/13 11:20
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.216		0.223	0.226	1.00	0.117	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.710		0.364	0.383	1.00	0.0928	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.467		0.292	0.303	1.00	0.0707	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*82.4*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-4

Lab Sample ID: 160-3592-4
Matrix: Solid

Date Collected: 08/20/13 12:45
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.480		0.308	0.319	1.00	0.110	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.561		0.323	0.336	1.00	0.0832	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.797		0.377	0.400	1.00	0.0509	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Client Sample ID: IHS1CS-4

Lab Sample ID: 160-3592-4
Matrix: Solid

Date Collected: 08/20/13 12:45
Date Received: 09/03/13 12:45

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	85.2		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-5

Lab Sample ID: 160-3592-5
Matrix: Solid

Date Collected: 08/20/13 12:55
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.704		0.344	0.363	1.00	0.0905	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.554		0.301	0.315	1.00	0.0678	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.614		0.315	0.331	1.00	0.0612	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.2		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-6

Lab Sample ID: 160-3592-6
Matrix: Solid

Date Collected: 08/20/13 13:05
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.435		0.269	0.278	1.00	0.0624	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.346		0.240	0.247	1.00	0.0588	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.390		0.251	0.260	1.00	0.0461	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.2		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-7

Lab Sample ID: 160-3592-7
Matrix: Solid

Date Collected: 08/20/13 13:15
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.476		0.296	0.307	1.00	0.0879	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.713		0.354	0.374	1.00	0.0587	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.498		0.294	0.305	1.00	0.0293	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	85.8		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Client Sample ID: IHS1CS-8

Lab Sample ID: 160-3592-8
Date Collected: 08/20/13 13:26
Matrix: Solid
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.604		0.318	0.334	1.00	0.0790	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.843		0.372	0.398	1.00	0.0677	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.605		0.315	0.331	1.00	0.0653	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.5*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-9

Lab Sample ID: 160-3592-9
Date Collected: 08/20/13 13:40
Matrix: Solid
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.590		0.319	0.334	1.00	0.0741	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.462		0.281	0.291	1.00	0.0607	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.481		0.286	0.297	1.00	0.0604	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.9*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-10

Lab Sample ID: 160-3592-10
Date Collected: 08/20/13 14:02
Matrix: Solid
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.415		0.267	0.276	1.00	0.0456	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.456		0.285	0.295	1.00	0.0760	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.317		0.243	0.249	1.00	0.0864	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*84.7*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-11

Lab Sample ID: 160-3592-11
Date Collected: 08/20/13 14:08
Matrix: Solid
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.452		0.279	0.289	1.00	0.0781	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.560		0.305	0.319	1.00	0.0503	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.350		0.240	0.247	1.00	0.0435	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Client Sample ID: IHS1CS-11

Lab Sample ID: 160-3592-11
Matrix: Solid
Date Collected: 08/20/13 14:08
Date Received: 09/03/13 12:45

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.3		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-12

Lab Sample ID: 160-3592-12
Matrix: Solid
Date Collected: 08/20/13 14:15
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.340		0.267	0.273	1.00	0.118	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.412		0.276	0.284	1.00	0.0780	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.422		0.274	0.283	1.00	0.0562	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	84.8		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-13

Lab Sample ID: 160-3592-13
Matrix: Solid
Date Collected: 08/20/13 14:25
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.493		0.287	0.298	1.00	0.0594	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.520		0.292	0.305	1.00	0.0436	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.479		0.279	0.291	1.00	0.0276	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.6		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-14

Lab Sample ID: 160-3592-14
Matrix: Solid
Date Collected: 08/20/13 14:35
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.773		0.367	0.390	1.00	0.113	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.562		0.303	0.317	1.00	0.0619	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.652		0.324	0.342	1.00	0.0556	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.2		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Client Sample ID: IHS1CS-15

Lab Sample ID: 160-3592-15
Matrix: Solid

Date Collected: 08/20/13 14:42
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.735		0.361	0.382	1.00	0.0740	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.606		0.325	0.341	1.00	0.0463	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.679		0.343	0.362	1.00	0.0460	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.9*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-16

Lab Sample ID: 160-3592-16
Matrix: Solid

Date Collected: 08/20/13 14:50
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.440		0.277	0.286	1.00	0.0763	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.371		0.252	0.260	1.00	0.0654	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.458		0.278	0.288	1.00	0.0601	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.4*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-17

Lab Sample ID: 160-3592-17
Matrix: Solid

Date Collected: 08/20/13 14:58
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.73		0.571	0.641	1.00	0.102	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.670		0.357	0.374	1.00	0.0846	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	1.79		0.573	0.647	1.00	0.0666	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*83.0*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Client Sample ID: IHS1CS-18

Lab Sample ID: 160-3592-18
Matrix: Solid

Date Collected: 08/20/13 15:12
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	7.66		1.16	1.73	1.00	0.0931	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.764		0.366	0.388	1.00	0.0466	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	6.27		1.05	1.48	1.00	0.0464	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Client Sample ID: IHS1CS-18

Lab Sample ID: 160-3592-18
Matrix: Solid
Date Collected: 08/20/13 15:12
Date Received: 09/03/13 12:45

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.0		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-19

Lab Sample ID: 160-3592-19
Matrix: Solid
Date Collected: 08/20/13 15:18
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.557		0.147	0.154	1.00	0.0439	pCi/g	09/09/13 09:38	09/19/13 08:51	1
Thorium-230	0.498		0.139	0.145	1.00	0.0501	pCi/g	09/09/13 09:38	09/19/13 08:51	1
Thorium-232	0.447		0.132	0.137	1.00	0.0498	pCi/g	09/09/13 09:38	09/19/13 08:51	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	96.7		30 - 110	09/09/13 09:38	09/19/13 08:51	1

Client Sample ID: IHS1CS-20

Lab Sample ID: 160-3592-20
Matrix: Solid
Date Collected: 08/20/13 15:28
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.463		0.300	0.310	1.00	0.110	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.542		0.308	0.321	1.00	0.0531	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.423		0.273	0.282	1.00	0.0627	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	86.4		30 - 110	09/09/13 09:38	09/18/13 16:41	1

Client Sample ID: IHS1CS-21

Lab Sample ID: 160-3592-21
Matrix: Solid
Date Collected: 08/20/13 15:35
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.466		0.287	0.298	1.00	0.0727	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-230	0.632		0.331	0.348	1.00	0.0620	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-232	0.538		0.304	0.317	1.00	0.0521	pCi/g	09/09/13 09:40	09/17/13 15:17	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.9		30 - 110	09/09/13 09:40	09/17/13 15:17	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Client Sample ID: IHS1CS-22

Lab Sample ID: 160-3592-22

Date Collected: 08/20/13 15:43
Matrix: Solid
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.650		0.348	0.364	1.00	0.0852	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-230	0.739		0.364	0.384	1.00	0.0303	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-232	0.668		0.345	0.363	1.00	0.0301	pCi/g	09/09/13 09:40	09/17/13 15:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*82.6*		*30 - 110*	*09/09/13 09:40*	*09/17/13 15:17*	*1*

Client Sample ID: IHS1CS-23

Lab Sample ID: 160-3592-23

Date Collected: 08/20/13 15:55
Matrix: Solid
Date Received: 09/03/13 12:45

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.494		0.291	0.303	1.00	0.0875	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-230	0.470		0.276	0.287	1.00	0.0428	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-232	0.552		0.298	0.312	1.00	0.0426	pCi/g	09/09/13 09:40	09/17/13 15:17	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.1*		*30 - 110*	*09/09/13 09:40*	*09/17/13 15:17*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-71427/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 73278 — **Prep Batch: 71427**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.01050	U	0.0420	0.0420	1.00	0.0284	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-230	0.1051		0.133	0.134	1.00	0.0284	pCi/g	09/09/13 09:38	09/18/13 16:41	1
Thorium-232	0.01699	U	0.0602	0.0602	1.00	0.0512	pCi/g	09/09/13 09:38	09/18/13 16:41	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.5*		*30 - 110*	*09/09/13 09:38*	*09/18/13 16:41*	*1*

Lab Sample ID: LCS 160-71427/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 73176 — **Prep Batch: 71427**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	25.79		5.27	1.00	0.106	pCi/g	105	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*88.2*		*30 - 110*

Lab Sample ID: 160-3592-1 DU — **Client Sample ID: IHS1CS-1**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 73223 — **Prep Batch: 71427**

Analyte	Sample Result	Sample Qual	DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	RER	RER Limit
Thorium-228	0.466		0.4143		0.283	1.00	0.0712	pCi/g	0.09	1
Thorium-230	0.634		0.9010		0.437	1.00	0.115	pCi/g	0.34	1
Thorium-232	0.528		0.3714		0.270	1.00	0.0833	pCi/g	0.27	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*83.5*		*30 - 110*

Lab Sample ID: MB 160-71428/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 73041 — **Prep Batch: 71428**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.001745	U	0.0773	0.0773	1.00	0.0926	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-230	0.05545		0.101	0.101	1.00	0.0550	pCi/g	09/09/13 09:40	09/17/13 15:17	1
Thorium-232	0.0000	U	0.00761	0.00761	1.00	0.0275	pCi/g	09/09/13 09:40	09/17/13 15:17	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.9*		*30 - 110*	*09/09/13 09:40*	*09/17/13 15:17*	*1*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-71428/2-A
Matrix: Solid
Analysis Batch: 73042

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 71428

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	22.93		4.74	1.00	0.112	pCi/g	94	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*89.2*		*30 - 110*

Lab Sample ID: 160-3592-22 MS
Matrix: Solid
Analysis Batch: 73046

Client Sample ID: IHS1CS-22
Prep Type: Total/NA
Prep Batch: 71428

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.739		4.29	5.068		1.28	1.00	0.0478	pCi/g	101	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*83.9*		*30 - 110*

Lab Sample ID: 160-3592-22 MSD
Matrix: Solid
Analysis Batch: 73048

Client Sample ID: IHS1CS-22
Prep Type: Total/NA
Prep Batch: 71428

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.739		4.26	5.006		1.23	1.00	0.0434	pCi/g	100	76 - 115	0.02	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*88.7*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Rad

Leach Batch: 70162

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3592-1	IHS1CS-1	Total/NA	Solid	Dry and Grind	
160-3592-1 DU	IHS1CS-1	Total/NA	Solid	Dry and Grind	
160-3592-2	IHS1CS-2	Total/NA	Solid	Dry and Grind	
160-3592-3	IHS1CS-3	Total/NA	Solid	Dry and Grind	
160-3592-4	IHS1CS-4	Total/NA	Solid	Dry and Grind	
160-3592-5	IHS1CS-5	Total/NA	Solid	Dry and Grind	
160-3592-6	IHS1CS-6	Total/NA	Solid	Dry and Grind	
160-3592-7	IHS1CS-7	Total/NA	Solid	Dry and Grind	
160-3592-8	IHS1CS-8	Total/NA	Solid	Dry and Grind	
160-3592-9	IHS1CS-9	Total/NA	Solid	Dry and Grind	
160-3592-10	IHS1CS-10	Total/NA	Solid	Dry and Grind	
160-3592-11	IHS1CS-11	Total/NA	Solid	Dry and Grind	
160-3592-12	IHS1CS-12	Total/NA	Solid	Dry and Grind	
160-3592-13	IHS1CS-13	Total/NA	Solid	Dry and Grind	
160-3592-14	IHS1CS-14	Total/NA	Solid	Dry and Grind	
160-3592-15	IHS1CS-15	Total/NA	Solid	Dry and Grind	
160-3592-16	IHS1CS-16	Total/NA	Solid	Dry and Grind	
160-3592-17	IHS1CS-17	Total/NA	Solid	Dry and Grind	
160-3592-18	IHS1CS-18	Total/NA	Solid	Dry and Grind	
160-3592-19	IHS1CS-19	Total/NA	Solid	Dry and Grind	
160-3592-20	IHS1CS-20	Total/NA	Solid	Dry and Grind	
160-3592-21	IHS1CS-21	Total/NA	Solid	Dry and Grind	
160-3592-22	IHS1CS-22	Total/NA	Solid	Dry and Grind	
160-3592-22 MS	IHS1CS-22	Total/NA	Solid	Dry and Grind	
160-3592-22 MSD	IHS1CS-22	Total/NA	Solid	Dry and Grind	
160-3592-23	IHS1CS-23	Total/NA	Solid	Dry and Grind	

Prep Batch: 71427

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3592-1	IHS1CS-1	Total/NA	Solid	ExtChrom	70162
160-3592-1 DU	IHS1CS-1	Total/NA	Solid	ExtChrom	70162
160-3592-2	IHS1CS-2	Total/NA	Solid	ExtChrom	70162
160-3592-3	IHS1CS-3	Total/NA	Solid	ExtChrom	70162
160-3592-4	IHS1CS-4	Total/NA	Solid	ExtChrom	70162
160-3592-5	IHS1CS-5	Total/NA	Solid	ExtChrom	70162
160-3592-6	IHS1CS-6	Total/NA	Solid	ExtChrom	70162
160-3592-7	IHS1CS-7	Total/NA	Solid	ExtChrom	70162
160-3592-8	IHS1CS-8	Total/NA	Solid	ExtChrom	70162
160-3592-9	IHS1CS-9	Total/NA	Solid	ExtChrom	70162
160-3592-10	IHS1CS-10	Total/NA	Solid	ExtChrom	70162
160-3592-11	IHS1CS-11	Total/NA	Solid	ExtChrom	70162
160-3592-12	IHS1CS-12	Total/NA	Solid	ExtChrom	70162
160-3592-13	IHS1CS-13	Total/NA	Solid	ExtChrom	70162
160-3592-14	IHS1CS-14	Total/NA	Solid	ExtChrom	70162
160-3592-15	IHS1CS-15	Total/NA	Solid	ExtChrom	70162
160-3592-16	IHS1CS-16	Total/NA	Solid	ExtChrom	70162
160-3592-17	IHS1CS-17	Total/NA	Solid	ExtChrom	70162
160-3592-18	IHS1CS-18	Total/NA	Solid	ExtChrom	70162
160-3592-19	IHS1CS-19	Total/NA	Solid	ExtChrom	70162
160-3592-20	IHS1CS-20	Total/NA	Solid	ExtChrom	70162
LCS 160-71427/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	

QC Association Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Rad (Continued)

Prep Batch: 71427 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
MB 160-71427/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 71428

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-3592-21	IHS1CS-21	Total/NA	Solid	ExtChrom	70162
160-3592-22	IHS1CS-22	Total/NA	Solid	ExtChrom	70162
160-3592-22 MS	IHS1CS-22	Total/NA	Solid	ExtChrom	70162
160-3592-22 MSD	IHS1CS-22	Total/NA	Solid	ExtChrom	70162
160-3592-23	IHS1CS-23	Total/NA	Solid	ExtChrom	70162
LCS 160-71428/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-71428/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-3592-1
SDG: NSF Indian Head

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	Client Sample ID	Th-229 (30-110)						
160-3592-1	IHS1CS-1	91.1						
160-3592-1 DU	IHS1CS-1	83.5						
160-3592-2	IHS1CS-2	89.0						
160-3592-3	IHS1CS-3	82.4						
160-3592-4	IHS1CS-4	85.2						
160-3592-5	IHS1CS-5	91.2						
160-3592-6	IHS1CS-6	91.2						
160-3592-7	IHS1CS-7	85.8						
160-3592-8	IHS1CS-8	91.5						
160-3592-9	IHS1CS-9	89.9						
160-3592-10	IHS1CS-10	84.7						
160-3592-11	IHS1CS-11	90.3						
160-3592-12	IHS1CS-12	84.8						
160-3592-13	IHS1CS-13	87.6						
160-3592-14	IHS1CS-14	94.2						
160-3592-15	IHS1CS-15	86.9						
160-3592-16	IHS1CS-16	90.4						
160-3592-17	IHS1CS-17	83.0						
160-3592-18	IHS1CS-18	87.0						
160-3592-19	IHS1CS-19	96.7						
160-3592-20	IHS1CS-20	86.4						
160-3592-21	IHS1CS-21	83.9						
160-3592-22	IHS1CS-22	82.6						
160-3592-22 MS	IHS1CS-22	83.9						
160-3592-22 MSD	IHS1CS-22	88.7						
160-3592-23	IHS1CS-23	92.1						
LCS 160-71427/2-A	Lab Control Sample	88.2						
LCS 160-71428/2-A	Lab Control Sample	89.2						
MB 160-71427/1-A	Method Blank	91.5						
MB 160-71428/1-A	Method Blank	92.9						

Tracer/Carrier Legend

Th-229 = Thorium-229

Appendix O
Waste Profile Sample Laboratory Data

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-1688-1
Client Project/Site: Waste Characterizations

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Mary Ann Tapia

Authorized for release by:
4/9/2013 3:59:55 PM

Erika Starman
Project Manager I
erika.starman@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-1688-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Waste Characterizations

Report Number: 160-1688-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

RECEIPT

The samples were received on 3/6/2013 1:40 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 6.0º C.

General Chemistry

Citrix server went down 3/19/13, rework samples were started for TCLP extraction using the fluid determination from the initial extraction.

TCLP VOLATILE ORGANIC COMPOUNDS (GC-MS)

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP volatile organic compounds (GC-MS) in accordance with EPA SW846 Method 1311/8260C. The samples were leached on 03/12/2013 and analyzed on 03/12/2013.

No difficulties were encountered during the VOCs analysis.

All quality control parameters were within the acceptance limits.

TCLP SEMIVOLATILE ORGANIC COMPOUNDS (GC-MS)

Job ID: 160-1688-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP semivolatile organic compounds (GC-MS) in accordance with EPA SW-846 Methods 1311 / 8270D. The samples were leached on 03/12/2013, prepared on 03/13/2013 and analyzed on 03/15/2013.

Terphenyl-d14 (Surr) failed the surrogate recovery criteria low for 1H-WP1MS (160-1688-1MS). The laboratory's SOP allows one acid surrogate and/or one base surrogate to be outside acceptance limits; therefore, re-extraction/re-analysis was not performed. These results have been reported and qualified. Refer to the QC report for details.

No other difficulties were encountered during the SVOCs analysis.

All other quality control parameters were within the acceptance limits.

TCLP CHLORINATED PESTICIDES

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP chlorinated pesticides in accordance with EPA SW-846 Methods 1311/ 8081B. The samples were leached on 03/12/2013, prepared on 03/18/2013 and analyzed on 03/19/2013.

Tetrachloro-m-xylene failed the surrogate recovery criteria low for LB 160-39306/1-B, 1H-WP1MS (160-1688-1MS), and 1H-WP1MSD (160-1688-1MSD). However the spike recovery for the LSC, MS, and MSD is within QC limits, thus showing a good extraction. Also the surrogate recovery for the sample was within QC limits. Refer to the QC report for details.

No other difficulties were encountered during the pesticides analysis.

All other quality control parameters were within the acceptance limits.

TCLP CHLORINATED HERBICIDES

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP chlorinated herbicides in accordance with EPA SW-846 Methods 1311/ 8151A. The samples were leached on 03/19/2013, and prepared and analyzed on 03/20/2013.

Surrogates are added during the extraction process prior to dilution. When the sample dilution is 5X or greater, surrogate recoveries are diluted out and no corrective action is required.

2,4-Dichlorophenylacetic acid failed the surrogate recovery criteria high for 1H-WP1MSD (160-1688-1MSD). This sample did not contain any target analytes above the RL; therefore, re-extraction and/or re-analysis was not performed. Refer to the QC report for details.

The MSD recovery for 2,4-D, and 2,4,5-TP is outside the upper QC limit and the RPD was poor, indicating a potential positive bias for these analytes. These analytes were not observed above the reporting limit in the associated samples; therefore the sample data was not adversely affected by this excursion.

No other difficulties were encountered during the herbicides analysis.

All other quality control parameters were within the acceptance limits.

TCLP METALS (ICP)

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP metals (ICP) in accordance with EPA SW-846 Method 1311/6010C. The samples were leached on 03/12/2013, prepared on 03/12/2013 and analyzed on 03/19/2013.

Barium, Chromium and Selenium were detected in method blank LB 160-39311/1-B at levels that were above the method detection limit but below the reporting limit. Refer to the QC report for details.

The serial dilution performed for the following sample(s) associated with batch 39344 was outside control limits for lead indicating a possible matrix interference: (160-1688-1 SD)

No other difficulties were encountered during the metals analysis.

All other quality control parameters were within the acceptance limits.

Job ID: 160-1688-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

TCLP MERCURY

Sample 1H-WP1 (160-1688-1) was analyzed for TCLP mercury in accordance with EPA SW-846 Methods 1311/7470A. The samples were leached on 03/12/2013, prepared on 04/02/2013 and analyzed on 04/04/2013.

The MS\MSD were spiked after preservation. Due to instrument related issues the batch needed to be re-extracted.

No difficulties were encountered during the mercury analysis.

All quality control parameters were within the acceptance limits.

IGNITABILITY,PENSKY-MARTENS CLOSED CUP METHOD

Sample 1H-WP2 (160-1688-2) was analyzed for Ignitability,Pensky-Martens Closed Cup Method in accordance with EPA SW-846 Method 1010. The samples were analyzed on 03/29/2013.

No other difficulties were encountered during the Ignitability, CCM analysis.

All other quality control parameters were within the acceptance limits.

REACTIVE CYANIDE

Sample 1H-WP2 (160-1688-2) was analyzed for reactive cyanide in accordance with EPA SW-846 Method 7.3.3. The samples were prepared and analyzed on 03/20/2013.

Cyanide, Reactive failed the recovery criteria low for LCS 160-41005/2-A and MS of sample 1H-WP2MS (160-1688-2). Since this test is semi-qualitative no further action is required. Refer to the QC report for details.

For the associated samples in Reactive CN Batch 41105, the samples were distilled and analyzed one day out of hold due to TALS being down for most of the day, prior to the prep analyst leaving. (160-1688-2 DU), (160-1688-2 MS), 1H-WP2 (160-1688-2)

No other difficulties were encountered during the Reactive cynide analysis.

All other quality control parameters were within the acceptance limits.

REACTIVE SULFIDE

Sample 1H-WP2 (160-1688-2) was analyzed for reactive sulfide in accordance with EPA SW-846 Method 7.3.4. The samples were prepared on 03/20/2013 and analyzed on 03/21/2013.

Sulfide, Reactive failed the recovery criteria high for LCS 160-41006/2-A. Refer to the QC report for details.

For Reactive Sulfide batch # 41093, the LCS was outside the upper QC limit, resulting in a potential positive bias for the samples associated with this batch. The analyte was not detected in the associated samples, therefore the results were not adversely affected.1H-WP2 (160-1688-2)

For Reactive Sulfide batch 41093, the sample was prepped and analyzed outside of holding time. Samples were prepped and analyzed within two times hold.1H-WP2 (160-1688-2)

No other difficulties were encountered during the sulfide analysis.

All other quality control parameters were within the acceptance limits.

PH

Sample 1H-WP2 (160-1688-2) was analyzed for pH in accordance with EPA SW-846 Method 9045D. The samples were leached on 03/13/2013 and analyzed on 03/13/2013.

No difficulties were encountered during the pH analysis.

Job ID: 160-1688-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

All quality control parameters were within the acceptance limits.

PERCENT SOLIDS

Sample 1H-WP2 (160-1688-2) was analyzed for percent solids in accordance with EPA Method 160.3 MOD. The samples were analyzed on 03/13/2013.

No difficulties were encountered during the % solids analysis.

All quality control parameters were within the acceptance limits.

CVR 4 34

St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

4/9/2013

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 3/5/2013	COC No: IH-4
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Starman	Carrier: Fed Ex	___ of ___ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Job No. USN-2011-008
Anchorage, AK 99518	Calendar (C) or Work Days (W) C			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			SDG No.
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample (Perform MS/MSD)	TCLP Volatiles, Semivolatiles, Metals, Herbicides, Pesticides	pH, Ignitibility, Reactive Sulfide, Reactive Cyanide	Sample Specific Notes:
IH-WP1	3/5/2013	0800	Composite	S	1		X		
IH-WP2	3/5/2013	0805	Composite	S	1			X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ___

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☒

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☒ *Disposal By Lab* ☐ *Archive For* ___ *Months*

Special Instructions/QC Requirements & Comments: QC Level IV.

Relinquished by:	Company: AWS	Date/Time: 3/5/2013/1500	Received by:	Company: Ta	Date/Time: 3/6/13 1340
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-1688-1

Login Number: 1688

List Source: TestAmerica St. Louis

List Number: 1

Creator: Daniels, Brian

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

GC/MS Semi VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

GC Semi VOA

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

Metals

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.
J	Estimated: The analyte was positively identified; the quantitation is an estimation

General Chemistry

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time
Q	One or more quality control criteria failed.
U	Undetected at the Limit of Detection.
J	Estimated: The quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method	Method Description	Protocol	Laboratory
8260C	Volatile Organic Compounds by GC/MS	SW846	TAL SL
8270D	Semivolatile Organic Compounds (GC/MS)	SW846	TAL SL
8081B	Organochlorine Pesticides (GC)	SW846	TAL SL
8151A	Herbicides (GC)	SW846	TAL SL
6010C	Metals (ICP)	SW846	TAL SL
7470A	Mercury (CVAA)	SW846	TAL SL
1010A	Ignitability,Pensky-Martens Closed Cup Method	SW846	TAL SL
9012	Cyanide, Reactive	SW846	TAL SL
9034	Sulfide, Reactive	SW846	TAL SL
9045D	pH	SW846	TAL SL
Moisture	Percent Moisture	EPA	TAL SL

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-1688-1	1H-WP1	Solid	03/05/13 08:00	03/06/13 13:40
160-1688-2	1H-WP2	Solid	03/05/13 08:05	03/06/13 13:40

Detection Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Client Sample ID: 1H-WP1 — Lab Sample ID: 160-1688-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	647		125	9.88	ug/L	1		6010C	TCLP
Cadmium	4.25	J	12.5	2.28	ug/L	1		6010C	TCLP
Lead	288		250	3.18	ug/L	1		6010C	TCLP
Selenium	7.00	J	500	6.65	ug/L	1		6010C	TCLP

Client Sample ID: 1H-WP2 — Lab Sample ID: 160-1688-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Flashpoint	>60		23.0	23.0	Degrees F	1		1010A	Total/NA
pH	6.70		0.100	0.100	SU	1		9045D	Soluble

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Client Sample ID: 1H-WP1

Date Collected: 03/05/13 08:00
Date Received: 03/06/13 13:40

Lab Sample ID: 160-1688-1

Matrix: Solid

Method: 8260C - Volatile Organic Compounds by GC/MS - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane	3.72	U	50.0	3.72	ug/L			03/12/13 19:52	1
1,4-Dichlorobenzene	2.60	U	50.0	2.60	ug/L			03/12/13 19:52	1
2-Butanone (MEK)	3.89	U	50.0	3.89	ug/L			03/12/13 19:52	1
Benzene	2.53	U	50.0	2.53	ug/L			03/12/13 19:52	1
Carbon tetrachloride	3.60	U	50.0	3.60	ug/L			03/12/13 19:52	1
Chlorobenzene	3.82	U	50.0	3.82	ug/L			03/12/13 19:52	1
Chloroform	0.920	U	50.0	0.920	ug/L			03/12/13 19:52	1
Tetrachloroethene	2.80	U	50.0	2.80	ug/L			03/12/13 19:52	1
Trichloroethene	2.90	U	50.0	2.90	ug/L			03/12/13 19:52	1
Vinyl chloride	4.28	U	100	4.28	ug/L			03/12/13 19:52	1
1,1-Dichloroethene	3.65	U	50.0	3.65	ug/L			03/12/13 19:52	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*101*		*85 - 115*		*03/12/13 19:52*	*1*
Dibromofluoromethane (Surr)	*101*		*85 - 115*		*03/12/13 19:52*	*1*
4-Bromofluorobenzene (Surr)	*95*		*84 - 120*		*03/12/13 19:52*	*1*
1,2-Dichloroethane-d4 (Surr)	*95*		*83 - 117*		*03/12/13 19:52*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
2,4-Dinitrotoluene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Hexachlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Hexachlorobutadiene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Hexachloroethane	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
2-Methylphenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
3 & 4 Methylphenol	5.00	U	100	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Nitrobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/15/13 01:49	1
Pentachlorophenol	10.0	U	250	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
Pyridine	25.0	U	100	25.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
2,4,5-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1
2,4,6-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/15/13 01:49	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*75*		*50 - 101*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
Nitrobenzene-d5 (Surr)	*78*		*45 - 102*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
Phenol-d5 (Surr)	*75*		*40 - 95*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
Terphenyl-d14 (Surr)	*56*		*56 - 118*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
2-Fluorobiphenyl (Surr)	*71*		*42 - 95*	*03/13/13 12:00*	*03/15/13 01:49*	*1*
2-Fluorophenol (Surr)	*82*		*38 - 98*	*03/13/13 12:00*	*03/15/13 01:49*	*1*

Method: 8081B - Organochlorine Pesticides (GC) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
gamma-BHC (Lindane)	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 18:39	1
Endrin	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Heptachlor	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 18:39	1
Heptachlor epoxide	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Methoxychlor	0.0500	U	1.00	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Toxaphene	0.0500	U	20.0	0.0500	ug/L		03/18/13 10:00	03/19/13 18:39	1
Technical Chlordane	0.200	U	5.00	0.200	ug/L		03/18/13 10:00	03/19/13 18:39	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Client Sample ID: 1H-WP1

Lab Sample ID: 160-1688-1

Date Collected: 03/05/13 08:00
Matrix: Solid
Date Received: 03/06/13 13:40

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*101*		*70 - 130*	*03/18/13 10:00*	*03/19/13 18:39*	*1*
Tetrachloro-m-xylene	*70*		*70 - 130*	*03/18/13 10:00*	*03/19/13 18:39*	*1*

Method: 8151A - Herbicides (GC) - TCLP - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	19.8	U J	40.0	19.8	ug/L		03/20/13 09:29	03/20/13 15:02	1
Silvex (2,4,5-TP)	2.98	U J	10.0	2.98	ug/L		03/20/13 09:29	03/20/13 15:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*127*		*56 - 147*	*03/20/13 09:29*	*03/20/13 15:02*	*1*

Method: 6010C - Metals (ICP) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.93	U	500	4.93	ug/L		03/12/13 12:42	03/19/13 17:29	1
Barium	**647**		125	9.88	ug/L		03/12/13 12:42	03/19/13 17:29	1
Cadmium	**4.25**	**J**	12.5	2.28	ug/L		03/12/13 12:42	03/19/13 17:29	1
Chromium	7.85	U	25.0	7.85	ug/L		03/12/13 12:42	03/19/13 17:29	1
Lead	**288**		250	3.18	ug/L		03/12/13 12:42	03/19/13 17:29	1
Selenium	**7.00**	**J**	500	6.65	ug/L		03/12/13 12:42	03/19/13 17:29	1
Silver	14.9	U	25.0	14.9	ug/L		03/12/13 12:42	03/19/13 17:29	1

Method: 7470A - Mercury (CVAA) - TCLP - RE

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.0790	U	1.00	0.0790	ug/L		04/02/13 11:05	04/04/13 16:06	1

Client Sample ID: 1H-WP2

Lab Sample ID: 160-1688-2

Date Collected: 03/05/13 08:05
Matrix: Solid
Date Received: 03/06/13 13:40

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Flashpoint	**>60**		23.0	23.0	Degrees F			03/29/13 16:04	1
Cyanide, Reactive	0.251	U H Q J	0.251	0.251	mg/Kg		03/20/13 15:29	03/20/13 19:43	1
Sulfide, Reactive	22.2	U H Q	22.2	22.2	mg/Kg		03/20/13 15:29	03/21/13 10:12	1

General Chemistry - Soluble

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
pH	**6.70**		0.100	0.100	SU			03/13/13 14:15	1

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8260C - Volatile Organic Compounds by GC/MS

Lab Sample ID: LCS 160-39507/9-A
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dichloroethane	500	452		ug/L		90	80 - 115
1,4-Dichlorobenzene	500	510		ug/L		102	85 - 115
2-Butanone (MEK)	500	454		ug/L		91	64 - 117
Benzene	500	467		ug/L		93	85 - 115
Carbon tetrachloride	500	494		ug/L		99	79 - 119
Chlorobenzene	500	441		ug/L		88	85 - 115
Chloroform	500	492		ug/L		98	85 - 115
Tetrachloroethene	500	527		ug/L		105	79 - 116
Trichloroethene	500	451		ug/L		90	85 - 115
Vinyl chloride	500	456		ug/L		91	72 - 136
1,1-Dichloroethene	500	465		ug/L		93	79 - 117

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
Toluene-d8 (Surr)	*107*		*85 - 115*
Dibromofluoromethane (Surr)	*101*		*85 - 115*
4-Bromofluorobenzene (Surr)	*93*		*84 - 120*
1,2-Dichloroethane-d4 (Surr)	*95*		*83 - 117*

Lab Sample ID: LB 160-39297/1-A LB
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: Method Blank
Prep Type: TCLP

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane	3.72	U	50.0	3.72	ug/L			03/12/13 19:27	1
1,4-Dichlorobenzene	2.60	U	50.0	2.60	ug/L			03/12/13 19:27	1
2-Butanone (MEK)	3.89	U	50.0	3.89	ug/L			03/12/13 19:27	1
Benzene	2.53	U	50.0	2.53	ug/L			03/12/13 19:27	1
Carbon tetrachloride	3.60	U	50.0	3.60	ug/L			03/12/13 19:27	1
Chlorobenzene	3.82	U	50.0	3.82	ug/L			03/12/13 19:27	1
Chloroform	0.920	U	50.0	0.920	ug/L			03/12/13 19:27	1
Tetrachloroethene	2.80	U	50.0	2.80	ug/L			03/12/13 19:27	1
Trichloroethene	2.90	U	50.0	2.90	ug/L			03/12/13 19:27	1
Vinyl chloride	4.28	U	100	4.28	ug/L			03/12/13 19:27	1
1,1-Dichloroethene	3.65	U	50.0	3.65	ug/L			03/12/13 19:27	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Toluene-d8 (Surr)	*101*		*85 - 115*		*03/12/13 19:27*	*1*
Dibromofluoromethane (Surr)	*100*		*85 - 115*		*03/12/13 19:27*	*1*
4-Bromofluorobenzene (Surr)	*97*		*84 - 120*		*03/12/13 19:27*	*1*
1,2-Dichloroethane-d4 (Surr)	*100*		*83 - 117*		*03/12/13 19:27*	*1*

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: 1H-WP1
Prep Type: TCLP

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,2-Dichloroethane	3.72	U	500	470		ug/L		94	85 - 115

Method: 8260C - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: 1H-WP1
Prep Type: TCLP

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,4-Dichlorobenzene	2.60	U	500	497		ug/L		99	85 - 115
2-Butanone (MEK)	3.89	U	500	456		ug/L		91	67 - 117
Benzene	2.53	U	500	467		ug/L		93	85 - 115
Carbon tetrachloride	3.60	U	500	449		ug/L		90	79 - 117
Chlorobenzene	3.82	U	500	447		ug/L		89	85 - 115
Chloroform	0.920	U	500	480		ug/L		96	85 - 115
Tetrachloroethene	2.80	U	500	516		ug/L		103	82 - 115
Trichloroethene	2.90	U	500	470		ug/L		94	84 - 115
Vinyl chloride	4.28	U	500	396		ug/L		79	75 - 132
1,1-Dichloroethene	3.65	U	500	421		ug/L		84	80 - 115

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
Toluene-d8 (Surr)	*102*		*85 - 115*
Dibromofluoromethane (Surr)	*100*		*85 - 115*
4-Bromofluorobenzene (Surr)	*91*		*84 - 120*
1,2-Dichloroethane-d4 (Surr)	*96*		*83 - 117*

Lab Sample ID: 160-1688-1 MSD
Matrix: Solid
Analysis Batch: 39507

Client Sample ID: 1H-WP1
Prep Type: TCLP

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,2-Dichloroethane	3.72	U	500	478		ug/L		96	85 - 115	2	20
1,4-Dichlorobenzene	2.60	U	500	512		ug/L		102	85 - 115	3	20
2-Butanone (MEK)	3.89	U	500	467		ug/L		93	67 - 117	2	20
Benzene	2.53	U	500	468		ug/L		94	85 - 115	0	20
Carbon tetrachloride	3.60	U	500	467		ug/L		93	79 - 117	4	20
Chlorobenzene	3.82	U	500	447		ug/L		89	85 - 115	0	20
Chloroform	0.920	U	500	469		ug/L		94	85 - 115	2	20
Tetrachloroethene	2.80	U	500	516		ug/L		103	82 - 115	0	20
Trichloroethene	2.90	U	500	458		ug/L		92	84 - 115	3	20
Vinyl chloride	4.28	U	500	410		ug/L		82	75 - 132	4	20
1,1-Dichloroethene	3.65	U	500	427		ug/L		85	80 - 115	2	20

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
Toluene-d8 (Surr)	*102*		*85 - 115*
Dibromofluoromethane (Surr)	*99*		*85 - 115*
4-Bromofluorobenzene (Surr)	*93*		*84 - 120*
1,2-Dichloroethane-d4 (Surr)	*96*		*83 - 117*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Lab Sample ID: LCS 160-39484/2-A
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 39484

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,4-Dichlorobenzene	500	376		ug/L		75	40 - 93
2,4-Dinitrotoluene	500	374		ug/L		75	49 - 95
Hexachlorobenzene	500	369		ug/L		74	46 - 87
Hexachlorobutadiene	500	342		ug/L		68	30 - 95
Hexachloroethane	500	383		ug/L		77	25 - 97
2-Methylphenol	500	419		ug/L		84	51 - 99
3 & 4 Methylphenol	1000	830		ug/L		83	53 - 96
Nitrobenzene	500	361		ug/L		72	45 - 95
Pentachlorophenol	500	343		ug/L		69	35 - 98
Pyridine	500	256		ug/L		51	10 - 72
2,4,5-Trichlorophenol	500	378		ug/L		76	47 - 92
2,4,6-Trichlorophenol	500	358		ug/L		72	47 - 88

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*81*		*50 - 101*
Nitrobenzene-d5 (Surr)	*75*		*45 - 102*
Phenol-d5 (Surr)	*79*		*40 - 95*
Terphenyl-d14 (Surr)	*56*		*56 - 118*
2-Fluorobiphenyl (Surr)	*71*		*42 - 95*
2-Fluorophenol (Surr)	*82*		*38 - 98*

Lab Sample ID: LB 160-39296/1-B LB
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 39484

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,4-Dichlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
2,4-Dinitrotoluene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Hexachlorobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Hexachlorobutadiene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Hexachloroethane	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
2-Methylphenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
3 & 4 Methylphenol	5.00	U	100	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Nitrobenzene	5.00	U	50.0	5.00	ug/L		03/13/13 12:00	03/14/13 20:09	1
Pentachlorophenol	10.0	U	250	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
Pyridine	25.0	U	100	25.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
2,4,5-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1
2,4,6-Trichlorophenol	10.0	U	50.0	10.0	ug/L		03/13/13 12:00	03/14/13 20:09	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4,6-Tribromophenol (Surr)	*77*		*50 - 101*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
Nitrobenzene-d5 (Surr)	*71*		*45 - 102*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
Phenol-d5 (Surr)	*73*		*40 - 95*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
Terphenyl-d14 (Surr)	*57*		*56 - 118*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
2-Fluorobiphenyl (Surr)	*67*		*42 - 95*	*03/13/13 12:00*	*03/14/13 20:09*	*1*
2-Fluorophenol (Surr)	*79*		*38 - 98*	*03/13/13 12:00*	*03/14/13 20:09*	*1*

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 39484

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
1,4-Dichlorobenzene	5.00	U	500	319		ug/L		64	35 - 93
2,4-Dinitrotoluene	5.00	U	500	344		ug/L		69	52 - 100
Hexachlorobenzene	5.00	U	500	335		ug/L		67	46 - 90
Hexachlorobutadiene	5.00	U	500	290		ug/L		58	29 - 96
Hexachloroethane	5.00	U	500	329		ug/L		66	23 - 104
2-Methylphenol	10.0	U	500	358		ug/L		72	44 - 106
3 & 4 Methylphenol	5.00	U	1000	710		ug/L		71	49 - 100
Nitrobenzene	5.00	U	500	318		ug/L		64	44 - 102
Pentachlorophenol	10.0	U	500	327		ug/L		65	35 - 108
Pyridine	25.0	U	500	252		ug/L		50	10 - 80
2,4,5-Trichlorophenol	10.0	U	500	331		ug/L		66	47 - 96
2,4,6-Trichlorophenol	10.0	U	500	316		ug/L		63	48 - 96

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*71*		*50 - 101*
Nitrobenzene-d5 (Surr)	*65*		*45 - 102*
Phenol-d5 (Surr)	*67*		*40 - 95*
Terphenyl-d14 (Surr)	*52*	*J*	*56 - 118*
2-Fluorobiphenyl (Surr)	*56*		*42 - 95*
2-Fluorophenol (Surr)	*71*		*38 - 98*

Lab Sample ID: 160-1688-1 MSD
Matrix: Solid
Analysis Batch: 40220

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 39484

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,4-Dichlorobenzene	5.00	U	500	375		ug/L		75	35 - 93	16	20
2,4-Dinitrotoluene	5.00	U	500	404		ug/L		81	52 - 100	16	20
Hexachlorobenzene	5.00	U	500	382		ug/L		76	46 - 90	13	20
Hexachlorobutadiene	5.00	U	500	341		ug/L		68	29 - 96	16	20
Hexachloroethane	5.00	U	500	383		ug/L		77	23 - 104	15	20
2-Methylphenol	10.0	U	500	415		ug/L		83	44 - 106	15	20
3 & 4 Methylphenol	5.00	U	1000	824		ug/L		82	49 - 100	15	20
Nitrobenzene	5.00	U	500	375		ug/L		75	44 - 102	16	20
Pentachlorophenol	10.0	U	500	358		ug/L		72	35 - 108	9	20
Pyridine	25.0	U	500	288		ug/L		58	10 - 80	13	20
2,4,5-Trichlorophenol	10.0	U	500	389		ug/L		78	47 - 96	16	20
2,4,6-Trichlorophenol	10.0	U	500	371		ug/L		74	48 - 96	16	20

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
2,4,6-Tribromophenol (Surr)	*83*		*50 - 101*
Nitrobenzene-d5 (Surr)	*77*		*45 - 102*
Phenol-d5 (Surr)	*78*		*40 - 95*
Terphenyl-d14 (Surr)	*58*		*56 - 118*
2-Fluorobiphenyl (Surr)	*71*		*42 - 95*
2-Fluorophenol (Surr)	*84*		*38 - 98*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8081B - Organochlorine Pesticides (GC)

Lab Sample ID: LCS 160-40486/2-A
Matrix: Solid
Analysis Batch: 40930

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 40486

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
gamma-BHC (Lindane)	5.00	4.39		ug/L		88	70 - 130
Endrin	5.00	4.53		ug/L		91	70 - 130
Heptachlor	5.00	4.06		ug/L		81	70 - 130
Heptachlor epoxide	5.00	4.34		ug/L		87	70 - 130
Methoxychlor	5.00	5.00		ug/L		100	70 - 130

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*103*		*70 - 130*
Tetrachloro-m-xylene	*68*	*J*	*70 - 130*

Lab Sample ID: LB 160-39306/1-B LB
Matrix: Solid
Analysis Batch: 40930

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 40486

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
gamma-BHC (Lindane)	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 17:58	1
Endrin	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Heptachlor	0.0150	U	0.500	0.0150	ug/L		03/18/13 10:00	03/19/13 17:58	1
Heptachlor epoxide	0.0500	U	0.500	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Methoxychlor	0.0500	U	1.00	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Toxaphene	0.0500	U	20.0	0.0500	ug/L		03/18/13 10:00	03/19/13 17:58	1
Technical Chlordane	0.200	U	5.00	0.200	ug/L		03/18/13 10:00	03/19/13 17:58	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
DCB Decachlorobiphenyl (Surr)	*112*		*70 - 130*	*03/18/13 10:00*	*03/19/13 17:58*	*1*
Tetrachloro-m-xylene	*69*	*J*	*70 - 130*	*03/18/13 10:00*	*03/19/13 17:58*	*1*

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 40930

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 40486

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
gamma-BHC (Lindane)	0.0150	U	5.00	4.58		ug/L		92	70 - 130
Endrin	0.0500	U	5.00	4.65		ug/L		93	70 - 130
Heptachlor	0.0150	U	5.00	4.32		ug/L		86	70 - 130
Heptachlor epoxide	0.0500	U	5.00	4.48		ug/L		90	70 - 130
Methoxychlor	0.0500	U	5.00	4.88		ug/L		98	70 - 130

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*95*		*70 - 130*
Tetrachloro-m-xylene	*69*	*J*	*70 - 130*

Method: 8081B - Organochlorine Pesticides (GC) (Continued)

Lab Sample ID: 160-1688-1 MSD — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 40930 — **Prep Batch: 40486**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
gamma-BHC (Lindane)	0.0150	U	5.00	4.55		ug/L		91	70 - 130	1	20
Endrin	0.0500	U	5.00	4.65		ug/L		93	70 - 130	0	20
Heptachlor	0.0150	U	5.00	4.16		ug/L		83	70 - 130	4	20
Heptachlor epoxide	0.0500	U	5.00	4.46		ug/L		89	70 - 130	0	20
Methoxychlor	0.0500	U	5.00	5.11		ug/L		102	70 - 130	5	20

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
DCB Decachlorobiphenyl (Surr)	*102*		*70 - 130*
Tetrachloro-m-xylene	*67*	*J*	*70 - 130*

Method: 8151A - Herbicides (GC)

Lab Sample ID: LCS 160-40921/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41055 — **Prep Batch: 40921**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4-D	250	257		ug/L		103	46 - 140
Silvex (2,4,5-TP)	25.0	28.2		ug/L		113	42 - 140

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
2,4-Dichlorophenylacetic acid	*106*		*56 - 147*

Lab Sample ID: LB 160-40693/1-B LB — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 41055 — **Prep Batch: 40921**

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2,4-D	19.8	U	40.0	19.8	ug/L		03/20/13 09:29	03/20/13 14:02	1
Silvex (2,4,5-TP)	2.98	U	10.0	2.98	ug/L		03/20/13 09:29	03/20/13 14:02	1

Surrogate	*LB %Recovery*	*LB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
2,4-Dichlorophenylacetic acid	*131*		*56 - 147*	*03/20/13 09:29*	*03/20/13 14:02*	*1*

Method: 8151A - Herbicides (GC) - RE

Lab Sample ID: 160-1688-1 MS — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 41055 — **Prep Batch: 40921**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
2,4-D - RE	19.8	U J	250	292		ug/L		117	52 - 150
Silvex (2,4,5-TP) - RE	2.98	U J	25.0	31.6		ug/L		126	45 - 150

Method: 8151A - Herbicides (GC) - RE (Continued)

Lab Sample ID: 160-1688-1 MS
Matrix: Solid
Analysis Batch: 41055

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 40921

Surrogate	MS %Recovery	MS Qualifier	Limits
2,4-Dichlorophenylacetic acid - RE	*124*		*56 - 147*

Lab Sample ID: 160-1688-1 MSD
Matrix: Solid
Analysis Batch: 41055

Client Sample ID: 1H-WP1
Prep Type: TCLP
Prep Batch: 40921

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2,4-D - RE	19.8	U J	250	394	J	ug/L		158	52 - 150	30	20
Silvex (2,4,5-TP) - RE	2.98	U J	25.0	45.0	J	ug/L		180	45 - 150	35	20

Surrogate	MSD %Recovery	MSD Qualifier	Limits
2,4-Dichlorophenylacetic acid - RE	*174*	*J*	*56 - 147*

Method: 6010C - Metals (ICP)

Lab Sample ID: LCS 160-39344/2-A
Matrix: Solid
Analysis Batch: 40682

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 39344

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	2500	2610		ug/L		105	80 - 120
Barium	2500	2580		ug/L		103	80 - 120
Cadmium	2500	2560		ug/L		102	80 - 120
Chromium	2500	2530		ug/L		101	80 - 120
Lead	2500	2500		ug/L		100	80 - 120
Selenium	2500	2720		ug/L		109	80 - 120
Silver	250	234		ug/L		93	80 - 120

Lab Sample ID: LB 160-39311/1-B LB
Matrix: Solid
Analysis Batch: 40682

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 39344

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	4.93	U	500	4.93	ug/L		03/12/13 12:42	03/19/13 17:22	1
Barium	12.0	J	125	9.88	ug/L		03/12/13 12:42	03/19/13 17:22	1
Cadmium	2.28	U	12.5	2.28	ug/L		03/12/13 12:42	03/19/13 17:22	1
Chromium	8.75	J	25.0	7.85	ug/L		03/12/13 12:42	03/19/13 17:22	1
Lead	3.18	U	250	3.18	ug/L		03/12/13 12:42	03/19/13 17:22	1
Selenium	9.00	J	500	6.65	ug/L		03/12/13 12:42	03/19/13 17:22	1
Silver	14.9	U	25.0	14.9	ug/L		03/12/13 12:42	03/19/13 17:22	1

Method: 6010C - Metals (ICP) (Continued)

Lab Sample ID: 160-1688-1 MS — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 40682 — **Prep Batch: 39344**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	4.93	U	2500	2550		ug/L		102	75 - 125
Barium	647		2500	3260		ug/L		104	75 - 125
Cadmium	4.25	J	2500	2550		ug/L		102	75 - 125
Chromium	7.85	U	2500	2490		ug/L		100	75 - 125
Lead	288		2500	2720		ug/L		97	75 - 125
Selenium	7.00	J	2500	2630		ug/L		105	75 - 125
Silver	14.9	U	250	230		ug/L		92	75 - 125

Lab Sample ID: 160-1688-1 MSD — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 40682 — **Prep Batch: 39344**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	4.93	U	2500	2520		ug/L		101	75 - 125	1	20
Barium	647		2500	3210		ug/L		103	75 - 125	1	20
Cadmium	4.25	J	2500	2530		ug/L		101	75 - 125	1	20
Chromium	7.85	U	2500	2480		ug/L		99	75 - 125	0	20
Lead	288		2500	2700		ug/L		97	75 - 125	1	20
Selenium	7.00	J	2500	2590		ug/L		103	75 - 125	1	20
Silver	14.9	U	250	230		ug/L		92	75 - 125	0	20

Method: 7470A - Mercury (CVAA) - RE

Lab Sample ID: LCS 160-43574/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury - RE	25.0	26.5		ug/L		106	80 - 120

Lab Sample ID: LB 160-39312/1-B LB — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury - RE	0.0790	U	1.00	0.0790	ug/L		04/02/13 11:05	04/04/13 16:03	1

Lab Sample ID: 160-1688-1 MS — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury - RE	0.0790	U	25.0	27.0		ug/L		108	70 - 130

Method: 7470A - Mercury (CVAA) - RE (Continued)

Lab Sample ID: 160-1688-1 MSD — **Client Sample ID: 1H-WP1**
Matrix: Solid — **Prep Type: TCLP**
Analysis Batch: 44437 — **Prep Batch: 43574**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury - RE	0.0790	U	25.0	26.1		ug/L		104	70 - 130	3	20

Method: 1010A - Ignitability,Pensky-Martens Closed Cup Method

Lab Sample ID: MB 160-43126/3 — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43126

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Flashpoint	>60		23.0	23.0	Degrees F			03/29/13 16:04	1

Lab Sample ID: LCS 160-43126/2 — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43126

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Flashpoint	77.0	77.0		Degrees F		100	95.9 - 104

Lab Sample ID: 160-1688-2 DU — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 43126

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Flashpoint	>60		>60		Degrees F		NC	20

Method: 9012 - Cyanide, Reactive

Lab Sample ID: MB 160-41005/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cyanide, Reactive	0.250	U	0.250	0.250	mg/Kg		03/20/13 15:29	03/20/13 19:36	1

Lab Sample ID: LCS 160-41005/2-A ^2 — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Cyanide, Reactive	6.25	0.500	U Q	mg/Kg		5	10 - 75

Lab Sample ID: 160-1688-2 MS — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Cyanide, Reactive	0.251	U H Q J	6.24	0.516	H J	mg/Kg		8	10 - 45

Method: 9012 - Cyanide, Reactive (Continued)

Lab Sample ID: 160-1688-2 DU — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41105 — **Prep Batch: 41005**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Cyanide, Reactive	0.251	U H Q J	0.248	U H Q	mg/Kg		NC	30

Method: 9034 - Sulfide, Reactive

Lab Sample ID: MB 160-41006/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Sulfide, Reactive	22.2	U	22.2	22.2	mg/Kg		03/20/13 15:29	03/21/13 10:12	1

Lab Sample ID: LCS 160-41006/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide, Reactive	201	291	Q	mg/Kg		144	10 - 128

Lab Sample ID: 160-1688-2 MS — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Sulfide, Reactive	22.2	U H Q	199	218		mg/Kg		109	10 - 121

Lab Sample ID: 160-1688-2 DU — **Client Sample ID: 1H-WP2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 41093 — **Prep Batch: 41006**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Sulfide, Reactive	22.2	U H Q	22.0	U Q	mg/Kg		NC	20

Method: 9045D - pH

Lab Sample ID: LCS 160-39480/5 — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 39480

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
pH	7.00	6.95		SU		99	99.0 - 101.0

Lab Sample ID: 160-1698-B-1-K DU — **Client Sample ID: Duplicate**
Matrix: Solid — **Prep Type: Soluble**
Analysis Batch: 39480

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
pH	6.46		6.42		SU		0.6	5

QC Association Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

GC/MS VOA

Leach Batch: 39297

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39297/1-A LB	Method Blank	TCLP	Solid	1311	

Analysis Batch: 39507

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	8260C	39297
160-1688-1 MS	1H-WP1	TCLP	Solid	8260C	39297
160-1688-1 MSD	1H-WP1	TCLP	Solid	8260C	39297
LB 160-39297/1-A LB	Method Blank	TCLP	Solid	8260C	39297
LCS 160-39507/9-A	Lab Control Sample	Total/NA	Solid	8260C	

GC/MS Semi VOA

Leach Batch: 39296

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39296/1-B LB	Method Blank	TCLP	Solid	1311	

Prep Batch: 39484

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	3510C	39296
160-1688-1 MS	1H-WP1	TCLP	Solid	3510C	39296
160-1688-1 MSD	1H-WP1	TCLP	Solid	3510C	39296
LB 160-39296/1-B LB	Method Blank	TCLP	Solid	3510C	39296
LCS 160-39484/2-A	Lab Control Sample	Total/NA	Solid	3510C	

Analysis Batch: 40220

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	8270D	39484
160-1688-1 MS	1H-WP1	TCLP	Solid	8270D	39484
160-1688-1 MSD	1H-WP1	TCLP	Solid	8270D	39484
LB 160-39296/1-B LB	Method Blank	TCLP	Solid	8270D	39484
LCS 160-39484/2-A	Lab Control Sample	Total/NA	Solid	8270D	39484

GC Semi VOA

Leach Batch: 39306

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39306/1-B LB	Method Blank	TCLP	Solid	1311	

Prep Batch: 40486

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	3510C	39306

GC Semi VOA (Continued)

Prep Batch: 40486 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 MS	1H-WP1	TCLP	Solid	3510C	39306
160-1688-1 MSD	1H-WP1	TCLP	Solid	3510C	39306
LB 160-39306/1-B LB	Method Blank	TCLP	Solid	3510C	39306
LCS 160-40486/2-A	Lab Control Sample	Total/NA	Solid	3510C	

Leach Batch: 40693

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	1311	
LB 160-40693/1-B LB	Method Blank	TCLP	Solid	1311	

Prep Batch: 40921

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	8151A	40693
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	8151A	40693
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	8151A	40693
LB 160-40693/1-B LB	Method Blank	TCLP	Solid	8151A	40693
LCS 160-40921/2-A	Lab Control Sample	Total/NA	Solid	8151A	

Analysis Batch: 40930

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	8081B	40486
160-1688-1 MS	1H-WP1	TCLP	Solid	8081B	40486
160-1688-1 MSD	1H-WP1	TCLP	Solid	8081B	40486
LB 160-39306/1-B LB	Method Blank	TCLP	Solid	8081B	40486
LCS 160-40486/2-A	Lab Control Sample	Total/NA	Solid	8081B	40486

Analysis Batch: 41055

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	8151A	40921
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	8151A	40921
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	8151A	40921
LB 160-40693/1-B LB	Method Blank	TCLP	Solid	8151A	40921
LCS 160-40921/2-A	Lab Control Sample	Total/NA	Solid	8151A	40921

Metals

Leach Batch: 39311

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD	1H-WP1	TCLP	Solid	1311	
LB 160-39311/1-B LB	Method Blank	TCLP	Solid	1311	

Leach Batch: 39312

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	1311	
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	1311	

Metals (Continued)

Leach Batch: 39312 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LB 160-39312/1-B LB - RE	Method Blank	TCLP	Solid	1311	

Prep Batch: 39344

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	3010A	39311
160-1688-1 MS	1H-WP1	TCLP	Solid	3010A	39311
160-1688-1 MSD	1H-WP1	TCLP	Solid	3010A	39311
LB 160-39311/1-B LB	Method Blank	TCLP	Solid	3010A	39311
LCS 160-39344/2-A	Lab Control Sample	Total/NA	Solid	3010A	

Analysis Batch: 40682

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1	1H-WP1	TCLP	Solid	6010C	39344
160-1688-1 MS	1H-WP1	TCLP	Solid	6010C	39344
160-1688-1 MSD	1H-WP1	TCLP	Solid	6010C	39344
LB 160-39311/1-B LB	Method Blank	TCLP	Solid	6010C	39344
LCS 160-39344/2-A	Lab Control Sample	Total/NA	Solid	6010C	39344

Prep Batch: 43574

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	7470A	39312
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	7470A	39312
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	7470A	39312
LB 160-39312/1-B LB - RE	Method Blank	TCLP	Solid	7470A	39312
LCS 160-43574/2-A - RE	Lab Control Sample	Total/NA	Solid	7470A	

Analysis Batch: 44437

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-1 - RE	1H-WP1	TCLP	Solid	7470A	43574
160-1688-1 MS - RE	1H-WP1	TCLP	Solid	7470A	43574
160-1688-1 MSD - RE	1H-WP1	TCLP	Solid	7470A	43574
LB 160-39312/1-B LB - RE	Method Blank	TCLP	Solid	7470A	43574
LCS 160-43574/2-A - RE	Lab Control Sample	Total/NA	Solid	7470A	43574

General Chemistry

Analysis Batch: 39412

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	Moisture	
160-1688-2 DU	1H-WP2	Total/NA	Solid	Moisture	

Leach Batch: 39462

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Soluble	Solid	DI Leach	
160-1698-B-1-K DU	Duplicate	Soluble	Solid	DI Leach	

Analysis Batch: 39480

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Soluble	Solid	9045D	39462
160-1698-B-1-K DU	Duplicate	Soluble	Solid	9045D	39462

General Chemistry (Continued)

Analysis Batch: 39480 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 160-39480/5	Lab Control Sample	Total/NA	Solid	9045D	

Prep Batch: 41005

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	7.3.3	
160-1688-2 DU	1H-WP2	Total/NA	Solid	7.3.3	
160-1688-2 MS	1H-WP2	Total/NA	Solid	7.3.3	
LCS 160-41005/2-A ^2	Lab Control Sample	Total/NA	Solid	7.3.3	
MB 160-41005/1-A	Method Blank	Total/NA	Solid	7.3.3	

Prep Batch: 41006

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	7.3.4	
160-1688-2 DU	1H-WP2	Total/NA	Solid	7.3.4	
160-1688-2 MS	1H-WP2	Total/NA	Solid	7.3.4	
LCS 160-41006/2-A	Lab Control Sample	Total/NA	Solid	7.3.4	
MB 160-41006/1-A	Method Blank	Total/NA	Solid	7.3.4	

Analysis Batch: 41093

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	9034	41006
160-1688-2 DU	1H-WP2	Total/NA	Solid	9034	41006
160-1688-2 MS	1H-WP2	Total/NA	Solid	9034	41006
LCS 160-41006/2-A	Lab Control Sample	Total/NA	Solid	9034	41006
MB 160-41006/1-A	Method Blank	Total/NA	Solid	9034	41006

Analysis Batch: 41105

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	9012	41005
160-1688-2 DU	1H-WP2	Total/NA	Solid	9012	41005
160-1688-2 MS	1H-WP2	Total/NA	Solid	9012	41005
LCS 160-41005/2-A ^2	Lab Control Sample	Total/NA	Solid	9012	41005
MB 160-41005/1-A	Method Blank	Total/NA	Solid	9012	41005

Analysis Batch: 43126

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-1688-2	1H-WP2	Total/NA	Solid	1010A	
160-1688-2 DU	1H-WP2	Total/NA	Solid	1010A	
LCS 160-43126/2	Lab Control Sample	Total/NA	Solid	1010A	
MB 160-43126/3	Method Blank	Total/NA	Solid	1010A	

Surrogate Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	12DCE
Lab Sample ID	Client Sample ID	(85-115)	(85-115)	(84-120)	(83-117)
LCS 160-39507/9-A	Lab Control Sample	107	101	93	95

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)

Method: 8260C - Volatile Organic Compounds by GC/MS

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)			
		TOL	DBFM	BFB	12DCE
Lab Sample ID	Client Sample ID	(85-115)	(85-115)	(84-120)	(83-117)
160-1688-1	1H-WP1	101	101	95	95
160-1688-1 MS	1H-WP1	102	100	91	96
160-1688-1 MSD	1H-WP1	102	99	93	96
LB 160-39297/1-A LB	Method Blank	101	100	97	100

Surrogate Legend

TOL = Toluene-d8 (Surr)
DBFM = Dibromofluoromethane (Surr)
BFB = 4-Bromofluorobenzene (Surr)
12DCE = 1,2-Dichloroethane-d4 (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)					
		TBP	NBZ	PHL	TPH	FBP	2FP
Lab Sample ID	Client Sample ID	(50-101)	(45-102)	(40-95)	(56-118)	(42-95)	(38-98)
LCS 160-39484/2-A	Lab Control Sample	81	75	79	56	71	82

Surrogate Legend

TBP = 2,4,6-Tribromophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPH = Terphenyl-d14 (Surr)
FBP = 2-Fluorobiphenyl (Surr)
2FP = 2-Fluorophenol (Surr)

Method: 8270D - Semivolatile Organic Compounds (GC/MS)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)					
		TBP	NBZ	PHL	TPH	FBP	2FP
Lab Sample ID	Client Sample ID	(50-101)	(45-102)	(40-95)	(56-118)	(42-95)	(38-98)
160-1688-1	1H-WP1	75	78	75	56	71	82
160-1688-1 MS	1H-WP1	71	65	67	52 J	56	71
160-1688-1 MSD	1H-WP1	83	77	78	58	71	84

Method: 8270D - Semivolatile Organic Compounds (GC/MS) (Continued)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)					
		TBP	NBZ	PHL	TPH	FBP	2FP
Lab Sample ID	Client Sample ID	(50-101)	(45-102)	(40-95)	(56-118)	(42-95)	(38-98)
LB 160-39296/1-B LB	Method Blank	77	71	73	57	67	79

Surrogate Legend

TBP = 2,4,6-Tribromophenol (Surr)
NBZ = Nitrobenzene-d5 (Surr)
PHL = Phenol-d5 (Surr)
TPH = Terphenyl-d14 (Surr)
FBP = 2-Fluorobiphenyl (Surr)
2FP = 2-Fluorophenol (Surr)

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)	
		DCB2	TCX2
Lab Sample ID	Client Sample ID	(70-130)	(70-130)
LCS 160-40486/2-A	Lab Control Sample	103	68 J

Surrogate Legend

DCB = DCB Decachlorobiphenyl (Surr)
TCX = Tetrachloro-m-xylene

Method: 8081B - Organochlorine Pesticides (GC)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)	
		DCB2	TCX2
Lab Sample ID	Client Sample ID	(70-130)	(70-130)
160-1688-1	1H-WP1	101	70
160-1688-1 MS	1H-WP1	95	69 J
160-1688-1 MSD	1H-WP1	102	67 J
LB 160-39306/1-B LB	Method Blank	112	69 J

Surrogate Legend

DCB = DCB Decachlorobiphenyl (Surr)
TCX = Tetrachloro-m-xylene

Method: 8151A - Herbicides (GC)

Matrix: Solid **Prep Type: Total/NA**

		Percent Surrogate Recovery (Acceptance Limits)
		DCPA2
Lab Sample ID	Client Sample ID	(56-147)
LCS 160-40921/2-A	Lab Control Sample	106

Surrogate Legend

DCPA = 2,4-Dichlorophenylacetic acid

Surrogate Summary

Client: Aleut World Solutions
Project/Site: Waste Characterizations

TestAmerica Job ID: 160-1688-1

Method: 8151A - Herbicides (GC)

Matrix: Solid **Prep Type: TCLP**

		Percent Surrogate Recovery (Acceptance Limits)						
		DCPA2						
Lab Sample ID	**Client Sample ID**	**(56-147)**						
160-1688-1 - RE	1H-WP1	127						
160-1688-1 MS - RE	1H-WP1	124						
160-1688-1 MSD - RE	1H-WP1	174 J						
LB 160-40693/1-B LB	Method Blank	131						

Surrogate Legend

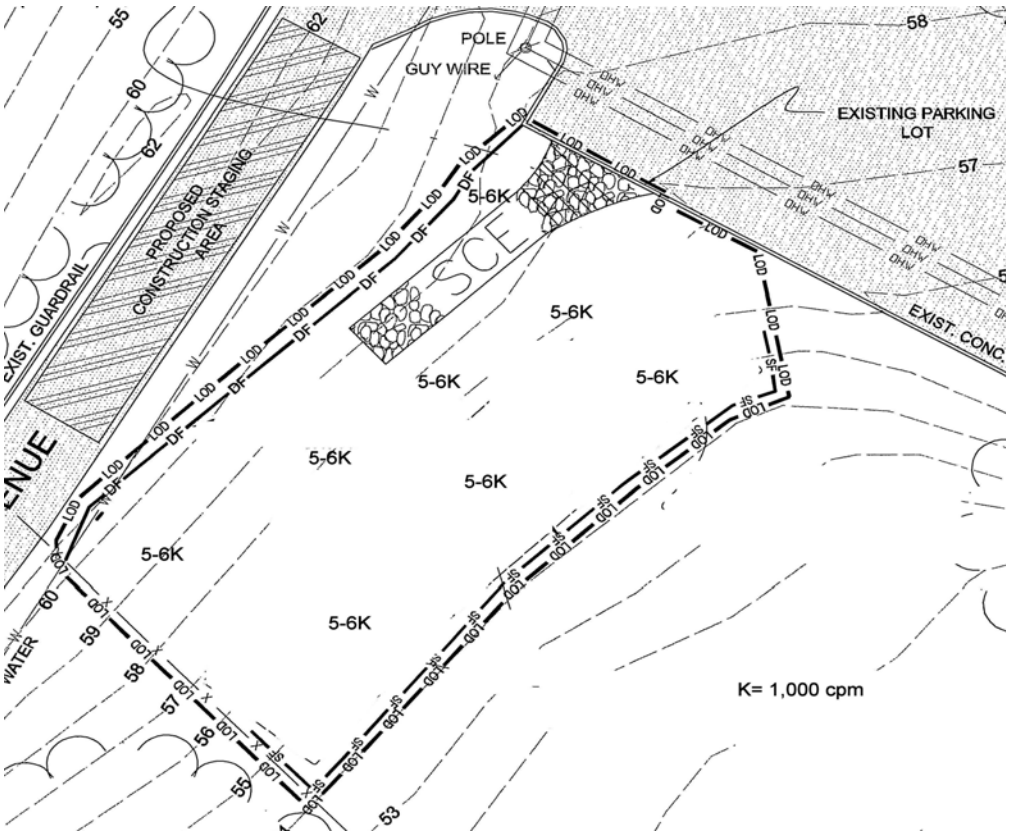
DCPA = 2,4-Dichlorophenylacetic acid

Appendix P
Soil Laydown Area Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
2/14/2013	10:15	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-001							
LOCATION:	NSF Indian Head IR Site 1 Soil Laydown Area							
SURVEYOR:	William Wylie, Daniel Spicuzza							
DATE: 2/14/2013	TIME: 16:15 / Reviewed by: William Haney	2350-1 44-10	126197 192598	4/20/2013				6000 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey



Comments:

This is a gamma scan survey of the IR Site 1 area.

K=1,000 CPM.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#)	denotes range of gamma scan survey in area
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-001

SURVEYOR: William Wylie, Daniel Spicuzza | LOCATION: NSF Indian Head IR Site 1 Soil Laydown Area

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
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Reviewer William Haney	Date: 2/14/2013 Time: 16:15	

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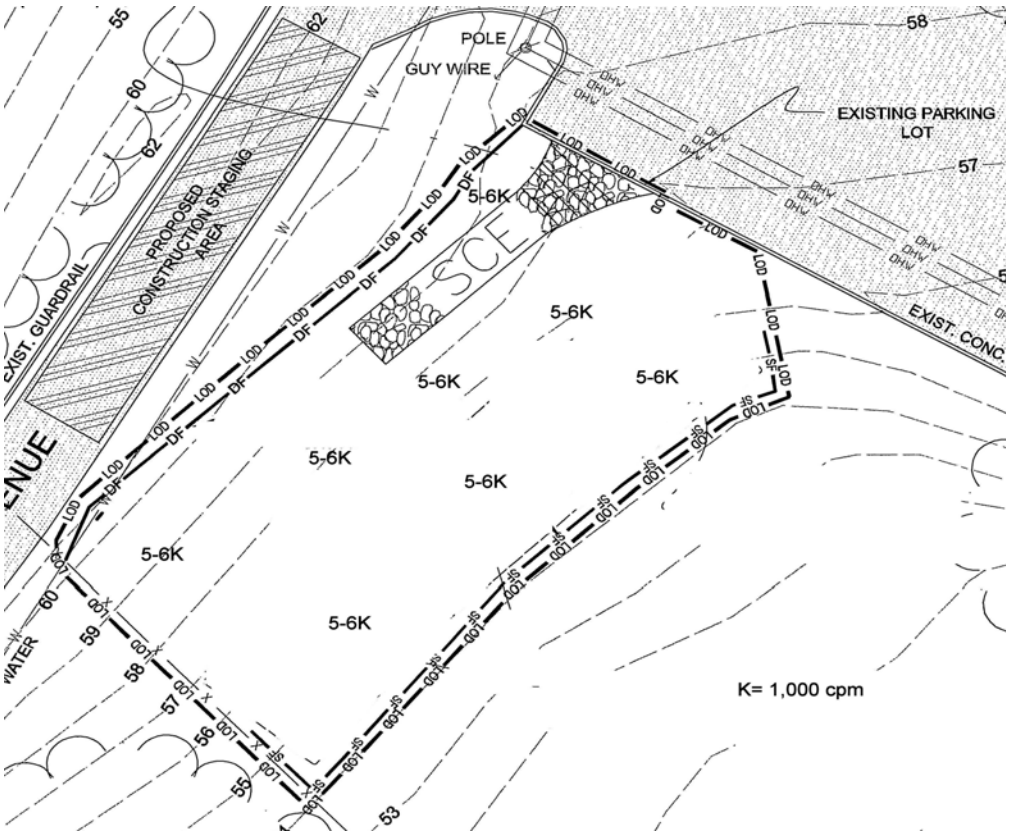
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/30/2013	12:30	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-018							
LOCATION:	NSF Indian Head IR Site 1 Soil Laydown Area							
SURVEYOR:	William Wylie, Daniel Spicuzza							
DATE: 8/30/2013	TIME: 16:25 / Reviewed by: William Haney	2350-1 44-10	98639 316936	6/27/2014				6000 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey



Comments:

This is a gamma scan survey of the IR Site 1 area.

K=1,000 CPM.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes range of gamma scan survey in area
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-018

SURVEYOR: William Wylie, Daniel Spicuzza | LOCATION: NSF Indian Head IR Site 1 Soil Laydown Area

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 8/30/2013
William Haney	Time: 16:25

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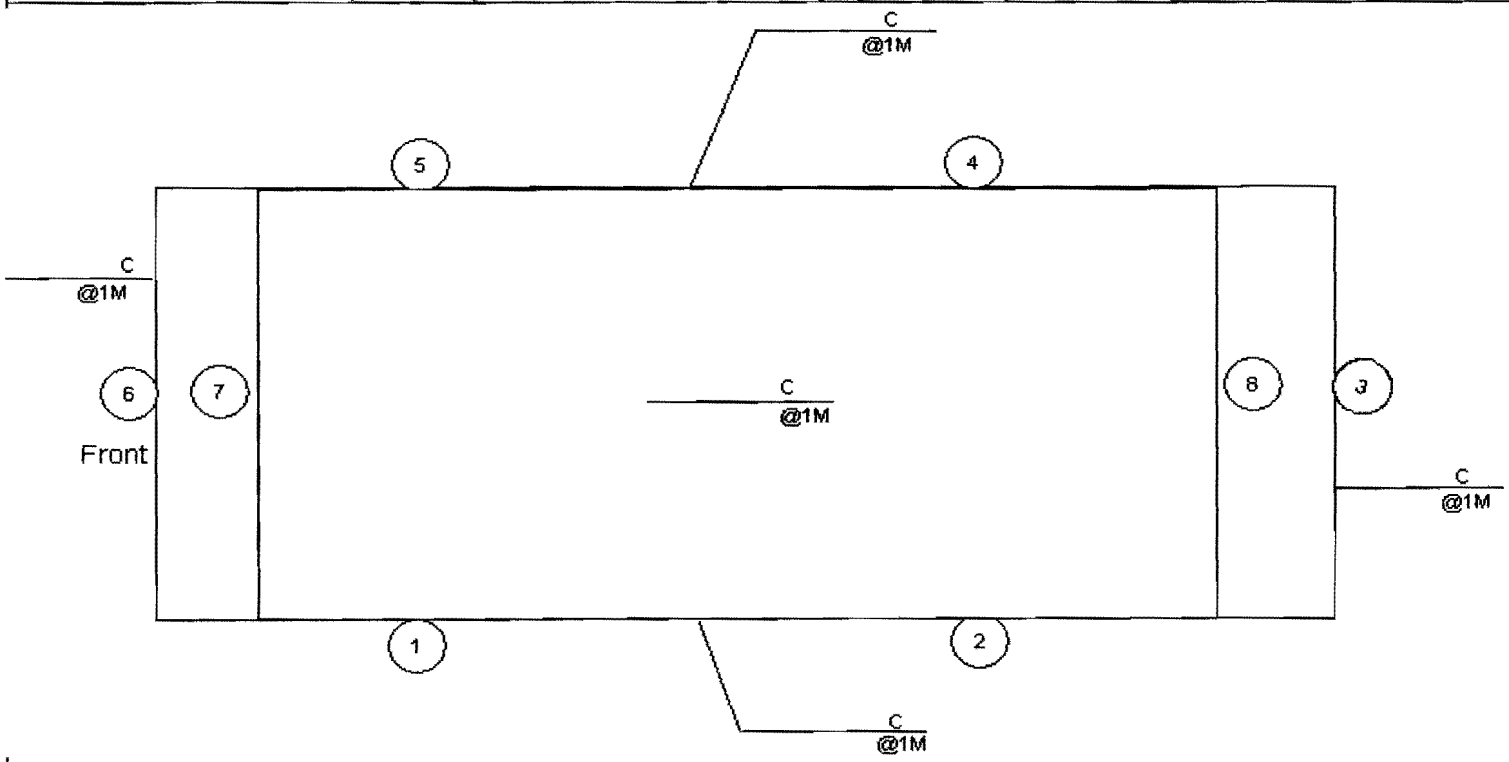
Appendix Q
Bin Outgoing Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/22/2013	TIME: 14:30		INSTRUMENTATION USED					
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 152.9	α 177.8% βγ 38048.8%
SURVEYOR: William Wylie			Model 19	115870	4/17/2014				5 μR/hr
DATE: 8/22/2013	TIME: 15:27	Reviewed By: Daniel Spicuzza							
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-001703 Outgoing Exterior Survey



Comments:

Tare Weight: 7,200 lbs.

Gross Weight: 42,230 lbs.

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☒

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001703 Outgoing Exterior Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	80	12				-1.8	18.6	Left Side
2	80	12				4.1	27.5	Left Side
3	6	5				-1.8	54.1	Rear
4	25	7				4.1	27.5	Right Side
5	25	7				-1.8	107.3	Right Side
6	15	6				4.1	45.2	Front
7	14	6				10.1	14.2	Top @ Front
8	14	6				4.1	178.3	Top @ Rear
9								
10								

Reviewer	Date: 8/22/2013
Daniel Spicuzza	Time: 15:27

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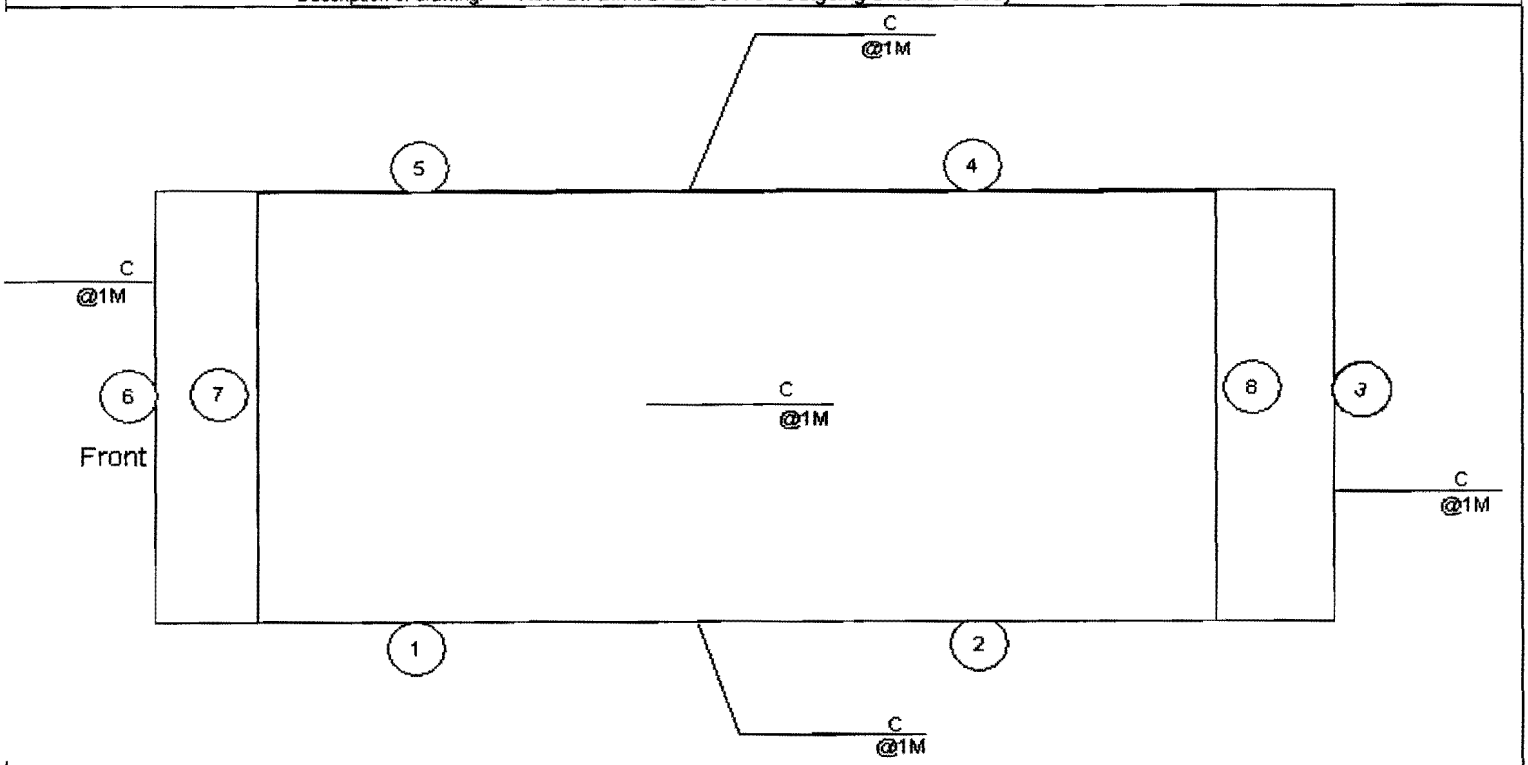
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/21/2013	TIME: 14:10		INSTRUMENTATION USED						
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 150.4	α 177.8% βγ 36718.4%
SURVEYOR: William Wylie			Model 19	115870	4/17/2014				5 μR/hr
DATE: 8/21/2013	TIME: 15:00	Reviewed By: Daniel Spicuzza							
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-001704 Outgoing Exterior Survey



Comments:

Tare Weight: 7,500 lbs.

Gross Weight: 40,180 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001704 Outgoing Exterior Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	50	6				1.2	5.3	Left Side
2	50	6				4.1	27.5	Left Side
3	7	5				4.1	31.9	Rear
4	100	8				1.2	58.5	Right Side
5	100	8				4.1	76.3	Right Side
6	10	5				-1.8	85.1	Front
7	8	5				4.1	80.7	Top @ Front
8	8	5				4.1	67.4	Top @ Rear
9								
10								

Reviewer	Date: 8/21/2013
Daniel Spicuzza	Time: 15:00

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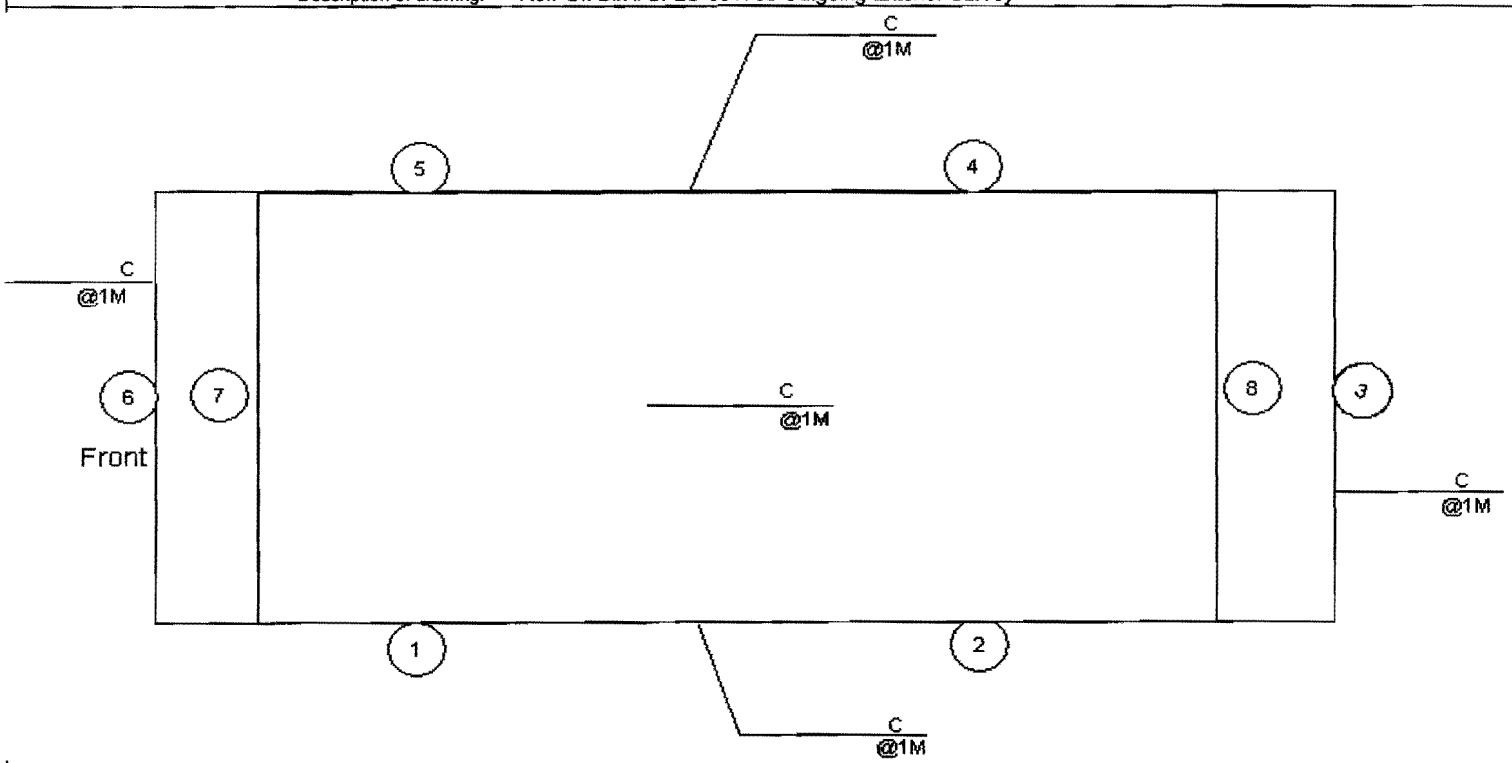
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/23/2013	TIME: 08:30		INSTRUMENTATION USED						
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 17.9 βγ 153.7	α 237.0% βγ 38492.2%
SURVEYOR: William Wylie			Model 19	115870	4/17/2014				5 μR/hr
DATE: 8/23/2013	TIME: 09:00	Reviewed By: Daniel Spicuzza							
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-001706 Outgoing Exterior Survey



Comments:

Tare Weight: 6,450 lbs.

Gross Weight: 40,100 lbs.

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☒

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001706 Outgoing Exterior Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	18	6				3.6	-21.3	Left Side
2	18	6				9.5	102.9	Left Side
3	13	5				-2.4	-30.2	Rear
4	14	5				3.6	40.8	Right Side
5	14	5				3.6	-12.4	Right Side
6	10	5				9.5	-3.5	Front
7	12	5				9.5	111.8	Top @ Front
8	12	5				9.5	58.5	Top @ Rear
9								
10								

Reviewer	Date:	
Daniel Spicuzza	8/23/2013	
	Time: 09:00	

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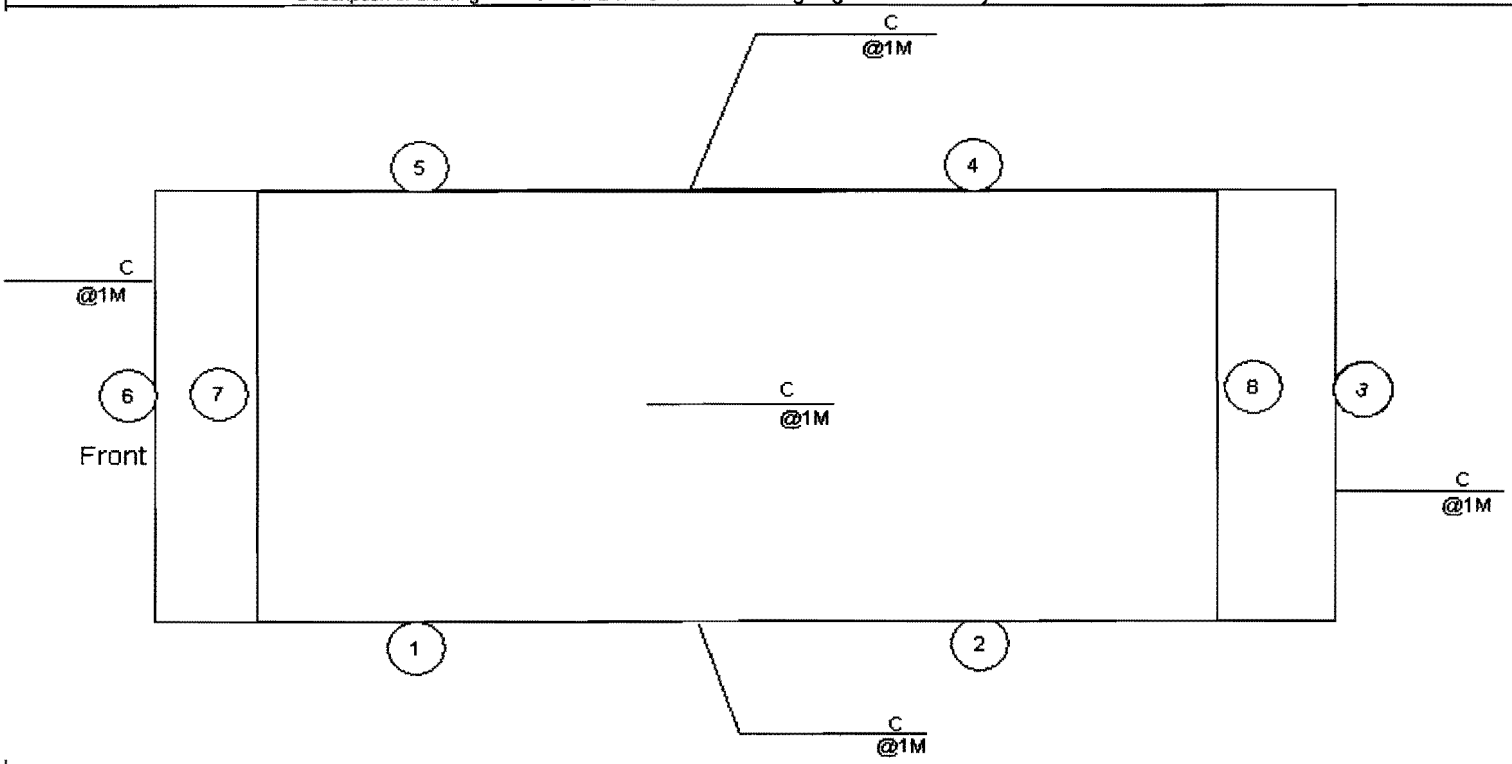
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/22/2013	TIME: 10:35		INSTRUMENTATION USED						
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 152.9	α 177.8% βγ 38048.8%
SURVEYOR: William Wylie			Model 19	115870	4/17/2014				5 µR/hr
DATE: 8/22/2013	TIME: 11:40	Reviewed By: Daniel Spicuzza							
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-2201 Outgoing Exterior Survey



Comments:

Tare Weight: 7,500 lbs.

Gross Weight: 41,730 lbs.

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☒

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in µr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-2201 Outgoing Exterior Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	18	6				-1.8	18.6	Left Side
2	18	6				16.0	36.4	Left Side
3	8	6				-1.8	9.8	Rear
4	20	6				16.0	27.5	Right Side
5	20	6				4.1	18.6	Right Side
6	20	7				10.1	54.1	Front
7	14	6				-1.8	9.8	Top @ Front
8	14	6				10.1	133.9	Top @ Rear
9								
10								

Reviewer	Date: 8/22/2013
Daniel Spicuzza	Time: 11:40

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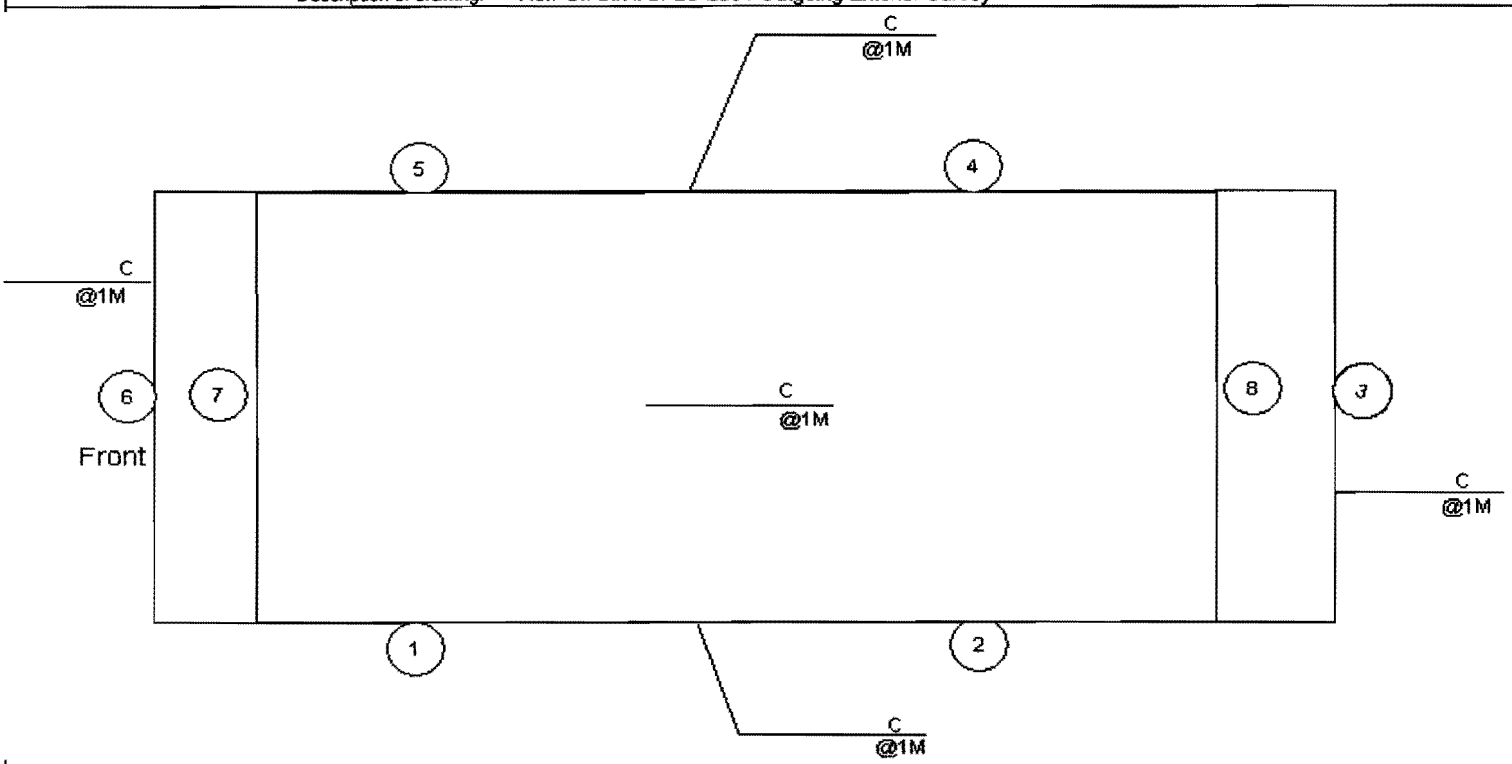
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/22/2013	TIME: 12:45		INSTRUMENTATION USED						
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 152.9	α 177.8% βγ 38048.8%
SURVEYOR: William Wylie			Model 19	115870	4/17/2014				5 µR/hr
DATE: 8/22/2013	TIME: 13:30	Reviewed By: Daniel Spicuzza							
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-2204 Outgoing Exterior Survey



Comments:

Tare Weight: 7,200 lbs.

Gross Weight: 42,230 lbs.

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☒

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in µr/hr unless otherwise noted

K = 1000

Rev 2 03/13/2006

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-2204 Outgoing Exterior Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	15	6				10.1	98.4	Left Side
2	15	6				4.1	63.0	Left Side
3	8	5				4.1	36.4	Rear
4	15	6				10.1	45.2	Right Side
5	15	6				10.1	71.8	Right Side
6	14	6				4.1	89.6	Front
7	12	5				4.1	94.0	Top @ Front
8	12	5				1.2	54.1	Top @ Rear
9								
10								

Reviewer	Date:	
Daniel Spicuzza	8/22/2013	
	Time: 13:30	

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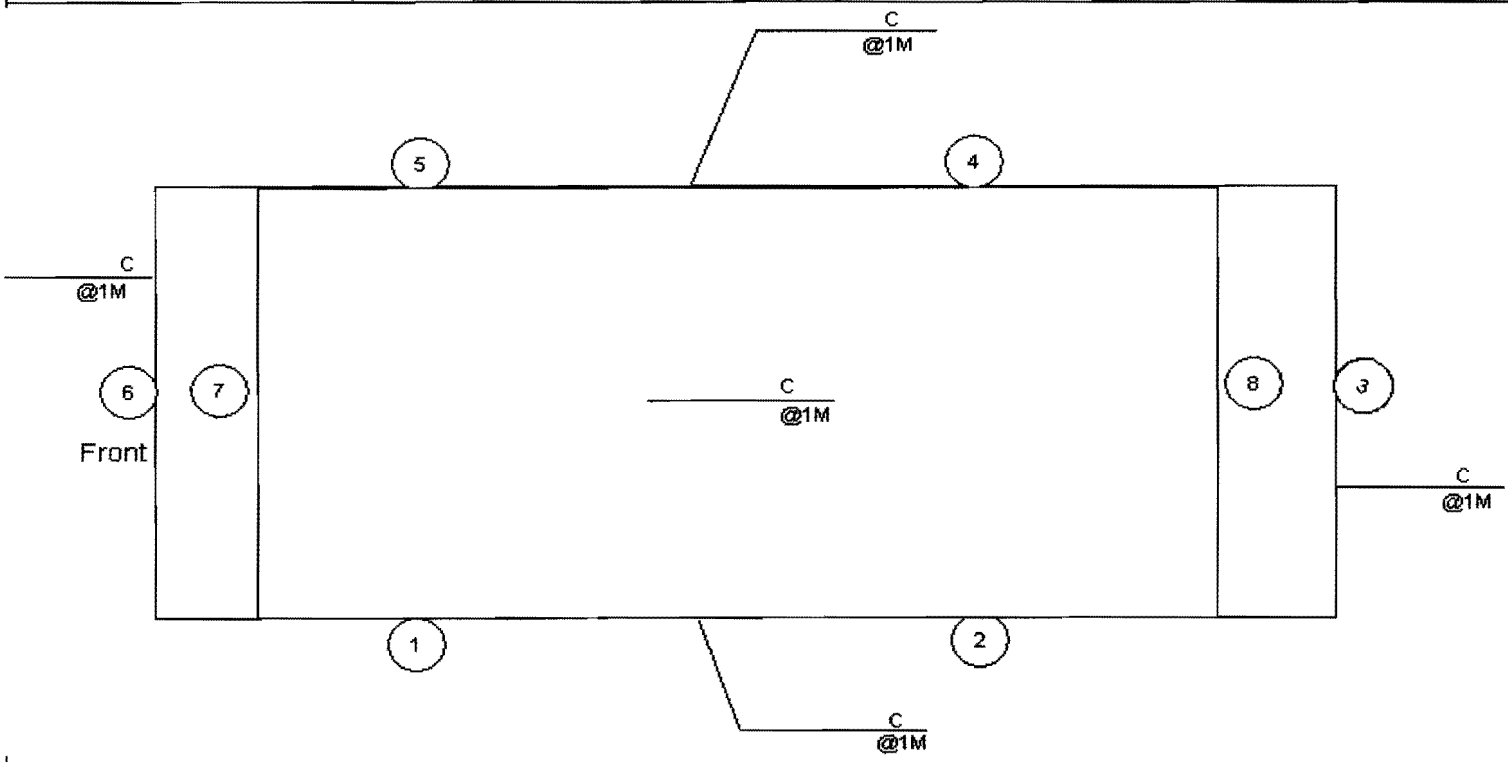
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/22/2013	TIME: 08:20		INSTRUMENTATION USED						
			Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A									
LOCATION: NSF Indian Head			2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 16.7 βγ 152.9	α 177.8% βγ 38048.8%
SURVEYOR: William Wylie			Model 19	115870	4/17/2014				5 µR/hr
DATE: 8/22/2013	TIME: 09:15	Reviewed By: Daniel Spicuzza							
Isotopes of Concern: Th-232									

Description of drawing: Roff-Off Bin #GFLU-2205 Outgoing Exterior Survey



Comments:

Tare Weight: 7,500 lbs.

Gross Weight: 39,170 lbs.

Routine (Daily / Weekly / Monthly) [ ] Non-routine [X]

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in µr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-2205 Outgoing Exterior Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	12	5				-1.8	5.3	Left Side
2	12	5				-1.8	-8.0	Left Side
3	8	5				4.1	18.6	Rear
4	35	6				10.1	80.7	Right Side
5	35	6				10.1	9.8	Right Side
6	15	5				-1.8	54.1	Front
7	9	5				4.1	45.2	Top @ Front
8	9	5				4.1	63.0	Top @ Rear
9								
10								

Reviewer	Date: 8/22/2013
Daniel Spicuzza	Time: 09:15

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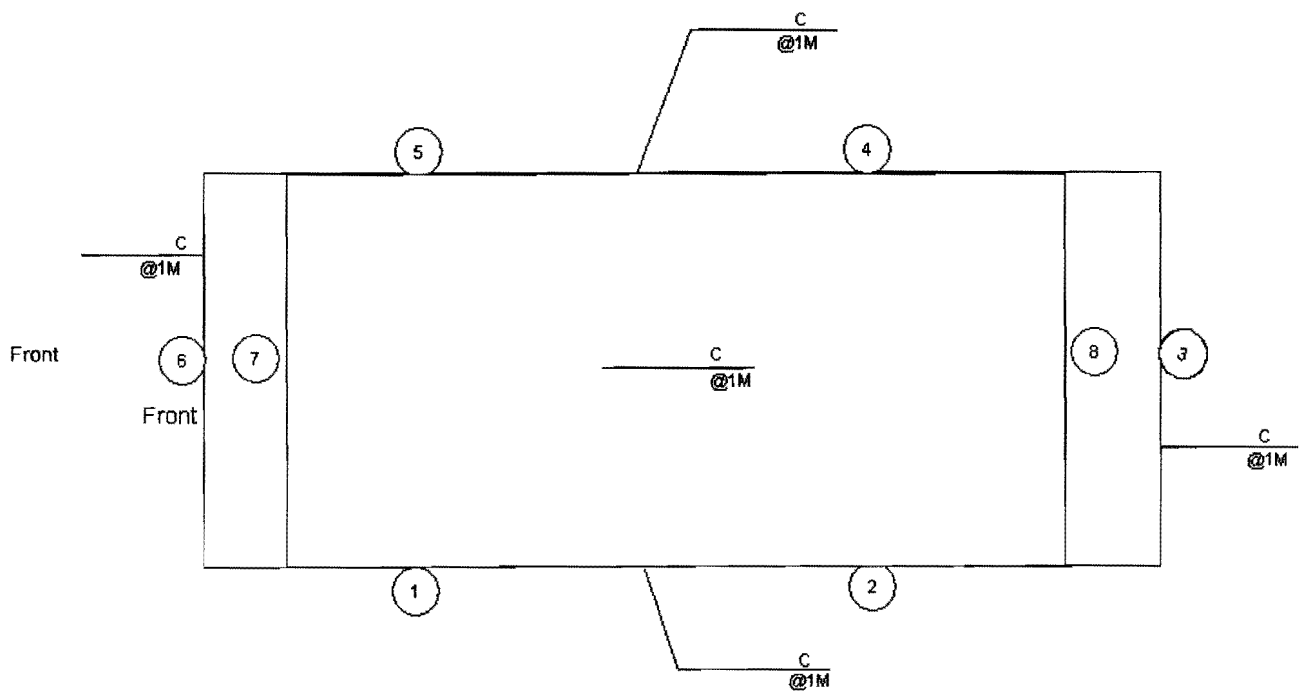
RADIATION/CONTAMINATION SURVEY FORM

DATE: 8/23/2013	TIME: 11:25	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER: N/A								
LOCATION: NSF Indian Head		2929	118417	10/26/2013	α 67.5% βγ 45.1%	α 16.9% βγ 11.3%	α 17.9 βγ 153.7	α 237.0% βγ 38492.2%
SURVEYOR: William Wylie		Model 19	115870	4/17/2014				5 μR/hr
DATE: 8/23/2013	TIME: 11:50	Reviewed By: Daniel Spicuzza						
Isotopes of Concern: Th-232								

Description of drawing: Roff-Off Bin #GFLU-001710 Outgoing Exterior Survey



Comments:

Tare Weight: 7,200 lbs.

Gross Weight: 39,150 lbs.

Routine (Daily / Weekly / Monthly) ☐ Non-routine ☒

(#) denotes swipe location and fixed α/β readings

# denotes G/A radiation readings

#/# denotes contact / 1 meter radiation readings.

* denotes highest radiation reading on contact

LAW denotes large area masslinn wipe

Δ denotes static location.

\+ Unless Otherwise Noted

All readings in μr/hr unless otherwise noted

K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY DESCRIPTION: Roff-Off Bin #GFLU-001710 Outgoing Exterior Survey

SURVEYOR: William Wylie

LOCATION: NSF Indian Head

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	15	7				3.6	-21.3	Left Side
2	15	7				9.5	111.8	Left Side
3	10	5				-2.4	-25.7	Rear
4	80	8				-2.4	-12.4	Right Side
5	80	8				9.5	31.9	Right Side
6	14	5				-2.4	40.8	Front
7	10	5				-2.4	-21.3	Top @ Front
8	10	5				9.5	76.3	Top @ Rear
9								
10								

Reviewer	Date:	
Daniel Spicuzza	8/23/2013	
	Time: 11:50	

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Appendix R
Waste Shipment Documents

15yds
40840#

1310010863 3

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2011-008-USEI-7
DATE: 8/26/13
WSID No.: 31442-0

NAME OF CARRIER No. 1: U.S. Environmental
NAME OF CARRIER No. 2: CSX Railway
NAME OF CARRIER No. 3: Greenfield Logistics
NAME OF CARRIER No. 4:
NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	USE Idaho			CONSIGNOR:	AWS for US Navy @ Indian Head NSWC		
STREET:	10.5 Miles NW on Hwy 78, Lemley Road			STREET:	3972 Ward Road		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No: 865-482-3896

Container No. GFLU-001706

Truck No.

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	12.46	40100	33650
Metal intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.40 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Remit C.O.D. to:
C.O.D. Amt:$
Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee:
Prepaid
Collect $
Total Charges $
Freight Charges
Freight Prepaid Check box if charges
except when box at right checked are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy NSE Indian Head	Received By:	USE Idaho
Signature:	Richard Willet	Signature:	Conan Kastner
Title:	Broker, Agent for US Army JMC	Title:	Receiving clerk
Date:	8/26/13	Date:	10/1/13

Carrier No. 1:	U.S. Environmental
Signature:	Date: 8/26/13
Carrier No.2:	CSX Railway
Signature:	C. Fause Date: 8/26/13
Carrier No. 3:	Greenfield Logistics
Signature:	Ken Hart Date: 10/1/13
Carrier No. 4:	0
Signature:	Date:
Carrier No. 5:	0
Signature:	Date:

Driver released pending resolution 10/1/13 CR

13100808957

39600
16yrds

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: **USN 2011-008-USEI-3**

NAME OF CARRIER No. 1: Freehold Cartage Inc. DATE: 9-5-13

NAME OF CARRIER No. 2: CSX Railway WSID No.: 31442-0

NAME OF CARRIER No. 3: Greenfield Logistics

NAME OF CARRIER No. 4:

NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	USE Idaho			CONSIGNOR:	AWS for US Navy @ Indian Head NSWC		
STREET:	10.5 Miles NW on Hwy 78, Lemley Road			STREET:	3972 Ward Road		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No: 865-482-3896

Container No. GFLU-2201

Truck No. 897

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		**Non-regulated DOT material (Soil)**	12.68	41730	34230
Metal intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.40 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Remit C.O.D. to:

C.O.D. Amt:$

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee:

Prepaid

Collect $

Total Charges $

Freight Charges

Freight Prepaid Check box if charges except when box at right checked are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF Indian Head	Received By:	USE Idaho
Signature:		Signature:	Corian Kastner
Title:	Broker, Agent for US Army JMC	Title:	Receiving clerk
Date:	9-5-13	Date:	10/8/13

Carrier No. 1:	Freehold Cartage Inc.	
Signature:	Tom Lm	Date: 9-5-13
Carrier No.2:	CSX Railway	
Signature:	T Jauree	Date: 9/6/13
Carrier No. 3:	Greenfield Logistics	
Signature:	Ken Hard	Date: 10-8-13
Carrier No. 4:	0	
Signature:		Date:
Carrier No. 5:	0	
Signature:		Date:

Actual Recieved 39600*, Driver Released pending Resolution 10/8/13 CK

1370080 8945 38,980# Lloyds

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2011-008-USEI-1

NAME OF CARRIER No. 1: US Environmental ~~Freehold Cartage Inc~~ DATE: 9-6-13

NAME OF CARRIER No. 2: CSX Railway WSID No.: 31442-0

NAME OF CARRIER No. 3: Greenfield Logistics

NAME OF CARRIER No. 4:

NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	USE Idaho			CONSIGNOR:	AWS for US Navy @ Indian Head NSWC		
STREET:	10.5 Miles NW on Hwy 78, Lemley Road			STREET:	3972 Ward Road		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No: 865-482-3896

Container No. GFLU-001704

Truck No. 617

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	12.10	40180	32680
Metal intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.40 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Remit C.O.D. to:

C.O.D. Amt:$

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee:

Prepaid

Collect $

Total Charges $

Freight Charges

Freight Prepaid Check box if charges are to be collected except when box at right checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF Indian Head	Received By:	USE Idaho
Signature:	Richard Wilhelm	Signature:	Cynthia Rodriguez
Title:	Broker, Agent for US Army JMC	Title:	Receiving Clerk
Date:	9-6-13	Date:	10/8/13

Carrier No. 1:	US Environmental ~~Freehold Cartage Inc~~	Date:	9-6-13
Signature:		Date:	9-8-13
Carrier No.2:	CSX Railway		
Signature:		Date:	9/7/13
Carrier No. 3:	Greenfield Logistics		
Signature:	Ken Hardy	Date:	10-8-13
Carrier No. 4:	0		
Signature:		Date:	
Carrier No. 5:	0		
Signature:		Date:	

Bill on released pending resolution 10/8/13

1370090 8995 42,420 # 1 Loads

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: **USN 2011-008-USEI-5**

NAME OF CARRIER No. 1: Freehold Cartage Inc. DATE: 9-5-13

NAME OF CARRIER No. 2: **CSX Railway** WSID No.: **31442-0**

NAME OF CARRIER No. 3: **Greenfield Logistics**

NAME OF CARRIER No. 4:

NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	USE Idaho			CONSIGNOR:	AWS for US Navy @ Indian Head NSWC		
STREET:	10.5 Miles NW on Hwy 78, Lemley Road			STREET:	3972 Ward Road		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No: 865-482-3896

Container No. GFLU-2204

Truck No. 897

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	12.97	42230	35030
Metal intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.40 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Richard White Signature

Remit C.O.D. to:

C.O.D. Amt:$

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee:

Prepaid

Collect $

Total Charges $

Freight Charges

Freight Prepaid Check box if charges except when box at right checked are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF Indian Head	Received By:	USE Idaho
Signature:	Richard White	Signature:	Joshua Bodmer
Title:	Broker, Agent for US Army JMC	Title:	Receiving Clerk
Date:	9-5-13	Date:	10/9/13

Carrier No. 1:	Freehold Cartage Inc.
Signature:	Terrell Mus Date: 9-5-13

Carrier No.2:	CSX Railway
Signature:	Date: 09/10/13

Carrier No. 3:	Greenfield Logistics
Signature:	Ken Hard Date: 10-9-13

Carrier No. 4:	0
Signature:	Date:

Carrier No. 5:	0
Signature:	Date:

Driver released pending resolution 10/9/13

1370090896 8

40800 184rds

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2011-008-USEI-4

NAME OF CARRIER No. 1: Freehold Cartage Inc. DATE: 9-6-13

NAME OF CARRIER No. 2: CSX Railway WSID No.: 31442-0

NAME OF CARRIER No. 3: Greenfield Logistics

NAME OF CARRIER No. 4:

NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	USE Idaho			CONSIGNOR:	AWS for US Navy @ Indian Head NSWC		
STREET:	10.5 Miles NW on Hwy 78, Lemley Road			STREET:	3972 Ward Road		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No: 865-482-3896

Container No. GFLU-001703

Truck No. 897

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	12.97	42230	35030
Metal intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.40 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Remit C.O.D. to:

C.O.D. Amt:$

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee:

Prepaid

Collect $

Total Charges $

Freight Charges

Freight Prepaid Check box if charges are to be collected except when box at right checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF Indian Head	Received By:	USE Idaho
Signature:		Signature:	
Title:	Broker, Agent for US Army JMC	Title:	Receiving Clerk
Date:	9-6-13	Date:	10/9/13

Carrier No. 1:	Freehold Cartage Inc.
Signature:	Date: 9-6-13
Carrier No.2:	CSX Railway
Signature:	Date: 9/10/13
Carrier No. 3:	Greenfield Logistics
Signature:	Date: 10-9-13
Carrier No. 4:	0
Signature:	Date:
Carrier No. 5:	0
Signature:	Date:

Actual Received 40800#
Driver released pending Resolution 10/9/13 cm

13101409153 41120# 18yds

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2011-008-USEI-6
DATE: 8/26/13
WSID No.: 31442-0

NAME OF CARRIER No. 1: U.S. Environmental
NAME OF CARRIER No. 2: CSX Railway
NAME OF CARRIER No. 3: Greenfield Logistics
NAME OF CARRIER No. 4:
NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	USE Idaho			CONSIGNOR:	AWS for US Navy @ Indian Head NSWC		
STREET:	10.5 Miles NW on Hwy 78, Lemley Road			STREET:	3972 Ward Road		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No: 865-482-3896

Container No. GFLU-001710
Truck No. TR631

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	11.83	39150	31950
Metal intermodal					
		Th-232 0.07 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding
$ <0.40 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation.
Signature

Remit C.O.D. to:
C.O.D. Amt:$
Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.
C.O.D. Fee:
Prepaid
Collect $
Total Charges $
Freight Charges
Freight Prepaid Check box if charges except when box at right checked are to be collected

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy NSF Indian Head	Received By:	USE Idaho
Signature:		Signature:	
Title:	Broker, Agent for US Army JMC	Title:	Receiving Clerk
Date:	8/26/13	Date:	10/14/13

Carrier No. 1:	U.S. Environmental
Signature:	Date: 8/26/13
Carrier No.2:	CSX Railway
Signature:	Date: 8/27/13
Carrier No. 3:	Greenfield Logistics
Signature:	Date: 10/14/13
Carrier No. 4:	0
Signature:	Date:
Carrier No. 5:	0
Signature:	Date:

Bill released pending resolution
10/14/13 SK

13101509208

38000#

18 yd

STRAIGHT BILL OF LADING

ORIGINAL - NOT NEGOTIABLE

SHIPMENT No: USN 2011-008-USEI-2

DATE: 8/26/13

WSID No.: 31442-0

NAME OF CARRIER No. 1: U.S. Environmental

NAME OF CARRIER No. 2: CSX Railway

NAME OF CARRIER No. 3: Greenfield Logistics

NAME OF CARRIER No. 4:

NAME OF CARRIER No. 5:

TO:				FROM:			
CONSIGNEE:	USE Idaho			CONSIGNOR:	AWS for US Navy @ Indian Head NSWC		
STREET:	10.5 Miles NW on Hwy 78, Lemley Road			STREET:	3972 Ward Road		
CITY:	Grand View	STATE:	ID	CITY:	Indian Head	STATE:	MD
ZIP CODE:	83624	PHONE:	800-274-1516	ZIP CODE:	20640	PHONE:	803-507-1529

24 HOUR EMERGENCY RESPONSE TELEPHONE No: 865-482-3896

Container No. GFLU-2205

Truck No. TR619

NO. OF UNITS & CONTAINER TYPE	HM	BASIC DESCRIPTION (PROPER SHIPPING NAME, HAZARD CLASS, IDENTIFICATION NO (UN OR NA), PACKING GROUP, PER 172.101, 172.202, 172.203	TOTAL QUANTITY (cubic yard)	Gross WEIGHT (lbs)	NET WEIGHT (lbs)
1		Non-regulated DOT material (Soil)	11.93	39710	32210
Metal intermodal					
		Th-232 0.08 mCi			

PLACARDS TENDERED: NO

Note-Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$ <0.40 per lb.

I hereby certify that the above-named materials are are properly classified, described, packaged, marked name and are classified, packed, marked and labeled, and are in proper condition for transportation according to applicable regulations of the Department of Transportation

Signature

Remit C.O.D. to:

C.O.D. Amt:$

Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

C.O.D. Fee:

Prepaid

Collect $

Total Charges $

Freight Charges

Freight Prepaid Check box if charges are to be collected except when box at right checked

RECEIVED, subject to the classifications and lawfully filed tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and conditions of contents of packages unknown), marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.
Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

Shipper:	AWS for US Navy, NSF Indian Head	Received By:	USE Idaho
Signature:	Richard Wilhelt	Signature:	Jenny Lyons
Title:	Broker, Agent for US Army JMC	Title:	receiving clerk
Date:	8/26/13	Date:	10/15/13

Carrier No. 1:	U.S. Environmental		
Signature:	[illegible]	Date:	8/26/13
Carrier No.2:	CSX Railway		
Signature:	T. Jeanne	Date:	8/27/13
Carrier No. 3:	Greenfield Logistics		
Signature:	Ken Hardy	Date:	101513
Carrier No. 4:	0		
Signature:		Date:	
Carrier No. 5:	0		
Signature:		Date:	

Driver released pending resolution 10/15/13 CR

CERTIFICATE OF DISPOSAL

October 28,2013

AWS FOR US NAVY @ INDIAN HEAD NSWC
3972 WARD ROAD
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2011-008-USEI-1/** was received by U.S. Ecology, Inc., on **10/08/2013**. The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of by **10/08/2013** in accordance with permits and laws regulating this facility.

Reference Number: 13100808945-USN 2011-008-USEI-1-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

October 28,2013

AWS FOR US NAVY @ INDIAN HEAD NSWC
3972 WARD ROAD
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2011-008-USEI-2/** was received by U.S. Ecology, Inc., on **10/15/2013**.The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of by **10/15/2013** in accordance with permits and laws regulating this facility.

Reference Number: 13101509208-USN 2011-008-USEI-2-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

October 28,2013

AWS FOR US NAVY @ INDIAN HEAD NSWC
3972 WARD ROAD
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2011-008-USEI-3/** was received by U.S. Ecology, Inc., on **10/08/2013**. The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of by **10/08/2013** in accordance with permits and laws regulating this facility.

Reference Number: 13100808957-USN 2011-008-USEI-3-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

October 28,2013

AWS FOR US NAVY @ INDIAN HEAD NSWC
3972 WARD ROAD
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2011-008-USEI-4/** was received by U.S. Ecology, Inc., on **10/09/2013**. The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of by **10/09/2013** in accordance with permits and laws regulating this facility.

Reference Number: 13100908968-USN 2011-008-USEI-4-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

October 28,2013

AWS FOR US NAVY @ INDIAN HEAD NSWC
3972 WARD ROAD
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2011-008-USEI-5/** was received by U.S. Ecology, Inc., on **10/09/2013**. The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of by **10/09/2013** in accordance with permits and laws regulating this facility.

Reference Number: 13100908995-USN 2011-008-USEI-5-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

October 16,2013

AWS FOR US NAVY @ INDIAN HEAD NSWC
3972 WARD ROAD
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2011-008-USEI-6/** was received by U.S. Ecology, Inc., on **10/14/2013**.The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of by **10/14/2013** in accordance with permits and laws regulating this facility.

Reference Number: 13101409153-USN 2011-008-USEI-6-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

Title: RECEIVING SUPERVISOR

CERTIFICATE OF DISPOSAL

October 14,2013

AWS FOR US NAVY @ INDIAN HEAD NSWC
3972 WARD ROAD
INDIAN HEAD, MD 20640

This is to certify that waste as defined on Waste Manifest number **USN 2011-008-USEI-7/** was received by U.S. Ecology, Inc., on **10/01/2013**.The waste(s) were subsequently treated, if required by 40 CFR Part 268 and U.S. Ecology's permits and disposed of by **10/01/2013** in accordance with permits and laws regulating this facility.

Reference Number: 13100108633-USN 2011-008-USEI-7-1-1
Material: 1 ROLL-OFF
Process: Direct Landfill
Management Code:
Facility: U.S. ECOLOGY IDAHO, INC.
20400 LEMLEY ROAD
GRAND VIEW, ID 83624
EPA ID: IDD073114654
Waste Type: NON HAZARDOUS WASTE
Customer: ALEUT WORLD SOLUTIONS, LLC

Printed Name: DONNA PULLEN

Signature: Donna Pullen

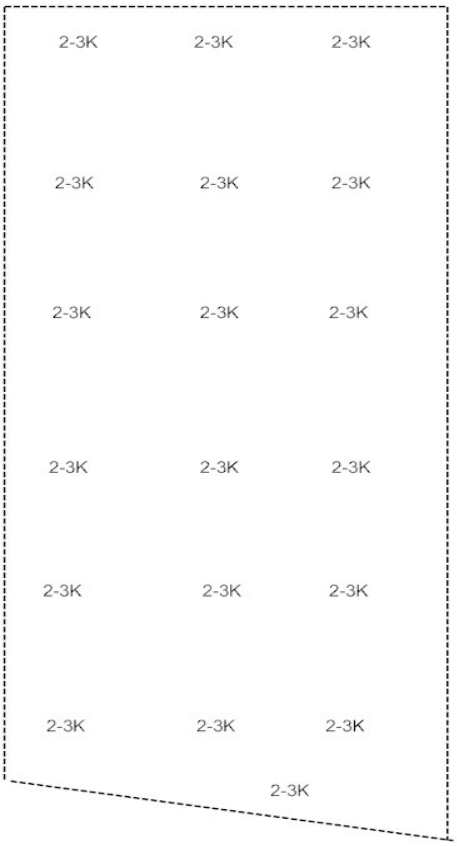
Title: RECEIVING SUPERVISOR

Appendix S
Bin Storage Area Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/20/2014	13:20	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-014							
LOCATION:	NSF Indian Head Bin Storage Area							
SURVEYOR:	William Wylie							
DATE: 8/20/2013	TIME: 14:45 / Reviewed by: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey of Bin Storage Area



Comments:

This is a gamma scan survey of the bin storage area. The area was 75% gamma scan surveyed

K=1,000 CPM.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes range of gamma scan survey in area
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT Page 2 of 2

SURVEY NUMBER: IHS1-014

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Bin Storage Area

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 8/20/2013 Time: 14:45	

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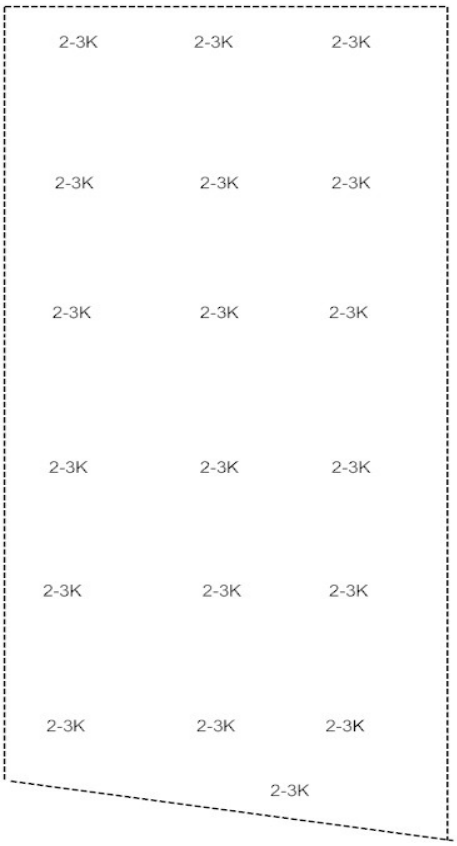
RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
9/5/2013	08:10	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-020							
LOCATION:	NSF Indian Head Bin Storage Area							
SURVEYOR:	William Wylie							
DATE: 9/5/2013	TIME: 09:45 / Reviewed by: Daniel Spicuzza	2350-1 44-10	98639 316936	6/27/2014				3000 CPM
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

Gamma Scan Survey of Bin Storage Area



Comments:

This is a gamma scan survey of the bin storage area. The area was 75% gamma scan surveyed

K=1,000 CPM.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes range of gamma scan survey in area
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in mr/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-020

SURVEYOR: William Wylie | LOCATION: NSF Indian Head Bin Storage Area

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 9/5/2013 Time: 9:45	

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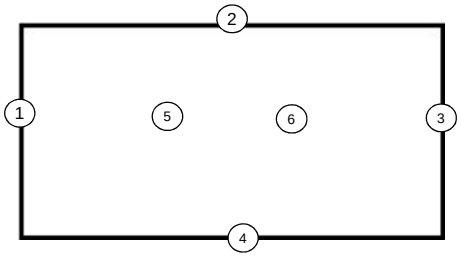
Appendix T
Miscellaneous Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE: 2/21/2013	TIME: 14:00	INSTRUMENTATION USED						
		Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm²)	Background + (dpm/100cm²)
SURVEY NUMBER:	IHS1-004							
LOCATION:	NSF Indian Head, IR Site 1	2929	118419	9/4/2013	α 67.2%	α 16.8%	α 17.8	α 6.0
					βγ 42.9%	βγ 10.7%	βγ 130.1	βγ 394.4
SURVEYOR:	William Wylie, Daniel Spicuzza	Model 19	167121	8/14/2013				5 µR/hr
DATE: 2/21/2013	TIME: 14:50 Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: N/A Minutes						

B-25 Box Survey



Comments:

Swipe # 6 was taken from the bottom of the box.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-004								
SURVEYOR: William Wylie, Daniel Spicuzza					LOCATION: NSF Indian Head, IR Site 1			
Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1	5	5				0.0	-5.9	Left Side
2	5	5				-2.0	-9.0	Back Side
3	5	5				-4.0	6.5	Right Side
4	7	5				-4.0	-2.8	Front Side
5	5	5				-4.0	-15.2	Top
6	7	5				-2.0	-9.0	Bottom
7								
8								
9								
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Reviewer Daniel Spicuzza	Date: 2/21/2013 Time: 14:50	

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RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
3/5/2013	08:15	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-010	2360	184949	7/11/2013	α 35.1%	α 8.8%	α 82.0	α 34.2
		43-93	268605		βγ 28.1%	βγ 7.0%	βγ 589.2	βγ 2092.5
LOCATION:	NSF Indian Head, IR Site 1	2929	118419	9/4/2013	α 67.2%	α 16.8%	α 17.8	α 6.0
					βγ 46.9%	βγ 11.7%	βγ 119.0	βγ 360.8
SURVEYOR:	James C. Young Jr.							
DATE: 3/5/2013	TIME: 10:50 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Release Survey Of Mini Excavator

This is a release survey of mini excavator.

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 120-170 cpm.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-010

SURVEYOR: James C. Young Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-22.8	270.5	-2.0	20.2	Left Track
2				-28.5	163.7	2.0	34.4	Left Track
3				-28.5	128.1	0.0	23.0	Right Track
4				5.7	298.9	-2.0	25.9	Right Track
5				0.0	427.0	6.0	-11.1	Inside Bucket
6				-17.1	661.9	2.0	37.2	Inside Bucket
7				-5.7	56.9	4.0	34.4	Outside Bucket
8				-22.8	-14.2	2.0	14.5	Outside Bucket
9				-17.1	56.9	-2.0	17.3	Inside Cab
10				-28.5	242.0	2.0	42.9	Inside Cab
11				-17.1	-28.5	4.0	-2.6	Front Blade
12				0.0	-192.2	6.0	11.7	Front Blade
8D						0.0	8.8	Duplicate Swipe
N/A								
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Reviewer Daniel Spicuzza	Date: 3/5/2013 Time: 10:50	

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-010	Date : 3/5/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Of Mini Excavator	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118419	9/4/2013	α	16.80%	α	5.95
			β	11.73%	β	360.77
2360 43-93	184949	7/11/2013	α	8.78%	α	34.19
			β	7.03%	β	2092.53

Contamination Levels:

5.7	dpm / 100cm^2	α	**Maximum Fixed**
661.9	dpm / 100cm^2	β	
6.0	dpm / 100cm^2	α	**Maximum Removable**
42.9	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: James C. Young Jr.	Date: 3/5/2013
	Time: 0815
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 3/5/2013 10:50:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
3/5/2013	09:45	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-011	2360	184949	7/11/2013	α 35.1%	α 8.8%	α 82.0	α 34.2
		43-93	268605		βγ 28.1%	βγ 7.0%	βγ 589.2	βγ 2092.5
LOCATION:	NSF Indian Head, IR Site 1	2929	118419	9/4/2013	α 67.2%	α 16.8%	α 17.8	α 6.0
					βγ 46.9%	βγ 11.7%	βγ 119.0	βγ 360.8
SURVEYOR:	James C. Young Jr.							
DATE: 3/5/2013	TIME: 10:00 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Release Survey Of Excavator

This is a release survey of excavator.

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-2 cpm.

Beta/gamma results: 130-180 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-011

SURVEYOR: James C. Young Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-28.5	7.1	7.9	85.6	Left Track
2				-17.1	-128.1	2.0	45.8	Left Track
3				-11.4	49.8	2.0	31.6	Right Track
4				0.0	14.2	0.0	74.2	Right Track
5				-5.7	0.0	4.0	51.5	Inside Bucket
6				17.1	448.4	2.0	31.6	Inside Bucket
7				22.8	14.2	4.0	60.0	Outside Bucket
8				28.5	-99.6	2.0	23.0	Outside Bucket
9				-17.1	-7.1	0.0	25.9	Inside Cab
10				-28.5	-71.2	4.0	65.7	Inside Cab
2D						0.0	37.2	Duplicate Swipe
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Reviewer Daniel Spicuzza	Date: 3/5/2013 Time: 10:00	

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-011	Date : 3/5/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Of Excavator	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118419	9/4/2013	α	16.80%	α	5.95
			β	11.73%	β	360.77
2360 43-93	184949	7/11/2013	α	8.78%	α	34.19
			β	7.03%	β	2092.53

Contamination Levels:

28.5	dpm / 100cm^2	α	**Maximum Fixed**
448.4	dpm / 100cm^2	β	
7.9	dpm / 100cm^2	α	**Maximum Removable**
85.6	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: James C. Young Jr.	Date: 3/5/2013
	Time: 0945
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 3/5/2013 10:00:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
3/5/2013	11:00	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-013	2360	184949	7/11/2013	α 35.1%	α 8.8%	α 82.0	α 34.2
		43-93	268605		βγ 28.1%	βγ 7.0%	βγ 589.2	βγ 2092.5
LOCATION:	NSF Indian Head, IR Site 1	2929	118419	9/4/2013	α 67.2%	α 16.8%	α 17.8	α 6.0
					βγ 46.9%	βγ 11.7%	βγ 119.0	βγ 360.8
SURVEYOR:	James C. Young Jr.							
DATE: 3/5/2013	TIME: 11:15 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Release Survey Of Wheel Loader

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 120-160 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-013

SURVEYOR: James C. Young Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1				-28.5	298.9	-4.0	17.3	Left Front Tire
2				-28.5	-7.1	2.0	20.2	Left Back Tire
3				-5.7	149.5	-2.0	51.5	Right Front Tire
4				-22.8	-64.1	2.0	42.9	Right Rear Tire
5				28.5	491.1	6.0	60.0	Inside Bucket
6				22.8	-42.7	0.0	37.2	Inside Bucket
7				-22.8	-163.7	0.0	74.2	Outside Bucket
8				-11.4	-35.6	2.0	25.9	Outside Bucket
9				-28.5	-106.8	4.0	8.8	Inside Cab
10				-28.5	64.1	2.0	57.1	Inside Cab
7D						-2.0	60.0	Duplicate Swipe
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 3/5/2013 Time: 11:15	

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-013	Date : 3/5/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Of Wheel Loader	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118419	9/4/2013	α	16.80%	α	5.95
			β	11.73%	β	360.77
2360 43-93	184949	7/11/2013	α	8.78%	α	34.19
			β	7.03%	β	2092.53

Contamination Levels:

28.5	dpm / 100cm^2	α	**Maximum Fixed**
491.1	dpm / 100cm^2	β	
6.0	dpm / 100cm^2	α	**Maximum Removable**
74.2	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: James C. Young Jr.	Date: 3/5/2013 Time: 1100
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 3/5/2013 11:15:00 AM

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/27/2013	10:50	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-015	2360	297848	11/8/2013	α 40.9%	α 10.2%	α 70.4	α 29.3
		43-93	323069		βγ 32.4%	βγ 8.1%	βγ 535.5	βγ 2000.0
LOCATION:	NSF Indian Head, IR Site 1	2929	118407	10/26/2013	α 67.5%	α 16.9%	α 13.4	α 0.6
					βγ 45.1%	βγ 11.3%	βγ 153.9	βγ 385.8
SURVEYOR:	Adolfo Matus Jr.							
DATE: 8/27/2013	TIME: 16:10 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Release Survey Of Excavator

This is a release survey of excavator.

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 100-160 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT **Page 2 of 2**

SURVEY NUMBER: IHS1-015

SURVEYOR: Adolfo Matus Jr. LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	Alpha dpm/100cm²	Beta/Gamma dpm/100cm²	
1				-9.8	-74.1	-0.6	-31.0	Left Track
2				-19.6	-24.7	-0.6	75.4	Left Track
3				-14.7	92.6	-0.6	13.3	Right Track
4				-19.6	49.4	-0.6	-26.6	Right Track
5				-19.6	-135.8	2.4	57.6	Inside Bucket
6				-14.7	43.2	5.3	66.5	Inside Bucket
7				-14.7	24.7	11.3	4.4	Outside Bucket
8				-19.6	-12.3	-0.6	39.9	Outside Bucket
9				-19.6	-179.0	-0.6	-31.0	Inside Cab
10				-14.7	129.6	2.4	-31.0	Inside Cab
5D						2.4	62.1	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
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Reviewer	Date: 8/27/2013
Daniel Spicuzza	Time: 16:10

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-015	Date : 8/27/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Of Excavator	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118407	10/26/2013	α	16.88%	α	0.59
			β	11.28%	β	385.81
2360 43-93	297848	11/8/2013	α	10.23%	α	29.34
			β	8.10%	β	2000.00

Contamination Levels:

-9.8	dpm / 100cm^2	α	**Maximum Fixed**
129.6	dpm / 100cm^2	β	
11.3	dpm / 100cm^2	α	**Maximum Removable**
75.4	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: Adolfo Matus Jr.	Date: 8/27/2013
	Time: 1050
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 8/27/2013 4:10:00 PM

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/27/2013	14:45	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-016	2360	297848	11/8/2013	α 40.9%	α 10.2%	α 60.2	α 19.6
		43-93	323069		βγ 32.4%	βγ 8.1%	βγ 502.5	βγ 1753.1
LOCATION:	NSF Indian Head, IR Site 1	2929	118407	10/26/2013	α 67.5%	α 16.9%	α 13.4	α 0.6
					βγ 45.1%	βγ 11.3%	βγ 153.9	βγ 385.8
SURVEYOR:	Adolfo Matus Jr./Daniel Spicuzza							
DATE: 8/27/2013	TIME: 16:10 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Release Survey Plastic Sheeting

This is a release survey of plastic sheeting.

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 100-160 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT Page 2 of 2

SURVEY NUMBER: IHS1-016

SURVEYOR: Adolfo Matus Jr./Daniel Spicuzza

LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				0.0	92.6	-0.6	-22.2	Plastic Sheeting
2				-14.7	-37.0	-0.6	-4.4	Plastic Sheeting
3				-9.8	-117.3	-0.6	13.3	Plastic Sheeting
4				-9.8	24.7	-0.6	17.7	Plastic Sheeting
5				-9.8	-24.7	2.4	22.2	Plastic Sheeting
6				-4.9	37.0	5.3	57.6	Plastic Sheeting
7				-4.9	30.9	11.3	-8.9	Plastic Sheeting
8				-9.8	-37.0	-0.6	-31.0	Plastic Sheeting
9				-9.8	-117.3	-0.6	-39.9	Plastic Sheeting
10				-4.9	-86.4	2.4	8.9	Plastic Sheeting
11				-9.8	0.0	2.4	-4.4	Plastic Sheeting
12				-4.9	37.0	5.3	13.3	Plastic Sheeting
13				-4.9	-6.2	5.3	-8.9	Plastic Sheeting
14				-14.7	-43.2	-0.6	-8.9	Plastic Sheeting
15				-14.7	18.5	-0.6	-17.7	Plastic Sheeting
16				0.0	43.2	8.3	-31.0	Plastic Sheeting
17				-4.9	24.7	5.3	4.4	Plastic Sheeting
18				-14.7	-92.6	-0.6	13.3	Plastic Sheeting
19				0.0	-55.6	8.3	48.8	Plastic Sheeting
20				-4.9	6.2	5.3	26.6	Plastic Sheeting
21				-9.8	30.9	2.4	13.3	Plastic Sheeting
22				-4.9	55.6	5.3	17.7	Plastic Sheeting
23				-9.8	67.9	2.4	22.2	Plastic Sheeting
24				-4.9	24.7	5.3	31.0	Plastic Sheeting
25				0.0	12.3	8.3	53.2	Plastic Sheeting
26				-14.7	18.5	2.4	39.9	Plastic Sheeting
27				-9.8	37.0	5.3	-4.4	Plastic Sheeting
28				-9.8	24.7	5.3	4.4	Plastic Sheeting
29				0.0	12.3	8.3	22.2	Plastic Sheeting
30				0.0	-43.2	11.3	-8.9	Plastic Sheeting
31				-4.9	-30.9	8.3	4.4	Plastic Sheeting
32				-4.9	0.0	5.3	13.3	Plastic Sheeting
33				-9.8	30.9	2.4	26.6	Plastic Sheeting
34				-14.7	-49.4	2.4	53.2	Plastic Sheeting
35				-9.8	-24.7	5.3	62.1	Plastic Sheeting
36				-14.7	-37.0	2.4	-4.4	Plastic Sheeting
37				-9.8	37.0	2.4	8.9	Plastic Sheeting
38				-14.7	86.4	-0.6	22.2	Plastic Sheeting
39				-19.6	61.7	-0.6	13.3	Plastic Sheeting
40				-9.8	74.1	2.4	62.1	Plastic Sheeting
41				-9.8	24.7	2.4	44.3	Plastic Sheeting
42				-19.6	-18.5	-0.6	35.5	Plastic Sheeting
43				0.0	-24.7	8.3	39.9	Plastic Sheeting
44				-4.9	6.2	5.3	4.4	Plastic Sheeting
45				-4.9	-98.8	5.3	-13.3	Plastic Sheeting
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Reviewer
Daniel Spicuzza

Date: 8/27/2013

Time: 16:10

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-016	Date : 8/27/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Plastic Sheeting	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118407	10/26/2013	α	16.88%	α	0.59
			β	11.28%	β	385.81
2360 43-93	297848	11/8/2013	α	10.23%	α	19.56
			β	8.10%	β	1753.09

Contamination Levels:

0.0	dpm / 100cm^2	α	**Maximum Fixed**
92.6	dpm / 100cm^2	β	
11.3	dpm / 100cm^2	α	**Maximum Removable**
62.1	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: Adolfo Matus Jr./Daniel Spicuzza	Date: 8/27/2013
	Time: 1445
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 8/27/2013 4:10:00 PM

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/27/2013	14:50	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-017	2360	297779	11/9/2013	α 40.7%	α 10.2%	α 47.1	α 9.8
		43-93	323064		βγ 25.9%	βγ 6.5%	βγ 675.8	βγ 2548.3
LOCATION:	NSF Indian Head, IR Site 1	2929	118407	10/26/2013	α 67.5%	α 16.9%	α 13.4	α 0.6
					βγ 45.1%	βγ 11.3%	βγ 153.9	βγ 385.8
SURVEYOR:	William Wylie							
DATE: 8/27/2013	TIME: 16:10 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

B-25 Box Release Survey

This is a release survey of empty B-25 Box.

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 130-170 cpm.

Routine (Daily / Weekly / Monthly) ☐ **Non-routine** X

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-017

SURVEYOR: William Wylie

LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (µR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				9.8	7.7	5.3	17.7	Inside Box
2				-4.9	-69.5	5.3	13.3	Inside Box
3				0.0	23.2	2.4	8.9	Inside Box
4				0.0	-30.9	-0.6	57.6	Inside Box
5				0.0	-77.2	2.4	39.9	Inside Box
6				4.9	46.3	5.3	31.0	Inside Box
7				4.9	-7.7	11.3	17.7	Inside Box
8				0.0	-15.4	-0.6	13.3	Inside Box
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Reviewer
Daniel Spicuzza

Date: 8/27/2013

Time: 16:10

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-017	Date : 8/27/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: B-25 Box Release Survey	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118407	10/26/2013	α	16.88%	α	0.59
			β	11.28%	β	385.81
2360 43-93	297779	11/9/2013	α	10.18%	α	9.83
			β	6.48%	β	2548.26

Contamination Levels:

9.8	dpm / 100cm^2	α	**Maximum Fixed**
46.3	dpm / 100cm^2	β	
11.3	dpm / 100cm^2	α	**Maximum Removable**
57.6	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: William Wylie	Date: 8/27/2013
	Time: 1450
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 8/27/2013 4:10:00 PM

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
8/30/2013	14:10	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-019	2360	297848	11/8/2013	α 40.9%	α 10.2%	α 70.4	α 29.3
		43-93	323069		βγ 32.4%	βγ 8.1%	βγ 522.6	βγ 1901.2
LOCATION:	NSF Indian Head, IR Site 1	2929	118407	10/26/2013	α 67.5%	α 16.9%	α 16.7	α 1.8
					βγ 45.1%	βγ 11.3%	βγ 150.7	βγ 369.0
SURVEYOR:	Adolfo Matus Jr.							
DATE: 8/30/2013	TIME: 15:15 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 2 Minutes						

Release Survey Of Wheel Loader

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 100-160 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-019

SURVEYOR: Adolfo Matus Jr. LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				-19.6	24.7	-1.8	-0.9	Left Front Tire
2				-14.7	30.9	-1.8	34.6	Left Rear tire
3				-9.8	67.9	1.2	16.9	Right Rear Tire
4				-14.7	104.9	-1.8	8.0	Right Front Tire
5				-19.6	12.3	1.2	21.3	Inside Bucket
6				-14.7	86.4	1.2	56.8	Inside Bucket
7				-9.8	123.5	4.1	52.3	Outside Bucket
8				-14.7	86.4	-1.8	34.6	Outside Bucket
9				-19.6	-37.0	-1.8	8.0	Inside Cab
10				-14.7	80.2	1.2	-14.2	Inside Cab
7D						1.2	43.5	Duplicate Swipe
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Reviewer Daniel Spicuzza	Date: 8/30/2013 Time: 15:15

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-019	Date : 8/30/2013
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Of Wheel Loader	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	118407	10/26/2013	α	16.88%	α	1.78
			β	11.28%	β	368.96
2360 43-93	297848	11/8/2013	α	10.23%	α	29.34
			β	8.10%	β	1901.23

Contamination Levels:

-9.8	dpm / 100cm^2	α	**Maximum Fixed**
123.5	dpm / 100cm^2	β	
4.1	dpm / 100cm^2	α	**Maximum Removable**
56.8	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: Adolfo Matus Jr.	Date: 8/30/2013
	Time: 1410
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 8/30/2013 3:15:00 PM

Appendix AA

Aleut World Solutions, LLC (AWS), 2015a. Final Characterization Survey Report Site 1 Removal Action, Naval Support Facility Indian Head, Indian Head, MD, Rev. 0 March 6, 2015.

ALEUT WORLD SOLUTIONS

Anchorage Corporate Office **Phone: (907) 278-2311**
615 E. 82nd Ave., Suite 200 **Fax: (907) 278-2350**
Anchorage, Alaska 99518 Website: www.aleutworldsolutions.com

FINAL CHARACTERIZATION SURVEY REPORT
IR SITE 1

NAVAL SUPPORT FACILITY INDIAN HEAD

INDIAN HEAD, MD

For the:

U.S. ARMY JOINT MUNITIONS COMMAND

ROCK ISLAND, IL

Project No. USN 2014-058

Contract No. W52P1J-08-D-0034/DO:0085

March 6, 2015

Rev. 0

Prepared by:

Aleut World Solutions
615 E. 82nd Ave., Suite 200
Anchorage, Alaska 99518

FINAL CHARACTERIZATION SURVEY REPORT
IR SITE 1

NAVAL SUPPORT FACILITY INDIAN HEAD

INDIAN HEAD, MD

For the:

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Prepared by:

Aleut World Solutions
615 E. 82nd Ave., Suite 200
Anchorage, Alaska 99518

March 6, 2015
Rev. 0

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Approvals Page

FINAL CHARACTERIZATION SURVEY REPORT

Written by: Daniel M. Spicuzza Date: 3/6/2015
Daniel Spicuzza, AWS Project Manager

Approved by: WG Haney Digitally signed by WG Haney DN: cn=WG Haney, c=US, o=AWS, LLC ou=Field Operations, email=whaney@aleutworldsolutions.com Date: 2016.06.23 10:19:50 -04'00' Date: 3/6/2015
William Haney, AWS Field Operations Manager

Approved by: WHITAKER.FRANK.C.JR.1270398916 Digitally signed by WHITAKER.FRANK.C.JR.1270398916 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=WHITAKER.FRANK.C.JR.1270398916 Date: 2016.06.07 15:51:36 -05'00' Date: 3/6/2015
U.S. Army JMC Representative

Approved by: Allen Ray Starbuck Jr. Date: 3/6/2015
RASO Representative

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Appendix F Laboratory Data Reports

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ABBREVIATIONS AND ACRONYMS

ALARA	As Low As Reasonably Achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOC	Areas of Concern
AWS	Aleut World Solutions
BLDG	Building
BSEn	Bering Sea Environmental
CFR	Code of Federal Regulations
cm	centimeter
cpm	counts per minute
DCGLs	Derived Concentration Guideline Limits
D&D	Decontamination and Decommissioning
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
dpm/100 cm^2	disintegrations per 100 square centimeters
DQO	Data Quality Objectives
ε_i	Instrument Efficiency
ε_s	Surface Efficiency Factor
Ft	Feet
ft^2	Square feet
HASP	Health and Safety Plan
ISO	International Organization for Standardization
LLRW	Low Level Radioactive Waste
M	Meter
m^2	square meter

MARSSIM	Multi Agency Radiation Survey & Site Investigation Manual
MDC	Minimum Detectable Concentration
MDCR	Minimal Detectable Count Rate
ml	Milliliter
MSDS	Material Safety Data Sheets
mrem/y	millirem per year
N/A	Not Applicable
NaI	Sodium iodide
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
NSF-IH	Naval Support facility Indian Head
OSHA	Occupational Safety and Health Administration
PM	Project Manager
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RASO	Naval Sea Systems Command Detachment, Radiological Affairs Support Office
RWP	Radiation Work Permit
SOPs	Standard Operating Procedures
TEDE	Total Effective Dose Equivalent
Th-232	Thorium-232
TLD	thermoluminescent dosimeter
µR/h	micro roentgens per hour
y	Year

RECORD OF REVISIONS

Revision Number	Description	Date
0	Final Characterization Survey Report	3/6/2015

1.0 EXECUTIVE SUMMARY

Aleut World Solutions (AWS) was contracted by the U.S. Army Joint Munitions Command (JMC) to perform a characterization survey and sampling effort in accordance with MARSSIM guidelines at the IR Site 1 located at the Naval Support Facility Indian Head (NSF-IH) in Indian Head, MD. Experiments with radioactive materials (Thorium-232) were conducted in the past in this area. The characterization surveys and sampling were performed during the period of 26 January through 30 January 2015. A map showing the location of the Naval Support Facility Indian Head is provided in Figure 1 below. Figure 2 presents an overview map of the site and the borehole locations.

Figure 1 Naval Support Facility Indian Head Location Map

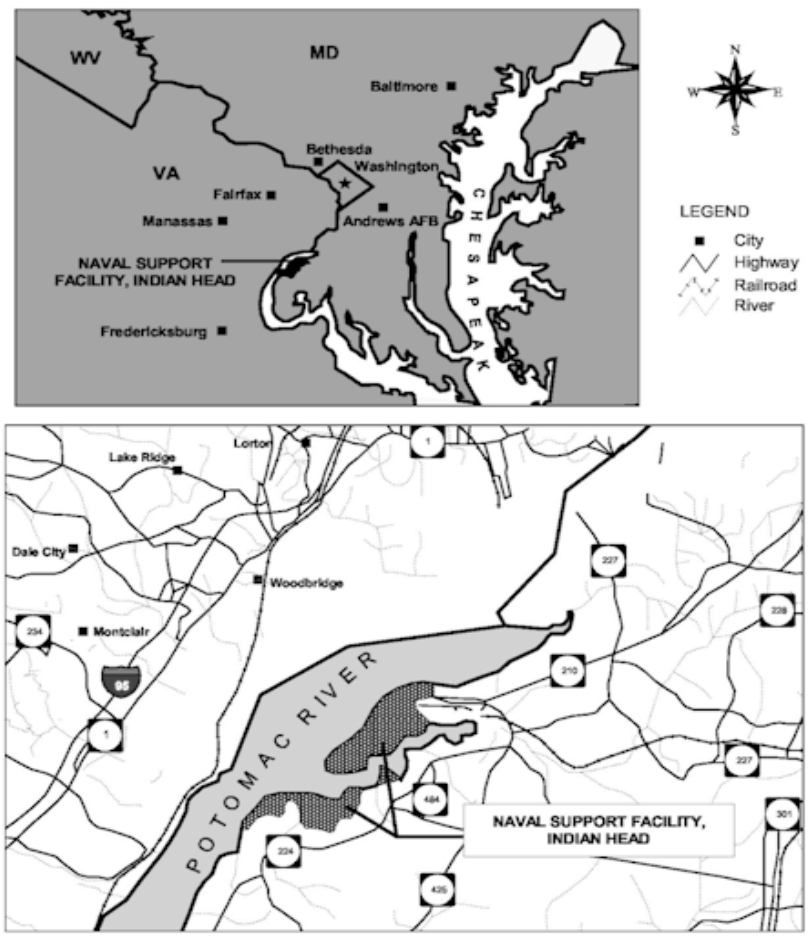
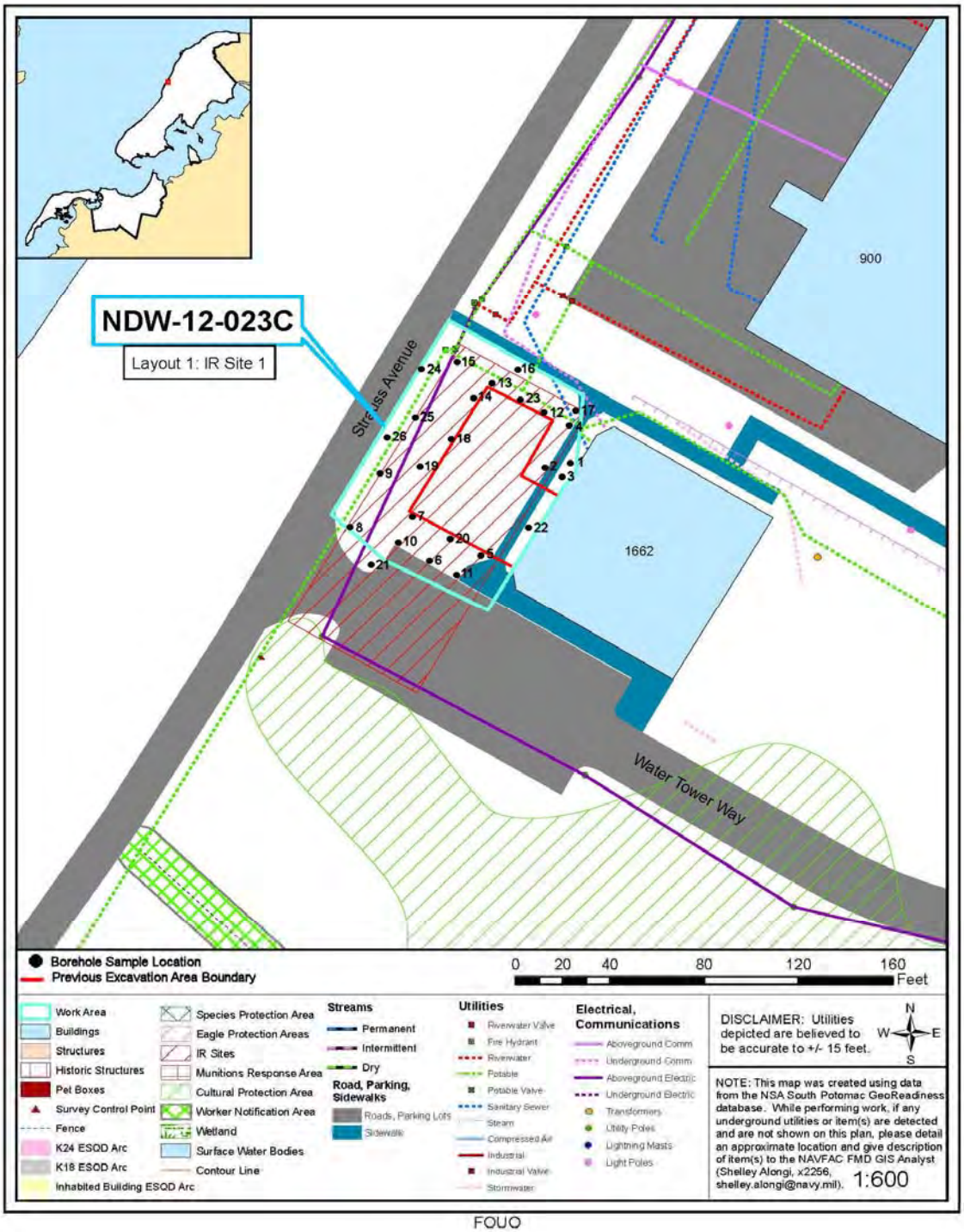


Figure 2 Site Overview Map



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1.1 Scope of Work Performed

The work that was performed included:

- Performed characterization surveys and sampling of the IR Site 1 area which included soil boreholes, gamma logging of the boreholes, gamma scan surveys, and soil sampling for offsite isotopic thorium analysis.

.

1.2 Conceptual Site Model

IR Site 1 was used for experiments with radioactive material in soil. The potential receptors would be workers excavating soil in the area and being exposed to contaminated soils.

Characterizations surveys of the areas were performed to identify any areas of residual radioactive material in the soils.

1.3 Surface Activity Derived Concentration Guideline Limits (DCGLs) for Radionuclide of Concern for Equipment and Tools

The surface activity DCGL's are stated in the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses, By-product, Source, or Special Nuclear Materials, (NRC 1987)", and "Termination of Operating Licenses for Nuclear Reactors, Regulatory Guide 1.86, (AEC 1974)."

These DCGL's were applied to incoming and outgoing surveys of equipment used during characterization survey activities. Table 1 presents the DCGL's. None of the values in Table 1 were exceeded during the characterization survey effort.

Table 1 Surface Activity DCGL's for Equipment and Tools

Radionuclide	Removable in dpm/100cm^2	Average [1] in dpm/100cm^2	Maximum [2] in dpm/100cm^2	Radiations Emitted
Th-232	200	1,000	3,000	$\alpha\gamma$

1. Measurements of average contaminant should not be over more than 1 m^2
2. The maximum contamination level applies to an area of not more than 100 cm^2

1.4 Derived Concentration Guideline Limit (DCGL) for Radionuclide of Concern for Soil

The DCGL for soils was calculated during the Engineering Evaluation and Cost Analysis (EE/CA) that was performed by Tetra Tech NUS, Inc. in September of 2010. The goal was to

develop a DCGL that corresponded to a cancer risk within the EPA acceptable (or presumably not unacceptable) risk range of 1×10^{-4} (1 in 10,000) and $1\times^{10-6}$ (1 in 1,000,000). The calculations were performed using the RESRAD Version 6.3 Modeling Code developed by Argonne National Laboratory to evaluate doses from exposure to radioactively open land areas.

RESRAD is a computer model designed to estimate radiation doses and risks from residual radioactive materials. It is the only code designated by the DOE in for the evaluation of radioactively contaminated sites.

NRC has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff.

The maximum DCGL that resulted in a cancer risk less than 1×10-4 was 3 pCi/g.

The maximum calculated total effective dose equivalent (TEDE) was 4.47 mrem/y at a period of 23.05 years. The NRC has a current target dose of 25 mrem/y TEDE for unrestricted release.

1.5 Types of Surveys Performed/Instrumentation

The characterization surveys consisted of gamma scan surveys and gamma logging of boreholes. Swipe surveys for gross alpha/beta removable contamination were also performed on equipment and tools.

Instruments were selected that were suitable for the physical and environmental conditions at the site. The instruments and measurement methods selected were able to detect the radionuclide(s) of concern and radiation types of interest, and in relation to the survey or analytical technique, capable of measuring levels that were equal to or less than the release limits.

The instruments used for gamma scan survey and gamma logging of the boreholes were Ludlum Model 2350-1 Data Loggers cou8pled to Ludlum Model 44-10 2” by 2” NaI detectors.

The instruments used for surveys of equipment and tools was a combination of large area scintillation detectors coupled to scalers/ratemeters. Audible indicators were used during the surveys. Swipes were counted on a dual channel phoswich scintillation counting system.

1.6 Results/Conclusions

The results of the characterization surveys and sampling defined the lateral and vertical boundaries of the contaminated soils in Site 1. Based on the area and depth of the areas still requiring removal, it is estimated that there are 200 cubic yards of contaminated soils requiring removal.

2.0 PROJECT BACKGROUND INFORMATION

2.1 Facility Location

NSF-IH is located in northwestern Charles County, Maryland. As shown on Figure 1. NSF-IH is approximately 25 miles southwest of Washington, D.C. NSF-IH is a military facility consisting of the Main Area on the Cornwallis Neck Peninsula and the Annex on Stump Neck. As shown on Figure 1, the Main Area is bounded by the Potomac River on the northwest, west, and south, the Mattawoman Creek to the south and east, and the Town of Indian Head to the northeast. Stump Neck Annex is located across the Mattawoman Creek and is not contiguous with the Main Area. The location of Site 1 is shown on Figure 2.

2.2 Facility History/Background

The Indian Head peninsula is located in the Atlantic Coastal Plain Physiographic Province, approximately 8 to 10 miles east of the Fall Line that marks the western extent of the physiographic province. Indian Head has gently rolling to undulating topography with elevations ranging from sea level to more than 100 feet (ft) above mean sea level (msl). The higher elevations are on the eastern portion of the facility, and the land surface generally slopes to the southwest and southeast. The portion of NSF-IH along the Potomac River is characterized by 20- to 100-ft bluffs. The portion along Mattawoman Creek is more gently sloping.

The primary mission of NSF-IH consists of the following:

- To provide services in energetics for all warfare centers through engineering, fleet and operation support, manufacturing technology, limited production, and industrial base support.

- To provide research, development, testing, and evaluation of energetic materials, ordnance devices and components, and other related ordnance engineering standards including chemicals, propellants and their propulsion systems, explosives, pyrotechnics, warheads, and simulators.

- To provide support to all warfare centers, military departments, and the ordnance industry for special weapons, explosive safety, and ordnance environmental issues.

In 1951, the Navy was assigned the joint-service explosive ordnance disposal (EOD) responsibilities for basic training and research and development. In 1953, the research and

development tasks were established as a separate organization, and re-designated the Naval EOD Technical Center. The training function was renamed the Naval School, EOD (NAVSCOLEOD). From 1955 on, all joint service EOD training was provided at NSF-IH until the school moved to Eglin Air Force Base (AFB). In 1958, the NAVSCOLEOD moved from its Jackson Road location to Strauss Avenue. The NAVSCOLEOD command moved to Eglin AFB in 1993, and the NAVSCOLEOD at NSF-IH was designated as a detachment.

The Commanding Officer and the NAVSCOLEOD Headquarters returned to NSF-IH in 1994 while a construction project was being completed at Elgin AFB. In January 1999, the NAVSCOLEOD was consolidated at Elgin AFB. A detachment of EOD personnel remains at NSF-IH.

2.3 Site Information

2.3.1 Site Description

Site 1 is an area of approximately 60 by 135 feet located between Building 1662 and Strauss Avenue (Figure 2). The area is currently covered by a parking lot and maintained lawn. Building 1662 is used for electrical and satellite communications.

Future land use is expected to be any military, industrial, or commercial use needed to support the NSF-IH mission. It is unlikely that the site area would be developed for residential use while under government control. (TTNUS, 2010).

2.3.2 Site Background

The Naval Sea Systems Command Detachment (NAVSEADET) Radiological Affairs Support Office (RASO) provided the historical information that served as the basis for site background information.

The construction of Building 1662 was completed in 1983. Building 900, located northeast of Building 1662, was in place prior to 1962.

Thorium was first placed on the ground at Site 1 in 1962 in connection with radiation training exercises conducted by the NAVSCOLEOD. Thorium ore from approximately five drums of 30 to 50-gallon capacity was spread over the site. No U.S. Atomic Energy Commission (USAEC) license was issued at the time the ore was purchased.

Thorium is a soft, silvery white metal that dissolves slowly in water. Thorium-232 has a half-life of 14 billion years and decays by alpha emission with accompanying gamma radiation. Thorium-232 is at the top of a long decay series

that contains key radionuclides such as radium-228, its direct decay product, and radon-220. Two other isotopes of thorium are thorium-230 and thorium-228. Both belong to other decay series. They also decay by alpha emission with accompanying gamma radiation, and have half-lives of 75,400 years and 1.9 years, respectively.

As mentioned above, thorite ore was first placed on Site 1 in 1962. Early in 1967, some of the thorite ore was removed from the site, placed into barrels, and transferred to an unknown destination. The residual soil on the site was then disked and harrowed several times to uniformly incorporate any residual thorite ore into the soil. It was reported that the soil was affected to a depth of 8 to 12 inches.

In 1971, a sample of the thorite ore was assayed for thorium content by the Engineering Division, U.S. Army Engineer Power Group, Fort Belvoir,Virginia. The results were reported as, "Thorium content 2.5 w/o thorium with a specific activity of 100 disintegrations per second (dps) per gram." A radiological survey conducted at Site 1 on March 28, 1972, determined that the affected areas included seven locations covering a total of approximately 600 square feet. The depths of the affected soil ranged from 12 to 18 inches below ground surface (bgs).

In July 1972, the radioactive soil was excavated, placed into fifty 55-gallon drums, and staged at the facility's radiation training area. The drums were shipped in October for disposal at the Nuclear Engineering Company, Inc., in Morehead, Kentucky.

Two subsequent radiological surveys, each followed by the removal of radioactive material, occurred on November 1972. The excavated area was backfilled with 18 to 24 inches of clean soil to reestablish original grade.

A final radiological survey of the area was performed by RASO personnel in February 1976. In a March 1976 memorandum, RASO indicated that based on the survey, "the subject area has been returned to background and may be released for unrestricted use."

However, in 1983, two buried drums containing thorium material, dirt, and gravel were discovered near the site during construction of Building 1662. The drums were shipped off-site for disposal as low-level radioactive waste.

Prior to constructing an addition to Building 900, a radiological survey was performed in October 2001 along the southeastern side of the building where the site was initially thought to be located.

Ten subsurface soil (0.5 to 2 ft bgs) samples were collected. The associated survey report concluded that "based on the laboratory results, no further actions regarding thorium are required at this time. Soil remediation will not be required as part of Building 900 Joint Interoperability Project."

In November 2004, RASO indicated that it considered all known drums of thorium ore to have been accounted for and properly disposed. However, RASO indicated in the same communication that "radiation measurements made in 1972 are not definitive as to the thorium concentrations remaining after the cleanup. Characterization surveys are still necessary."

Following a search of historical files, RASO provided a description of the location of Site 1:

Clean soil covers the 60-ft by 90-ft area to a depth of 12 to 18 inches as a result of the 1972 removal of contaminated soil and its replacement with clean soil. No drums currently exist at the site. If contamination exists at the site, it will be found below the 12 to 18 inches of clean soil and within the next12 inches of depth (i.e., the bottom of the interval in question is 24 to 30 inches bgs). (TTNUS, 2010).

2.3.3 Previous Investigations and Activities

The investigation at Site 1 began in 2005 to determine whether historical practices resulted in the release of thorium at concentrations of potential environmental concern. During the investigation, soil samples were collected from the RASO-approved Reference Area and from the onsite study area. Samples were collected from variable depth intervals (18 to 24, 24 to 30, or 30 to36 inches bgs) from a 3-inch diameter borehole and sent to a laboratory for thorium-232 analysis using alpha spectroscopy. The appropriate depth interval for laboratory sample selection was based on the highest gross gamma radiation reading in the field from a gamma probe scintillator lowered down each borehole.

The presence or absence of residual contamination at Site 1 was determined by evaluating analytical results between the site and the Reference Area (uncontaminated background conditions). Background conditions, or a derived concentration guideline level (DCGL), were/was established by adding 1 picoCurie per gram (pCi/g) to each of the Reference Area data (determined by RASO to be an appropriate incremental concentration by which the site could not exceed the Reference Area). The site and background data sets were compared using the Wilcoxon Rank Sum (WRS) test.

The results of the 2005 effort, along with additional research on historical activities, indicated an expanded study area was required.

Subsequently, a larger study area was established and additional soil samples were collected in 2007 and analyzed for thorium-232 [a subset of samples also were analyzed for naturally occurring radioactive material (NORM) by gamma spectroscopy].

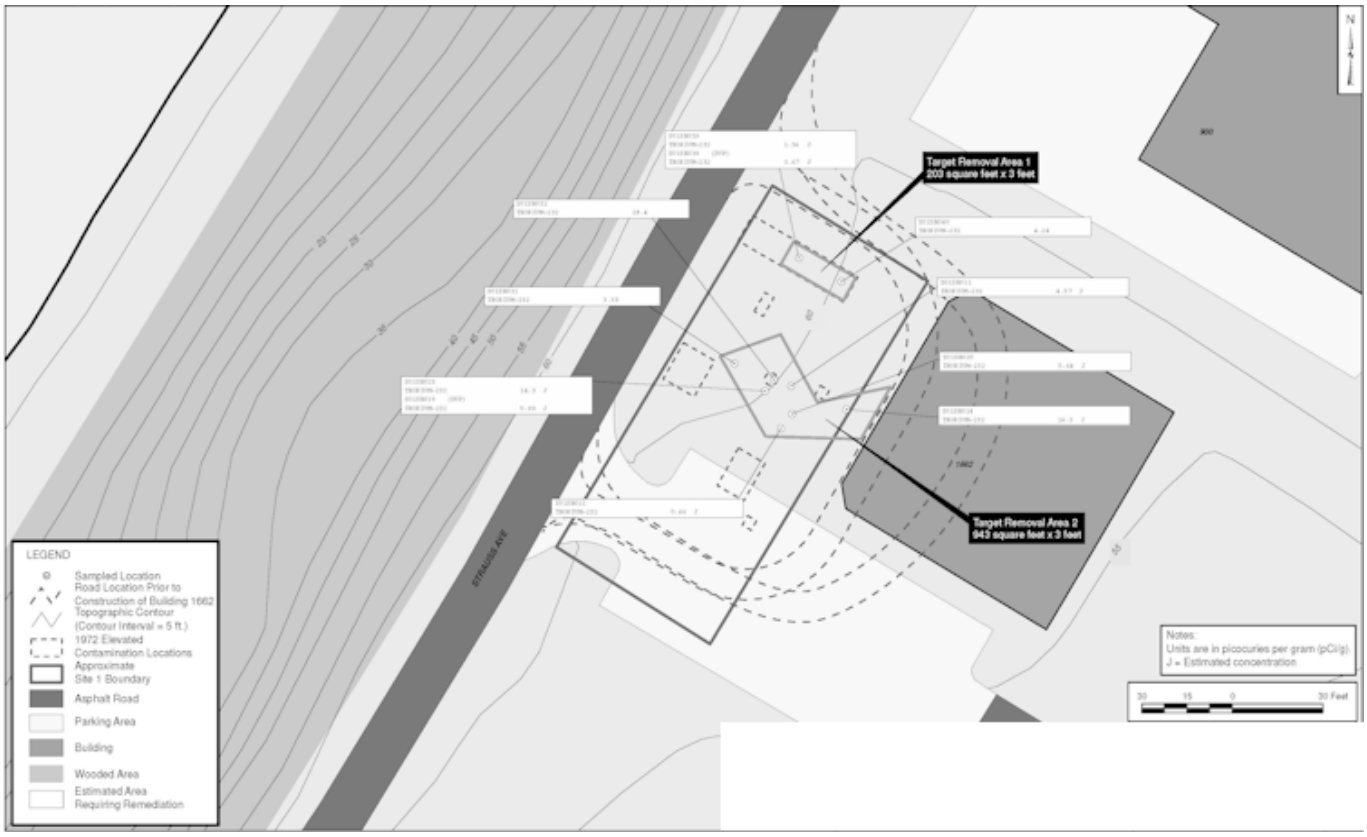
After evaluating both the 2005 and the expanded 2007 data sets, it was determined that nine sample locations (S01SB011, S01SB014, S01SB020, S01SB021, S01SB023, S01SB031, S01SB032, S01SB039, and S01SB040) exhibited elevated activity considering the DCGL and field measurements. Figure 3 shows these areas.

Based on exceedences of the DCGL and elevated field readings, there are nine sampling locations within two areas that are candidates for excavation and removal to depths ranging from 24 to 36 inches bgs.

The first area is defined by sample locations S01SB039 and S01SB40 in the northern portion of the site. The estimated area of contamination is 300 square feet, and the depth of contamination is 30 inches (2.5 feet).

The second area is defined by the remaining sample locations in the central portion of the site. The estimated area of contamination is 775 square feet, and the average depth of contamination is 30 inches (2.5 feet). (TTNUS, 2010).

Figure 3 Site 1 Soil Removal Areas



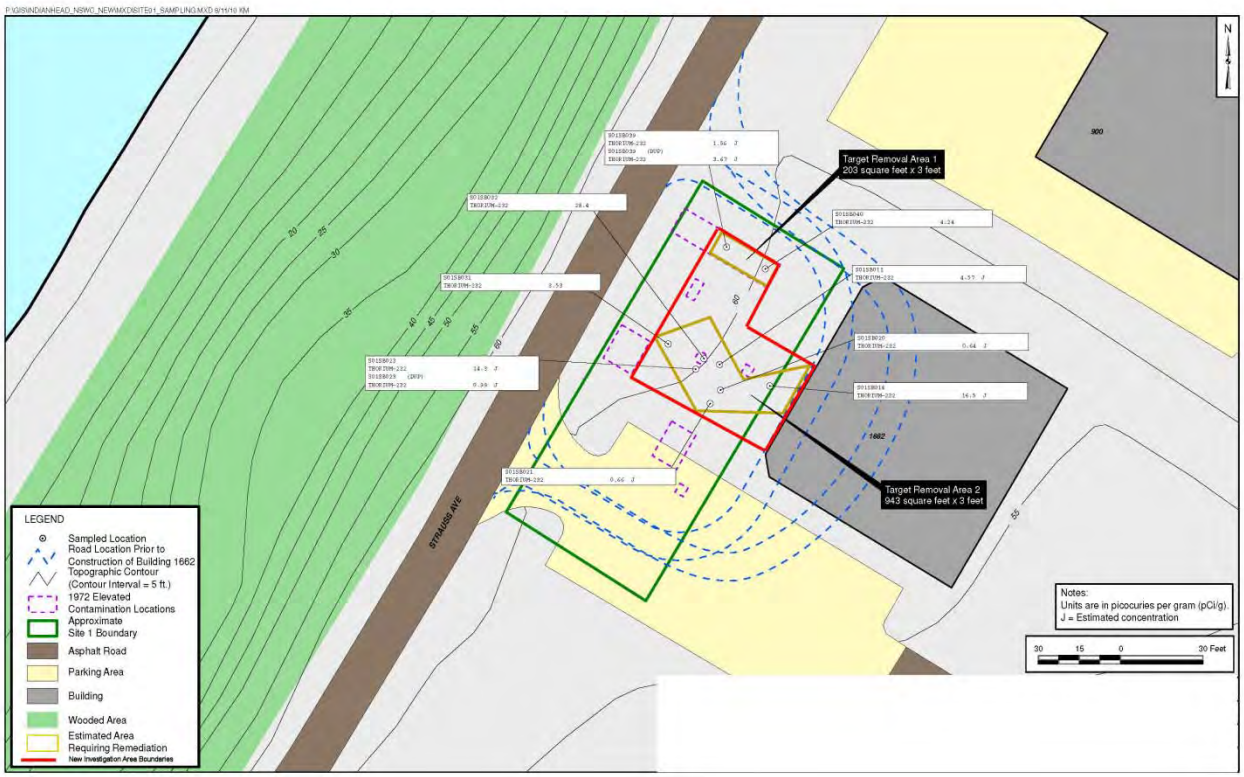
2.3.4 Previous Remediation Activities

AWS performed a removal action at Site 1 from 11 February 2013 to 8 March 2013 and from 19 August 2013 to 6 September 2013.

In order to reduce the number of survey units, individual soil stockpile areas, and soil samples, Target Removal Area 1 and Target Removal Area 2 was combined into one contiguous area.

Figure 4 presents a map of the consolidated soil removal area. The area is outlined in red.

Figure 4 Soil Removal Area



The original plan was to remove soils in the excavation area to a depth of 4' below grade surface (bgs). However, due to the unexpected amount of radiologically impacted soils discovered in the first 2 feet of the excavation and also the discovery of potential unexploded ordnance in the area, a stop work order was issued by the Navy.

At approximately 0835 hours on 1 March 2013 while walking down the excavation area prior to soil removal, potential unexploded ordinance was discovered in the area. A phone call was placed to NSF-IH security and the area was evacuated.

A Navy unexploded ordnance (UXO) team was dispatched to the site from the Naval Surface Warfare Center Dahlgren. The UXO team entered the area and proceeded to find what appeared to be a submunition, two land mines, and a grenade in the area. All of the items were determined to be training/practice items and inert.

As a precautionary measure, the items were removed from the excavation area and taken to a remote location in the 'Restricted Area" at NSF-IH to be destroyed. Prior to removal to that area the items were surveyed for radiological contamination. No detectable activity above background was found on any of the items.

At this time a stop work order was issued by the Navy and no further excavation was performed in the area. The area was secured and the work crew was demobilized from the site in the following days.

On 19 August 2013 the crew was mobilized back to the site under a modified work scope. At this time the Navy directed AWS to perform a limited characterization survey in the excavation area footprint, package and transport removed contaminated soils off site for disposal, and backfill and restore the excavation area. No further excavation was to be done in the area.

In addition, the removed radiologically impacted and non impacted soils were to be screened for UXO by UXO personnel during loading into roll off bins for disposal, and into the excavation area for backfill.

During the two site visits, work that was completed included:

- Providing a radiation safety briefing to staff assigned to the project who have not previously received a radiation safety briefing.
- Performing incoming equipment and material surveys.
- Excavation of former burial areas down to 2’ below grade surface in 6” lifts.
- Surveying and surface soil sampling of over burden soils as Class 1 areas (6” lifts) in accordance with MARSSIM guidelines.
- Surveying and surface soil sampling of former burial areas as a Class 1 area following excavation down to 2’ below grade surface in accordance with MARSSIM guidelines.
- Loaded seven 25 cubic yard intermodal roll off bins with contaminated soils for disposal following screening for UXO by UXO personnel.
- Providing radiological monitoring during the collection of samples.
- Performing personnel surveys while the work is being performed, if necessary.
- Performing radiological release surveys on outgoing equipment and material.
- Performed a limited characterization survey effort in the excavation area to determine the remaining volume of radiologically impacted soils that would require removal in the future.
- Backfilled and restored the excavation area following screening for UXO by UXO personnel. Restoration included backfilling, compaction, and reseeding of the area.

A detailed summary of the work performed can be found in the Final Report (AWS, 2013).

3.0 RADIOLOGICAL CONTROL REQUIREMENTS

3.1 Radiation Work Permit

A Radiation Work Permit (RWP) was prepared and specified the activities to be performed and all radiological safety requirements for the work. All personnel assigned to site work were required to read and sign the RWP, acknowledging that they understood the requirements of the RWP, prior to beginning work.

The RWP was also used as an information document for industrial safety. Hazards other than radiological were included in the RWP so proper protection could be taken for all possible hazards.

The RWP listed tasks and specific levels of protection for each worker covered by the RWP. The RWP also detailed the dosimetry requirements, the protective clothing requirements, and the expected radiation and contamination levels to be encountered during the field survey activity.

A copy of the RWP is presented in Appendix A.

3.2 Personnel Monitoring and Dosimetry

Even though the work consisted of area surveys, and the likelihood that personnel will receive any external or internal exposure is very minimal, Aleut World Solutions administrative policies require the use of external dosimetry on any field project that has the potential for exposure to radioactive material. The Project Manager (PM) was responsible for ensuring that all AWS personnel assigned to perform the survey were appropriately monitored for exposure to ionizing radiation. Each individual working at the site wore the dosimetry devices specified in the RWP. The PM specified the requirement for work assignments. Personnel were issued appropriate personnel monitoring devices consisting of a thermoluminescent dosimeter (TLD). The issuance of monitoring devices was documented on a Badge Issue Log.

3.3 Proper Location for Wearing Dosimetry Devices

Personnel monitoring dosimetry was worn on the front of the body between the neck and the waist.

3.4 Official Exposure Determination and Project Dose Estimate

The official and permanent record of accumulated external dose received by individuals was obtained from the processing of the personnel monitoring devices. The vendor TLD processing report showed that no personnel received any detectable whole body exposure greater than 10 millirem, which is the detection threshold of the TLDs.

A copy of the vendor TLD report can be furnished upon request.

4.0 SITE PREPARATION, EQUIPMENT AND PERSONNEL

4.1 Accessibility

Access to the active work areas were restricted using barricades, and boundary rope/tape. The appropriate postings were displayed. This limited access to only those personnel performing work in the areas.

4.2 Restroom Facilities/Office Space

A temporary restroom and hand wash sink was used. A temporary office space was not used for this project.

4.3 Electrical Power

A portable generator was used for electrical power when needed.

4.4 IR Work Approval Permits

Installation Restoration (IR) work approval permits were issued by NSF-IH prior to the start of onsite work activities. Copies of these work approval permits are in this report in Appendix B.

4.5 Underground Utility Location

A licensed subcontractor (Line Locator's Inc.) visited the site prior to the start of excavation activities to locate and mark underground utilities in the Site 1 area.

4.6 Training

Prior to the start of work, all site personnel attended a briefing that discussed expected radiological conditions and radiological controls that were implemented at the site.

4.7 Personnel

Task personnel consisted of the following:

Project Manager - Responsible for the overall operations and safety of the project team.

Health Physics Technicians - Perform surveys, sampling operations.

Bering Sea Environmental Senior UXO Supervisor- Was responsible for the supervision of the screening of soils for the presence of UXO.

Bering Sea Environmental UXO II Tech- Was responsible for the screening of soils for the presence of UXO.

All AWS and BSEn personnel were trained and experienced at the tasks to be performed.

5.0 PLANNING PHASE OF RADIOLOGICAL SURVEYS

The design of this characterization survey incorporated the methods and locations for performing sampling, gamma scan surveys, and gamma logging of boreholes in order to assess the nature and extent of the thorium contamination in the soils in and around Site 1.

5.1 Radionuclide of Concern

Based upon historical information from previous survey and investigation activities conducted in the area the radionuclide of concern was thorium-232 (^{232}Th). Table 2 lists the radionuclide of concern with the half-life and principle types of radiation (alpha, beta, or gamma).

Table 2 Radionuclide of Concern

Radionuclide	Half-life	Radiations
Thorium-232	14 billion years	Alpha (α)/gamma (γ)

5.2 Surface Activity Derived Concentration Guideline Limits (DCGLs) for Radionuclide of Concern for Equipment and Tools

The surface activity DCGL's are stated in the "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses, By-product, Source, or Special Nuclear Materials, (NRC 1987)." Table 3 presents the DCGL's.

Table 3 Surface Activity DCGL's for Equipment and Tools

Radionuclide	Removable in dpm/100cm^2	Average [2] in dpm/100cm^2	Maximum [3] in dpm/100cm^2	Radiations Emitted
Th-232	200	1,000	3,000	$\alpha\gamma$
3. Measurements of average contaminant should not be over more than 1 m^2 4. The maximum contamination level applies to an area of not more than 100 cm^2				

5.3 Derived Concentration Guideline Limit (DCGL) for Radionuclide of Concern for Soil

The DCGL for soils was calculated during the Engineering Evaluation and Cost Analysis (EE/CA) that was performed by Tetra Tech NUS, Inc. in September of 2010. The goal was to develop a DCGL that corresponded to a cancer risk within the EPA acceptable (or presumably not unacceptable) risk range of 1×10^{-4} (1 in 10,000) and $1\times^{10-6}$ (1 in 1,000,000). The calculations were performed using the RESRAD Version 6.3 Modeling Code developed by Argonne National Laboratory to evaluate doses from exposure to radioactively open land areas.

RESRAD is a computer model designed to estimate radiation doses and risks from residual radioactive materials. It is the only code designated by the DOE in for the evaluation of radioactively contaminated sites.

NRC has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff.

The maximum DCGL that resulted in a cancer risk less than 1×10-4 was 3 pCi/g.

The maximum calculated total effective dose equivalent (TEDE) was 4.47 mrem/y at a period of 23.05 years. The NRC has a current target dose of 25 mrem/y TEDE for unrestricted release.

5.4 Data Quality Objectives

Data quality objectives (DQOs) were developed for this characterization effort using the U.S. Environmental Protection Agency's (EPA's) seven-step DQO process described in *EPA QA -G4: Guidance for the Data Quality Objective Process* (EPA, 2000). Below is a summary of the seven-step process and the resulting project-specific DQOs.

5.4.1 Statement of the Problem (Step 1)

The problem is determining the nature and extent of thorium contamination in the soils in the Site 1 and surrounding areas. The objective of the characterization activities described in this report was to obtain data of sufficient quality and quantity to support the decision that areas have or have not been impacted by radiological activities at the site. Areas that have been impacted will require a removal action.

5.4.2 Identification of Decisions (Step 2)

The principle study question for this project through completion of the characterization survey is:

Have areas in and around Site 1 been impacted by the radiological activities at the site?

Potential actions include: additional investigation of radiologically impacted areas (i.e., additional review of existing data, collection of additional environmental data, and/or additional remediation) or release of non-impacted areas from radiological controls. Impacted areas have a possibility of containing residual radioactivity in excess of natural background (NRC, 2000). Non-impacted areas have no reasonable possibility of residual radioactivity. All areas are either impacted or non-impacted.

5.4.3 Inputs to the Decision (Step 3)

In order to resolve the decision statements listed in the previous section, a variety of data is required. The following site characteristics were determined through site survey and sampling activities in order to resolve the applicable decision statements:

Locate and survey a reference area where meaningful background radiation levels can be determined;

Radiological survey data indicating the nature and extent of elevated gross gamma activity;

The drilling of 6” diameter boreholes down to a depth of 6’ bgs at various locations along the perimeter of the previously excavated area in Site1;

Collection of soil samples from the boreholes at various depths;

Statistical analysis of collected data.

5.4.4 Definition of Study Boundaries (Step 4)

The spatial boundary for this survey effort was the areas immediately surrounding the previous Site 1 excavation area.

5.4.5 Development of a Decision Rule (Step 5)

The primary parameters of interest are natural thorium and associated decay progeny in secular equilibrium.

The decision rules for this characterization effort are as follows:

5.4.5.1 Equipment and Tools

If the radioactivity concentration exceeded the DCGL (see Section

5.2) then the items were designated as radiologically contaminated and marked for decontamination. None of the equipment and tools required decontamination following a normal wipe down with masslinn.

5.4.5.2 Soil DCGL

The DCCL for soil was 3 pCi/g for Th-232 (see Section 5.3).

5.4.6 Limits on Decision Errors (Step 6)

Actions to minimize errors were implemented during the data collection phase of the radiological survey. Qualified radiation survey personnel performed the survey and recorded the data. Additional actions, such as instrument calibration, daily instrument source checks, and backup surveys with separate instruments provided the primary steps to be taken to avoid errors in the data collection phase of the survey process.

In order to minimize errors, the applicable requirements of AWS Standard Operating Procedures (SOPs) for performing surveys and instrumentation calibration and use were followed.

Data collection and transcribing is the first phase where errors may arise. To avoid data errors for manual surveys, experienced personnel will record and transcribe the data.

The ongoing on-site analyses and evaluation of survey results provides a final check for errors, which if detected, can be corrected.

There are two types of decision errors that can be made when performing the statistical tests described in this plan. The first type of decision error, called a Type I error, occurs when the null hypothesis is rejected when it is actually true. A Type I error is sometimes called a “false positive.” The probability of a Type I error is usually denoted by α. The Type I error rate is often referred to as the significance level or size of the test.

The second type of decision error, called a Type II error, occurs when the null hypothesis is not rejected when it is actually false. A Type II error is sometimes called a “false negative.” The probability of a Type II error is usually denoted by β. The *power* of a statistical test is defined as the probability of rejecting the null hypotheses when it is false. It is numerically equal to $1-\beta$, where β is the Type II error rate.

This characterization survey was designed to limit Type I and Type II errors to 5%. It is important to minimize the chances that survey units exceeding the release limits will be missed (Type I Error) and survey units meeting the release limits will be rejected

as too high (Type II Error). The probability of either of these occurring was set at a maximum of 5%.

5.4.7 Optimizing Data Collection (Step 7)

The survey and sampling activities described in the following sections of this document constitute a characterization approach that achieved the stated project objectives within the available resource and schedule constraints. This approach represents the optimal design for characterizing Site 1 based on the currently available information.

Field survey techniques, instrument selection and detection capabilities, survey and sampling frequency, and the DQO process was re-evaluated, as appropriate, throughout the data collection effort to focus resources and improve data quality. As data was collected and evaluated, the assumptions in this plan will be reviewed for accuracy. The survey, sampling, and analysis process detailed in this plan will be revisited if initial data indicate that conditions are significantly different from the initial assumptions

6.0 IMPLEMENTATION PHASE OF SURVEYS

6.1 Background Reference Radiation Levels

A site background reference area was chosen that had similar physical, chemical, geological, radiological, and biological characteristics as the survey unit being evaluated. Background reference areas are normally selected from non-impacted areas, but are not limited to natural areas undisturbed by human activities. Areas inside of Building 30884 were chosen as the background reference area.

The site background count rate levels were established for the characterization surveys by obtaining thirty, 1-minute static gross gamma readings (with each instrument used), taken at ~ 4” from the surface soil from areas unlikely to be affected by the residual radioactive materials that could be present at the different survey areas. The average value for these readings was used as the area background radiation levels.

In addition, a borehole was drilled in the area down to 6’ below grade surface (bgs). Five 1-minute static gross gamma readings were collected at 1’ intervals down to 6 feet.

The background reference area data is summarized in Table 4 below.

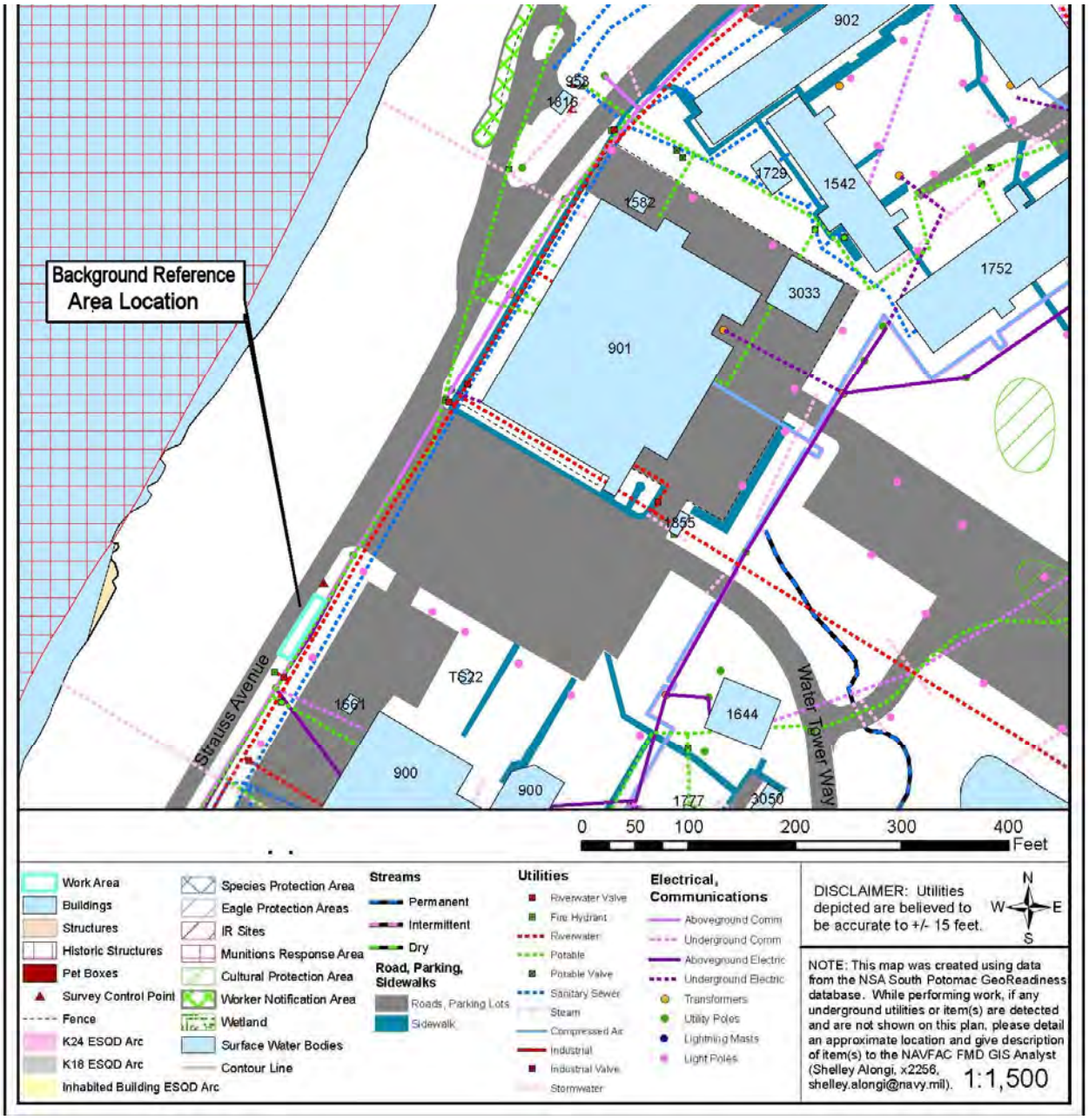
The background reference area data is presented in this report in Appendix C.

A map showing the background reference area is presented in Figure 5 below.

Table 4 Background Reference Area Summary Table

Depth Below Grade Surface in Feet	Average Background Count Rate in CPM
Surface	3,748
1’	6,718
2’	6,983
3’	7,328
4’	7,233
5’	7,283
6’	7,007

Figure 5 Background Reference Area Map



6.2 Survey Instrumentation

6.2.1 Instrumentation Selection

Instruments were selected that are suitable for the physical and environmental conditions at the site. The instruments and measurement methods selected were able to detect the radionuclide of concern or radiation types of interest, and are, in relation to the survey or analytical technique, capable of measuring levels that are equal to or less than the release limits.

6.2.2 Instrument for the Scan Surveys for Alpha and Beta Surface Activity (Personnel, Equipment, and Tools)

Surface scan surveys for alpha and beta radiation were conducted with Ludlum Model 44-9 thin windowed GM probes or equivalent, coupled to Ludlum Model 3 survey meters or equivalent. The probes had 1.7 mg/cm^2 ± 0.3 mg/cm^2 thick mica windows. The detectors were moved over the surface being surveyed at a rate of 0.5 cm per second. The detectors were held within ¼" of the surface being surveyed. Audible indicators were used during the surveys

6.2.3 Instrument for the Scan Surveys for Alpha and Beta Surface Activity (Equipment, and Tools)

Surface scan surveys for alpha and beta radiation were conducted with Ludlum Model 43-93 large area scintillation probes or equivalent, coupled to Ludlum Model 2360 Data Loggers or equivalent. The probes had 1.2 mg/cm^2 thick mylar windows. The detectors were moved over the surface being surveyed at a rate of 0.5 cm per second. The detectors were held within ¼" of the surface being surveyed. Audible indicators were used during the surveys

6.2.4 Instrument for the Direct Measurements for Alpha and Beta Surface Activity (Equipment, and Tools)

Direct surface contamination surveys for alpha and beta radiation were conducted with Ludlum Model 43-93 large area scintillation probes or equivalent, coupled to Ludlum Model 2360 Data Loggers or equivalent. The probes had 1.2 mg/cm^2 thick mylar windows. Direct measurements were conducted with the detector ¼" away from the surface for a period of 1 minute.

6.2.5 Gross Beta-Gamma-Alpha Loose Surface Contamination Surveys

Loose surface contamination surveys of alpha and beta/gamma emitters were performed using cloth smears.

The swipe survey was performed by wiping over an area of 100 cm^2 (~ 4" by 4") with a cloth smear, and applying moderate pressure.

The smears were analyzed with a Ludlum Model-2929 Dual Channel Scaler

phoswich detector or equivalent.

6.2.6 Instrument for the Measurement of Gamma Surface Activity

Static and scan surveys for gamma (photon) radiation were performed using a Ludlum Model 2350-1 data logger. This instrument is equipped with Ludlum Model 44-10 scintillation detector assemblies that featured a 2-inch by 2-inch sodium iodide (NaI) crystal. Capable of detecting gamma photon energies ranging from 60 kilo-electron volts (keV) to 3 mega-electron volts (MeV), the instruments were programmed to respond to the full spectrum of gamma photon energies.

Static gamma measurements require positioning the detector assembly 4 inches (10 centimeters [cm]) above the designated surveillance surface and recording a stationary 60-second integrated count. NaI scintillation detectors are very sensitive to photon gamma radiation and are ideal for locating elevated radiation levels above background when performing gamma scans and static measurements.

6.2.7 Instrument for the Measurement of Gamma Exposure Rates

Gamma exposure rate measurements were performed using a Ludlum Model 19 microR/meter. The Ludlum Model 19 is a high sensitivity gamma microR/meter employing an internally housed 1-inch diameter by 1-inch thick NaI crystal.

6.3 Detection Sensitivity—Static and Scan Minimum Detectable Concentration (MDC), Gross Alpha-Gross Beta Surveys

6.3.1 Determination of Instrument Efficiency (ε_I) for Alpha and Beta Surface Activity Measurements

The instrument efficiency (ε_i) is determined during calibration and is defined as the ratio between the net count rate (in counts per minute (cpm)) of the instrument and the surface emission rate of the calibration source for a specified geometry. The surface emission rate is the 2π particle fluence that is affected by both the attenuation and backscatter of the radiation emitted from the calibration source. Equation 1 will be used to calculate the instrument efficiency in counts per particle, although efficiency is typically reported as having no units or unitless.

Equation 1

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\Pi}\left(W_A / S_A\right)}$$

Where,
R_{S+B} = the gross count rate of the calibration measurement (cpm)
R_B = the background count rate in cpm
$q_{2\pi}$ = surface emission rate of the calibration source (NIST traceable)
W_A = Active Area of the detector window (cm^2)
S_A = Area of the source (cm^2)

Note: This equation assumes that the dimensions of the calibration source are sufficient to cover the window of the instrument detector. If the dimensions of the calibration source are smaller than the detector's window, set W_A equal to the dimensions of the calibration source, i.e., set the quotient of W_A and S_A equal to 1.

The instrument efficiency is determined during calibration by obtaining static counts with the detector over a calibration source that has a National Institute of Standards and Technology (NIST) traceable surface emission rate. The 2π particle fluence rate is corrected for decay, attenuation and scatter, then; the surface emission rate of the source must be corrected for the area subtended by the probe. Factors that can also affect the instruments efficiency are discussed below:

Calibration Sources: The calibration sources selected emit alpha or beta radiation with energies similar to those expected from the contaminant in the field, i.e., similar to the expected radionuclide(s) of concern.

Source Geometry Factors: The instrument efficiency is determined with a calibration source equal to or greater than the area of the probe.

Source-to-Detector Distance: The detector is calibrated at a source-to-detector distance that is the same as the detector-to-surface distance used in the field.

Window Density Thickness: The detector is calibrated with a probe window density thickness that is the same as the probe window density thickness used in the field.

Detector-Related Factors - Ambient Conditions: If ambient conditions such as the temperature, pressure, and humidity vary significantly, during calibration and during field use, corrections to the detector's response will be considered.

6.3.2 Surface Efficiency (ε_s) for Surface Activity Measurements

The surface efficiency term in Equations 2 and 3 is used to determine the 4π total efficiency for a particular surface and condition. Suitable values are based on the radiation and radiation energy, and are primarily impacted by the backscatter and self-absorption characteristics of the surface on which the contamination exists in the field. Backscatter is most affected by the energy of the radiation and the density of the surface

material. Self-absorption characteristics or attenuation are also a function of the radiation's energy and surface condition. Surfaces typically encountered in the field include concrete, wood, dry wall, plaster, carpet, and metal. Surface conditions include both physical effects, such as scabbled concrete, and the effect of surface coatings, i.e., dust, paint, rust, water, and oil.

In the absence of experimentally determined surface efficiencies, ISO-7503-1 and NUREG 1507, provide conservative recommendations for surface efficiencies. ISO-7503-1, recommends a surface efficiency of 0.5 for maximum beta energies exceeding 0.5 MeV, and to use a surface efficiency of 0.25 for beta energies between 0.15 and 0.4 MeV and for alpha emitters (ISO, 1998), (NRC, 1997). NUREG-1507 provides surface efficiencies based on studies performed primarily at ORISE. In general, NUREG-1507 indicates that the ISO rule-of-thumb for surface efficiencies is conservative, particularly for beta-emitting radionuclides with end-point energies between 0.25 MeV and 0.4 MeV.

The surface condition on the floor in rooms 102 and 103 were concrete surfaces that were slightly covered with dust. The surface efficiency for alpha emitters used in accordance with ISO-7503-1 is 0.25 and for beta emitters is 0.25.

6.3.3 Probe Area Correction Factor for Surface Activity Measurements

In Equation 2, W_A is the size of the "active" area of the detector window. If the area of the detector window (cm^2) does not equal 100 cm^2, it is necessary to convert the detector response to units of dpm per 100 cm^2.

6.3.4 Static MDC for Gross Alpha-Beta Surveys

The static MDC is the level of radioactivity, on a surface, that is practically achievable by the overall measurement process. The conventional equation, Equation 2, was used to calculate instrument MDCs in dpm per 100 cm^2 when the background and sample were counted for the same time intervals.

Equation 2

$$MDC = \frac{3 + 4.65\sqrt{C_B * T_B}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_B}$$

Where;
C_B = background count rate (cpm)
T_B = background counting time (min)

ε_i = instrument efficiency (count per particle)
ε_s = contaminated surface efficiency (particle per disintegration)
W_A= area of the detector window (cm^2)

If the background and sample were counted for different time intervals, Equation 3 was used to calculate the MDC in dpm per 100 cm^2.

Equation 3

$$MDC = \frac{3 + 3.29\sqrt{R_B T_{S+B}\left(1 + \frac{T_{S+B}}{T_B}\right)}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_{S+B}}$$

Where;
R_B = background count rate (cpm)
T_B = background counting time (min)
T_{S+B} = sample counting time (min)
ε_i = the instrument efficiency (count per particle)
ε_s = the contaminated surface efficiency (particle per disintegration)
W_A = the area of the detector window (cm^2)

6.3.5 Scanning Minimal Detectable Count Rate, (MDCR)

The minimum detectable number of net source counts in the scan interval, for an ideal observer, can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in *d'*) as shown in Equation 4.

Equation 4

$$MDCR = d'\sqrt{b_i} \times 60/i$$

Where,

d' = index of sensitivity (α and β error) – MARSSIM Table 6.5
b_i = number of background counts in scan time interval (count)
i = scan or observation interval (s) (time that a typical source remains under the

probe during the scan)

6.3.6 Scan MDCs for Equipment, and Tools (Beta-Gamma, 100cm^2 probe)

The scan MDC is determined from the minimum detectable count rate (MDCR) by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. As discussed below, the MDCR accounts for the background level, performance criteria (d'), and observation interval. The observation interval during scanning is the actual time that the detector can respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity.

The scan MDC for building, equipment, material, and tool surfaces is calculated using Equation 5.

Equation 5

$$Scan\ MDC = \frac{MDCR}{\sqrt{p}\ \varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

Where;
MDCR = discussed in Section 6.3.5
p = surveyor efficiency factor
ε_ι = instrument efficiency (count per particle)
ε_s = contaminated surface efficiency (particles per disintegration)
W_A = area of the detector window (cm^2)

6.3.7 Scan MDC for Equipment, and Tools (Alpha, 100cm^2 probe)

Scanning for alpha emitters differs significantly from scanning for beta and gamma emitters in that the expected background response of most alpha detectors is very close to zero. The following section covers scanning for alpha emitters and assumes that the surface being surveyed is similar in nature to the material on which the detector was calibrated. In this respect, the approach is purely theoretical. Surveying surfaces that are dirty, non-planar, or weathered can significantly affect the detection efficiency and therefore bias the expected MDC for the scan. The use of reasonable detection efficiency values instead of optimistic values is highly recommended.

Since the time a contaminated area is under the probe varies and the background count rate of some alpha instruments is less than 1 cpm, it is not reasonable to determine a fixed MDC for scanning. Instead, it is more practical to determine the probability of

detecting an area of contamination at a predetermined DCGL for given scan rates.

For alpha survey instrumentation with backgrounds ranging from <1 to 3 cpm, a single count provides a surveyor sufficient cause to stop and investigate further. Assuming this to be true, the probability of detecting given levels of alpha surface contamination can be calculated by use of Poisson summation statistics.

Given a known scan rate and a surface contamination release limit, the probability of detecting a single count while passing over the contaminated area is calculated using Equation 6 below:

Equation 6

$$P(n \geq 1) = 1 - e^{\frac{-GEd}{60v}}$$

Where;

P(n≥1)	=	probability of observing a single count
G	=	contamination activity (dpm)
E	=	detector efficiency (4π)
d	=	width of detector in direction of scan (cm)
v	=	scan speed (cm/s)

Once a count is recorded and the guideline level of contamination is present the surveyor should stop and wait until the probability of getting another count is at least 90%. This time interval can be calculated using Equation 7 below:

Equation 7

$$t = \frac{13,800}{CAE}$$

Where

t	=	time period for static count(s)
C	=	contamination guideline (dpm/100cm^2)

A = physical probe area (cm^2)

E = detector efficiency (4π)

6.3.8 Scan MDC (Alpha)

Using the following equation (Abelquist, 2001), one can calculate the activity of a 100 cm^2 "hot spot" with a 90 % probability of detection using Equation 8 below.

Equation 8

$$\alpha\ scanMDC = \frac{[-\ln(1-P(n \geq 1))]60}{t\varepsilon_s\varepsilon_i}$$

Where

t = dwell time over source (seconds)

ε_i = Instrument efficiency (counts per particle)

ε_s = contaminated surface efficiency (particles per disintegration)

6.4 Detection Sensitivity—Static and Scan Minimum Detectable Concentration (MDC), Gamma Surveys

6.4.1 Static MDC

The static MDC represents the smallest level of radioactivity, on a surface, that is statistically detectable by the measurement process. Equation 9 was used to calculate the MDC for gamma radiation.

Equation 9

$$MDC_\gamma = \frac{3+3.29\sqrt{R_B\,T_B}}{T_B}$$

Where:

R_B = background count rate (cpm)
T_B = background counting time (min)

6.4.2 Scanning Minimum Detectable Count Rate, Gamma

The minimum detectable number of net source counts in the scan interval, for an ideal observer, can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in *d'*) as shown in Equation 10 below.

Equation 10

$$MDCR = d'\sqrt{b_i}\left(\frac{60}{i}\right)$$

Where:

d' = index of sensitivity (α and β error)
b_i = number of background counts in scan time interval (count)
i = scan or observation interval(s)

6.4.3 Scan MDC for Gamma Surveys (2-inch by 2-inch NaI Probe)

The gamma scan MDC (in pCi/g) for land areas is based on the area of elevated activity, depth of contamination, and the radionuclide (i.e., energy and yield of gamma emissions). Table 6.7 of MARSSIM states a scan MDC for a 2” by 2” NaI detector as 1.8 pCi/g for Th-232.

Table 5 presents a summary of the instrumentation that was used while performing the characterization surveys.

Table 5 Instrument Summary Table

Information	Alpha Measurements	Beta Measurements	Gamma Measurements
Areas Surveyed	Metal	Metal	Site 1 Soils
Instrument Model	Ludlum 2360	Ludlum 2360	Ludlum 2350
Instrument Serial No.	275827	275827	126197
Instrument Detector	Scintillation 43-93	Scintillation 43-93	NaI 44-10
Probe Serial No.	PR 335833	PR 335833	PR 229176
Calibration Source	Th-230 100 cm^2	Tc-99 100 cm^2	Cs-137 Button
Probe Window Thickness mg/cm^2	1.2	1.2	N/A
Probe Size in cm^2	100	100	2" by 2"
Instrument Efficiency (ε_i)	.282	.339	N/A
Instrument Background (CPM)	1	145	3,748
Static Count Time (Minutes)	1	1	N/A
Surface Efficiency (ε_s)	0.25	0.25	N/A
Total Efficiency (4π) (ε_t)	.07	.08	N/A
Radionuclide of Concern	Th-232	Th-232	Th-232
Static MDC in $dpm/100cm^2$	109	697	N/A
Scan Observation Interval (Seconds)	7	7	2
Scan Probability % Alpha Measurements	100	N/A	N/A
Scan MDC in $dpm/100cm^2$ Beta Measurements	N/A	1,930	N/A
Scan MDC in $dpm/100cm^2$ @ 90% Probability Alpha Measurements	280	N/A	N/A
Investigation Level in CPM Gamma	N/A	N/A	5,495
Scan MDC in pCi/g	N/A	N/A	1.8
Gross DCGL	1,000	N/A	3 pCi/g

6.5 Survey Design

6.5.1 Equipment and Tools

6.5.1.1 Gross Alpha/Gross Beta Scan Surveys

The survey consisted of direct scan surveys for alpha-beta radiations using a large area scintillation detector system (Ludlum Instruments Model 2360 Data Logger or equivalent coupled to a Ludlum Instruments Model 43-93 large area (100 cm^2) scintillation detectors or the equivalent).

6.5.1.2 Gross Alpha/Gross Beta-Gamma Direct Measurements

The survey consisted of 1 minute direct measurement surveys for alpha-beta radiations using a large area scintillation detector system (Ludlum Instruments Model 2360 Data Logger or equivalent coupled to a Ludlum Instruments Model 43-93 large area (100 cm^2) scintillation detectors or the equivalent).

The results of the direct measurements were recorded on form AWS-001RCS, Radiation Contamination Survey Cover Sheet or equivalent electronic spreadsheet.

6.5.1.3 Gross Beta-Gamma-Alpha Loose Surface Contaminations Surveys

Loose surface contamination surveys of alpha and beta/gamma emitters were performed using cloth smears.

The swipe survey was performed by wiping over an area of 100 cm^2 (~ 4" by 4") with a cloth smear, and applying moderate pressure.

The smears were analyzed with a Ludlum Model-2929 Dual Channel Scaler phoswich detector or equivalent in accordance with AWS SOP IOP-2, “Operation and Calibration of the Ludlum Model 2929 Dual Channel Scaler”.

One swipe sample was collected at each gross alpha/beta direct measurement location.

The results of the smears were recorded on form AWS-006, Smear Counting Analysis Report or equivalent electronic spreadsheet.

6.5.2 Site 1 Sample Boreholes

6.5.2.1 Gamma Logging

The surveys consisted of 1-minute direct measurements at 1' vertical increments in each sample borehole location using a Ludlum Instruments Model 2350-1 Data Logger or equivalent coupled to a Ludlum Instruments Model 44-10 2" by 2" NaI detector or the equivalent.

6.5.2.2 Gamma Logging

The surveys consisted of 1-minute direct measurements at 1' vertical increments in each sample borehole location using a Ludlum Instruments Model 2350-1 Data Logger or equivalent coupled to a Ludlum Instruments Model 44-10 2" by 2" NaI detector or the equivalent.

7.0 HEALTH AND SAFETY CONSIDERATIONS

The characterization surveys at NSF-IH were conducted in accordance with the AWS Site Health and Safety Plan. All on site personnel read and understood the contents of the plan prior to beginning work on the project.

7.1 Hazard Analysis

The job hazard Analysis identifies potential safety, health and environmental hazards and provides for the protection of personnel, the community, and the environment.

7.1.1 Radiological Exposure

Residual amounts of low-level radioactive material were present in the soils in the work area at the NSF-IH. Personnel performing the characterization surveys wore dosimetry and modified Level D PPE as described in Sections 3.2 and 7.2.2 of this report.

7.2 Hazard Controls

The following control measures were implemented during the survey activities. The control measures were intended to supplement the HASP.

7.2.1 Radiation Work Permit

A Radiation Work Permit (RWP) was prepared and specified the activities to be performed and all radiological safety requirements for the work. All personnel assigned to site work were required to read and sign the RWP acknowledging that they understand the requirements prior to beginning work.

The RWP was also used as an information document for industrial safety. Hazards other than radiological were included in the RWP so proper protection could be taken for all possible hazards from one controlling document. Implicit in any RWP is the need for a briefing on the radiological conditions present in the work environment.

The RWP listed tasks and specific levels of protection for each worker covered by the RWP. The RWP also detailed the dosimetry requirements, the protective clothing requirements, and the expected radiation and contamination levels to be encountered during the job. A copy of the RWP is presented in Appendix A.

7.2.2 PPE

Personnel performing the work at NSF-IH wore modified Level D PPE in

accordance with the PPE selection matrix in the HASP.

The modified Level D PPE consisted of:

- Steel-toed shoes;
- Safety glasses;
- Latex rubber or equivalent gloves (when collecting soil/swipe samples).

7.2.3 Safety Equipment

In addition to other equipment specified in this report, the following safety equipment was staged at the NSF-IH job site:

- First aid kit
- Eye wash kit

7.3 Training

Personnel performing activities associated with the NSF-IH work activities received training, which included a review of the Work Plan.

All on-site project personnel have completed at least 40 hours of hazardous waste operations-related training, as required by the Occupational Safety and Health administration (OSHA) Regulation 29 CFR Part 1910.120. Those personnel who had completed the 40-hour training more than 12 months prior to start of field activities had completed an 8-hour refresher course within the past twelve months.

The Project Manager had completed an additional 8 hours of relevant supervisory health and safety training.

Personnel operating the survey detection equipment were qualified ANSI 3.1 Senior Health Physics Technicians based on training and experience outlined in Section 4.4.6 and 4.5.3.2 of ANSI standard ANSI/ANS-3.1-1993 (ANSI/ANS, 1993).

A formal review of the key personnel qualifications to perform the required work was made by management and verified during the pre job briefing that was conducted prior to start of work.

The personnel were familiar with the handling and storage of radioactive materials, contamination controls, and the use of radiation survey equipment.

7.4 Hazard Communications

The Project Manager ensured that crewmembers understand their obligation to safety and ensure that members were familiar with the elements of the safety program. A copy of this plan was maintained on-site.

Daily tailgate safety meetings were conducted and documented as specified in the Health and Safety Plan. Material Safety Data Sheets (MSDSs) for all hazardous substances and materials that were used on site were maintained in the on-site project office.

8.0 QUALITY ASSURANCE

8.1 Equipment

The instruments and systems were calibrated on an annual frequency using the manufacturer's calibration protocol to National Institute of Standards and Technology (NIST) traceable sources.

The instrumentation calibration paperwork is presented in Appendix D of this report.

Radioactive source readings were used to check instruments for consistency prior to use in each daily shift. The instrument was used after readings are compared and agree within +/- 20 % of the true source reading in accordance with the requirements of ANSI Standard N323A-1997, "American National Standard Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments".

The daily instrument response check data is presented in Appendix E of this report.

8.2 Records and Reports

The Project Manager was responsible for reviewing data for accuracy and completeness before on-site activities were concluded. Electronic records were substituted, provided appropriate access authorization procedures were in place and quality assurance requirements were met.

All data, notes, measurements, calibrations, and other information pertinent to a survey site were recorded and maintained. Records must conform to the following basic requirements:

- Marked with date of entry.
- Signed or initialed (by hand or electronically) by the author of the entry.
- Written or printed in a legible manner.
- Contain all pertinent information in a concise, accurate entry.

Column headings or requested information on record data forms may be inappropriate or incorrect for specific site situations. If so, appropriate handwritten changes must be made on the forms. When certain information requested on the presented form is not required, the space or

columns should be crossed through or marked "NA" (not applicable) as an indication that such information was not required, rather than having possibly been forgotten.

If data corrections are necessary a single line will be drawn through the entry. New data, initials of the surveyor, and date of correction will be recorded. Data will not be obliterated by erasing or with the use of white-out.

All training records and accident investigation documents were maintained. The training records included brief biographies (resumes) certifications, or documents that demonstrate the qualifications of the personnel performing the work.

The Characterization Survey Report contains records and information necessary to document and support the Characterization Survey effort. All generated records for the project were maintained in the on-site office. Records that must be controlled and maintained during the project and presented in the Characterization Survey Report, in addition to site activities may have included but were not limited to:

- Description of survey design;
- Instrument calibration data;
- Daily instrument performance check data;
- Instrument efficiency determination data;
- Survey records;
- Dates surveys were performed;
- Survey results and data;
- Description of instrumentation used;
- Instrumentation MDC calculations;
- Smear sample location records;
- Identification of release limits used;
- Sample analysis results;
- Survey maps;
- Quality control data;

Listed records were maintained on site during project activities. All listed records will be transmitted with this final project report and will be maintained at the AWS corporate office in Anchorage, AK.

8.3 Quality Control Samples

Field duplicate swipe samples were collected at a frequency of 10%. The results of the QC field duplicate samples were compared to each other. A maximum deviation of ± 20% was the satisfactory objective of the comparison of the samples. All field duplicate swipe samples results were within 20% goal.

8.4 Data Management

Data was maintained in the on-site office. Backup copies of data was made routinely and maintained on the computer provided. Further, backup copies of survey and sample results were routinely made to CDs or other removable electronic media.

9.0 SURVEY PROCEDURES AND MEASUREMENT DATA INTERPRETATION

9.1 Surface Activity Measurements

Measurements to quantify surface activity levels represent the fundamental compliance measurements for buildings and structures. ISO-7503, NUREG-1507, and ASTM were used as technical guidance to ensure the accurate measurement of surface activity.

Equation 11 was used to document and calculate the surface activity in dpm per 100 cm^2.

Equation 11

$$A_S = \frac{R_{S+B} - R_B}{\varepsilon_i \varepsilon_S \frac{W_A}{100\, cm^2}}$$

Where;

A_S = total surface activity (dpm/100 cm^2)

R_{S+B} = the gross count rate of the measurement in cpm,

R_B = the background count rate in cpm

ε_ι = the instrument efficiency (counts per particle)

ε_s = the contaminated surface efficiency (particles per disintegration)

W_A = the area of the detector window (cm^2)

This equation has two efficiency terms, which account for differences between the conditions under which the detector is calibrated, and conditions under which the detector is used in the field. The instrument efficiency (ε_i) is discussed in Section 6.3.1, and is determined under ideal conditions in the laboratory. The surface efficiency, is discussed in Section 6.3.3, and is used to determine the 4π total efficiency for a particular surface and condition.

9.2 Data Assessment

Basic statistical quantities were calculated for the data in order to identify patterns, relationships and any type anomaly.

The Project Manager reviewed the data at the end of each day to determine the validity of the results and adequate coverage of the survey areas.

10.0 SURVEY ANALYSIS AND RESULTS

10.1 Boreholes and Gamma Logging

A total of twenty six 6” diameter boreholes were drilled to a maximum depth of 6’along the perimeter of the previous excavation area in order to define the lateral extent of the contaminated soils requiring removal. Obstructions were encountered at Boreholes #17 and #25 preventing drilling to a depth of 6’ bgs at those two locations. Downhole clearance was provided by UXO personnel, and UXO avoidance protocol was adhered to during all borehole drilling activities.

At each 1 foot interval a 1-minute static gamma log was collected and recorded in order to help determine soil sample locations. The highest gamma log was 38,092 cpm which was at 2’ bgs at Borehole #2. The average count rate of all of the gamma logs was 8,304 cpm.

Figure 6 shows the borehole locations.

Tables 6, 7, and 8 below present summaries of the gamma logging results.

Figure 6 Borehole Location Map

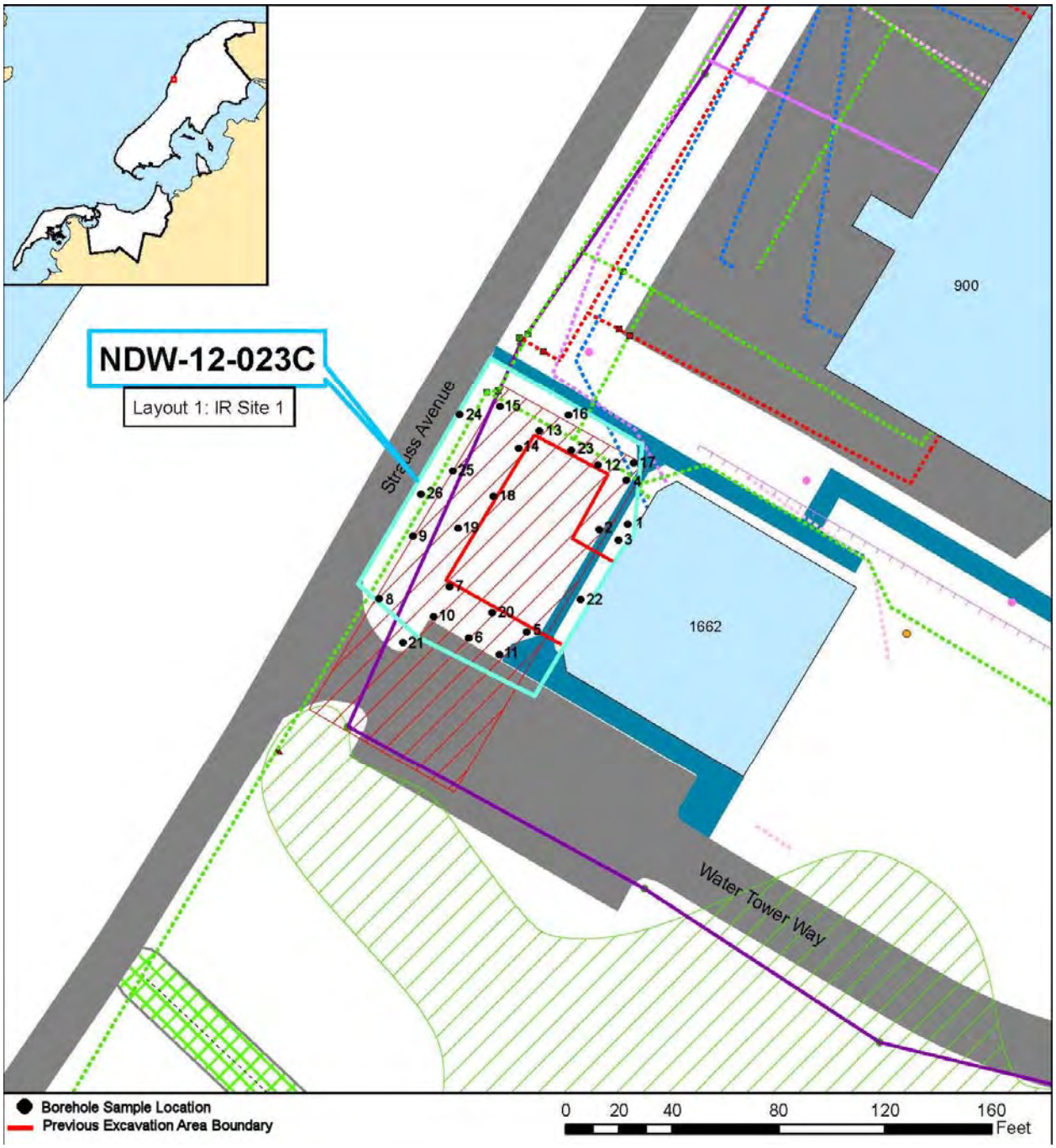


Table 6 Boreholes #1 through #9 Gamma Logs

Borehole #	Depth BGS in Feet	2" by 2" NaI Reading in 1,000 cpm	Date Surveyed	Sample Collection Time
1	1	5234	1/27/2015	N/A
1	2	8998	1/27/2015	0835
1	3	6012	1/27/2015	0845
1	4	5043	1/27/2015	0850
1	5	5234	1/27/2015	0900
1	6	5047	1/27/2015	0905
2	1	17121	1/27/2015	0930
2	2	38092	1/27/2015	0932
2	3	13145	1/27/2015	0935
2	4	6021	1/27/2015	0940
2	5	6045	1/27/2015	0942
2	6	6067	1/27/2015	0945
3	1	8021	1/27/2015	N/A
3	2	9045	1/27/2015	0950
3	3	13121	1/27/2015	0955
3	4	8023	1/27/2015	N/A
3	5	7123	1/27/2015	1000
3	6	7054	1/27/2015	N/A
4	1	6123	1/27/2015	1005
4	2	8045	1/27/2015	N/A
4	3	10021	1/27/2015	1010
4	4	7123	1/27/2015	N/A
4	5	6120	1/27/2015	1015
4	6	6089	1/27/2015	N/A
5	1	7854	1/27/2015	N/A
5	2	9213	1/27/2015	1045
5	3	7132	1/27/2015	N/A
5	4	6089	1/27/2015	1050
5	5	6156	1/27/2015	N/A
5	6	6084	1/27/2015	1055
6	1	8132	1/27/2015	1100
6	2	8198	1/27/2015	N/A
6	3	7054	1/27/2015	1105
6	4	6143	1/27/2015	N/A
6	5	6029	1/27/2015	N/A
6	6	6144	1/27/2015	1110
7	1	8067	1/27/2015	1215
7	2	12132	1/27/2015	1220
7	3	12177	1/27/2015	N/A
7	4	7231	1/27/2015	1222
7	5	6104	1/27/2015	N/A
7	6	6096	1/27/2015	N/A
8	1	7123	1/27/2015	N/A
8	2	8096	1/27/2015	1230
8	3	7321	1/27/2015	1235
8	4	7046	1/27/2015	1240
8	5	7123	1/27/2015	N/A
8	6	7245	1/27/2015	N/A
9	1	7321	1/27/2015	N/A
9	2	10135	1/27/2015	1255
9	3	8221	1/27/2015	1300
9	4	6321	1/27/2015	1305
9	5	6238	1/27/2015	N/A
9	6	5198	1/27/2015	N/A

Table 7 Boreholes #10 through #18 Gamma Logs

Borehole #	Depth BGS in Feet	2" by 2" NaI Reading in 1,000 cpm	Date Surveyed	Sample Collection Time
10	1	8123	1/28/2015	0835
10	2	7243	1/28/2015	N/A
10	3	6135	1/28/2015	0840
10	4	6212	1/28/2015	0842
10	5	5067	1/28/2015	N/A
10	6	5123	1/28/2015	0846
11	1	8232	1/28/2015	0852
11	2	9124	1/28/2015	0855
11	3	8334	1/28/2015	N/A
11	4	6246	1/28/2015	0858
11	5	6321	1/28/2015	0902
11	6	6209	1/28/2015	N/A
12	1	7123	1/28/2015	0930
12	2	10421	1/28/2015	0932
12	3	9232	1/28/2015	0935
12	4	8327	1/28/2015	0940
12	5	6111	1/28/2015	N/A
12	6	6023	1/28/2015	N/A
13	1	11130	1/28/2015	0947
13	2	13452	1/28/2015	0950
13	3	12789	1/28/2015	0952
13	4	8353	1/28/2015	N/A
13	5	8267	1/28/2015	0957
13	6	7239	1/28/2015	N/A
14	1	9233	1/28/2015	1007
14	2	12385	1/28/2015	1010
14	3	10196	1/28/2015	N/A
14	4	9124	1/28/2015	1013
14	5	6203	1/28/2015	N/A
14	6	6102	1/28/2015	N/A
15	1	10294	1/28/2015	1022
15	2	12209	1/28/2015	1025
15	3	11101	1/28/2015	1028
15	4	9203	1/28/2015	1120
15	5	8028	1/28/2015	N/A
15	6	6135	1/28/2015	N/A
16	1	8043	1/28/2015	1230
16	2	12112	1/28/2015	1235
16	3	11232	1/28/2015	1237
16	4	9321	1/28/2015	N/A
16	5	7210	1/28/2015	1239
16	6	6232	1/28/2015	N/A
17	1	8132	1/28/2015	N/A
17	2	9155	1/28/2015	1246
17	3	Obstruction	1/28/2015	N/A
18	1	10248	1/28/2015	1255
18	2	12192	1/28/2015	N/A
18	3	9341	1/28/2015	1310
18	4	7092	1/28/2015	N/A
18	5	7121	1/28/2015	N/A
18	6	6045	1/28/2015	N/A

Table 8 Boreholes #19 through #26 Gamma Logs

Borehole #	Depth BGS in Feet	2" by 2" NaI Reading in 1,000 cpm	Date Surveyed	Sample Collection Time
19	1	9166	1/28/2015	1320
19	2	10321	1/28/2015	N/A
19	3	8128	1/28/2015	1325
19	4	7343	1/28/2015	N/A
19	5	7213	1/28/2015	1338
19	6	7632	1/28/2015	N/A
20	1	9057	1/29/2015	0830
20	2	10122	1/29/2015	0832
20	3	9342	1/29/2015	N/A
20	4	7124	1/29/2015	0835
20	5	6070	1/29/2015	N/A
20	6	5148	1/29/2015	N/A
21	1	6179	1/29/2015	0842
21	2	8324	1/29/2015	0848
21	3	7432	1/29/2015	N/A
21	4	6233	1/29/2015	0852
21	5	6110	1/29/2015	N/A
21	6	5436	1/29/2015	N/A
22	1	7387	1/29/2015	N/A
22	2	11334	1/29/2015	N/A
22	3	13983	1/29/2015	0907
22	4	8225	1/29/2015	N/A
22	5	7124	1/29/2015	0910
22	6	6432	1/29/2015	N/A
23	1	8224	1/29/2015	N/A
23	2	12097	1/29/2015	0935
23	3	12358	1/29/2015	N/A
23	4	9023	1/29/2015	0938
23	5	6342	1/29/2015	N/A
23	6	6236	1/29/2015	N/A
24	1	9237	1/29/2015	N/A
24	2	10145	1/29/2015	0945
24	3	9467	1/29/2015	0948
24	4	7323	1/29/2015	0950
24	5	7298	1/29/2015	N/A
24	6	6136	1/29/2015	N/A
25	1	10378	1/29/2015	1000
25	2	10243	1/29/2015	1002
25	3	8133	1/29/2015	N/A
25	4	8376	1/29/2015	1005
25	5	Obstruction	1/29/2015	N/A
26	1	8120	1/29/2015	1010
26	2	10326	1/29/2015	1013
26	3	8278	1/29/2015	1015
26	4	7542	1/29/2015	N/A
26	5	7231	1/29/2015	1019
26	6	6356	1/29/2015	N/A

10.2 Soil Samples

Soils samples were collected at various depths at the borehole locations and sent to the offsite laboratory for Isotopic Thorium (Method A-01-R Alpha Spectroscopy) analysis. The laboratory used for the project was:

Test America Laboratories, Inc.

13715 Rider Trail North

Earth City, MO 63045

DOD ELAP Cert # ADE-1430

The maximum sample result for Th-232 was 2.74 pCi/g at Borehole #2 location. The average result for all of the samples was 0.60 pCi/g.

Tables 9 and 10 below present summaries of the soil sample results. The laboratory data reports are presented in Appendix of this report.

Table 9 Soil Sample Results Summary Table Boreholes #1 through #12

						Isotopic Thorium/Alpha Spectroscopy		
Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in Feet	Sample Matrix	Location/Description	Th-228 Results in pCi/g	Th-230 Results in pCi/g	Th-232 Results in pCi/g
IHBH1-2	1/27/2015	O835	2	Soil	Borehole #1	0.582	0.517	0.488
IHBH1-3	1/27/2015	O845	3	Soil	Borehole #1	0.714	0.702	0.506
IHBH1-4	1/27/2015	O850	4	Soil	Borehole #1	0.536	0.608	0.427
IHBH1-5	1/27/2015	O900	5	Soil	Borehole #1	0.462	0.403	0.456
IHBH1-6	1/27/2015	O905	6	Soil	Borehole #1	0.466	0.423	0.423
IHBH2-1	1/27/2015	O930	1	Soil	Borehole #2	1.02	0.724	0.932
IHBH2-2	1/27/2015	O932	2	Soil	Borehole #2	3.05	0.746	2.74
IHBH2-3	1/27/2015	O935	3	Soil	Borehole #2	1.1	0.724	1.06
IHBH2-4	1/27/2015	O940	4	Soil	Borehole #2	1.12	0.545	1.02
IHBH2-5	1/27/2015	O942	5	Soil	Borehole #2	0.484	0.418	0.404
IHBH2-6	1/27/2015	O945	6	Soil	Borehole #2	0.376	0.419	0.471
IHBH3-2	1/27/2015	O950	2	Soil	Borehole #3	0.6	0.492	0.656
IHBH3-3	1/27/2015	O955	3	Soil	Borehole #3	1.03	0.58	1.06
IHBH3-5	1/27/2015	1000	5	Soil	Borehole #3	0.609	0.535	0.459
IHBH4-1	1/27/2015	1005	1	Soil	Borehole #4	0.586	0.5	0.528
IHBH4-3	1/27/2015	1010	3	Soil	Borehole #4	0.693	0.679	0.567
IHBH4-5	1/27/2015	1015	5	Soil	Borehole #4	0.497	0.336	0.393
IHBH5-2	1/27/2015	1045	2	Soil	Borehole #5	0.496	0.543	0.602
IHBH5-4	1/27/2015	1050	4	Soil	Borehole #5	0.606	0.738	0.649
IHBH5-6	1/27/2015	1055	6	Soil	Borehole #5	0.48	0.569	0.529
IHBH6-1	1/27/2015	1100	1	Soil	Borehole #6	0.645	0.538	0.528
IHBH6-3	1/27/2015	1105	3	Soil	Borehole #6	0.54	0.6	0.47
IHBH6-6	1/27/2015	1110	6	Soil	Borehole #6	0.358	0.509	0.373
IHBH7-1	1/27/2015	1215	1	Soil	Borehole #7	0.732	0.609	0.728
IHBH7-2	1/27/2015	1220	2	Soil	Borehole #7	0.709	0.463	0.68
IHBH7-4	1/27/2015	1222	4	Soil	Borehole #7	0.49	0.639	0.47
IHBH8-2	1/27/2015	1230	2	Soil	Borehole #8	0.448	0.538	0.541
IHBH8-3	1/27/2015	1235	3	Soil	Borehole #8	0.538	0.46	0.478
IHBH8-4	1/27/2015	1240	4	Soil	Borehole #8	0.608	0.505	0.454
IHBH9-2	1/27/2015	1255	2	Soil	Borehole #9	0.424	0.436	0.527
IHBH9-3	1/27/2015	1300	3	Soil	Borehole #9	0.463	0.573	0.338
IHBH9-4	1/27/2015	1305	4	Soil	Borehole #9	0.443	0.503	0.381
IHBH10-1	1/28/2015	O835	1	Soil	Borehole #10	0.454	0.551	0.576
IHBH10-3	1/28/2015	O840	3	Soil	Borehole #10	0.369	0.431	0.355
IHBH10-4	1/28/2015	O842	4	Soil	Borehole #10	0.306	0.494	0.407
IHBH10-6	1/28/2015	O846	6	Soil	Borehole #10	0.326	0.478	0.343
IHBH11-1	1/28/2015	O852	1	Soil	Borehole #11	0.521	0.647	0.602
IHBH11-2	1/28/2015	O855	2	Soil	Borehole #11	0.565	0.464	0.692
IHBH11-4	1/28/2015	O858	4	Soil	Borehole #11	0.487	0.482	0.562
IHBH11-5	1/28/2015	O902	5	Soil	Borehole #11	0.598	0.491	0.324
IHBH12-1	1/28/2015	O930	1	Soil	Borehole #12	0.322	0.545	0.325
IHBH12-2	1/28/2015	O932	2	Soil	Borehole #12	0.324	0.472	0.431
IHBH12-3	1/28/2015	O935	3	Soil	Borehole #12	0.538	0.623	0.578
IHBH12-4	1/28/2015	O940	4	Soil	Borehole #12	0.46	0.602	0.512
					Maximum:	**3.050**	**0.746**	**2.740**
					Average:	**0.618**	**0.542**	**0.592**
					Standard Deviation:	**0.422**	**0.098**	**0.379**

U-Result is less than the sample detection limit.
ND- Not detected.

Table 10 Soil Sample Results Summary Table Boreholes #13 through #26

						Isotopic Thorium/Alpha Spectroscopy		
Sample ID#	Date Sampled	Time Sampled	Sample Depth Below Grade Surface in Feet	Sample Matrix	Location/Description	Th-228 Results in pCi/g	Th-230 Results in pCi/g	Th-232 Results in pCi/g
IHBH13-1	1/28/2015	O947	1	Soil	Borehole #13	0.698	0.578	0.51
IHBH13-2	1/28/2015	O950	2	Soil	Borehole #13	0.72	0.691	0.541
IHBH13-3	1/28/2015	O952	3	Soil	Borehole #13	0.686	0.736	0.65
IHBH13-5	1/28/2015	O957	5	Soil	Borehole #13	0.63	0.544	0.664
IHBH14-1	1/28/2015	1007	1	Soil	Borehole #14	0.565	0.594	0.614
IHBH14-2	1/28/2015	1010	2	Soil	Borehole #14	0.661	0.729	0.762
IHBH14-4	1/28/2015	1013	4	Soil	Borehole #14	0.698	0.778	0.692
IHBH15-1	1/28/2015	1022	1	Soil	Borehole #15	0.689	0.596	0.607
IHBH15-2	1/28/2015	1025	2	Soil	Borehole #15	0.834	0.717	0.675
IHBH15-3	1/28/2015	1028	3	Soil	Borehole #15	0.692	0.695	0.61
IHBH15-4	1/28/2015	1120	4	Soil	Borehole #15	0.714	0.539	0.543
IHBH16-1	1/28/2015	1230	1	Soil	Borehole #16	0.588	0.782	0.471
IHBH16-2	1/28/2015	1235	2	Soil	Borehole #16	0.742	0.674	0.657
IHBH16-3	1/28/2015	1237	3	Soil	Borehole #16	0.745	0.698	0.606
IHBH16-5	1/28/2015	1239	5	Soil	Borehole #16	0.449	0.503	0.363
IHBH17-2	1/28/2015	1246	2	Soil	Borehole #17	0.646	0.56	0.616
IHBH18-1	1/28/2015	1255	1	Soil	Borehole #18	0.631	0.673	0.517
IHBH18-3	1/28/2015	1310	3	Soil	Borehole #18	0.713	0.66	0.567
IHBH19-1	1/28/2015	1320	1	Soil	Borehole #19	0.723	0.657	0.705
IHBH19-3	1/28/2015	1325	3	Soil	Borehole #19	0.571	0.526	0.431
IHBH19-5	1/28/2015	1338	5	Soil	Borehole #19	0.626	0.687	0.654
IHBH20-1	1/29/2015	O830	1	Soil	Borehole #20	0.686	0.588	0.543
IHBH20-2	1/29/2015	O832	2	Soil	Borehole #20	0.805	0.461	0.619
IHBH20-4	1/29/2015	O835	4	Soil	Borehole #20	0.633	0.664	0.626
IHBH21-1	1/29/2015	O842	1	Soil	Borehole #21	0.527	0.604	0.53
IHBH21-2	1/29/2015	O848	2	Soil	Borehole #21	0.509	0.657	0.617
IHBH21-4	1/29/2015	O852	4	Soil	Borehole #21	0.589	0.552	0.363
IHBH22-3	1/29/2015	O907	3	Soil	Borehole #22	0.59	0.752	0.627
IHBH22-5	1/29/2015	O910	5	Soil	Borehole #22	0.788	0.69	0.921
IHBH23-2	1/29/2015	O935	2	Soil	Borehole #23	0.62	0.642	0.814
IHBH23-4	1/29/2015	O938	4	Soil	Borehole #23	0.527	0.539	0.608
IHBH24-2	1/29/2015	O945	2	Soil	Borehole #24	0.694	0.665	0.757
IHBH24-3	1/29/2015	O948	3	Soil	Borehole #24	0.556	0.54	0.63
IHBH24-4	1/29/2015	O950	4	Soil	Borehole #24	0.655	0.615	0.563
IHBH25-1	1/29/2015	1000	1	Soil	Borehole #25	0.761	0.785	0.654
IHBH25-2	1/29/2015	1002	2	Soil	Borehole #25	0.694	0.608	0.682
IHBH25-4	1/29/2015	1005	4	Soil	Borehole #25	0.602	0.556	0.682
IHBH26-1	1/29/2015	1010	1	Soil	Borehole #26	0.54	0.578	0.673
IHBH26-2	1/29/2015	1013	2	Soil	Borehole #26	0.557	0.672	0.714
IHBH26-3	1/29/2015	1015	3	Soil	Borehole #26	0.503	0.598	0.601
IHBH26-5	1/29/2015	1019	5	Soil	Borehole #26	0.316	0.434	0.445
					Maximum:	**0.834**	**0.785**	**0.921**
					Average:	**0.638**	**0.630**	**0.613**
					Standard Deviation:	**0.102**	**0.086**	**0.110**

U-Result is less than the sample detection limit.
ND- Not detected.

10.3 Equipment Release Surveys

Equipment release surveys were performed after all sampling activities were completed. These surveys consisted of gross alpha/beta scan and direct measurement surveys. In addition, swipe samples were collected and analyzed for gross alpha/beta activity. All of the survey results were below the release criteria present in Table 3.

Copies of the radiological survey reports are presented in Appendix G of this report.

11.0 WASTE MANAGEMENT

There was no investigation-derived waste (IDW) generated during boring and sampling activities.

12.0 CONCLUSION

Bases upon the characterization survey results it is estimated that there is ~ 200 cubic yards of radiologically soil remaining that will require removal. This equates to ~ seventeen 20-25 cubic yard intermodal roll off containers.

13.0 REFERENCES

American National Standards Institute/American Nuclear Society (ANSI/ANS), 1993. *Selection, Qualification, and Training of Personnel for Nuclear Power Plants*, ANSI/ANS, 1993.

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International Organization for Standardization, (ISO), 1988. *Evaluation of Surface Contamination -Part 1 :Beta-emitters (Maximum Beta Energy Greater Than 0,15 MeV) and Alpha-emitters, 1st Edition*, 1 August 1988

U.S. Atomic Energy Commission (AEC), 1974. *Termination of Operating Licenses for Nuclear Reactors, Regulatory Guide 1.86*, June, 1974.

U.S. Environmental Protection Agency (EPA), 2000. *Guidance for the Data Quality Objectives Process, EPA QA/G-4*, U.S. Environmental Protection Agency, Office of Research and Development, August, 2000.

U.S. Nuclear Regulatory Commission, (NRC) 1992a. *Air Sampling in the Workplace*, RegGuide 8.25, Rev. 0, Office of Nuclear Regulatory Research, Washington, DC, June, 1992.

U.S. Nuclear Regulatory Commission (NRC), 1997. *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions, NUREG-1507*, December, 1997.

U.S. Nuclear Regulatory Commission (NRC), 1998. *A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys,NUREG-1505* June, 1998.

U.S. Nuclear Regulatory Commission (NRC), 2000, *Multi-Agency Radiation Survey and Site Investigation Manual, MARSSIM, NUREG-1575, EPA 402-R-97-016*.

Appendix A

Radiation Work Permit (RWP)

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2015-01 Regular X Extended

SECTION I

Contract # USN-2014-058	Date: 1-26-15	Time: 1300

Location/Project: NSF Indian Head, MD IR Site 1

Exposure Category: D&D Source Transfer Waste Processing Characterization

Job Description: Characterization surveys and sampling. Collection of characterization borehole samples around Building 1662.

Estimated Start Date: 1/26/2015 Estimated End Date: 1/30/2015

SECTION II

Existing Radiological Conditions:

Radiation Survey No. N/A Airborne Survey No. N/A Contamination Survey No. N/A .

Existing General Area Radiation Level(s):	Existing General Contamination Levels:	Airborne DAC Level(s):
.006-.01 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	< 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 100 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	< 10 % P < 10 % P N/A % H_3
Existing Maximum Radiation Level(s):	Existing Maximum Contamination Level(s)	Hot Particle?
.010 mR/hr/γ N/A mrad/hr/corrected β N/A mrem/hr/η	< 20 dpm/100cm² α Loose < 200 dpm/100cm² βγ Loose < 20 dpm/100cm² α Fixed < 200 dpm/100cm² βγ Fixed	Yes No

Remarks: None.

SECTION III

Radiological Limits:

Maximum Allowed WB Exposure Rate : 5 mr/hr γ or mrem/hr η

Corrected : N/A mrad/hr Maximum Extremity Exposure Rate: 5 mr/hr

Maximum Allowed Contamination Level : 20 dpm/100cm² α Loose : 200 dpm/100cm² βγ Loose

Maximum Allowed Contamination Level : 100 dpm/100cm² α Fixed : 1,000 dpm/100cm² βγ Fixed

Maximum Allowed Airborne Concentration Level: 10 % DAC

Remarks:

Industrial Hygiene/Safety Concerns: Heavy equipment, Cold stress.

RADIATION WORK PERMIT (RWP)

RWP #: NSFIH-2015-01 Regular X Extended

SECTION IV

WORKER REQUIREMENTS

CLOTHING:	DOSIMETRY:	INSTRUCTIONS:	RESPIRATORY:
☐ Coveralls	☒ TLD	☒ Contact HP for Line Breaks	☐ FFNP
☐ Lab Coat	☐ Film Badge	☒ Protect Cuts	☐ FFAL
☐ Cloth Hood	☐ SRD	☒ Pre-Job Briefing	☐ SCBA
☒ Paper Coveralls[1]	☒ Standard	☒ Post-Job Briefing	☐ PAPR
☐ Plastic Suit	☐ Elbows	☒ Contact HP Prior to Work In New Areas	☒ Dust Mask[1]
☒ Plastic Booties[1]	☐ Gonad Pack	☐ Modesty Required	☐ Half Face
☐ Rubber Shoe Covers	☐ Hot Cell Entry	☒ Site Specific Instructions	☐ Bubble Hood
☐ Canvas Shoe Covers	☐ Extremity	☒ Equipment Monitor at Job End	
☐ Cotton Gloves	☐ Head Pack	☒ Clean Up Work Area During and After Job	Cartridges:
☒ Rubber Gloves[1 2]	☐ Special	☒ Eating, Drinking, Smoking, Chewing Prohibited	☐ Particulate
☒ Leather Gloves[1]	☐ Knees	☒ Frisk Upon Exiting Contaminated Area	☐ Vapor
☐ Beta Goggles/Face Shield	☐ Varying Field	☒ Have Prescribed HP Coverage or Stop Work	☐ Combination
☐ Extra	☐ Upper Field	☒ Exit Area Immediately Upon Emergency or Injury. Notify HP Immediately	☐ Other
☐ Other Clothing	☐ Ground Field		
	☐ Alarming Dosimetry		
	☐ None		
Stay Time (Heat Stress, Radiaton, Exposure Limits, etc.): 6 hrs.			

Special Instructions: [1] Per HP supervision instructions. [2] When collecting soil samples and handling potentially contaminated items.

SECTION V

Health Physics Requirements

1. Job Coverage: Continuous ☐ Intermittent ☒ Start ☐ End of Job ☐
2. Air Sampling: General Area ☐ Breathing Zone ☐ Lapel ☐ AgZ ☐
   Tritium/C-14 ☐ Particulate ☐ Charcoal ☐ LoVol ☐ HiVol ☐
3. Exposure Rate Surveys: Start of Job ☒ Continuous Monitoring ☐ Area Monitoring ☐
   Intermittent Monitoring ☒ End of Job ☒
4. Contamination Surveys: Start of Job ☒ Continuous Monitoring ☐
   Intermittent Monitoring ☒ End of Job ☒
5. Is the ALARA Consideration Complete and Attached? Yes No Why? _____
6. Other: _____

RWP #: NSFIH-2015-01 Regular X Extended

SECTION VI

Personnel Authorized to Perform Work & Acceptance of Responsibility

*My signature verifies that I have read and fully understand the RWP Requirements

Date	Name (Print)	Signature*	Last Four Digits SSN	HPS Init	Year Dose to Date (Rem) TEDE	TODE	LDE	SDE WB	SDE EX
1/26/15	Kelley N Bezpat	[illegible]	0514	[illegible]	0	0	0	0	0
1/26/15	Kathy A Brooks	Kathy A Brooks	~~7799~~	KAB	0	0	0	0	0
1-26-15	Adolfo Matus	[illegible]	6734	AM	0	0	0	0	0
1-26-15	William Ogle	[illegible]	1205	WO	0	0	0	0	0
1-26-15	Josefina L. Matos	[illegible]	3078	[illegible]	0	0	0	0	0
1-26-15	Dan Spencer	[illegible]	4551	[illegible]	0	0	0	0	0

H	Approvals/Reviews	I	Termination
Technician Generating RWP: [illegible] Date/Time: 1-26-15 / 1300		Date: 1/26/15 Time: 1500	
Industrial Hygiene Approval: Date/Time: N/A		Health Physics Rep: [illegible]	
HP Supervisor Approval: Date/Time: N/A		Reason: (Job Complete) RWP Revision	
RSO Manager Approval: [illegible] Date/Time: 1/26/15 / 1315		HP Supervisor Review: [illegible]	

Appendix B

Work Permit

IR Work Approval Permit

1/24/2011 Revision

NSASP Comprehensive Work Approval Planning (CWAP) – NSF Indian Head

Section A. Customer Information

Tracking Number: NDW-12-023C

Project Name: Site 1 Characterization Survey

Application Date: 10/30/2014 **Building Number(s):** 1662

Organization Submitting Application: NAVFAC **Organization Funding Proposed Action:** NAVFAC

Name of Applicant: Nick Carros **POC from Funding Organization:** Joe Rail

Phone Ext: x2263 **POC Phone Ext:** 202-685-3105

Email: nicholas.carros@navy.mil **POC Email:** joseph.rail@navy.mil

Anticipated Dates of Work: Start: 11/17/2014 **Completion:** 1/1/2015 **Expiration Date:** 365 Days from Date of Approval

Section B. Site Issues

Checked Issues must be approved by the appropriate Resource Manager.

Work Restriction Area	Approval Date	Work Restriction Area	Approval Date
☐ Explosives Safety		☐ Air Emissions	
☐ Survey Control/Property Points		☑ Waste (Hazard and Non-Hazard)	11/6/2014
☐ Earth Disturbance		☐ Archeological Area	
☑ Installation Restoration (IR) Site	11/6/2014	☐ Historic Building	
☑ Worker Safety	11/6/2014	☑ Buried Utilities	11/6/2014
☐ Surface Water/Wetlands/Floodplain		☐ Munitions Response (MRP) Site	
☐ Stormwater Management		☐ Other Pipe Work	
☐ Eagle Nest Buffer		☑ Other Work Restriction Area	11/6/2014
☐ Natural Resources/Species Protection		☐ No Work Restriction Areas	

Land Use Site Approval Required? ○ Yes ◉ No	Real Estate Package Required? ○ Yes ◉ No	IMIG/RMIG Review Required? ○ Yes ◉ No

Conditions Identified for Work Execution

IR Site Conditions

Work must be conducted in accordance with the work plan.

Worker Safety Conditions

Workers must follow the health and safety work plan and wear the proper PPE.

Waste (Hazard and Non-Hazard) Conditions

Coordinate with the Environmental Office (x2268) for storage and disposal of the IDW.

Buried Utilities Conditions

Utility location required before any earth disturbance.

Other Work Restrictions

- Work will impact the parking next to building 1662. Coordinate with Jerry Welch (743-4163) or Ray Hrynko (743-4162) prior to starting the project.
- Large trucks/equipment shall not be staged along the road running parallel to the shoreline due to issues weight limits associated with the shoreline repair project.

IRT Approval Date: 11/6/2014

Signature of Environmental Division Director or Designee: _____

Signature of Facilities Management Division Director or Designee: _____

This IR Work Approval Permit identifies the conditions that must be satisfied in order to proceed with project execution.
Note: Signed Work Approval Permit must be on site while all work is being performed.

Section C. Project Details

Project Description:

Project includes the following:

- Utility Clearance
-background soil samples will be collect at the two potential locations shown on the map
- 4-6" diameter boreholes at various locations at the site to a maximum depth of 6' feet below grade surface (bgs). The soil cuttings will be gamma scanned.
- outdoor gamma scan surface survey
- approximately 300 to 500 grams of soil will be collected from each location and sent to an off-site laboratory for alpha spectroscopy analysis

Work will be conducted by a contractor over the course of a couple weeks. Soil exceeding the investigation level will be put back into the borehole unless it is in the top 1 foot layer where it will be placed in a drum and disposed of accordingly.

Location Description:

Site 1 is located next to building 1662

Will this project involve removing, breaking or opening any piping, tubing or hoses? ○ Yes ◉ No

Section D. Project Tracking Information

Facility Engineering and Acquisition Division Number: N/A

Estimated Project Cost: **Less than $100,000**

Funding Type: ER'N

Acquisitions Branch Contract Number: W52P1J-08-D-0034

Delivery Order: 0085

Work Request / Service Ticket Number(s): N/A

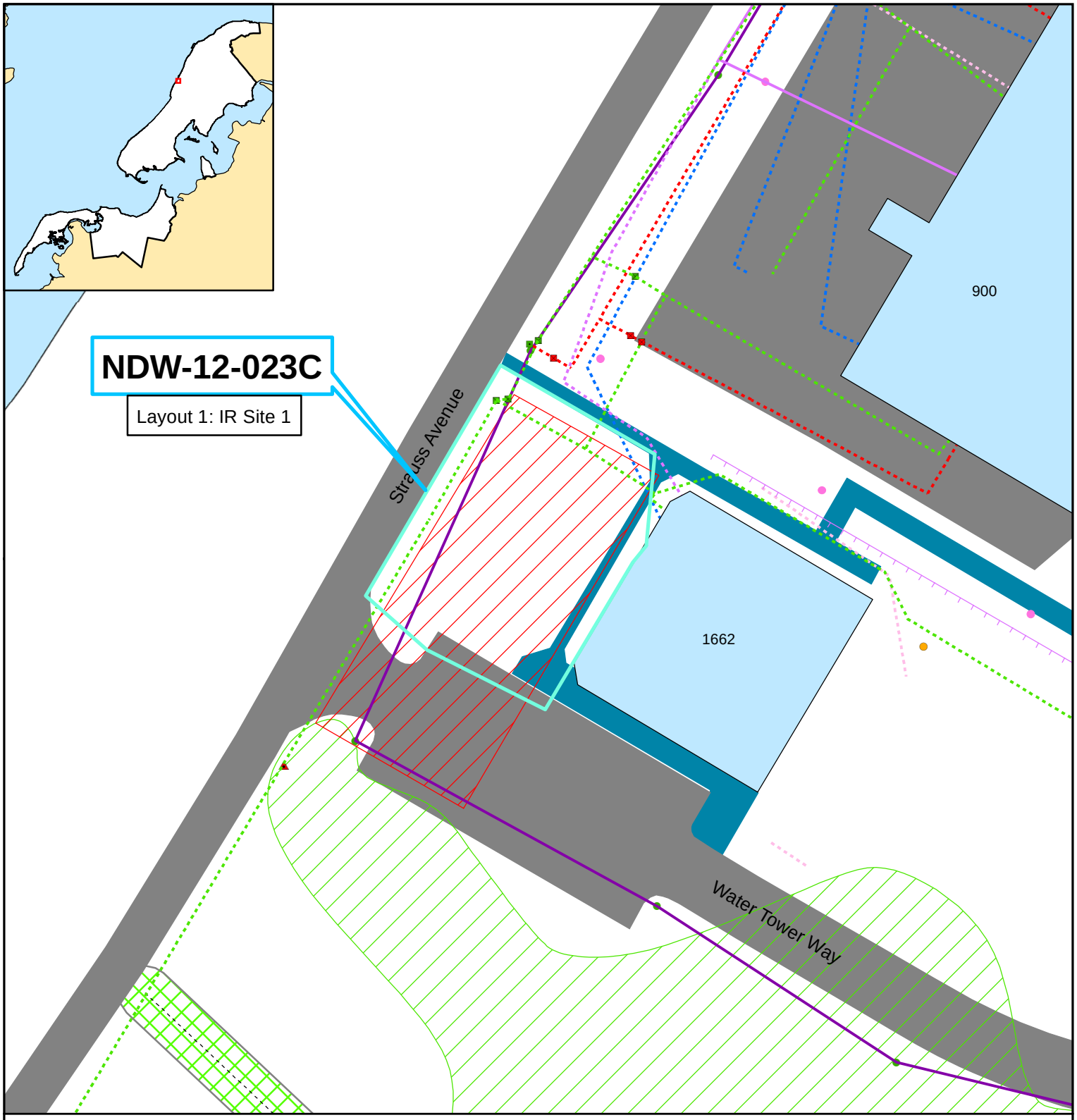
Asset Management Project Number: N/A

WebSAR Project Number: N/A

Section E. IRT Contact Information

Seth Berry	Natural Resources	seth.m.berry@navy.mil	x2273	Bldg. 554
Nick Carros	IR and MRP	nicholas.carros@navy.mil	x2263	Bldg. 554
Tony Chinyere	Asset Management Branch Head	anthony.chinyere@navy.mil	x2192	Bldg. 351
Robert Collins	NDW Fire Prevention	robert.e.collins3@navy.mil	x4370	Bldg. D-339
George David	Facilities Planning	george.d.david@navy.mil	x2163	Bldg. 351
Billy Fabey	Stormwater	william.fabey@navy.mil	x2275	Bldg. 554
Marissa Fabey	MWR Branch Head	marissa.fabey@navy.mil	x6587	Bldg. D328
Kathy Frey	Potable Water	mary.frey@navy.mil	x2258	Bldg. 289
Ray Geckle	NSWC IHEODTD Safety	raymond.geckle@navy.mil	x6799	Bldg. 482
David Hartnett	Tank Management	david.j.hartnett@navy.mil	x2259	Bldg. 289
Dave Hoffman	Air	frederick.d.hoffman@navy.mi	x1616	Bldg. 289
Dave Jenkins	Utilities Management	david.h.jenkins1@navy.mil	x4480	Bldg. 873
Larry Kijek	NSWC IHEODTD Explosives Safety Officer	lawrence.kijek@navy.mil	x6871	Bldg. 2151
Mike Knutson	N6 - Telecommunciations	michael.l.knutson@navy.mil	540-653-6463	Bldg. 108 DL
John Mikles	Asbestos and Lead Saftey	john.mikles@navy.mil	x2272	Bldg. 289
Adrian Mood	Industrial Wastewater	adrian.mood@navy.mil	x2280	Bldg. 289
Heidi Morgan	RCRA	heidi.a.morgan@navy.mil	540-653-2035	Bldg. 189 DL

Bill Potter	PWD Environmental Planning & Compliance	william.y.potter@navy.mil	x2261	Bldg. 554
Patrick Reitz	PWD Safety	patrick.reitz@navy.mil	x1298	Bldg. 510
Diana Rose	Sanitary Wastewater	diana.rose@navy.mil	x2267	Bldg. 289
Jerry Schenemann	Assistant Fire Chief Prevention	jerry.schenemann@navy.mil	540-653-8626	Bldg. 246 DL
John Smallhorn	Solid and Hazardous Waste	john.smallhorn@navy.mil	x2268	Bldg. 289
Dennis Tomlinson	NSASP Safety	dennis.tomlinson@navy.mil	x2469	Bldg. D-339
George Turner	NSASP Explosives Safety Officer	george.w.turner1@navy.mil	540-284-4363	Bldg. 246
Kenneth Waits	Industrial Hygenist	kenneth.waits@med.navy.mil	x4910	Bldg. 1895
Brian Washburn	Force Protection and Physical Security	brian.washburn@navy.mil	x4414	Bldg. D328
Bob Wetherald	PWD Constructability and Design	bob.wetherald@navy.mil	x2168	Bldg. 551
Tommy Wright	NEPA and Cultural Resources	thomas.a.wright@navy.mil	x2260	Bldg. 554



NSFIH Work Approval Permit

0 20 40 80 120 160 Feet

- Work Area
- Buildings
- Structures
- Historic Structures
- Pet Boxes
- Survey Control Point
- Fence
- K24 ESQD Arc
- K18 ESQD Arc
- Inhabited Building ESQD Arc
- Species Protection Area
- Eagle Protection Areas
- IR Sites
- Munitions Response Area
- Cultural Protection Area
- Worker Notification Area
- Wetland
- Surface Water Bodies
- Contour Line

Streams
- Permanent
- Intermittent
- Dry

Road, Parking, Sidewalks
- Roads, Parking Lots
- Sidewalk

Utilities
- Riverwater Valve
- Fire Hydrant
- Riverwater
- Potable
- Potable Valve
- Sanitary Sewer
- Steam
- Compressed Air
- Industrial
- Industrial Valve
- Stormwater

Electrical, Communications
- Aboveground Comm
- Underground Comm
- Aboveground Electric
- Underground Electric
- Transformers
- Utility Poles
- Lightning Masts
- Light Poles

DISCLAIMER: Utilities depicted are believed to be accurate to +/- 15 feet.

N W E S

NOTE: This map was created using data from the NSA South Potomac GeoReadiness database. While performing work, if any underground utilities or item(s) are detected and are not shown on this plan, please detail an approximate location and give description of item(s) to the NAVFAC FMD GIS Analyst (Shelley Alongi, x2256, shelley.alongi@navy.mil).

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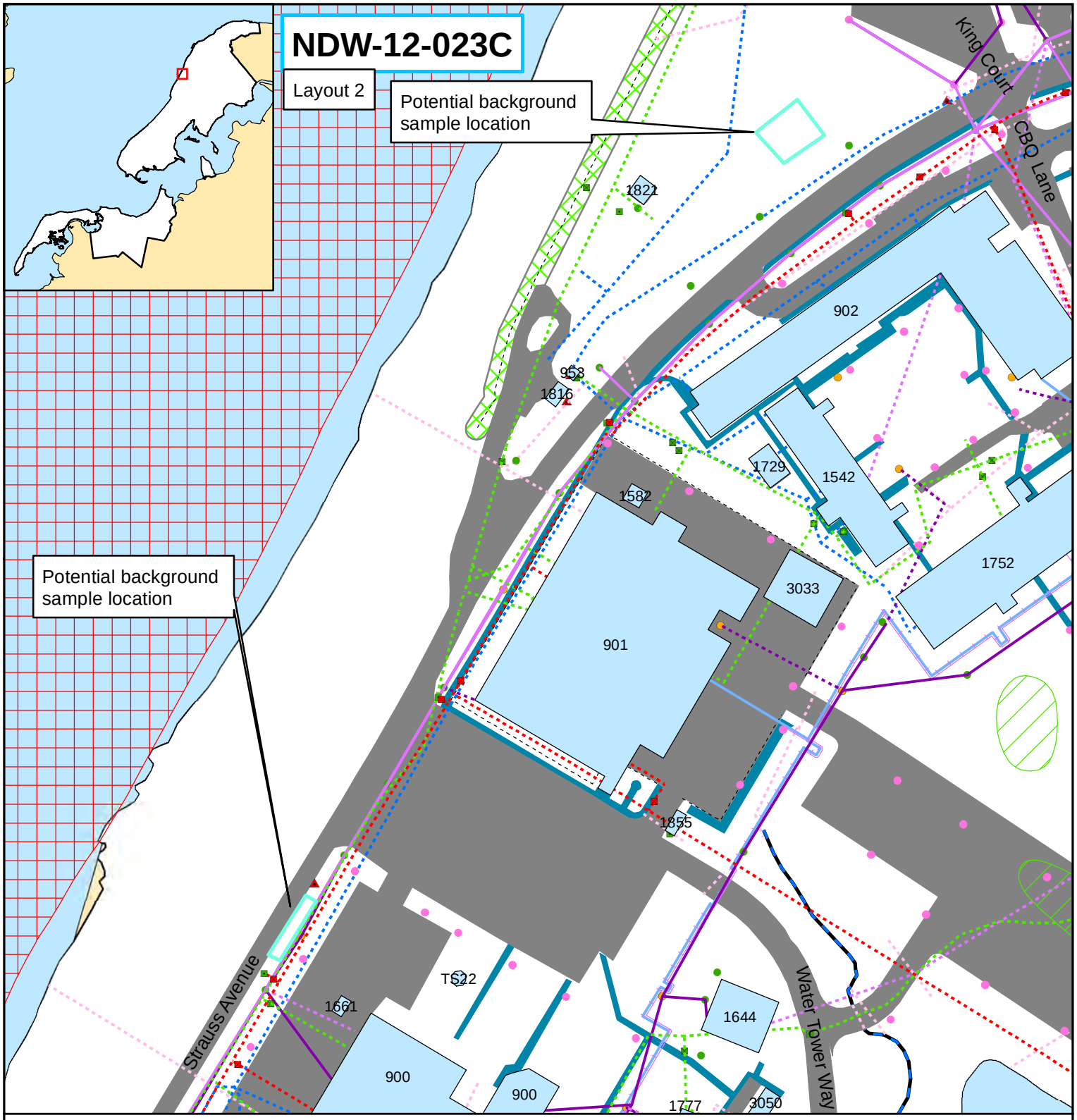

NSFIH Work Approval Permit

0 50 100 200 300 400 Feet

- Work Area
- Buildings
- Structures
- Historic Structures
- Pet Boxes
- Survey Control Point
- Fence
- K24 ESQD Arc
- K18 ESQD Arc
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N W E S

NOTE: This map was created using data from the NSA South Potomac GeoReadiness database. While performing work, if any underground utilities or item(s) are detected and are not shown on this plan, please detail an approximate location and give description of item(s) to the NAVFAC FMD GIS Analyst (Shelley Alongi, x2256, shelley.alongi@navy.mil).

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Appendix C

Background Reference Area Data

Ambient Background Data

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	95352	
Last Calibration Date:	4/15/2014				
Detector Model:	44-10		Detector Serial No.:	192589	
Today's Date:	1/25/2015		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background				
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	2407	-137.67		18952.11
2	2586	41.33		1708.44
3	2489	-55.67		3098.78
4	2535	-9.67		93.44
5	2521	-23.67		560.11
6	2489	-55.67		3098.78
7	2487	-57.67		3325.44
8	2512	-32.67		1067.11
9	2609	64.33		4138.78
10	2499	-45.67		2085.44
11	2453	-91.67		8402.78
12	2512	-32.67		1067.11
13	2523	-21.67		469.44
14	2620	75.33		5675.11
15	2632	87.33		7627.11
16	2587	42.33		1792.11
17	2569	24.33		592.11
18	2612	67.33		4533.78
19	2603	58.33		3402.78
20	2587	42.33		1792.11
21	2475	-69.67		4853.44
22	2603	58.33		3402.78
23	2544	-0.67		0.44
24	2587	42.33		1792.11
25	2574	29.33		860.44
26	2569	24.33		592.11
27	2498	-46.67		2177.78
28	2513	-31.67		1002.78
29	2601	56.33		3173.44
30	2544	-0.67		0.44
Mean Count: $\bar{x}$	2544.67		SUM	91338.67
Standard Deviation (σ)	56.12		Variance:	3149.61
Background Count Rate:		2544.67	CPM + -	112.24

CPM Low	CPM High
2432.42	2656.91

Calculations Completed by:	William Wylie	Date:	1/25/2015
Reviewed by:	Daniel Spicuzza	Date:	1/25/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head					
Instrument Model:	2350-1		Instrument Serial No.	126197		
Last Calibration Date:	4/15/2014					
Detector Model:	44-10		Detector Serial No.:	229176		
Today's Date:	1/25/2015		Data Collected by:	William Wylie		
	Alpha		Beta-Gamma	X	Gamma	
Remarks:	Instrument Ambient Background					
Type of Surface:	Ambient		Count Time:	1	Minutes	
Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$		
1	2704	6.93		48.07		
2	2769	71.93		5174.40		
3	2814	116.93		13673.40		
4	2650	-47.07		2215.27		
5	2670	-27.07		732.60		
6	2587	-110.07		12114.67		
7	2765	67.93		4614.94		
8	2654	-43.07		1854.74		
9	2804	106.93		11434.74		
10	2723	25.93		672.54		
11	2743	45.93		2109.87		
12	2598	-99.07		9814.20		
13	2643	-54.07		2923.20		
14	2678	-19.07		363.54		
15	2786	88.93		7909.14		
16	2687	-10.07		101.34		
17	2598	-99.07		9814.20		
18	2632	-65.07		4233.67		
19	2685	-12.07		145.60		
20	2731	33.93		1151.47		
21	2745	47.93		2297.60		
22	2759	61.93		3835.74		
23	2764	66.93		4480.07		
24	2598	-99.07		9814.20		
25	2676	-21.07		443.80		
26	2648	-49.07		2407.54		
27	2712	14.93		223.00		
28	2802	104.93		11011.00		
29	2697	-0.07		0.00		
30	2590	-107.07		11463.27		
Mean Count: $\bar{x}$	2697.07		SUM	137077.87		
Standard Deviation (σ)	68.75		Variance:	4726.82		CPM Low / CPM High
Background Count Rate:		2697.07	CPM + -	137.50	CPM	2559.56 / 2834.57
Calculations Completed by:		William Wylie				Date: 1/25/2015
Reviewed by:		Daniel Spicuzza				Date: 1/25/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2929		Instrument Serial No.	79980	
Last Calibration Date:	7/30/2014				
Detector Model:	43-10-1		Detector Serial No.:	082908	
Today's Date:	1/25/2015		Data Collected by:	William Wylie	
X	Alpha		Beta-Gamma		Gamma
Remarks:	Instrument Ambient Background			Instrument Efficiency:	0.726
Type of Surface:	N/A		Count Time:	1	Minutes

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	0	-0.33		0.11
2	0	-0.33		0.11
3	0	-0.33		0.11
4	1	0.67		0.44
5	0	-0.33		0.11
6	1	0.67		0.44
7	0	-0.33		0.11
8	0	-0.33		0.11
9	1	0.67		0.44
10	0	-0.33		0.11
11	1	0.67		0.44
12	0	-0.33		0.11
13	0	-0.33		0.11
14	0	-0.33		0.11
15	1	0.67		0.44
16	0	-0.33		0.11
17	1	0.67		0.44
18	0	-0.33		0.11
19	0	-0.33		0.11
20	1	0.67		0.44
21	0	-0.33		0.11
22	0	-0.33		0.11
23	0	-0.33		0.11
24	1	0.67		0.44
25	0	-0.33		0.11
26	1	0.67		0.44
27	0	-0.33		0.11
28	1	0.67		0.44
29	0	-0.33		0.11
30	0	-0.33		0.11
Mean Count: $\bar{x}$	0.33		SUM	6.67
Standard Deviation (σ)	0.48		Variance:	0.23
Background Count Rate:		0.33	CPM + -	0.96 CPM

Instrument Background in DPM	
1.84	
CPM Low	CPM High
-0.6	1.3

Calculations Completed by:	William Wylie	Date:	1/25/2015
Reviewed by:	Daniel Spicuzza	Date:	1/25/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2929		Instrument Serial No.	79980	
Last Calibration Date:	7/30/2014				
Detector Model:	43-10-1		Detector Serial No.:	082908	
Today's Date:	1/25/2015		Data Collected by:	William Wylie	
	Alpha	X	Beta-Gamma		Gamma
Remarks:	Instrument Ambient Background		Instrument Efficiency:	0.441	
Type of Surface:	N/A		Count Time:	1	Minutes

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	49	10.07		101.34
2	34	-4.93		24.34
3	41	2.07		4.27
4	38	-0.93		0.87
5	34	-4.93		24.34
6	32	-6.93		48.07
7	38	-0.93		0.87
8	41	2.07		4.27
9	39	0.07		0.00
10	42	3.07		9.40
11	51	12.07		145.60
12	42	3.07		9.40
13	36	-2.93		8.60
14	38	-0.93		0.87
15	39	0.07		0.00
16	34	-4.93		24.34
17	43	4.07		16.54
18	40	1.07		1.14
19	37	-1.93		3.74
20	36	-2.93		8.60
21	34	-4.93		24.34
22	43	4.07		16.54
23	41	2.07		4.27
24	40	1.07		1.14
25	37	-1.93		3.74
26	40	1.07		1.14
27	36	-2.93		8.60
28	39	0.07		0.00
29	36	-2.93		8.60
30	38	-0.93		0.87
Mean Count: $\bar{x}$	38.93		SUM	505.87
Standard Deviation (σ)	4.18		Variance:	17.44
Background Count Rate:		38.93	CPM + -	8.35 CPM

Instrument Background in DPM	
353.14	
CPM Low	CPM High
30.6	47.3

Calculations Completed by:	William Wylie	Date:	1/25/2015
Reviewed by:	Daniel Spicuzza	Date:	1/25/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2360		Instrument Serial No.	278551	
Last Calibration Date:	4/16/2014				
Detector Model:	43-93		Detector Serial No.:	312642	
Today's Date:	1/25/2015		Data Collected by:	William Wylie	

X	Alpha		Beta-Gamma		Gamma	

Remarks: Instrument Ambient Background Instrument Efficiency: 0.281

Type of Surface:	Ambient		Count Time:	1	Minutes
Count Number	**CPM**	$(x - \overline{x})$		$(x - \overline{x})^2$	
1	0	-0.27		0.07	
2	0	-0.27		0.07	
3	0	-0.27		0.07	
4	0	-0.27		0.07	
5	0	-0.27		0.07	
6	0	-0.27		0.07	
7	0	-0.27		0.07	
8	0	-0.27		0.07	
9	1	0.73		0.54	
10	0	-0.27		0.07	
11	1	0.73		0.54	
12	0	-0.27		0.07	
13	0	-0.27		0.07	
14	1	0.73		0.54	
15	0	-0.27		0.07	
16	0	-0.27		0.07	
17	0	-0.27		0.07	
18	0	-0.27		0.07	
19	1	0.73		0.54	
20	0	-0.27		0.07	
21	0	-0.27		0.07	
22	0	-0.27		0.07	
23	0	-0.27		0.07	
24	1	0.73		0.54	
25	1	0.73		0.54	
26	0	-0.27		0.07	
27	1	0.73		0.54	
28	0	-0.27		0.07	
29	0	-0.27		0.07	
30	1	0.73		0.54	
Mean Count: $\overline{x}$	0.27		SUM	5.87	
Standard Deviation (σ)	0.45		Variance:	0.20	
Background Count Rate:		0.27	CPM + -	0.90	CPM

Background in dpm/100cm^2	
3.80	
CPM Low	CPM High
-0.63	1.17

Calculations Completed by:	William Wylie	Date:	1/25/2015
Reviewed by:	Daniel Spicuzza	Date:	1/25/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2360		Instrument Serial No.	278551	
Last Calibration Date:	4/16/2014				
Detector Model:	43-93		Detector Serial No.:	312642	
Today's Date:	1/25/2015		Data Collected by:	William Wylie	
	Alpha	X	Beta-Gamma		Gamma
Remarks:	Instrument Ambient Background		Instrument Efficiency:	0.315	
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	139	-4.20		17.64
2	141	-2.20		4.84
3	132	-11.20		125.44
4	152	8.80		77.44
5	129	-14.20		201.64
6	144	0.80		0.64
7	150	6.80		46.24
8	158	14.80		219.04
9	147	3.80		14.44
10	143	-0.20		0.04
11	141	-2.20		4.84
12	142	-1.20		1.44
13	148	4.80		23.04
14	137	-6.20		38.44
15	149	5.80		33.64
16	139	-4.20		17.64
17	143	-0.20		0.04
18	126	-17.20		295.84
19	143	-0.20		0.04
20	138	-5.20		27.04
21	152	8.80		77.44
22	141	-2.20		4.84
23	138	-5.20		27.04
24	152	8.80		77.44
25	144	0.80		0.64
26	148	4.80		23.04
27	152	8.80		77.44
28	149	5.80		33.64
29	140	-3.20		10.24
30	139	-4.20		17.64
Mean Count: $\bar{x}$	143.20		SUM	1498.80
Standard Deviation (σ)	7.19		Variance:	51.68
Background Count Rate:		143.20	CPM + -	14.38 CPM

Background in dpm/100cm^2	
1818.41	
CPM Low	CPM High
128.82	157.58

Calculations Completed by:	William Wylie	Date:	1/25/2015
Reviewed by:	Daniel Spicuzza	Date:	1/25/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2360		Instrument Serial No.	275827	
Last Calibration Date:	4/16/2014				
Detector Model:	43-93		Detector Serial No.:	335833	
Today's Date:	1/25/2015		Data Collected by:	William Wylie	

X	Alpha		Beta-Gamma		Gamma	

Remarks: Instrument Ambient Background Instrument Efficiency: 0.282

Type of Surface:	Ambient		Count Time:	1	Minutes
Count Number	**CPM**	$(x - \overline{x})$		$(x - \overline{x})^2$	
1	0	-0.17		0.03	
2	0	-0.17		0.03	
3	0	-0.17		0.03	
4	0	-0.17		0.03	
5	0	-0.17		0.03	
6	1	0.83		0.69	
7	0	-0.17		0.03	
8	0	-0.17		0.03	
9	0	-0.17		0.03	
10	0	-0.17		0.03	
11	0	-0.17		0.03	
12	0	-0.17		0.03	
13	0	-0.17		0.03	
14	0	-0.17		0.03	
15	0	-0.17		0.03	
16	0	-0.17		0.03	
17	0	-0.17		0.03	
18	1	0.83		0.69	
19	0	-0.17		0.03	
20	0	-0.17		0.03	
21	0	-0.17		0.03	
22	1	0.83		0.69	
23	0	-0.17		0.03	
24	1	0.83		0.69	
25	0	-0.17		0.03	
26	1	0.83		0.69	
27	0	-0.17		0.03	
28	0	-0.17		0.03	
29	0	-0.17		0.03	
30	0	-0.17		0.03	
Mean Count: $\overline{x}$	0.17		SUM	4.17	
Standard Deviation (σ)	0.38		Variance:	0.14	
Background Count Rate:		0.17	CPM + -	1.14	CPM

Background in dpm/100cm^2	
2.36	
CPM Low	CPM High
-0.97	1.30

Calculations Completed by:	William Wylie	Date:	1/25/2015
Reviewed by:	Daniel Spicuzza	Date:	1/25/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2360		Instrument Serial No.	275827	
Last Calibration Date:	4/16/2014				
Detector Model:	43-93		Detector Serial No.:	335833	
Today's Date:	1/25/2015		Data Collected by:	William Wylie	
	Alpha	X	Beta-Gamma		Gamma
Remarks:	Instrument Ambient Background			Instrument Efficiency:	0.339
Type of Surface:	Ambient		Count Time:	1	Minutes

Count Number	CPM	$(x - \bar{x})$		$(x - \bar{x})^2$
1	121	-3.83		14.69
2	120	-4.83		23.36
3	118	-6.83		46.69
4	124	-0.83		0.69
5	116	-8.83		78.03
6	129	4.17		17.36
7	136	11.17		124.69
8	123	-1.83		3.36
9	128	3.17		10.03
10	129	4.17		17.36
11	132	7.17		51.36
12	121	-3.83		14.69
13	122	-2.83		8.03
14	128	3.17		10.03
15	121	-3.83		14.69
16	122	-2.83		8.03
17	120	-4.83		23.36
18	128	3.17		10.03
19	122	-2.83		8.03
20	123	-1.83		3.36
21	118	-6.83		46.69
22	131	6.17		38.03
23	127	2.17		4.69
24	124	-0.83		0.69
25	120	-4.83		23.36
26	129	4.17		17.36
27	126	1.17		1.36
28	131	6.17		38.03
29	130	5.17		26.69
30	126	1.17		1.36
Mean Count: $\bar{x}$	124.83		SUM	686.17
Standard Deviation (σ)	4.86		Variance:	23.66
Background Count Rate:		124.83	CPM + -	14.59 CPM

Background in dpm/100cm^2	
1472.96	
CPM Low	CPM High
110.24	139.43

Calculations Completed by:	William Wylie	Date:	1/25/2015
Reviewed by:	Daniel Spicuzza	Date:	1/25/2015

Soil Background Data

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	126197	
Last Calibration Date:	4/15/2014				
Detector Model:	44-10		Detector Serial No.:	229176	
Today's Date:	1/26/2015		Data Collected by:	Adolfo Matus Jr.	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background				
Type of Surface:	Surface Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	3198	-550.90		303490.81
2	3135	-613.90		376873.21
3	3194	-554.90		307914.01
4	3090	-658.90		434149.21
5	3169	-579.90		336284.01
6	3263	-485.90		236098.81
7	3139	-609.90		371978.01
8	3183	-565.90		320242.81
9	3167	-581.90		338607.61
10	3144	-604.90		365904.01
11	2743	-1005.90		1011834.81
12	3138	-610.90		373198.81
13	3626	-122.90		15104.41
14	3612	-136.90		18741.61
15	3588	-160.90		25888.81
16	3597	-151.90		23073.61
17	4007	258.10		66615.61
18	3889	140.10		19628.01
19	4312	563.10		317081.61
20	4221	472.10		222878.41
21	4460	711.10		505663.21
22	4404	655.10		429156.01
23	4535	786.10		617953.21
24	4326	577.10		333044.41
25	4410	661.10		437053.21
26	4354	605.10		366146.01
27	4448	699.10		488740.81
28	4367	618.10		382047.61
29	4329	580.10		336516.01
30	4419	670.10		449034.01
Mean Count: $\bar{x}$	3748.90		SUM	9830942.70
Standard Deviation (σ)	582.24		Variance:	338998.02
Background Count Rate:		3748.90	CPM + -	1164.47 CPM

Action Level
5495.61

Calculations Completed by:	Adolfo Matus Jr.	Date:	1/26/2015
Reviewed by:	Daniel Spicuzza	Date:	1/26/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	95352	
Last Calibration Date:	4/15/2014				
Detector Model:	44-10		Detector Serial No.:	192589	
Today's Date:	1/26/2015		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma
Remarks:	Instrument Ambient Background				
Type of Surface:	Soil		Count Time:	1	Minutes

Count Number		$(x - \bar{x})$		$(x - \bar{x})^2$
1	3966	268.37		72020.67
2	3021	-676.63		457832.67
3	3056	-641.63		411693.33
4	3028	-669.63		448408.80
5	3103	-594.63		353588.80
6	3215	-482.63		232934.93
7	3067	-630.63		397698.40
8	3054	-643.63		414263.87
9	3101	-596.63		355971.33
10	3098	-599.63		359560.13
11	2687	-1010.63		1021379.73
12	3012	-685.63		470093.07
13	3548	-149.63		22390.13
14	3576	-121.63		14794.67
15	3497	-200.63		40253.73
16	3475	-222.63		49565.60
17	3954	256.37		65723.87
18	3789	91.37		8347.87
19	4207	509.37		259454.40
20	4198	500.37		250366.80
21	4265	567.37		321904.93
22	4322	624.37		389833.73
23	4453	755.37		570578.80
24	4298	600.37		360440.13
25	4377	679.37		461539.07
26	4295	597.37		356846.93
27	4327	629.37		396102.40
28	4308	610.37		372547.47
29	4287	589.37		347353.07
30	4345	647.37		419083.60
Mean Count: $\bar{x}$	3697.63		SUM	9702572.97
Standard Deviation (σ)	578.42		Variance:	334571.48
Background Count Rate:		3697.63	CPM + -	1156.84 CPM

Action Level
5432.90

Calculations Completed by:	William Wylie	Date:	1/26/2015
Reviewed by:	Daniel Spicuzza	Date:	1/26/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	126197	
Last Calibration Date:	4/15/2014				
Detector Model:	44-10		Detector Serial No.:	229176	
Today's Date:	1/26/2015		Data Collected by:	Adolfo Matus Jr.	

	Alpha		Beta-Gamma	X	Gamma	

Remarks: Instrument Ambient Background

Type of Surface:		Borehole		Count Time:	1	Minutes
Count Number			$(x - \bar{x})$		$(x - \bar{x})^2$	
1	1'	6576	-516.50		266772.25	
2	1'	6799	-293.50		86142.25	
3	1'	6654	-438.50		192282.25	
4	1'	6821	-271.50		73712.25	
5	1'	6743	-349.50		122150.25	
6	2'	6932	-160.50		25760.25	
7	2'	7092	-0.50		0.25	
8	2'	6937	-155.50		24180.25	
9	2'	7022	-70.50		4970.25	
10	2'	6932	-160.50		25760.25	
11	3'	7305	212.50		45156.25	
12	3'	7445	352.50		124256.25	
13	3'	7227	134.50		18090.25	
14	3'	7251	158.50		25122.25	
15	3'	7413	320.50		102720.25	
16	4'	7054	-38.50		1482.25	
17	4'	7187	94.50		8930.25	
18	4'	7345	252.50		63756.25	
19	4'	7398	305.50		93330.25	
20	4'	7185	92.50		8556.25	
21	5'	7204	111.50		12432.25	
22	5'	7332	239.50		57360.25	
23	5'	7266	173.50		30102.25	
24	5'	7295	202.50		41006.25	
25	5'	7321	228.50		52212.25	
26	6'	7014	-78.50		6162.25	
27	6'	7132	39.50		1560.25	
28	6'	7022	-70.50		4970.25	
29	6'	6984	-108.50		11772.25	
30	6'	6887	-205.50		42230.25	
Mean Count: $\bar{x}$		7092.50		SUM	1572939.50	
Standard Deviation (σ)		232.89		Variance:	54239.29	
Background Count Rate:			7092.50	CPM + -	465.79	CPM

Action Level
7791.18

Calculations Completed by:	Adolfo Matus Jr.	Date:	1/26/2015
Reviewed by:	Daniel Spicuzza	Date:	1/26/2015

Aleut World Solutions
Background Determination Data Sheet

Project/Location:	NSF Indian Head				
Instrument Model:	2350-1		Instrument Serial No.	95352	
Last Calibration Date:	4/15/2014				
Detector Model:	44-10		Detector Serial No.:	192589	
Today's Date:	1/26/2015		Data Collected by:	William Wylie	
	Alpha		Beta-Gamma	X	Gamma

Remarks: Instrument Ambient Background

Type of Surface: Borehole | Count Time: 1 Minutes

Count Number			$(x - \bar{x})$		$(x - \bar{x})^2$
1	1'	6431	-323.43		104609.12
2	1'	6238	-516.43		266703.39
3	1'	6145	-609.43		371408.99
4	1'	6321	-433.43		187864.45
5	1'	6298	-456.43		208331.39
6	2'	6898	143.57		20611.39
7	2'	6903	148.57		22072.05
8	2'	6901	146.57		21481.79
9	2'	6898	143.57		20611.39
10	2'	6802	47.57		2262.59
11	3'	6887	132.57		17573.92
12	3'	6875	120.57		14536.32
13	3'	6938	183.57		33696.72
14	3'	6958	203.57		41439.39
15	3'	7005	250.57		62783.65
16	4'	6952	197.57		39032.59
17	4'	6023	-731.43		534994.72
18	4'	7072	317.57		100848.59
19	4'	6798	43.57		1898.05
20	4'	6828	73.57		5412.05
21	5'	6823	68.57		4701.39
22	5'	6984	229.57		52700.85
23	5'	6789	34.57		1194.85
24	5'	6797	42.57		1811.92
25	5'	6854	99.57		9913.52
26	6'	6875	120.57		14536.32
27	6'	6789	34.57		1194.85
28	6'	6821	66.57		4431.12
29	6'	6902	147.57		21775.92
30	6'	6828	73.57		5412.05
Mean Count: $\bar{x}$		6754.43		SUM	2195845.37
Standard Deviation (σ)		275.17		Variance:	75718.81
Background Count Rate:			6754.43	CPM + -	550.34 CPM

Action Level
7579.94

Calculations Completed by:	William Wylie	Date:	1/26/2015
Reviewed by:	Daniel Spicuzza	Date:	1/26/2015

Appendix D

Instrument Calibration Data

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

Customer Information		Instrument Information	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2929	Serial Number: 79980
Contact Name: Tony Riggs		Probe: 43-10-1	Serial Number: 082908
Customer Purchase Order Number: N/A	Work Order Number: 2014-13727	Calibration Method: Electronic And Source	

Instrument Calibration Information

M&TE	ID Number	Calibration Due Date	Environmental Conditions	
Thermometer	3590	10/09/2014	Temperature (°C)	24.1
Barometer	3590	10/09/2014	Pressure (mmHg)	741
Hygrometer	992290	03/12/2015	Humidity (%)	34
Pulse Generator	120935	10/29/2014	Calibrated in accordance with CP-IN-WI-235	
DVM	20380178	08/20/2014		

Isotope	Source ID Number	Decayed Activity (dpm)	2Pi Emissions (EPM)	Source Cert. Date
Pu^{239}	071201	20,574	10,390/ min	05/01/2012
Tc^{99}	099608	21,311	10,500 / min	08/08/1996
Th^{230}	119738	18,600	8,640 / min	10/20/1997
Sry^{90}	129676	12,150	8,558 /min	05/12/2003

Frequency Calibration

Desired (cpm)	Tolerances (cpm)	Alpha As Found (cpm)	Alpha As Left (cpm)	Beta As Found (cpm)	Beta As Left (cpm)
40	40	39	39	39	39
400	(392 - 408)	398	398	399	399
4,000	(3,920 - 4,080)	3,986	3,986	3,986	3,986
40,000	(39.2K - 40.8K)	39,841	39,841	39,857	39,857
400,000	(392K - 408K)	398,492	398,492	398,540	398,540

Background Determination	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Counts, C_b	4	4	937	937
Time, T_b (min)	20	20	20	20
Rate, R_b (cpm)	0.2	0.2	46.85	46.85

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: M. Rau Reviewed By: Jeff Dickinson Date: 7/30/14

Calibration Date: 07/30/2014 * Calibration Due (6 mo.): 01/30/2015
* Calibration Due (12 mo.): 07/30/2015

* Calibration due date is dependent on users regulatory requirements.

CROSS TALK & EFFICIENCY SHEET

Instrument ID: 79980

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
185	185

Alpha Source: Cross Talk – Performed using Pu^{239} #071201

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	29,433	29,433	840	840
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 5{,}887$	$R_{s[\alpha]} = 5{,}887$	$R_{s[\beta]} = 168$	$R_{s[\beta]} = 168$
4π EFF (% Net cpm/dpm) (>25%)	28.6%	28.6%	N/A	N/A
2π EFF (% Net cpm/emissions)	56.7%	56.7%	N/A	N/A
%Crosstalk [α to β] (< 10%)	$\frac{R_{s[\beta]} - R_{b[\beta]}}{R_{s[\alpha]} - R_{b[\alpha]}} = \frac{168 - 46.85}{5887 - 0.2} = 2.058\%$			

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
4.2 mV	4.2 mV	48 mV	48 mV

Beta Source: Cross Talk Performed Using Tc^{99} #099608

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	6	6	23,400	23,400
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 1.2$	$R_{s[\alpha]} = 1.2$	$R_{s[\beta]} = 4{,}680$	$R_{s[\beta]} = 4{,}680$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	21.7%	21.7%
2π EFF (% Net cpm/emissions)	N/A	N/A	44.1%	44.1%
%Crosstalk [β to α] (< 1%)	$\frac{R_{s[\alpha]} - R_{b[\alpha]}}{R_{s[\beta]} - R_{b[\beta]}} = \frac{1.2 - 0.2}{4680 - 46.85} = 0.022\%$			

High Voltage Power Supply Calibration

Desired Voltage	Tolerance	DVM As Found	DVM As Left	2929 Meter As Found	2929 Meter As Left
600	540 - 660	579	579	600	600
800	720 - 880	778	778	800	800
1,000	900 - 1,100	976	976	1,000	1,000
1,200	1,080 - 1,320	1,172	1,172	1,200	1,200
1,300	1,170 - 1,430	1,280	1,280	1,300	1,300

High Voltage	As Found	Vern Dial Reading	As Left	Vern Dial Reading
	850V	3.40	850V	3.40

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: M. Pa[illegible] **Reviewed By:** [illegible] **Date:** 7/30/14

Calibration Date: 07/30/2014

* Calibration Due (6 mo.): 01/30/2015

* Calibration Due (12 mo.): 07/30/2015

* Calibration due date is dependent on users regulatory requirements.

EFFICIENCY SHEET

Instrument ID: 79980

As Found Alpha Threshold (mV)	As Left Alpha Threshold (mV)
185	185

Alpha Source: Efficiency determined using Th^{230} #119738

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	31,349	31,349	2,889	2,889
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 6{,}270$	$R_{s[\alpha]} = 6{,}270$	$R_{s[\beta]} = 577.8$	$R_{s[\beta]} = 577.8$
4π EFF (% Net cpm/dpm) (>25%)	33.7%	33.7%	N/A	N/A
2π EFF (% Net cpm/emissions)	72.6%	72.6%	N/A	N/A

As Found Beta Low Threshold	As Left Beta Low Threshold	As Found Beta High Threshold	As Left Beta High Threshold
4.2 mV	4.2 mV	48 mV	48 mV

Beta Source: Efficiency determined using Sr^{90} #129676

Parameter and Tolerance	Alpha As Found	Alpha As Left	Beta As Found	Beta As Left
Source Count, C_s	32	32	19,137	19,137
Time, T_s (min)	5	5	5	5
Rate, R_s (cpm)	$R_{s[\alpha]} = 6.4$	$R_{s[\alpha]} = 6.4$	$R_{s[\beta]} = 3{,}827$	$R_{s[\beta]} = 3{,}827$
4π EFF (% Net cpm/dpm) (>10%)	N/A	N/A	31.1%	31.1%
2π EFF (% Net cpm/emissions)	N/A	N/A	44.2%	44.2%

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Calibrated By: M. [illegible] **Reviewed By:** Jeff Dickinson **Date:** 7/30/14

Calibration Date: 07/30/2014

*** Calibration Due (6 mo.): 01/30/2015**

*** Calibration Due (12 mo.): 07/30/2015**

* Calibration due date is dependent on users regulatory requirements.

Instrument ID: 79980

Source and Background Plateau Worksheet								
High Voltage	Background		Alpha Source		Beta Source		Cross Talk	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α
600								
650								
700								
750								
800								
850		Plateau not required—All As Founds within tolerance						
900								
950			As Found HV = As Left HV					
1000								
1050								
1100								
1150								

Statement of Certification

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: H. Atkinson	Date: 7/30/14
Calibration Date: 07/30/2014	* Calibration Due (6 mo.): 01/30/2015 * Calibration Due (12 mo.): 07/30/2015	

* Calibration due date is dependent on users regulatory requirements.

Alpha Source Chi-Square Test

Ludlum Model 2929	Serial Number:	79980	Source Nuclide Th-230	Source ID 119738

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	6264	30.95	957.90
2	6236	2.95	8.70
3	6096	-137.05	18782.70
4	6099	-134.05	17969.40
5	6359	125.95	15863.40
6	6257	23.95	573.60
7	6275	41.95	1759.80
8	6186	-47.05	2213.70
9	6185	-48.05	2308.80
10	6144	-89.05	7929.90
11	6333	99.95	9990.00
12	6312	78.95	6233.10
13	6234	0.95	0.90
14	6214	-19.05	362.90
15	6150	-83.05	6897.30
16	6277	43.95	1931.60
17	6222	-11.05	122.10
18	6302	68.95	4754.10
19	6264	30.95	957.90
20	6252	18.95	359.10
Σ=	124661	(x-Mean)² =	99976.95

Mean = 6233.05

Chi² = 16.04

σ = 72.54

2σ= 145.0785268

Reduce Chi Square= 0.844201

3σ= 217.62

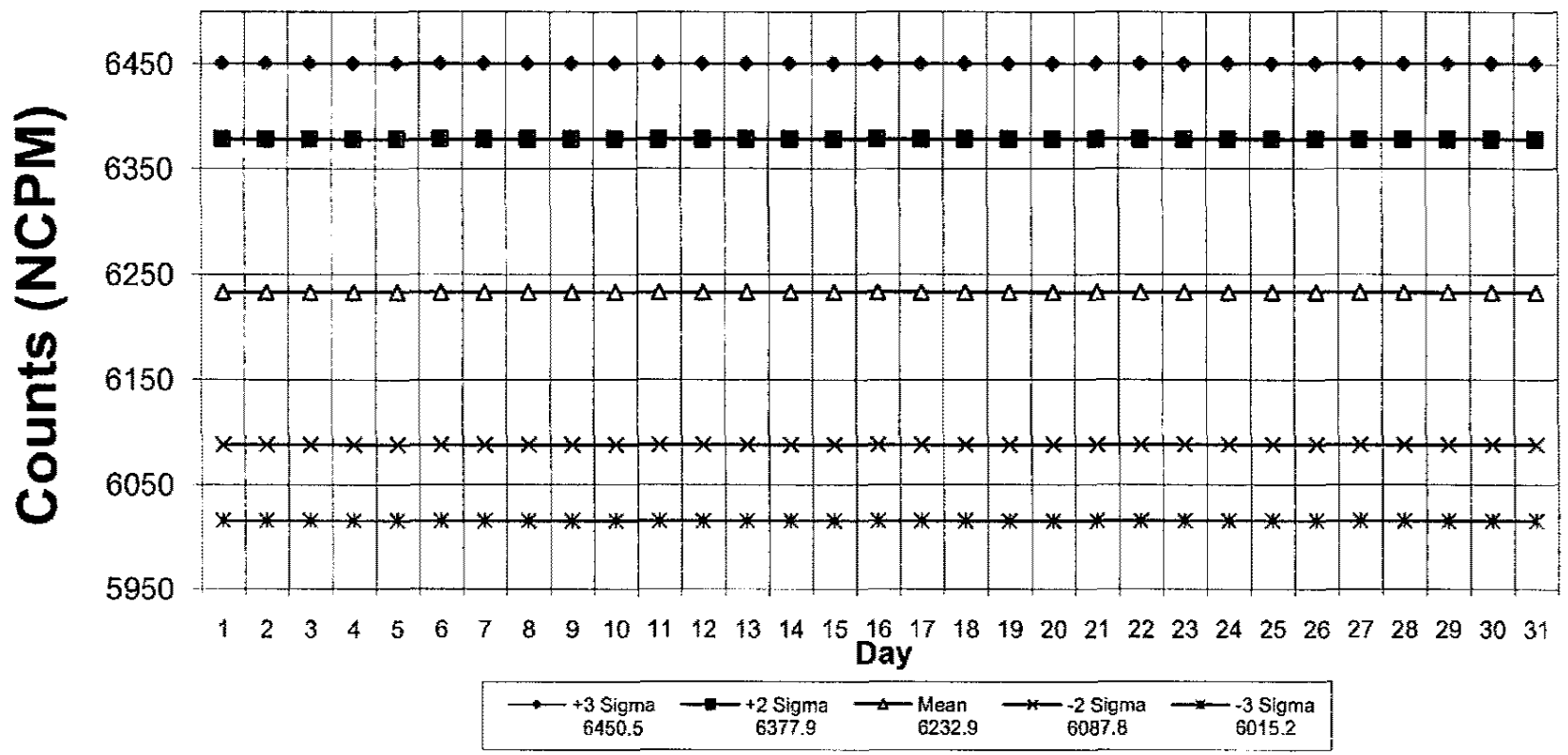
Reduced Chi Pass/Fail= PASS

Performed By/Date M. Paul / 7/30/2014

Reviewed By/Date J. Atkinson / 7/30/14

Control Chart **Month Of_____20_____**

Instrument_____, Source#_____, Isotope_____



Reviewed By_____Date_____

Computer Equivalent of Form IN-WI-235-F1 (Page 4 of 6)

Beta Source Chi-Square Test

Ludlum Model 2929 Serial Number: 79980 Tc-99 099608

Count Number (N)	Source Count (x)	x-Mean	(x-Mean)²
1	4567	-88.00	7744.00
2	4608	-47.00	2209.00
3	4727	72.00	5184.00
4	4679	24.00	576.00
5	4656	1.00	1.00
6	4606	-49.00	2401.00
7	4638	-17.00	289.00
8	4578	-77.00	5929.00
9	4608	-47.00	2209.00
10	4694	39.00	1521.00
11	4724	69.00	4761.00
12	4635	-20.00	400.00
13	4705	50.00	2500.00
14	4655	0.00	0.00
15	4790	135.00	18225.00
16	4720	65.00	4225.00
17	4793	138.00	19044.00
18	4619	-36.00	1296.00
19	4507	-148.00	21904.00
20	4591	-64.00	4096.00
Σ=	93100	(x-Mean)² =	104514.00

Mean = 4655.00 Chi² = 22.45

σ = 74.17 2σ= 148.3339

Reduce Chi Square= 1.181684 3σ= 222.50

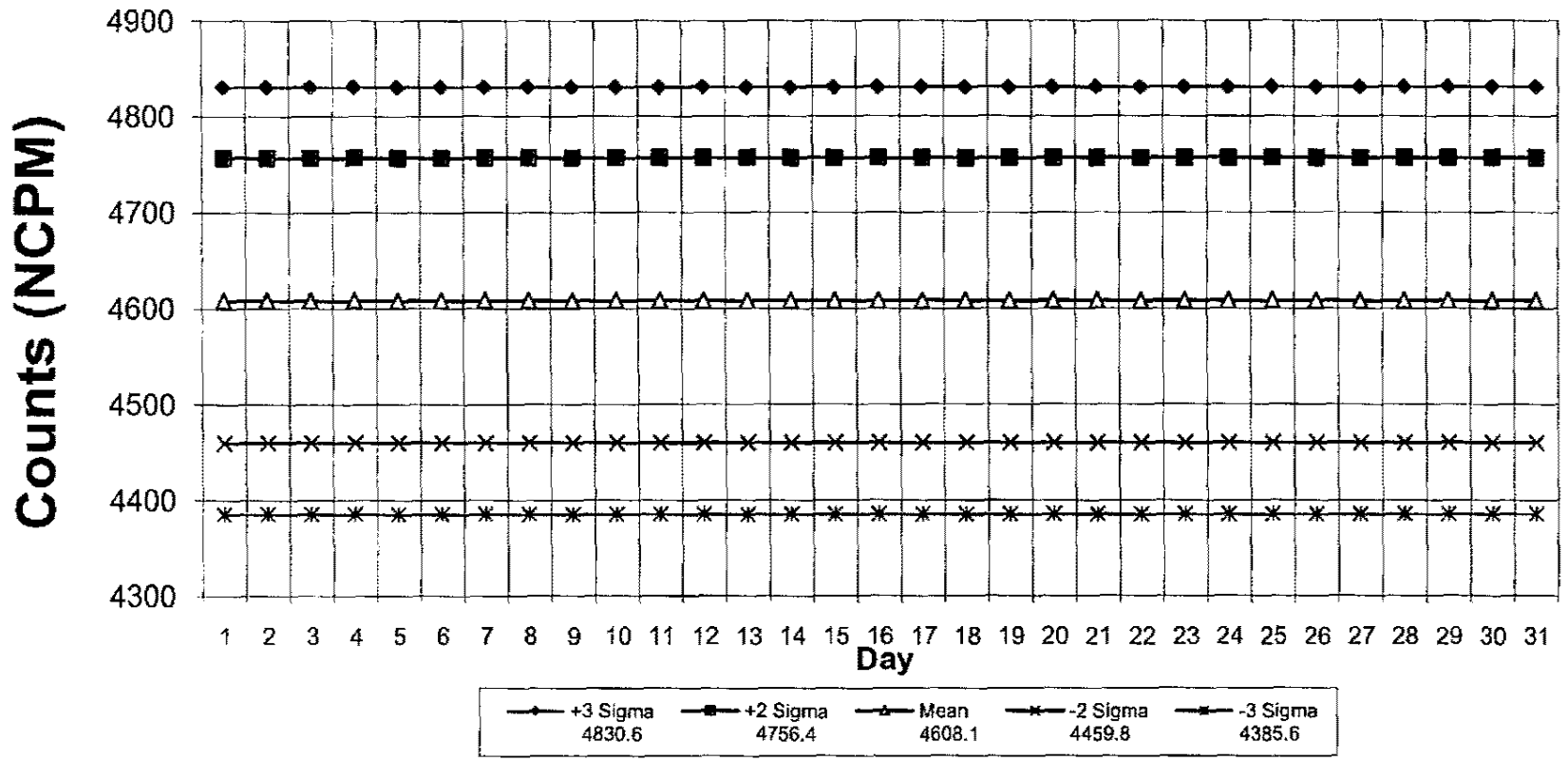
Reduced Chi Pass/Fail= PASS

Performed By/Date M. Paul / 7/30/2014

Reviewed By/Date Jeff Nilemso / 7/30/14

Control Chart **Month Of_____20_____**

Instrument_____, Source#_____, Isotope_____



Reviewed By_____Date_____

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 19	Serial Number: 209746
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2015-14036	Calibration Method: Electronic And Source	

INSTRUMENT CALIBRATION INFORMATION

Range (µR/hr)	Calibration Standard Value	Tolerances (µR/hr)	Instrument Response		Comments
			As Found (µR/hr)	As Left (µR/hr)	Calibrated in accordance with CP-IN-WI-211
5000 Black	4,000 µR/hr	3,600 - 4,400	3,500	3,850	Pulser: 100272 Cal Due: 03/17/2015
	2,500 µR/hr	2,250 - 2,750	2,200	2,500	DVM: 97960214 Cal Due: 06/27/2015
	1,000 µR/hr	900 - 1,100	900	1,000	Temp/Press: 3076 Cal Due: 01/06/2016
500 Black	400 µR/hr	360 - 440	370	395	Humidity: 992290 Cal Due: 03/12/2015
	250 µR/hr	225 - 275	230	250	Temp: 21.9 °C Humidity: 27 % Pressure: 739 mmHg
	Input cpm = 16,200	90 - 110	92	100	
250 Red	Input cpm = 32,000	180 - 220	180	200	
	Input cpm = 19,200	108 - 132	100	120	Geotropism: SAT Over Range: SAT
	Input cpm = 8,000	45 - 55	42	50	Batteries: SAT Mech. Zero: SAT
50 Black	Input cpm = 6,450	36 - 44	34	40	F/S Response: SAT Audio: SAT
	Input cpm = 4,010	22.5 - 27.5	21	25	Light: SAT
	Input cpm = 1,610	9 - 11	9	9.8	
25 Red	Input cpm = 3,200	18 - 22	18	20	Source: Cs137# 049711 Due Date: 09/09/2015
	Input cpm = 1,920	10.8 - 13.2	10	12	High Voltage As Found: 650V As Left: 650V
	Input cpm = 800	4.5 - 5.5	4.2	5	cpm/µR/hr: As Found: 196 As Left: 160

Precision Test—Reading 1: 250µR/hr 2: 250µR/hr 3: 250µR/hr Mean: 250µR/hr Precision Test: SAT

COMMENTS

Special Remarks: High Voltage: 650 Volts cpm/µR/hr: 160

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By:	Date: 1/20/15
Certification Date: 01/20/2015	*Certification Due (6 mo.): 07/20/2015	
	*Certification Due (12 mo.): 01/20/2016	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 95352
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2014-	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-239	
400	400	397	397	Pulser: 151067	Cal Due: 01/16/15
4,000	4,000	3,984	3,984	DVM: 88020324	Cal Due: 02/07/15
40,000	40,000	39,725	39,725	Temp/Press: 3590	Cal Due: 10/09/14
400,000	400,000	397,413	397,413	Humidity: 958670	Cal Due: 04/26/14
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N28 I/O Firmware Version: 37123N05	
500	(490-510)	500	500		
1,500	(1,498-1,502)	1,499	1,499		
2,000	(1,940-2,060)	1,991	1,991	Temp: 24.4°C Pressure: 739 mmHg Humidity: 43.9%	
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	10.1	10.1	BAT >4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	49.7	49.7	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	98	98	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By:	Reviewed By:	Date: 4/14/14	
Calibration Date: 04/14/2014	*Certification Due (6mo): 10/14/2014		
	*Certification Due (12mo): 04/14/2015		

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 192589
Customer Purchase Order Number: N/A	Work Order Number: 2014-	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION			
1) Source Nuclide: Cs^{137}	Serial Number: 019455	Activity: 5µCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 08/28/2014

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#117573	Count 1	2.01
Due Date	04/15/2015	Count 2	2.01
Threshold	T=100 (10mV)	Count 3	2.01
Cable Length	25ft.	Average	2.01
Temp/Press: 3590	Cal Due: 10/09/2014	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 04/26/2014	Pass/Fail	
Temp: 23.3 °C		Humidity: 42.6 %	Press: 735 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 66,050	High Sample Activity (2mR/hr) Using Source #2 = 247,913	Dead Time (DT): 1.508498E-05	Calibration Constant (CC): 5.402307E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.398	0.398
Voltage Plateau:	√YES	NO	1.00	0.900-1.100	0.969	0.969
High Voltage: 1300V			2	1.8-2.2	2.01	2.01

COMMENTS

Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1 to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By:	Reviewed By:	Date: 4/16/14
Certification Date: 04/15/2014	*Certification Due (6mo): 10/15/2014	
	*certification Due (12mo): 04/15/2015	

* Calibration due date is dependant on users regulatory requirements.

background plateau 44-10 #192589 4/15/2014 with 25 foot cable

700	11
750	17
800	38
850	105
900	163
950	280
1000	442
1050	568
1100	684
1150	841
1200	865
1250	951
→ 1300	907
1350	891

source plateau cs137 #019455 5uCi button

700	10
750	30
800	129
850	667
900	1025
950	1481
1000	1848
1050	2313
1100	2620
1150	2753
1200	2884
1250	3015
→ 1300	2924
1350	3043

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 04/15/2014.
The current time of day is: 18:30:51.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: R

Comments:

Model 2350 Serial # =	117573.
User I.D. =	
High Voltage =	1300 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.690000E-05.
Detector Calibration Constant =	5.939665E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	192589.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.2 volts.

det1 Generated: 04/15/2014 18:32:45.

Model 2350 Serial #117573

H1300$H
Set High Voltage: 1300

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.690000E-05$O
Set Dead Time: 1.690000E-05

SC5.939665E+10$0
Set Calibration Constant: 5.939665E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N192589$A
Set Detector Serial #: 192589

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 04/15/2014.
The current time of day is: 18:31:13.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: TR

Comments:

Model 2350 Serial # =	117573.
User I.D. =	
High Voltage =	1300 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.508498E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	192589.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	6.2 volts.

det2 Generated: 04/15/2014 18:33:28.

Model 2350 Serial #117573

H1300$H
Set High Voltage: 1300

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.508498E-05$0
Set Dead Time: 1.508498E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N192589$A
Set Detector Serial #: 192589

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Rd
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2350-1	Serial Number: 126197
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: N/A	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range (CPM)	Calibration Standard Value (CPM)	Instrument Response (±10%)		Comments	
		Before Calibration	After Calibration	Calibrated in accordance with CP-IN-WI-239	
400	400	398	398	Pulser: 120935	Cal Due: 10/29/2014
4,000	4,000	3,985	3,985	DVM: 20380178	Cal Due: 08/20/2014
40,000	40,000	39,847	39,847	Temp/Press: 3590	Cal Due: 10/09/2014
400,000	400,000	398,975	398,975	Humidity: 992290	Cal Due: 03/12/2015
HV Cal Values (M2350 HV Entry)	Desired HV Tolerance (Voltmeter) (VDC)	As Found (VDC)	As Left (VDC)	CP Firmware Version: 37122N21 I/O Firmware Version: 37123N04	
500	(490-510)	500	500		
1,500	(1,498-1,502)	1,499	1,499	Temp: 23.6°C Pressure: 742 mmHg Humidity: 33 %	
2,000	(1,940-2,060)	1,500	1,500		
Parameter	Tolerance (±10%)	As Found	As Left		
Threshold T = 100	10 ± (9 to 11) mVDC	9.8	10.8	BAT > 4.5: SAT	
Threshold T = 500	50 ± (45 to 55) mVDC	40.7	49.8	Volume: SAT	ACK/Scroll: SAT
Threshold T =1000	100 ± (90 to 110) mVDC	79	97	Audio Divide: SAT	Count: SAT
Window Width W = 100	10 ± (9 to 11) mVDC	10	10	Backlight: SAT	Alarms: SAT
Display-to-mV ratio:	100 to 10 mV			Overload Test: SAT	Physical Cond: SAT

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: J. Robinson	Date: 8/7/14	
Calibration Date: 08/06/2014		*Certification Due (6mo): 02/06/2015	
		*Certification Due (12mo): 08/06/2015	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum
Address: 1570 Bear Creek Road Oak Ridge, TN 37830		Detector Model: 44-10
Contact Name: Tony Riggs		Serial Number: 229176
Customer Purchase Order Number: N/A	Work Order Number: 2014-	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Cs^{137}	Serial Number: 019455	Activity: 5μCi nominal	Certification Date: N/A (Used for Plateau Only)
2) Source Nuclide: Cs^{137}	Serial Number: 049711	Activity: Variable	Due Date: 08/28/2014

Scaler Information		Precision Test	mR/Hr (Source #2)
2350-1	#120633	Count 1	2.00
Due Date	04/15/2015	Count 2	1.99
Threshold	T=100 (10mV)	Count 3	2.01
Cable Length	25ft.	Average	2.00
Temp/Press: 3590	Cal Due: 10/09/2014	Tolerance ±10%	All counts within ±10% of Average
Humidity Pen: 958670	Cal Due: 04/26/2014	Pass/Fail	
Temp: 23.3 °C		Humidity: 42.6 %	Press: 735 mmHg

Low Sample Activity (400uR/hr): Using Source #2 = 65,336	High Sample Activity (2mR/hr) Using Source #2 = 240,990	Dead Time (DT): 1.632676E-05	Calibration Constant (CC): 5.378300E+10

ATTACHMENTS			DETECTOR DATA: DOSE RATE PROBES (mR/Hr)			
Detector Setup Report	√YES	NO	Desired Exposure	Tolerance ±10%	As Found	As Left
Barcode Report	√YES	NO	0.400	0.360-0.440	0.405	0.405
Voltage Plateau:	√YES	NO	1.00	0.900-1.100	0.974	0.974
High Voltage: 1300V			2	1.8-2.2	2.00	2.00

COMMENTS

Detectors set up with a 2350-1 may be used with any 2350-1 provided that the 2350-1 to be used is in calibration and the setup parameters are scanned into the 2350-1 prior to use with that specific detector

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By:	Reviewed By:	Date: 4/16/14
Certification Date: 04/15/2014	*Certification Due (6mo): 10/15/2014	
	*certification Due (12mo): 04/15/2015	

* Calibration due date is dependant on users regulatory requirements.

background plateau 44-10 #229176 4/15/2014 25ft cable

700	7
750	14
800	28
850	96
900	181
950	297
1000	399
1050	607
1100	762
1150	914
1200	1031
1250	990
1300	1051
1350	1067

source plateau cs137 5uCi button #019455

700	3
750	12
800	30
850	764
900	1078
950	1590
1000	2103
1050	2655
1100	2940
1150	3250
1200	3341
1250	3392
1300	3417
1350	3463

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D1 in the Model 2350.
Today's date is 04/15/2014.
The current time of day is: 18:34:31.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: K

Comments:

Model 2350 Serial # =	120633.
User I.D. =	
High Voltage =	1200 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	12 seconds.
Readout Units =	R.
Readout Time Base =	hr.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.632676E-05.
Detector Calibration Constant =	5.378300E+10.
Detector Model =	44-10DOSE.
Detector Serial # =	229176.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.4 volts.

det1 Generated: 04/15/2014 18:35:45.

Model 2350 Serial #120633

H1200$G
Set High Voltage: 1200

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F12$E
Set Scaler Count Time: 12

SU4$F
Set Readout Units = R

SB2$.
Set Readout Time Base = hr

SM0$3
Set Readout Range Multiplier = auto

SL1.632676E-05$$
Set Dead Time: 1.632676E-05

SC5.378300E+10$Q
Set Calibration Constant: 5.378300E+10

M44-10DOSE$D
Set Detector Model: 44-10DOSE

N229176$3
Set Detector Serial #: 229176

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP1$7
SAVE PARAMETERS AS D1

DETECTOR SETUP CHECK LIST REPORT

The following list is stored as detector setup D2 in the Model 2350.
Today's date is 04/15/2014.
The current time of day is: 18:34:55.

I have verified the list below
has NO discrepancies with the DETECTOR SETTINGS TABLE: M

Comments:

Model 2350 Serial # =	120633.
User I.D. =	
High Voltage =	1200 volts.
Threshold =	100.
Window =	1000,Off.
Overload Current =	40.0 micro amperes.
Scaler Count Time =	60 seconds.
Readout Units =	counts.
Readout Time Base =	min.
Readout Range Multiplier =	auto.
Detector Dead Time =	1.632676E-05.
Detector Calibration Constant =	1.000000E+00.
Detector Model =	44-10CPM.
Detector Serial # =	229176.
Ratemeter Alarm Setting =	1.000000E+09.
Scaler Alarm Setting =	1000000.
Integrated Dose Alarm Setting =	1.000000E+09.
Low Count Alarm Setting =	X.
Operating Battery Voltage =	5.4 volts.

det2 Generated: 04/15/2014 18:36:24.

Model 2350 Serial #120633

H1200$G
Set High Voltage: 1200

T100$Q
Set Threshold: 100

W1000$WOFF$P
Set Window: 1000,OFF

O400$OOFF$C
Set Overload: 400,OFF

F60$H
Set Scaler Count Time: 60

SU7$I
Set Readout Units = counts

SB1$-
Set Readout Time Base = min

SM0$3
Set Readout Range Multiplier = auto

SL1.632676E-05$$
Set Dead Time: 1.632676E-05

SC1.000000E+00$0
Set Calibration Constant: 1.000000E+00

M44-10CPM$-
Set Detector Model: 44-10CPM

N229176$3
Set Detector Serial #: 229176

J1.000000E+09$V
Set Ratemeter Alarm: 1.000000E+09

K1000000$H
Set Scaler Alarm: 1000000

P1.000000E+09$.
Set Dose Alarm: 1.000000E+09

SP2$8
SAVE PARAMETERS AS D2

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2360	Serial Number: 278551
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2014-13521	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Ratemeter Response (cpm) (Tolerance ±10 % of Calibration Standard Values)		Calibration Standard Value (cpm)	Time Base (min)	Tolerances (counts) ± 2%	Scaler Response (counts)	
		As Found	As Left				As Found	As Left
X 1	100	100	100	40,000 CPM	0.1	3.92K - 4.08K	3,974	3,974
X 1	250	250	250	40,000 CPM	0.5	19.6K - 20.4K	19,869	19,869
X 1	400	395	400	40,000 CPM	1	39.2K - 40.8K	39,736	39,736
X 10	1,000	1,000	1,000	40,000 CPM	2	78.4K - 81.6K	79,461	79,461
X 10	2,500	2,500	2,500					
X 10	4,000	3,950	4,000					
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	39,500	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	395,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: Mike Yonce	Reviewed By: Jeff Robinson Date: 4/16/14
Calibration Date: 04/16/2014	* Calibration Due (6 mo.): 10/16/2014
	* Calibration Due (12 mo.): 04/16/2015

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 278551

M&TE					Environmental Conditions			
Volt Meter	ID#:	83880126	Cal Due:	04/29/14	Barometer	ID#:	3590	Cal Due: 10/09/14
Pulser	ID#:	43855	Cal Due:	05/03/14	Thermometer	ID#:	3590	Cal Due: 10/09/14
Humidity	ID#:	958670	Cal Due:	04/26/14	Temp: 22.5 °C	Pressure: 748 mmHg		Humidity: 29.5 %

Special Test

Mechanical Zero	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
BAT Check	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)

Voltage	Tolerance	As Found	As Left
500	450 - 550	509	511
1000	900 - 1,100	996	1,000
1500	1,350 - 1,650	1,490	1,496

Alpha Sensitivity = 100 mV	Alpha Sensitivity = 120 mV
Beta Sensitivity = 3.1 mV	Beta Sensitivity = 3.5 mV
Beta Window = 28.0 mV	Beta Window = 30 mV

Beta Setpoints -- Pulser counts detected at 3.5 mV ± 1 mV and shut off at 30 mV for beta. For Alpha channel counts detected at 120 mV and above.

H.V. Set With Detector Not Connected

Overload to be set with detector to be used

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5 ft. cable

Instrument

Calibrated By: Mike Yonce

Reviewed By: [illegible] Date: 4/16/14

Calibration Date: 04/16/2014

* Calibration Due (6 mo.): 10/16/2014

* Calibration Due (12 mo.): 04/16/2015

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 312642
Customer Purchase: Order Number: N/A	Work Order Number: 2014-13521	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	071203	16,590	8,379 / min	2,352	14.2	28.1
Tc-99	099608	21,311	10,499 / min	3,303	15.5	31.5
Pu^{239}	071201	20,573	10,389 / min	3,853	18.7	37.1
SrY-90	129676	12,201	8,595 / min	3,390	27.8	39.4

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	278551	04/16/15	1	700V	Alpha (120 mV)
2360	278551	04/16/15	188	700V	Beta (3.5 - 30 mV)

ATTACHMENTS

Voltage Plateau: √YES NO MDA/Cross Talk Evaluation: √YES NO

COMMENTS	LINEARITY TEST (Gross Counts)	
Calibrated with 5 ft. cable Linearity test performed with Tc-99, #099608. Calibrated in accordance with original equipment technical manual.	Count 1 (Toe)	3,511
	Count 2 (Mid)	3,571
	Count 3 (Heel)	3,391
	Average	3,491
	Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: Mike Yonce	Reviewed By: [illegible]	Date: 4/16/14
Certification Date: 04/16/2014	* Certification Due (6 mo.): 10/16/2014 * Certification Due (12 mo.): 04/16/2015	

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd Oak Ridge, TN 37830			Model:	2360	S.N.	278551
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	312642
Customer PO No.:	N/A	Work Order Number:	14-13521	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,573
β Source	Tc-99	099608	8/8/96	21,311

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	650	0	101	3,298	239	4	2,327	4.32%	0.18%	16.03%	10.45%
	675	1	152	3,647	317	2	2,978	4.72%	0.04%	17.72%	13.26%
SET	**700**	**2**	**189**	**3,768**	**407**	**3**	**3,558**	**6.09%**	**0.03%**	**18.31%**	**15.81%**
	725	1	218	3,919	462	3	3,999	6.59%	0.05%	19.04%	17.74%
	750	3	244	3,878	724	3	4,208	13.21%	0.00%	18.84%	18.60%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: Mike Yonce Reviewed By: J. H. Nibemor Date: 4/16/14

Calibration Date: 4/16/14 Calibration Due: 4/16/15

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Fax: (865) 220-1346

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 2360	Serial Number: 275827
Contact Name: Tony Riggs		Probe: N/A	Serial Number: N/A
Customer Purchase Order Number: N/A	Work Order Number: 2014-13521	Calibration Method: Electronic	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Ratemeter Response (cpm) (Tolerance ±10 % of Calibration Standard Values)		Calibration Standard Value (cpm)	Time Base (min)	Tolerances (counts) ± 2%	Scaler Response (counts)	
		As Found	As Left				As Found	As Left
X 1	100	100	100	40,000 CPM	0.1	3.92K - 4.08K	3,967	3,967
X 1	250	250	250	40,000 CPM	0.5	19.6K - 20.4K	19,833	19,833
X 1	400	395	400	40,000 CPM	1	39.2K - 40.8K	39,663	39,663
X 10	1,000	1,000	1,000	40,000 CPM	2	78.4K - 81.6K	79,318	79,318
X 10	2,500	2,500	2,500					
X 10	4,000	3,950	4,000					
X 100	10,000	10,000	10,000					
X 100	25,000	25,000	25,000					
X 100	40,000	39,500	40,000					
X 1000	100,000	100,000	100,000	Calibrated in accordance with OEM Technical Manual				
X 1000	250,000	250,000	250,000					
X 1000	400,000	395,000	400,000					

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: Mike Yoncc	Reviewed By: [illegible] Date: 4/16/14
Calibration Date: 04/16/2014	* Calibration Due (6 mo.): 10/16/2014
	* Calibration Due (12 mo.): 04/16/2015

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

Model: 2360 Serial Number: 275827

M&TE					Environmental Conditions			
Volt Meter	ID#:	83880126	Cal Due:	04/29/14	Barometer	ID#:	3590	Cal Due: 10/09/14
Pulser	ID#:	43855	Cal Due:	05/03/14	Thermometer	ID#:	3590	Cal Due: 10/09/14
Humidity	ID#:	958670	Cal Due:	04/26/14	Temp: 22.5 °C	Pressure: 748 mmHg		Humidity: 29.5 %

Special Test

Mechanical Zero	Sat (√) Unsat ( )	Geotropism	Sat (√) Unsat ( )
LCD Display Check	Sat (√) Unsat ( )	Audio Check	Sat (√) Unsat ( )
BAT Check	Sat (√) Unsat ( )	Low BAT Set	Sat (√) Unsat ( )
Reset	Sat (√) Unsat ( )		
HV Analog Display	Sat (√) Unsat ( )	As Found	As Left

High Voltage Calibration (± 10%)				Alpha Sensitivity = 90 mV	Alpha Sensitivity = 120 mV
Voltage	Tolerance	As Found	As Left	Beta Sensitivity = 3.1 mV	Beta Sensitivity = 3.5 mV
500	450 - 550	513	516	Beta Window = 28.0 mV	Beta Window = 30 mV
1000	900 - 1,100	993	1,000	Beta Setpoints -- Pulser counts detected at 3.5 mV ± 1 mV and shut off at 30 mV for beta. For Alpha channel counts detected at 120 mV and above.	
1500	1,350 - 1,650	1,484	1,494		
H.V. Set With Detector Not Connected				Overload to be set with detector to be used	

COMMENTS

Calibrated in accordance with OEM Technical Manual

See detector certificate for High Voltage setting

Calibrated with 5 ft. cable

Instrument Calibrated By: Mike Yunce	Reviewed By: [illegible] Date: 4/16/14
Calibration Date: 04/16/2014	* Calibration Due (6 mo.): 10/16/2014
	* Calibration Due (12 mo.): 04/16/2015

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Instrument Services
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFstaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 43-93
Contact Name: Tony Riggs		Serial Number: 335833
Customer Purchase: Order Number: N/A	Work Order Number: 2014-13521	Evaluation Method: Source

DETECTOR EVALUATION INFORMATION

Source Nuclide	Serial Number	Activity (dpm)	2 Pi Emissions	Net Response (cpm)	4pi Eff (%)	2pi Eff (%)
Th-230	071203	16,590	8,379 / min	2,362	14.2	28.2
Tc-99	099608	21,311	10,499 / min	3,561	16.7	33.9
Pu^{239}	071201	20,573	10,389 / min	3,890	18.9	37.4
SrY-90	129676	12,201	8,595 / min	3,393	27.8	39.5

SCALER INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
2360	275827	04/16/15	1	825V	Alpha (120 mV)
2360	275827	04/16/15	189	825V	Beta (3.5 - 30 mV)

ATTACHMENTS

Voltage Plateau: √YES NO

MDA/Cross Talk Evaluation: √YES NO

COMMENTS	LINEARITY TEST (Gross Counts)	
Calibrated with 5 ft. cable Linearity test performed with Tc-99, #099608. Calibrated in accordance with original equipment technical manual.	Count 1 (Toe)	3,660
	Count 2 (Mid)	3,810
	Count 3 (Heel)	3,780
	Average	3,750
	Pass/Fail	PASS (+/-15% Tolerance)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector

Certified By: Mike Yonce Reviewed By: [illegible] Date: 4/16/14

Certification Date: 04/16/2014

* Certification Due (6 mo.): 10/16/2014

* Certification Due (12 mo.): 04/16/2015

* Calibration due date is dependent on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc
1570 Bear Creek Road
Oak Ridge, TN 37830

Phone: (877) 462-4873
Fax: (865) 220-1346
Email: lsfstaff@energysolutions.com

http://www.energysolutions.com/

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION				INSTRUMENT INFORMATION			
Customer Name:	EnergySolutions			Manufacturer:			
Address:	1570 Bear Creek Rd Oak Ridge, TN 37830			Model:	2360	S.N.	275827
Contact Name:	Tony Riggs			Probe:	43-93	S.N.	335833
Customer PO No.:	N/A	Work Order Number:	14-13521	Calibration Method:	Source		

Source Information

	Isotope	Source ID	Certifcation Date	Activity (dpm)
α Source	Pu-239	071201	5/1/12	20,573
β Source	Tc-99	099608	8/8/96	21,311

Ludlum Model 43-93 High Voltage Plateau with crosstalk

Operating Voltage	High Voltage	Background		Alpha Source		Beta Source		Crosstalk		Efficiency	
		Alpha	Beta	Alpha	Beta	Alpha	Beta	α to β	β to α	α	β
	725	0	74	3,341	169	2	1,977	2.91%	0.11%	16.24%	8.93%
	750	1	101	3,590	189	0	2,488	2.52%	0.00	17.45%	11.20%
	775	1	130	3,648	229	1	3,009	2.81%	0.00%	17.73%	13.51%
	800	0	156	3,736	258	4	3,524	2.85%	0.12%	18.16%	15.80%
SET	**825**	**0**	**188**	**3,776**	**330**	**2**	**3,864**	**3.96%**	**0.05%**	**18.35%**	**17.25%**
	850	3	223	3,881	393	3	4,096	4.65%	0.00%	18.85%	18.17%

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Comments:

Calibrated By: Mike Jones Reviewed By: Jeff Dickerson Date: 4/16/14

Calibration Date: 4/16/14 Calibration Due: 4/16/15

23 May 1996 Men/wo
Page 1 of 2 pages, Issue 07/95

069604

Amersham Buchler
GmbH & Co KG
Gieselweg 1
D-38110 Braunschweig
Postfach 11 49
D-38001 Braunschweig
Tel. (05307) 930-0
Fax (05307) 930-213
Fax-Zentrale 930-237

Amersham
The Health Science Group

CERTIFICATE

No. 177445

for a Sealed Radioactive Source

Source Type: Beta Wide Area Reference Source

Product Code	TCRX1896
Drawing	VZ-1368
Dimensions of Active Surface	Ø 36 mm
Overall Dimensions	Ø 47 mm x 3 mm
Source No.	EZ 259
Nuclide	Technetium-99

Measurement Data

Activity	364 Bq
Overall Uncertainty*	± 10 %
Beta Surface Emission Rate	179 s^{-1} ± 10 % in 2 π steradian
Reference Date	9 May 1996
Traceability*	Defined on page 2

Leakage and Contamination Test(s)

Test Method(s)*	I
Test(s) passed on	22 May 1996

Additional Information

ISO Classification*	C.34645
Recommended Working Life*	10 years
Remark	---

* see page 2 for explanation

Amersham Buchler

i.V.

(Production Manager)

10 September 1996 Men/wo
Page 1 of 2 pages, Issue 07/95

099605

Amersham Buchler
GmbH & Co KG
Gieselweg 1
D-38110 Braunschweig
Postfach 11 49
D-38001 Braunschweig

Tel. (05307) 930-0
Fax (05307) 930-293
Fax-Zentrale 930-237

Amersham
The Health Science Group

CERTIFICATE

No. 215395

for a Sealed Radioactive Source

Source Type: Alpha Wide Area Reference Source

Product Code	TZRX1922
Drawing	VZ-1368
Dimensions of Active Surface	Ø 36 mm
Overall Dimensions	Ø 47 mm x 3 mm
Source No.	FD 763
Nuclide	Thorium-230

Measurement Data

Activity	339 Bq
Overall Uncertainty*	± 10 %
Alpha Surface Emission Rate	158 s^{-1} ± 5 % in 2 π steradian
Reference Date	3 September 1996
Traceability*	Defined on page 2

Leakage and Contamination Test(s)

Test Method(s)*	I
Test(s) passed on	10 September 1996

Additional Information

ISO Classification*	C.34645
Recommended Working Life*	10 years
Remark	---

* see page 2 for explanation

Amersham Buchler

(Production Manager)

SGG 045409

CERTIFICATE OF CALIBRATION

CUSTOM BETA STANDARD[1]

Radionuclide Tc-99 Activity 11.98 nCi Serial Number B398

Reference Date April 1, 1994 Half-Life[2] $(2.13 \pm 0.05) \times 10^5$ years

Beta Flux Rate (2 pi emission rate) 15292.5 particles/minute

4 pi 30,585

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
beta	E_{max} = 294 E_{avg} = 85	100

SOURCE DESCRIPTION
The activity is homogeneously incorporated into the anodized layer of an aluminum plate. The active dimensions are 150 mm by 67 mm and the overall dimensions are 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION
This is a provisional assay. Final assay results will be reported for this source upon completion of intercomparison with the National Institute of Standards and Technology.

The total activity and beta flux rate were calibrated on a wide-area gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the U.S. Council for Energy Awareness.

TOTAL UNCERTAINTY (99% Confidence Level)

Systematic uncertainty	± 3.08%
Weighing uncertainty	± 1.01%
Total uncertainty	± 4.09%

Calibration Laboratory

4-8-94
Date

Notes

(1) A provisional assay is provided as specified in the Method of Calibration.
(2) Table of Radioactive Isotopes, 7th edition, 1986.

COPY ORIGINAL

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

CERTIFICATE OF CALIBRATION SEG FF

CUSTOM ALPHA STANDARD 089404

Radionuclide Th-230 Activity 100.2 Bq (2.709 nCi) S/N B633

Reference Date June 1, 1994 Half-Life[2] 87.74 ± 0.09 years

PRINCIPAL EMISSIONS[2]

Type	Energy (keV)	Intensity (%)
alpha	5456.47	28.3
	5499.21	71.6

SOURCE DESCRIPTION

The activity is homogeneously incorporated into the anodized layer of an aluminum plate. The active dimension are 150 mm by 67 mm with overall dimensions of 159 mm by 69 mm by 6.35 mm thick.

METHOD OF CALIBRATION

The source was calibrated on a gas-flow proportional counter using an efficiency determined through intercomparison with the National Institute of Standards and Technology.

North American Scientific, Inc. actively participates in the Radioactivity Measurements Assurance Program conducted by the National Institute of Standards and Technology in cooperation with the Nuclear Energy Institute.

TOTAL UNCERTAINTY (99% Confidence Level)

Systematic uncertainty	± 3.00%
Random uncertainty	± 1.69%
Total uncertainty (quadratic sum)	± 3.44%

Calibration Laboratory

8-17-94
Date

REFERENCES

(1) Table of Radioactive Isotopes, 7th edition, 1986.

ORIGINAL

•LEAK TEST CERTIFICATION ON REVERSE•

North American Scientific, Inc. 7435 Greenbush Ave., North Hollywood, CA 91605 (818) 503-9201 Fax (818) 503-0764

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 87482
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: 2014-13486	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%) Before Calibration	Instrument Response (± 10%) After Calibration	Comments: Calibrated in accordance with CP-IN-WI-219	
X0.1	100	100	100	Pulser: 120935	Cal Due: 10/29/14
X0.1	250	250	250	DVM: 97960214	Cal Due: 06/27/15
X0.1	400	390	390	Temp/Press: 3590	Cal Due: 10/09/14
X 1	1,000	1,000	1,000	Humidity: 992290	Cal Due: 03/12/15
X 1	2,500	2,500	2,500	Temp: 24.1 ° C Humidity: 36% Pressure: 742 mmHg	
X 1	4,000	3,900	3,900		
X 10	10,000	10,000	10,000		
X 10	25,000	26,000	25,000	Reset: SAT	Sensitivity: SAT
X 10	40,000	40,500	39,500	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT: SAT
X 100	250,000	260,000	250,000	Limited Use: X100 scale for info only. Use with GM Detector.	
X 100	400,000	405,000	395,000		
Mech. Zero	0	0	0		
HV Verification					
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT		HV Set at 900 volts to be used with GM detectors.	
				Precision Test Reading 1 = 24,500 Reading 2 = 24,500 Reading 3 = 25,000 Mean = 24,666 ☒ SAT ☐ UNSAT	

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: Jeff Dickinson	Date: 9/30/14
Certification Date: 09/29/2014	*Certification Due (6 mo.): 03/29/2015	
	*Certification Due (12 mo.): 09/29/2015	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 44-9
Contact Name: Tony Riggs		Serial Number: 182586
Customer Purchase Order Number: N/A	Work Order Number: 2013-13846	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	Serial Number: 119720	Original Activity (dpm): 2,562	Certification Date: 10/14/97
2) Source Nuclide: Tc-99	Serial Number: 119718	Original Activity (dpm): 20,520	Certification Date: 10/14/97
3) Source Nuclide: Tc-99	Serial Number: 069507	Original Activity (dpm): 237,960	Certification Date: 04/01/95

Efficiency determined using 180-2 J/g @ 1/8" geometry

Source #	Gross CPM	Net CPM	4pi Efficiency				
Source 1	295	255	10.0%				
Source 2	2,200	2,160	10.5%				
Source 3	25,000	24,960	10.5%				

INSTRUMENT INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
3	87482	09/29/2015	40	900 Volts	35 mV

COMMENTS

Detectors calibrated with a Model 3 or 12 and may be used with any Model 3 or 12 provided that the instrument is in calibration and the Instrument was previously set up to be used with a GM detector (operating voltage 900Volts)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector).

Detector Certified By: M. Paul	Reviewed By: Jeff Dubenson Date: 9/30/14
Certification Date: 09/29/2014	* Certification Due (6 mo.): 03/29/2015 * Certification Due (12 mo.): 09/29/2015

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

CALIBRATION CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		INSTRUMENT INFORMATION	
Customer Name: EnergySolutions Instrument Services		Manufacturer: Ludlum	
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Model: 3	Serial Number: 164070
Contact Name: Tony Riggs			
Contract/Task Number: N/A	Work Order Number: 2014-13846	Calibration Method: Electronic and Source	

INSTRUMENT CALIBRATION INFORMATION

Instrument Range	Calibration Standard Value (cpm)	Instrument Response (± 10%) Before Calibration	Instrument Response (± 10%) After Calibration	Comments: Calibrated in accordance with CP-IN-WI-219	
X0.1	100	100	100	Pulser: 120935	Cal Due: 10/29/14
X0.1	300	300	300	DVM: 97960214	Cal Due: 06/27/15
X0.1	500	500	490	Temp/Press: 3590	Cal Due: 10/09/14
X 1	1,000	1,050	1,000	Humidity: 992290	Cal Due: 03/12/15
X 1	3,000	3,250	3,000	Temp: 24.1 ° C Humidity: 36% Pressure: 742 mmHg	
X 1	5,000	5,400	4,900		
X 10	10,000	10,000	10,000		
X 10	30,000	31,500	30,000	Reset: SAT	Sensitivity: SAT
X 10	50,000	52,000	49,500	Audio: SAT	Geotropism: SAT
X 100	100,000	100,000	100,000	F/S Resp: SAT	BAT: SAT
X 100	300,000	310,000	300,000	Limited Use: X100 scale for info only. Use with GM Detector.	
X 100	500,000	520,000	500,000		
Mech. Zero	0	0	0		
HV Verification					
HV Adjustable from 400 to 1,500		☒ SAT ☐ UNSAT		HV Set at 900 volts to be used with GM detectors.	
				Precision Test Reading 1 = 33,000 Reading 2 = 32,500 Reading 3 = 33,000 Mean = 32,833 ☒ SAT ☐ UNSAT	

STATEMENT OF CERTIFICATION

We Certify that the instrument listed above was calibrated and inspected prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this instrument).

Instrument Calibrated By: M. Paul	Reviewed By: [signature]	Date: 9/30/14
Certification Date: 09/29/2014	*Certification Due (6 mo.): 03/29/2015	
	*Certification Due (12 mo.): 09/29/2015	

* Calibration due date is dependant on users regulatory requirements.

ENERGYSOLUTIONS

DETECTOR CERTIFICATE

EnergySolutions Services, Inc.
1570 Bear Creek Road
Oak Ridge, TN 37830
Phone: (877) 462-4873
Email: ISFStaff@energysolutions.com

This Certificate will be accompanied by Calibration Charts or Readings where applicable

CUSTOMER INFORMATION		DETECTOR INFORMATION
Customer Name: EnergySolutions Services, Inc.		Manufacturer: Ludlum
Address: 1570 Bear Creek Road, Oak Ridge, TN 37830		Detector Model: 44-9
Contact Name: Tony Riggs		Serial Number: 091215
Customer Purchase Order Number: N/A	Work Order Number: 2013-13846	Evaluation Method: Source

DETECTOR EFFICIENCY/RESPONSE/PRECISION INFORMATION

1) Source Nuclide: Tc-99	Serial Number: 119720	Original Activity (dpm): 2,562	Certification Date: 10/14/97
2) Source Nuclide: Tc-99	Serial Number: 119718	Original Activity (dpm): 20,520	Certification Date: 10/14/97
3) Source Nuclide: Tc-99	Serial Number: 069507	Original Activity (dpm): 237,960	Certification Date: 04/01/95

Efficiency determined using 180-2 jig @ 1/8" geometry

Source #	Gross CPM	Net CPM	4pi Efficiency				
Source 1	320	285	11.1%				
Source 2	2,500	2,465	12.0%				
Source 3	36,500	36,465	15.3%				

INSTRUMENT INFORMATION			DETECTOR INFORMATION		
Model	Serial Number	Due Date	Background	Operating Voltage	Threshold
3	294731	09/29/2015	35	900 Volts	35 mV

COMMENTS

Detectors calibrated with a Model 3 or 12 and may be used with any Model 3 or 12 provided that the instrument is in calibration and the Instrument was previously set up to be used with a GM detector (operating voltage 900Volts)

STATEMENT OF CERTIFICATION

We Certify that the detector listed above was evaluated for proper operation prior to shipment and that it met all the Manufacturers published operating specifications. We further certify that our Calibration Measurements are traceable to the National Institute of Standards and Technology. (We are not responsible for damage incurred during shipment or use of this detector)

Detector Certified By: M. Paul	Reviewed By: Geoff Sutcliffe Date: 9/30/14
Certification Date: 09/29/2014	* Certification Due (6 mo.): 03/29/2015 * Certification Due (12 mo.): 09/29/2015

* Calibration due date is dependant on users regulatory requirements.

Appendix E

Daily Instrument Response Check Data

Chi Square Tests

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2929			Instrument Serial No.	79980	
Last Calibration Date:		7/30/2014			Background Count Rate:	0.33	C_B
Detector Model:		43-10-1			Detector Serial No.:	082908	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	099605	Activity	9,480	alphas/min	Efficiency:	72.6 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**6431**	6430.67		95.50	9120.25	
2		**6348**	6347.67		12.50	156.25	
3		**6217**	6216.67		-118.50	14042.25	
4		**6252**	6251.67		-83.50	6972.25	
5		**6321**	6320.67		-14.50	210.25	
6		**6289**	6288.67		-46.50	2162.25	
7		**6342**	6341.67		6.50	42.25	
8		**6412**	6411.67		76.50	5852.25	
9		**6339**	6338.67		3.50	12.25	
10		**6297**	6296.67		-38.50	1482.25	
11		**6412**	6411.67		76.50	5852.25	
12		**6225**	6224.67		-110.50	12210.25	
13		**6345**	6344.67		9.50	90.25	
14		**6289**	6288.67		-46.50	2162.25	
15		**6256**	6255.67		-79.50	6320.25	
16		**6312**	6311.67		-23.50	552.25	
17		**6339**	6338.67		3.50	12.25	
18		**6349**	6348.67		13.50	182.25	
19		**6423**	6422.67		87.50	7656.25	
20		**6512**	6511.67		176.50	31152.25	
Total		126710	126703.4		SUM	106243	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			6335				
Chi Squared Value (C^2):		16.77	10.11 - 30.14	Standard Deviation:	75		
+ 20% Value:	7602	- 20% Value:	5068				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2929			Instrument Serial No.	79980	
Last Calibration Date:		7/30/2014			Background Count Rate:	38	C_B
Detector Model:		43-10-1			Detector Serial No.:	082908	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	069604	Activity	10,740	betas/min	Efficiency:	44.1 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**4968**	4930		22.50	506.25	
2		**4865**	4827		-80.50	6480.25	
3		**5110**	5072		164.50	27060.25	
4		**5021**	4983		75.50	5700.25	
5		**4876**	4838		-69.50	4830.25	
6		**4923**	4885		-22.50	506.25	
7		**4984**	4946		38.50	1482.25	
8		**4856**	4818		-89.50	8010.25	
9		**4897**	4859		-48.50	2352.25	
10		**4935**	4897		-10.50	110.25	
11		**4850**	4812		-95.50	9120.25	
12		**4957**	4919		11.50	132.25	
13		**4878**	4840		-67.50	4556.25	
14		**5093**	5055		147.50	21756.25	
15		**4969**	4931		23.50	552.25	
16		**4876**	4838		-69.50	4830.25	
17		**4934**	4896		-11.50	132.25	
18		**5032**	4994		86.50	7482.25	
19		**4989**	4951		43.50	1892.25	
20		**4897**	4859		-48.50	2352.25	
Total		98910	98150		SUM	109845	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			4908				
Chi Squared Value (C^2):		22.38	10.11 - 30.14	Standard Deviation:	76		
+ 20% Value:	5889	- 20% Value:	3926				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	278551	
Last Calibration Date:		4/16/2014			Background Count Rate:	0.27	C_B
Detector Model:		43-93			Detector Serial No.:	312642	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	089404	Activity	3,000	alphas/min	Efficiency:	28.1 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**664**	663.73		-2.05	4.20	
2		**699**	698.73		32.95	1085.70	
3		**674**	673.73		7.95	63.20	
4		**675**	674.73		8.95	80.10	
5		**679**	678.73		12.95	167.70	
6		**699**	698.73		32.95	1085.70	
7		**632**	631.73		-34.05	1159.40	
8		**671**	670.73		4.95	24.50	
9		**662**	661.73		-4.05	16.40	
10		**654**	653.73		-12.05	145.20	
11		**652**	651.73		-14.05	197.40	
12		**679**	678.73		12.95	167.70	
13		**658**	657.73		-8.05	64.80	
14		**663**	662.73		-3.05	9.30	
15		**689**	688.73		22.95	526.70	
16		**632**	631.73		-34.05	1159.40	
17		**667**	666.73		0.95	0.90	
18		**601**	600.73		-65.05	4231.50	
19		**692**	691.73		25.95	673.40	
20		**679**	678.73		12.95	167.70	
Total		13321	13315.6		SUM	11030.95	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			666				
Chi Squared Value (C^2):		16.57	10.11 - 30.14	Standard Deviation:	24		
+ 20% Value:	799	- 20% Value:	533				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	278551	
Last Calibration Date:		4/16/2014			Background Count Rate:	143	C_B
Detector Model:		43-93			Detector Serial No.:	312642	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	049409	Activity	15,292	betas/min	Efficiency:	31.5 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**4280**	4137		77.70	6037.29	
2		**4382**	4239		179.70	32292.09	
3		**4292**	4149		89.70	8046.09	
4		**4241**	4098		38.70	1497.69	
5		**4185**	4042		-17.30	299.29	
6		**4135**	3992		-67.30	4529.29	
7		**4128**	3985		-74.30	5520.49	
8		**4238**	4095		35.70	1274.49	
9		**4139**	3996		-63.30	4006.89	
10		**4287**	4144		84.70	7174.09	
11		**4198**	4055		-4.30	18.49	
12		**4239**	4096		36.70	1346.89	
13		**4187**	4044		-15.30	234.09	
14		**4156**	4013		-46.30	2143.69	
15		**4112**	3969		-90.30	8154.09	
16		**4137**	3994		-65.30	4264.09	
17		**4175**	4032		-27.30	745.29	
18		**4158**	4015		-44.30	1962.49	
19		**4143**	4000		-59.30	3516.49	
20		**4234**	4091		31.70	1004.89	
Total		84046	81186		SUM	94068.2	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			4059				
Chi Squared Value (C^2):		23.17	10.11 - 30.14	Standard Deviation:	70		
+ 20% Value:	4871	- 20% Value:	3247				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	275827	
Last Calibration Date:		4/16/2014			Background Count Rate:	0.6	C_B
Detector Model:		43-93			Detector Serial No.:	335833	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	089404	Activity	3,000	alphas/min	Efficiency:	28.2 %	
Radionuclide:	Th-230	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**726**	725.4		-25.05	627.50	
2		**715**	714.4		-36.05	1299.60	
3		**720**	719.4		-31.05	964.10	
4		**709**	708.4		-42.05	1768.20	
5		**736**	735.4		-15.05	226.50	
6		**777**	776.4		25.95	673.40	
7		**789**	788.4		37.95	1440.20	
8		**721**	720.4		-30.05	903.00	
9		**764**	763.4		12.95	167.70	
10		**732**	731.4		-19.05	362.90	
11		**755**	754.4		3.95	15.60	
12		**798**	797.4		46.95	2204.30	
13		**721**	720.4		-30.05	903.00	
14		**743**	742.4		-8.05	64.80	
15		**765**	764.4		13.95	194.60	
16		**782**	781.4		30.95	957.90	
17		**719**	718.4		-32.05	1027.20	
18		**775**	774.4		23.95	573.60	
19		**782**	781.4		30.95	957.90	
20		**792**	791.4		40.95	1676.90	
Total		15021	15009		SUM	17008.95	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			750				
Chi Squared Value (C^2):		22.67	10.11 - 30.14	Standard Deviation:	30		
+ 20% Value:	901	- 20% Value:	600				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2360			Instrument Serial No.	275827	
Last Calibration Date:		4/16/2014			Background Count Rate:	146	C_B
Detector Model:		43-93			Detector Serial No.:	335833	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	049409	Activity	15,292	betas/min	Efficiency:	33.9 %	
Radionuclide:	Tc-99	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**4287**	4141		0.85	0.72	
2		**4287**	4141		0.85	0.72	
3		**4392**	4246		105.85	11204.22	
4		**4401**	4255		114.85	13190.52	
5		**4337**	4191		50.85	2585.72	
6		**4321**	4175		34.85	1214.52	
7		**4316**	4170		29.85	891.02	
8		**4380**	4234		93.85	8807.82	
9		**4258**	4112		-28.15	792.42	
10		**4321**	4175		34.85	1214.52	
11		**4265**	4119		-21.15	447.32	
12		**4179**	4033		-107.15	11481.12	
13		**4276**	4130		-10.15	103.02	
14		**4329**	4183		42.85	1836.12	
15		**4176**	4030		-110.15	12133.02	
16		**4123**	3977		-163.15	26617.92	
17		**4265**	4119		-21.15	447.32	
18		**4333**	4187		46.85	2194.92	
19		**4201**	4055		-85.15	7250.52	
20		**4276**	4130		-10.15	103.02	
Total		85723	82803		SUM	102516.55	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			4140				
Chi Squared Value (C^2):		24.76	10.11 - 30.14	Standard Deviation:	73		
+ 20% Value:	4968	- 20% Value:	3312				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2350-1			Instrument Serial No.	126197	
Last Calibration Date:		4/15/2014			Background Count Rate:	2697	C_B
Detector Model:		44-10			Detector Serial No.:	229176	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	092040	Activity	11,900,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**218696**	215999		179.35	32166.42	
2		**218589**	215892		72.35	5234.52	
3		**218589**	215892		72.35	5234.52	
4		**218431**	215734		-85.65	7335.92	
5		**217957**	215260		-559.65	313208.12	
6		**218621**	215924		104.35	10888.92	
7		**217897**	215200		-619.65	383966.12	
8		**217863**	215166		-653.65	427258.32	
9		**219221**	216524		704.35	496108.92	
10		**218698**	216001		181.35	32887.82	
11		**218984**	216287		467.35	218416.02	
12		**218752**	216055		235.35	55389.62	
13		**217652**	214955		-864.65	747619.62	
14		**218544**	215847		27.35	748.02	
15		**217843**	215146		-673.65	453804.32	
16		**219810**	217113		1293.35	1672754.22	
17		**218732**	216035		215.35	46375.62	
18		**217894**	215197		-622.65	387693.02	
19		**218783**	216086		266.35	70942.32	
20		**218777**	216080		260.35	67782.12	
Total		4370333	4316393		SUM	5435814.55	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			215820				
Chi Squared Value (C^2):		25.19	10.11 - 30.14	Standard Deviation:	535		
+ 20% Value:	258984	- 20% Value:	172656				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Aleut World Solutions
Chi-Squared Test of Reliability Data Sheet

Project/Location:		NSF Indian Head					
Instrument Model:		2350-1			Instrument Serial No.	95352	
Last Calibration Date:		4/15/2014			Background Count Rate:	2544	C_B
Detector Model:		44-10			Detector Serial No.:	192589	
Today's Date:		1/25/2015			Data Collected by:	William Wylie	
Source ID:	090240	Activity	11,900,000	dpm	Efficiency: N/A	%	
Radionuclide:	Cs-137	CPM	CPM				
Count Number		(Gross) C_G	(Net) C_I		$(C_I - \bar{c})$	$(C_I - \bar{c})^2$	
1		**212375**	209831		90.75	8235.56	
2		**212507**	209963		222.75	49617.56	
3		**212457**	209913		172.75	29842.56	
4		**211897**	209353		-387.25	149962.56	
5		**212765**	210221		480.75	231120.56	
6		**211398**	208854		-886.25	785439.06	
7		**212785**	210241		500.75	250750.56	
8		**213092**	210548		807.75	652460.06	
9		**213042**	210498		757.75	574185.06	
10		**212785**	210241		500.75	250750.56	
11		**212495**	209951		210.75	44415.56	
12		**212394**	209850		109.75	12045.06	
13		**211895**	209351		-389.25	151515.56	
14		**212341**	209797		56.75	3220.56	
15		**212387**	209843		102.75	10557.56	
16		**212654**	210110		369.75	136715.06	
17		**211786**	209242		-498.25	248253.06	
18		**211654**	209110		-630.25	397215.06	
19		**211398**	208854		-886.25	785439.06	
20		**211578**	209034		-706.25	498789.06	
Total		4245685	4194805		SUM	5270529.75	$\Sigma(C_I - c)^2$
Mean Count: $\bar{c}$			209740				
Chi Squared Value (C^2):		25.13	10.11 - 30.14	Standard Deviation:	527		
+ 20% Value:	251688	- 20% Value:	167792				
Calculations Completed by:			William Wylie			Date:	1/25/2015
Reviewed by:			Daniel Spicuzza			Date:	1/25/2015

Daily Instrument Response Checks

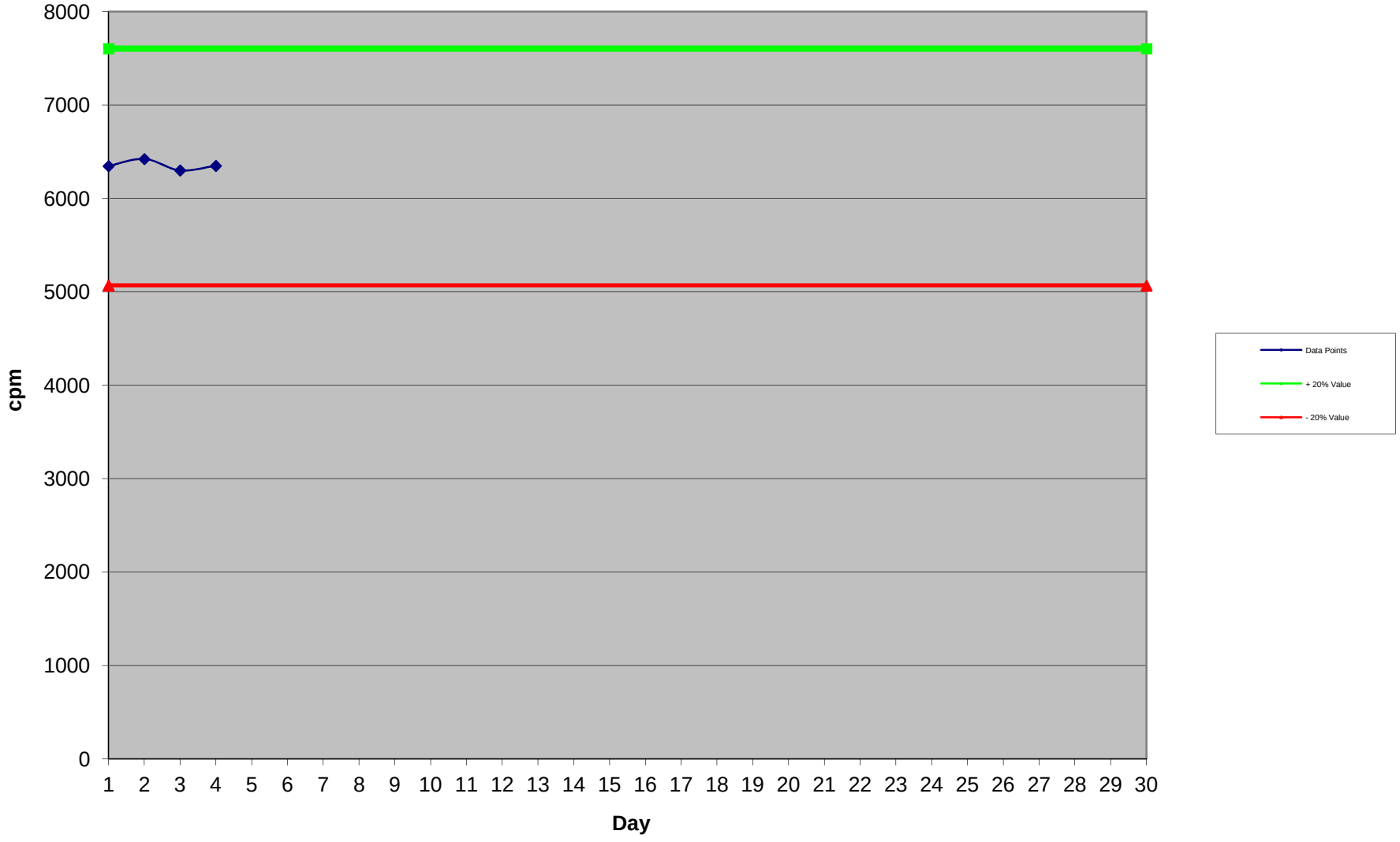
LUDLUM MODEL 2929
DAILY 30 MINUTE BACKGROUND AND EFFICIENCY

For:	January 2015, NSF Indian Head							
Instrument ID:	79980				Detector ID:	O82908		
Cal Due Date:	7/30/2015							
Sources Used:			Alpha S/N:	Th-230/099605		Activity:	9,480	alphas/min
			Beta S/N:	Tc-99/069404		Activity:	10,740	betas/min
			Acceptable Range of Background:		0	CPM to	1.3	CPM α
Background Count Time:	30	Minutes			30	CPM to	47	CPM βγ

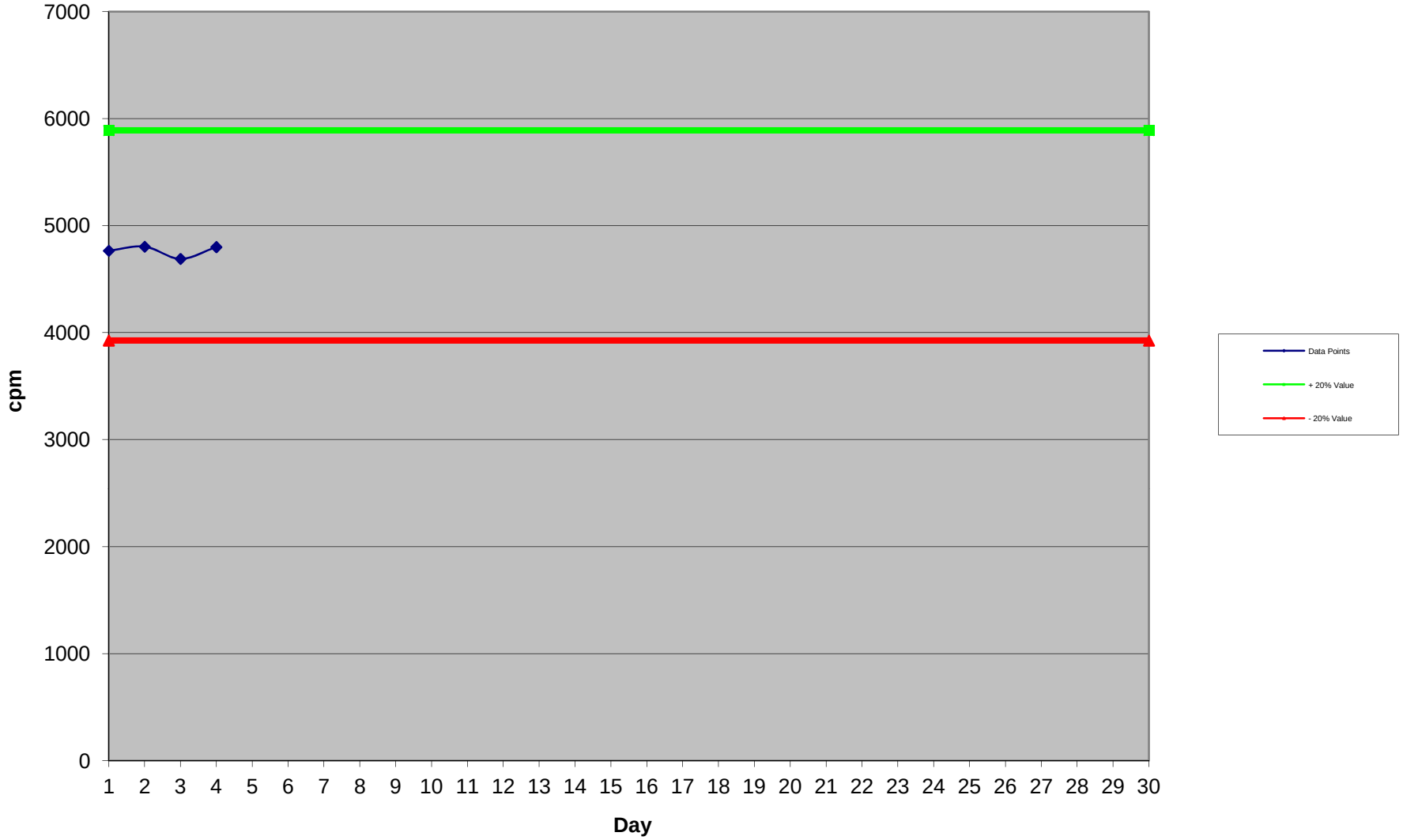
Date	Total Counts α	Total Counts βγ	30-Minute Background (CPM) α	30-Minute Background (CPM) βγ	1-min α Source Counts 5068-7602	Eff. α	1- min βγ Source Counts 3926-5889	Eff. βγ	Initials
1/26/2015	5	1278	0.2	42.6	6345	67.5	4765	44.1	WW
1/27/2015	6	1185	0.2	39.5	6421	67.5	4802	44.1	WW
1/28/2015	8	1165	0.3	38.8	6298	67.5	4689	44.1	WW
1/29/2015	6	1232	0.2	41.1	6348	67.5	4799	44.1	WW

Reviewed by: *Daniel Spicuzza* Date: 1/30/2015

Model 2929 Alpha Control Chart



Model 2929 Beta Control Chart

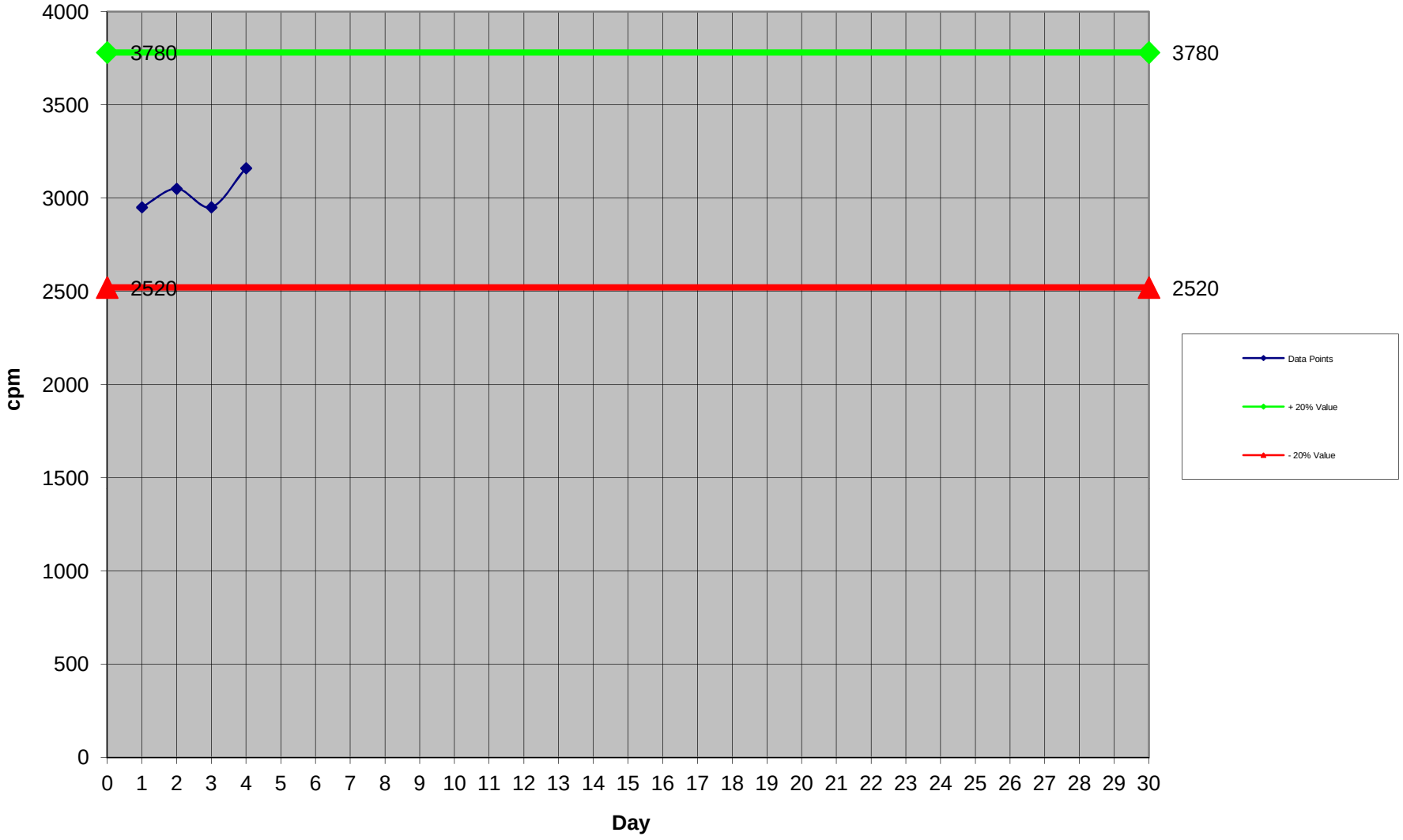


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2520-3780	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	3/44-9	164070/091215	N	9/29/2015	069604	10,740	50	3000	2950	27	P	WW
1/27/2015	3/44-9	164070/091215	N	9/29/2015	069604	10,740	50	3100	3050	28	P	WW
1/28/2015	3/44-9	164070/091215	N	9/29/2015	069604	10,740	50	3000	2950	27	P	WW
1/29/2015	3/44-9	164070/091215	N	9/29/2015	069604	10,740	40	3200	3160	29	P	WW

Beta Control Chart

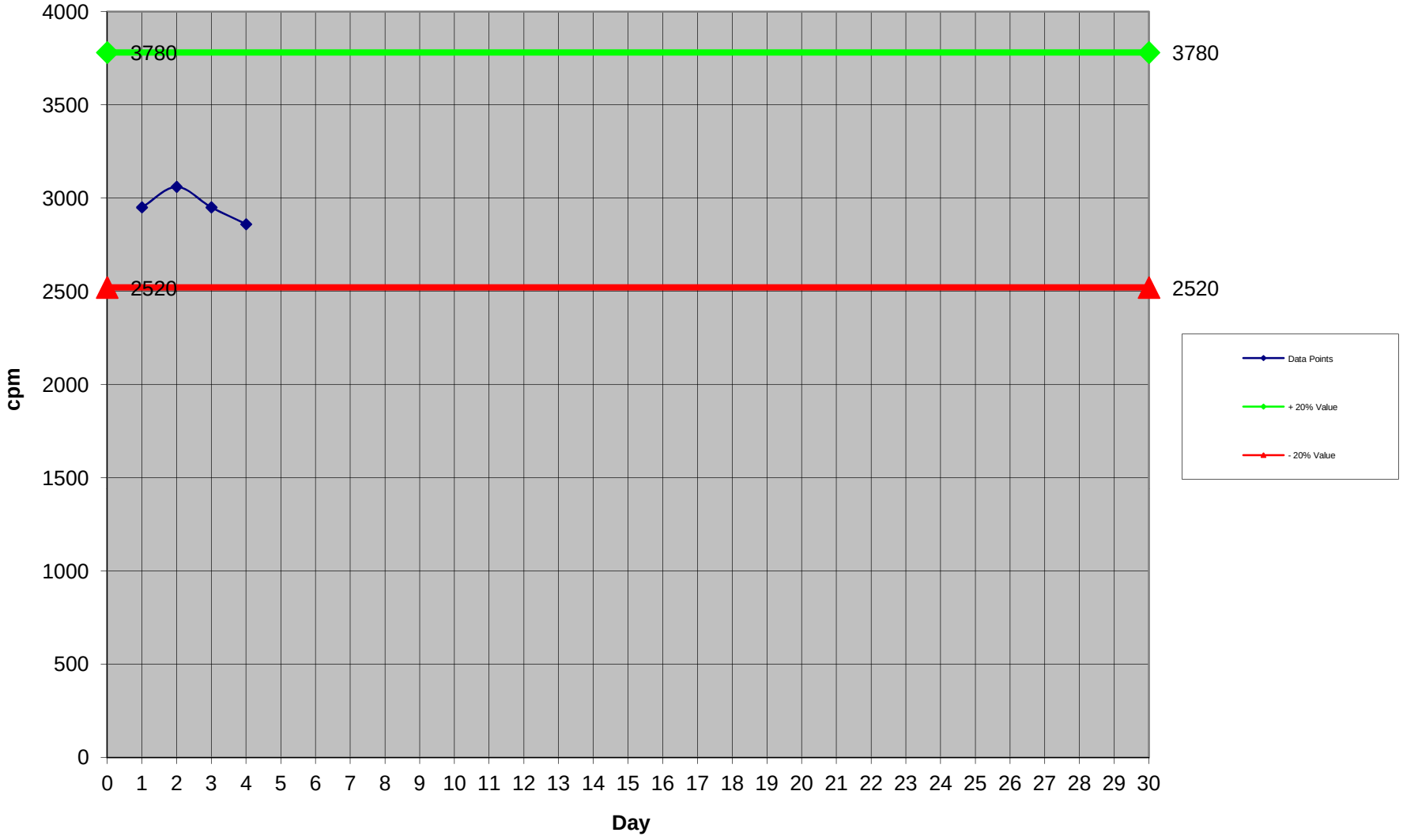


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 2520-3780	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	3/44-9	87482/182656	N	9/29/2015	069604	10,740	50	3000	2950	27	P	WW
1/27/2015	3/44-9	87482/182656	N	9/29/2015	069604	10,740	40	3100	3060	28	P	WW
1/28/2015	3/44-9	87482/182656	N	9/29/2015	069604	10,740	50	3000	2950	27	P	WW
1/29/2015	3/44-9	87482/182656	N	9/29/2015	069604	10,740	40	2900	2860	27	P	WW

Beta Control Chart

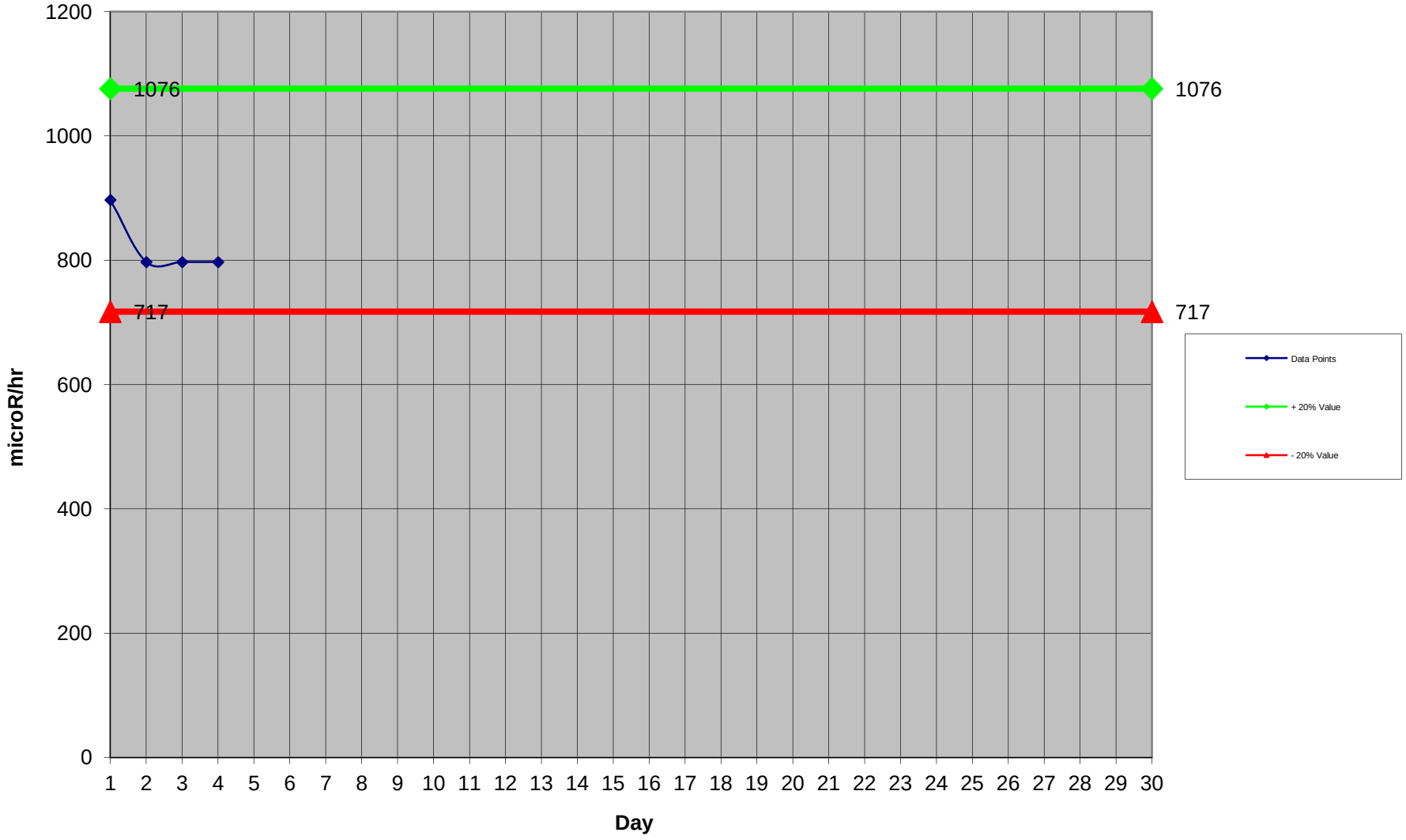


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY dpm	BACKGROUND microR/hr	READING microR/hr	Net microR/hr 717-1076	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	19	209746	N	1/20/2016	092040	11,900,000	3	900	897	N/A	P	WW
1/27/2015	19	209746	N	1/20/2016	092040	11,900,000	3	800	797	N/A	P	WW
1/28/2015	19	209746	N	1/20/2016	092040	11,900,000	3	800	797	N/A	P	WW
1/29/2015	19	209746	N	1/20/2016	092040	11,900,000	3	800	797	N/A	P	WW

Gamma Control Chart

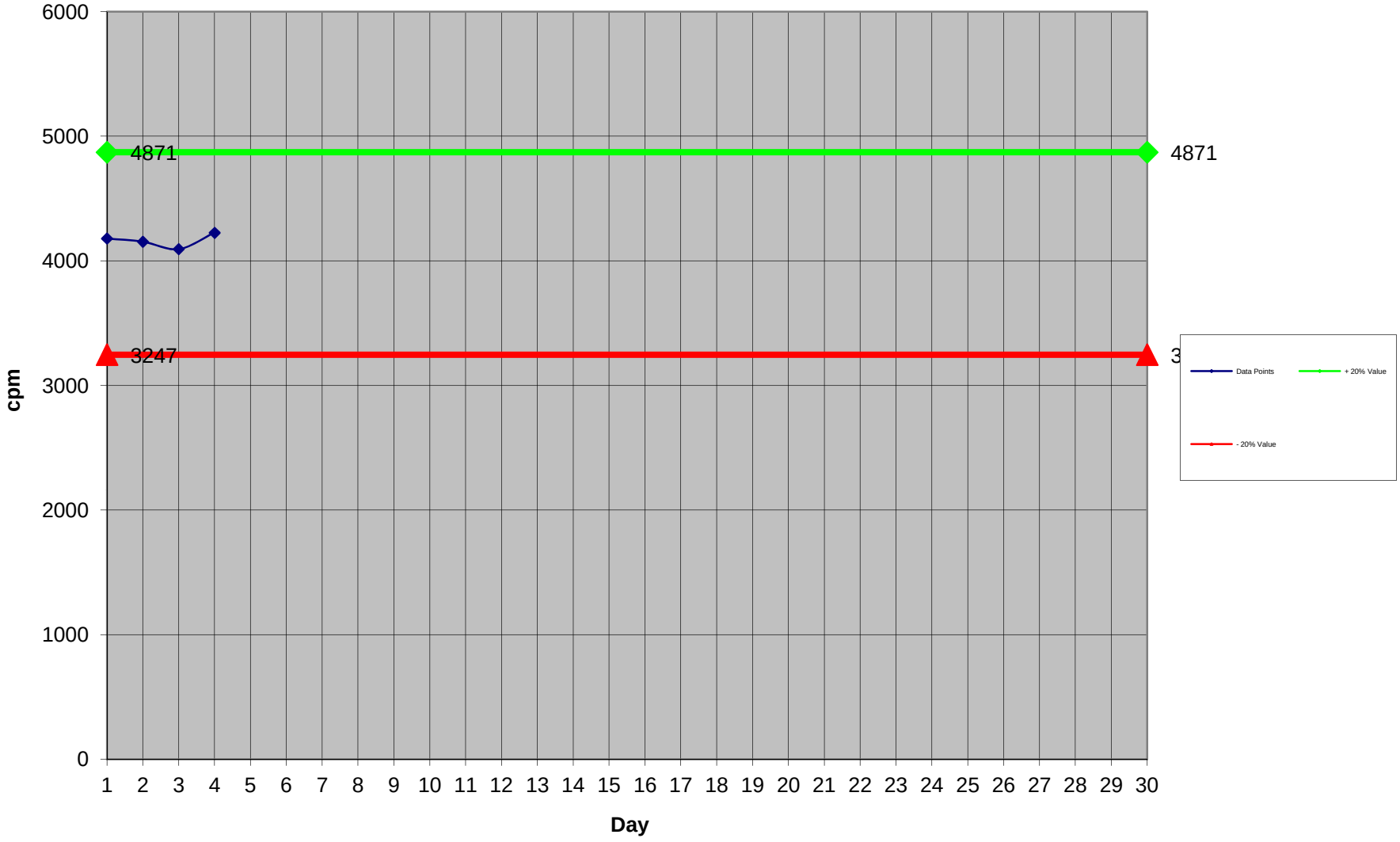


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 3247-4871	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	2360/43-93	278551/312642	N	4/16/2015	049409	15,292	143	4322	4179	31.5	P	WW
1/27/2015	2360/43-93	278551/312642	N	4/16/2015	049409	15,292	132	4285	4153	31.5	P	WW
1/28/2015	2360/43-93	278551/312642	N	4/16/2015	049409	15,292	123	4217	4094	31.5	P	WW
1/29/2015	2360/43-93	278551/312642	N	4/16/2015	049409	15,292	140	4365	4225	31.5	P	WW

Beta Control Chart

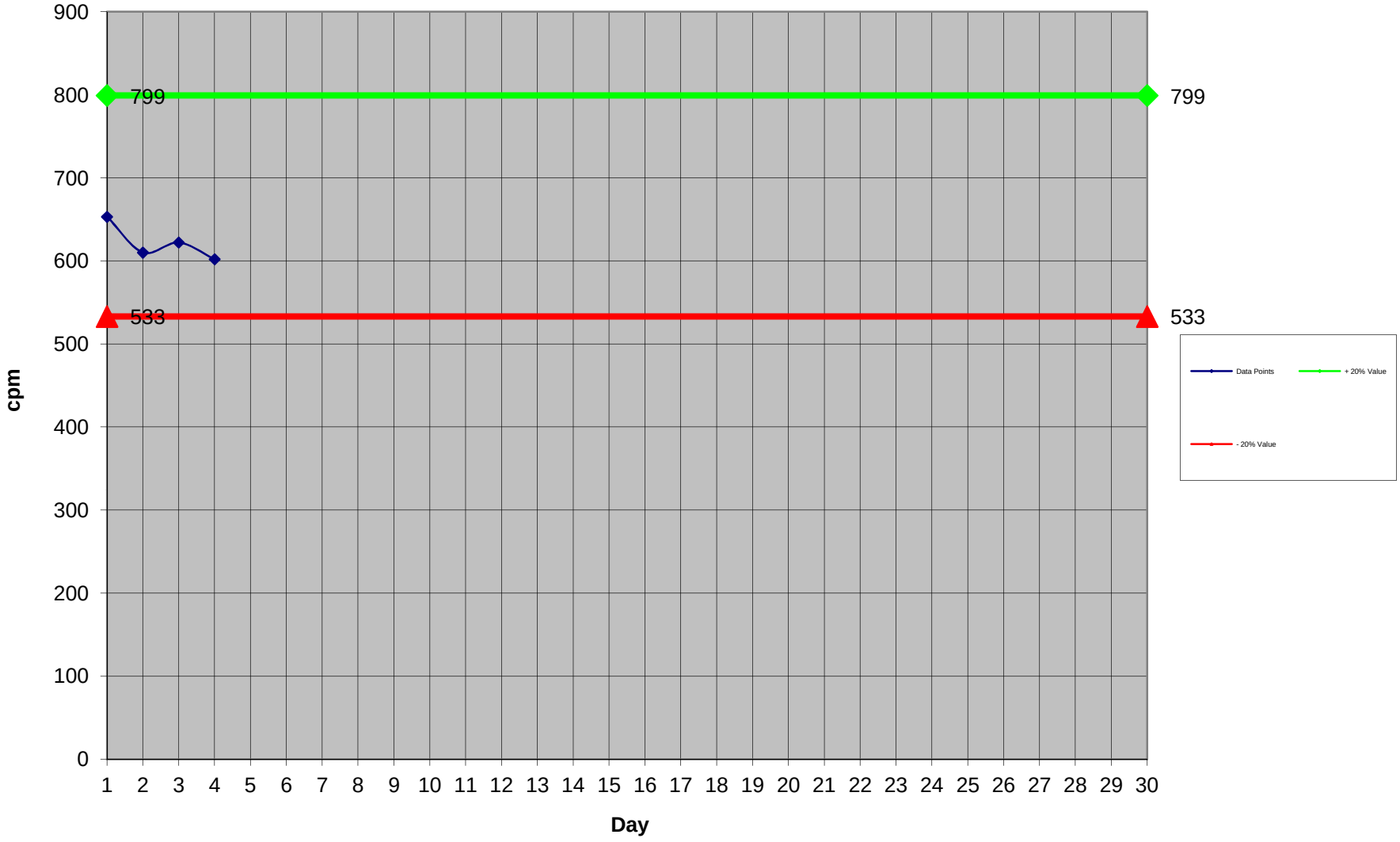


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND CPM	READING CPM	Net CPM 533-799	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	2360/43-93	278551/312642	N	4/16/2015	089404	3,000	1	654	653	28.1	P	WW
1/27/2015	2360/43-93	278551/312642	N	4/16/2015	089404	3,000	1	611	610	28.1	P	WW
1/28/2015	2360/43-93	278551/312642	N	4/16/2015	089404	3,000	1	623	622	28.1	P	WW
1/29/2015	2360/43-93	278551/312642	N	4/16/2015	089404	3,000	2	604	602	28.1	P	WW

Alpha Control Chart

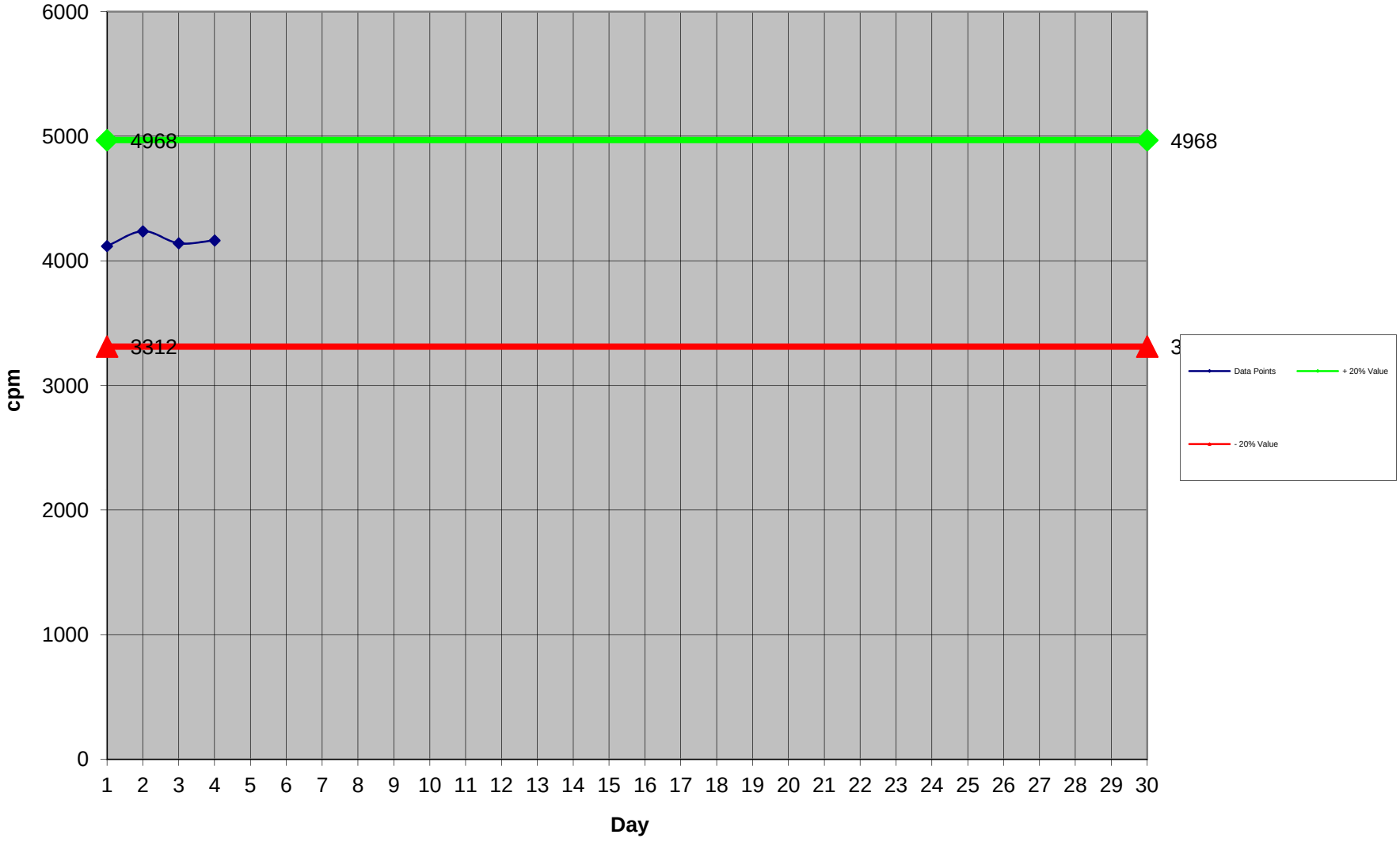


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Tc-99	SOURCE ACTIVITY betas/min	BACKGROUND CPM	READING CPM	Net CPM 3312-4968	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	2360/43-93	275827/335833	N	4/15/2015	049409	15,292	126	4244	4118	33.9	P	WW
1/27/2015	2360/43-93	275827/335833	N	4/15/2015	049409	15,292	139	4376	4237	33.9	P	WW
1/28/2015	2360/43-93	275827/335833	N	4/15/2015	049409	15,292	135	4276	4141	33.9	P	WW
1/29/2015	2360/43-93	275827/335833	N	4/15/2015	049409	15,292	145	4308	4163	33.9	P	WW

Beta Control Chart

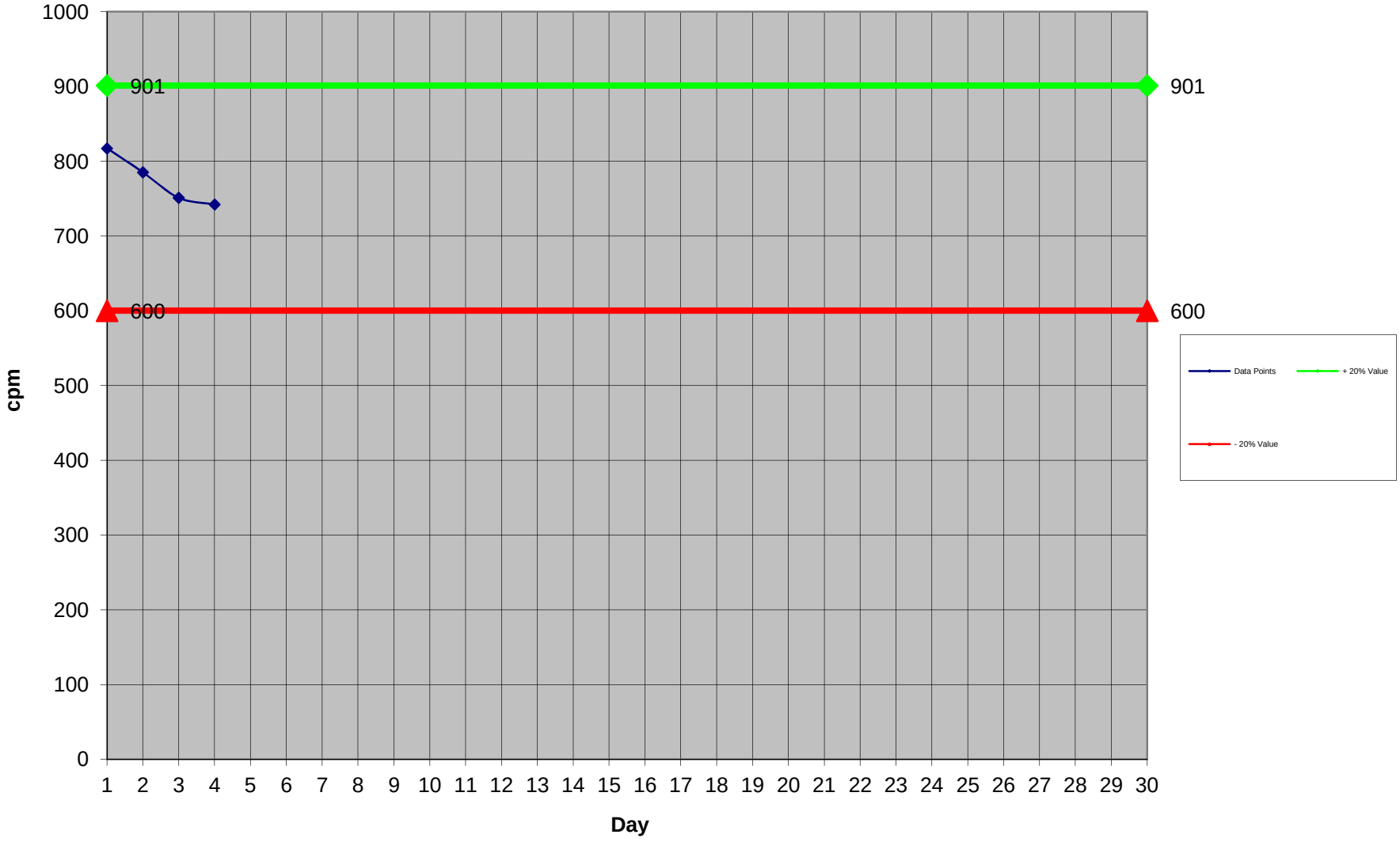


DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Th-230	SOURCE ACTIVITY alphas/min	BACKGROUND CPM	READING CPM	Net CPM 600-901	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	2360/43-93	275827/335833	N	4/15/2015	089404	3,000	0	769	817	28.2	P	WW
1/27/2015	2360/43-93	275827/335833	N	4/15/2015	089404	3,000	0	785	785	28.2	P	WW
1/28/2015	2360/43-93	275827/335833	N	4/15/2015	089404	3,000	1	752	751	28.2	P	WW
1/29/2015	2360/43-93	275827/335833	N	4/15/2015	089404	3,000	1	743	742	28.2	P	WW

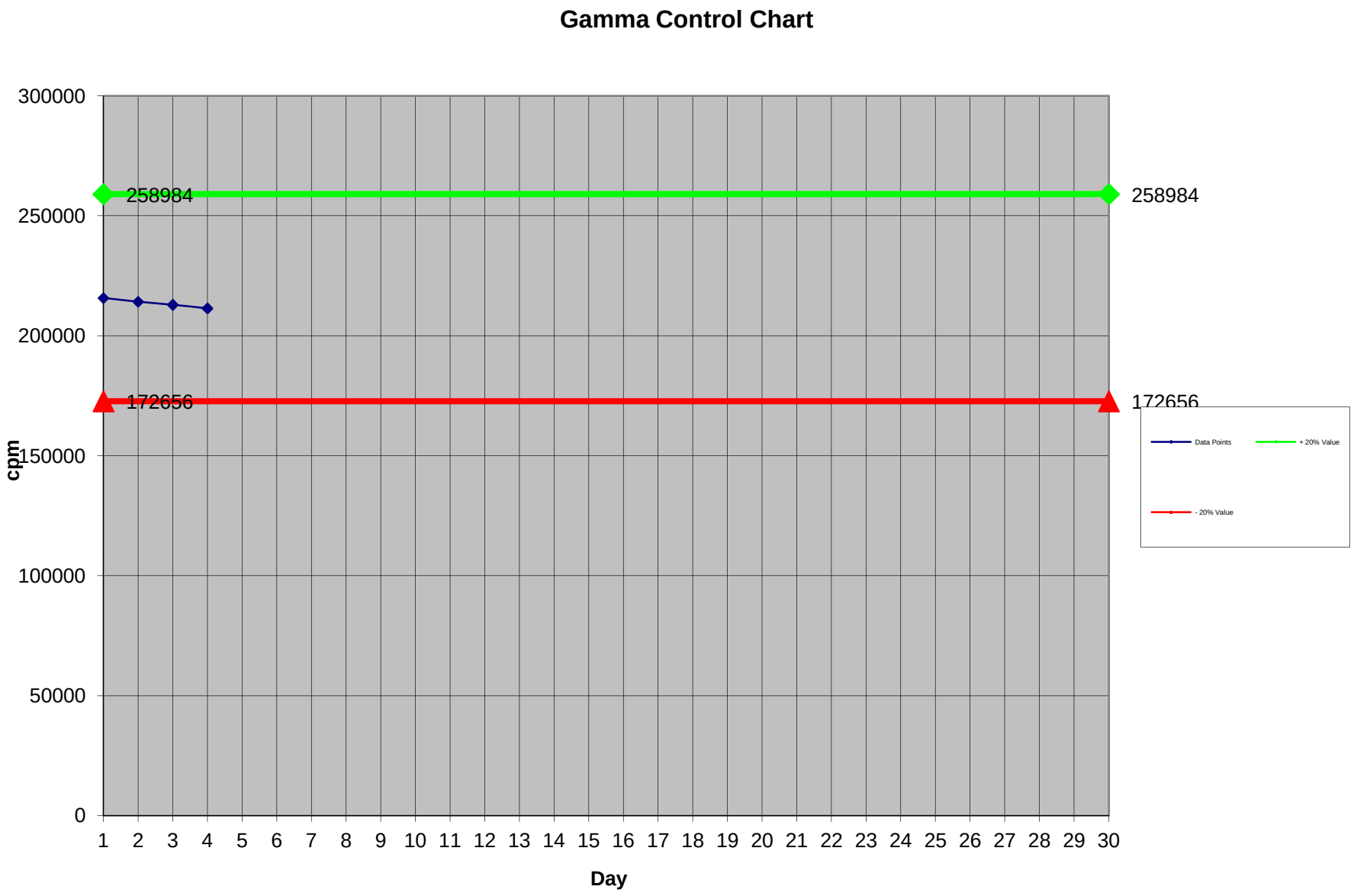
Alpha Control Chart



DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

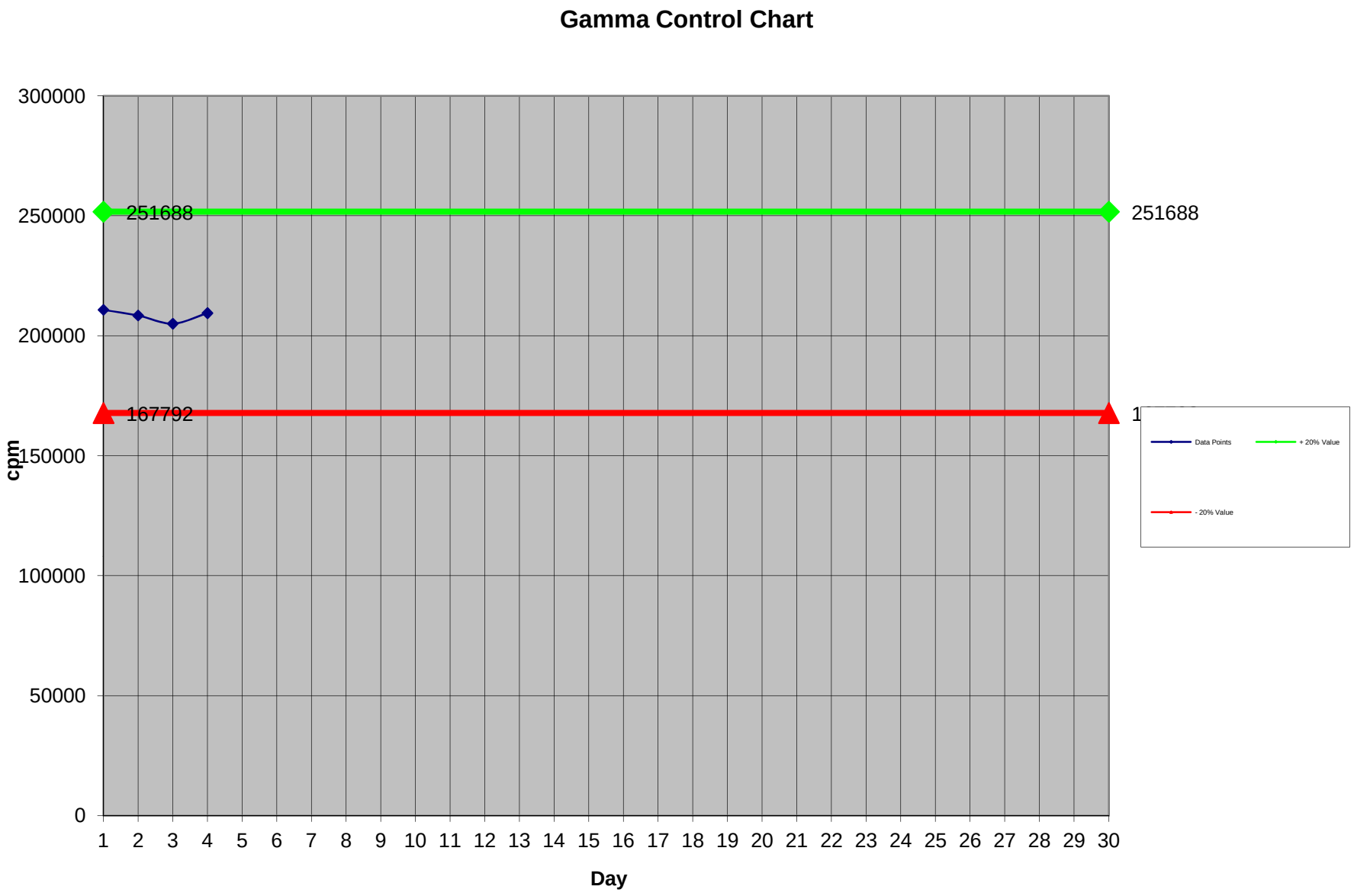
DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY DPM	BACKGROUND CPM	READING CPM	Net CPM 172656-258984	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	2350-1/44-10	126197/229176	N	4/15/2015	090240	11,900,000	2931	218642	215711	N/A	P	WW
1/27/2015	2350-1/44-10	126197/229176	N	4/15/2015	090240	11,900,000	3042	217222	214180	N/A	P	WW
1/28/2015	2350-1/44-10	126197/229176	N	4/15/2015	090240	11,900,000	2865	215762	212897	N/A	P	WW
1/29/2015	2350-1/44-10	126197/229176	N	4/15/2015	090240	11,900,000	2954	214337	211383	N/A	P	WW


Gamma Control Chart
300000
250000
200000
150000
100000
50000
0
cpm
258984
258984
172656
172656
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

DAILY INSTRUMENT PERFORMANCE TEST LOG SHEET

Project: NSF Indian Head

DATE	MODEL/TYPE (Meter/Detector)	S/N (Meter/Detector)	PHYSICAL DAMAGE Y/N	CAL. DUE DATE	SOURCE I.D Cs-137	SOURCE ACTIVITY DPM	BACKGROUND CPM	READING CPM	Net CPM 167792-251688	EFF. %	PASS/ FAIL (P/F)	TECH. INIT.
1/26/2015	2350-1/44-10	95352/192589	N	4/15/2015	090240	11,900,000	2434	213232	210798	N/A	P	WW
1/27/2015	2350-1/44-10	95352/192589	N	4/15/2015	090240	11,900,000	2512	210954	208442	N/A	P	WW
1/28/2015	2350-1/44-10	95352/192589	N	4/15/2015	090240	11,900,000	2487	207543	205056	N/A	P	WW
1/29/2015	2350-1/44-10	95352/192589	N	4/15/2015	090240	11,900,000	2543	211983	209440	N/A	P	WW


Gamma Control Chart
300000
250000
200000
150000
100000
50000
0
cpm
251688
251688
167792
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day
Data Points
+ 20% Value
- 20% Value

Appendix F

Laboratory Data Reports

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-10348-1
Client Project/Site: Indian Head

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Daniel Spicuzza

Authorized for release by:
2/26/2015 3:25:20 PM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Receipt Checklists 8
Definitions/Glossary 9
Method Summary 10
Sample Summary 11
Client Sample Results 12
QC Sample Results 20
QC Association Summary 22
Tracer Carrier Summary 24

Job ID: 160-10348-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Indian Head

Report Number: 160-10348-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-10348-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 2/3/2015 1:50 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 17.0º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHBH18-1 (160-10348-1), IHBH18-3 (160-10348-2), IHBH19-1 (160-10348-3), IHBH19-3 (160-10348-4), IHBH19-5 (160-10348-5), IHBH20-1 (160-10348-6), IHBH20-2 (160-10348-7), IHBH20-4 (160-10348-8), IHBH21-1 (160-10348-9), IHBH21-2 (160-10348-10), IHBH21-4 (160-10348-11), IHBH22-3 (160-10348-12), IHBH22-5 (160-10348-13), IHBH23-2 (160-10348-14), IHBH23-4 (160-10348-15), IHBH24-2 (160-10348-16), IHBH24-3 (160-10348-17), IHBH24-4 (160-10348-18), IHBH25-1 (160-10348-19), IHBH25-2 (160-10348-20), IHBH25-4 (160-10348-21), IHBH26-1 (160-10348-22), IHBH26-2 (160-10348-23), IHBH26-3 (160-10348-24) and IHBH26-5 (160-10348-25) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 02/04/2015, prepared on 02/06/2015 and 02/10/2015 and analyzed on 02/17/2015, 02/18/2015, 02/19/2015 and 02/23/2015.

The following sample(s) could not be thoroughly homogenized before sub-sampling was performed due to sample matrix: IHBH18-1 (160-10348-1), IHBH18-3 (160-10348-2), IHBH19-1 (160-10348-3), IHBH19-3 (160-10348-4), IHBH19-5 (160-10348-5), IHBH20-1 (160-10348-6), IHBH20-2 (160-10348-7), IHBH20-4 (160-10348-8), IHBH21-1 (160-10348-9), IHBH21-2 (160-10348-10). The samples contain rocks.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

160-10348 Chain of Custody

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

TestAmerica Laboratories, Inc.

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 1/28/2015	COC No: IH-2015-7
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	1 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH18-1	1/28/2015	1255	G	S	1	N	N	X	
IHBH18-3	1/28/2015	1310	G	S	1	N	N	X	
IHBH19-1	1/28/2015	1320	G	S	1	N	N	X	
IHBH19-3	1/28/2015	1325	G	S	1	N	N	X	
IHBH19-5	1/28/2015	1338	G	S	1	N	N	X	
IHBH20-1	1/29/2015	0830	G	S	1	N	N	X	
IHBH20-2	1/29/2015	0832	G	S	1	N	N	X	
IHBH20-4	1/29/2015	0835	G	S	1	N	N	X	
IHBH21-1	1/29/2015	0842	G	S	1	N	N	X	
IHBH21-2	1/29/2015	0848	G	S	1	N	N	X	
IHBH21-4	1/29/2015	0852	G	S	1	N	N	X	
IHBH22-3	1/29/2015	0907	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 1/29/15 1400	Received by: Jill Clarke	Company: TA STL	Date/Time: 2.3.15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:1/29/2015	COC No: IH-2015-8
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	2 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH22-5	1/29/2015	0910	G	S	1	N	N	X	
IHBH23-2	1/29/2015	0935	G	S	1	N	N	X	
IHBH23-4	1/29/2015	0938	G	S	1	N	N	X	
IHBH24-2	1/29/2015	0945	G	S	1	N	N	X	
IHBH24-3	1/29/2015	0948	G	S	1	N	N	X	
IHBH24-4	1/29/2015	0950	G	S	1	N	N	X	
IHBH25-1	1/29/2015	1000	G	S	1	N	N	X	
IHBH25-2	1/29/2015	1002	G	S	1	N	N	X	
IHBH25-4	1/29/2015	1005	G	S	1	N	N	X	
IHBH26-1	1/29/2015	1010	G	S	1	N	N	X	
IHBH26-2	1/29/2015	1013	G	S	1	N	N	X	
IHBH26-3	1/29/2015	1015	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl, 3= H2SO4, 4=HNO3, 5=NaOH, 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months.

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	AWS	1/29/15 1700	Jill Clarke	TA SL	2.3.15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 1/29/2015	COC No: IH-2015-9
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	3 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	Isotopic Thorium	Sample Specific Notes:
IHBH26-5	1/29/2015	1019	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 1/29/15 1400	Received by: Gil Clarke	Company: TA STL	Date/Time: 2-3-15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-10348-1

Login Number: 10348

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10348-1	IHBH18-1	Solid	01/28/15 12:55	02/03/15 13:50
160-10348-2	IHBH18-3	Solid	01/28/15 13:10	02/03/15 13:50
160-10348-3	IHBH19-1	Solid	01/28/15 13:20	02/03/15 13:50
160-10348-4	IHBH19-3	Solid	01/28/15 13:25	02/03/15 13:50
160-10348-5	IHBH19-5	Solid	01/28/15 13:38	02/03/15 13:50
160-10348-6	IHBH20-1	Solid	01/29/15 08:30	02/03/15 13:50
160-10348-7	IHBH20-2	Solid	01/29/15 08:32	02/03/15 13:50
160-10348-8	IHBH20-4	Solid	01/29/15 08:35	02/03/15 13:50
160-10348-9	IHBH21-1	Solid	01/29/15 08:42	02/03/15 13:50
160-10348-10	IHBH21-2	Solid	01/29/15 08:48	02/03/15 13:50
160-10348-11	IHBH21-4	Solid	01/29/15 08:52	02/03/15 13:50
160-10348-12	IHBH22-3	Solid	01/29/15 09:07	02/03/15 13:50
160-10348-13	IHBH22-5	Solid	01/29/15 09:10	02/03/15 13:50
160-10348-14	IHBH23-2	Solid	01/29/15 09:35	02/03/15 13:50
160-10348-15	IHBH23-4	Solid	01/29/15 09:38	02/03/15 13:50
160-10348-16	IHBH24-2	Solid	01/29/15 09:45	02/03/15 13:50
160-10348-17	IHBH24-3	Solid	01/29/15 09:48	02/03/15 13:50
160-10348-18	IHBH24-4	Solid	01/29/15 09:50	02/03/15 13:50
160-10348-19	IHBH25-1	Solid	01/29/15 10:00	02/03/15 13:50
160-10348-20	IHBH25-2	Solid	01/29/15 10:02	02/03/15 13:50
160-10348-21	IHBH25-4	Solid	01/29/15 10:05	02/03/15 13:50
160-10348-22	IHBH26-1	Solid	01/29/15 10:10	02/03/15 13:50
160-10348-23	IHBH26-2	Solid	01/29/15 10:13	02/03/15 13:50
160-10348-24	IHBH26-3	Solid	01/29/15 10:15	02/03/15 13:50
160-10348-25	IHBH26-5	Solid	01/29/15 10:19	02/03/15 13:50

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH18-1

Lab Sample ID: 160-10348-1

Date Collected: 01/28/15 12:55
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.631		0.139	0.149	1.00	0.0719	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.673		0.141	0.152	1.00	0.0451	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.517		0.124	0.132	1.00	0.0571	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*98.9*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH18-3

Lab Sample ID: 160-10348-2

Date Collected: 01/28/15 13:10
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.713		0.154	0.165	1.00	0.0830	pCi/g	02/06/15 14:40	02/23/15 16:22	1
Thorium-230	0.660		0.145	0.155	1.00	0.0525	pCi/g	02/06/15 14:40	02/23/15 16:22	1
Thorium-232	0.567		0.134	0.142	1.00	0.0438	pCi/g	02/06/15 14:40	02/23/15 16:22	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.3*		*30 - 110*	*02/06/15 14:40*	*02/23/15 16:22*	*1*

Client Sample ID: IHBH19-1

Lab Sample ID: 160-10348-3

Date Collected: 01/28/15 13:20
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.723		0.156	0.167	1.00	0.0776	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.657		0.146	0.156	1.00	0.0451	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.705		0.150	0.162	1.00	0.0241	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.0*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH19-3

Lab Sample ID: 160-10348-4

Date Collected: 01/28/15 13:25
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.571		0.147	0.155	1.00	0.0658	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.526		0.141	0.148	1.00	0.0631	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.431		0.126	0.131	1.00	0.0446	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH19-3

Lab Sample ID: 160-10348-4
Matrix: Solid
Date Collected: 01/28/15 13:25
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	76.1		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample ID: IHBH19-5

Lab Sample ID: 160-10348-5
Matrix: Solid
Date Collected: 01/28/15 13:38
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.626		0.146	0.155	1.00	0.0860	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.687		0.149	0.160	1.00	0.0493	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.654		0.146	0.156	1.00	0.0595	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.0		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample ID: IHBH20-1

Lab Sample ID: 160-10348-6
Matrix: Solid
Date Collected: 01/29/15 08:30
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.686		0.151	0.162	1.00	0.0786	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.588		0.138	0.146	1.00	0.0530	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.543		0.131	0.139	1.00	0.0382	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.8		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample ID: IHBH20-2

Lab Sample ID: 160-10348-7
Matrix: Solid
Date Collected: 01/29/15 08:32
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.805		0.164	0.177	1.00	0.0688	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.461		0.122	0.128	1.00	0.0242	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.619		0.142	0.151	1.00	0.0450	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.6		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH20-4

Lab Sample ID: 160-10348-8
Date Collected: 01/29/15 08:35
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.633		0.143	0.153	1.00	0.0846	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.664		0.142	0.152	1.00	0.0365	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.626		0.138	0.147	1.00	0.0441	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.0*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH21-1

Lab Sample ID: 160-10348-9
Date Collected: 01/29/15 08:42
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.527		0.131	0.138	1.00	0.0644	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.604		0.138	0.147	1.00	0.0381	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.530		0.129	0.137	1.00	0.0407	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.0*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH21-2

Lab Sample ID: 160-10348-10
Date Collected: 01/29/15 08:48
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.509		0.134	0.140	1.00	0.0822	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.657		0.147	0.157	1.00	0.0457	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.617		0.143	0.152	1.00	0.0542	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*87.3*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH21-4

Lab Sample ID: 160-10348-11
Date Collected: 01/29/15 08:52
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.589		0.136	0.145	1.00	0.0749	pCi/g	02/10/15 13:32	02/17/15 12:38	1
Thorium-230	0.552		0.129	0.137	1.00	0.0460	pCi/g	02/10/15 13:32	02/17/15 12:38	1
Thorium-232	0.363		0.105	0.109	1.00	0.0494	pCi/g	02/10/15 13:32	02/17/15 12:38	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH21-4

Lab Sample ID: 160-10348-11
Date Collected: 01/29/15 08:52
Matrix: Solid
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	96.0		30 - 110	02/10/15 13:32	02/17/15 12:38	1

Client Sample ID: IHBH22-3

Lab Sample ID: 160-10348-12
Date Collected: 01/29/15 09:07
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.590		0.141	0.149	1.00	0.0843	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.752		0.153	0.166	1.00	0.0235	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.627		0.140	0.150	1.00	0.0413	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.5		30 - 110	02/10/15 13:32	02/18/15 14:09	1

Client Sample ID: IHBH22-5

Lab Sample ID: 160-10348-13
Date Collected: 01/29/15 09:10
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.788		0.172	0.184	1.00	0.0865	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.690		0.158	0.168	1.00	0.0435	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.921		0.181	0.197	1.00	0.0268	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	80.0		30 - 110	02/10/15 13:32	02/18/15 14:09	1

Client Sample ID: IHBH23-2

Lab Sample ID: 160-10348-14
Date Collected: 01/29/15 09:35
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.620		0.146	0.155	1.00	0.0831	pCi/g	02/10/15 13:32	02/19/15 20:51	1
Thorium-230	0.642		0.144	0.154	1.00	0.0451	pCi/g	02/10/15 13:32	02/19/15 20:51	1
Thorium-232	0.814		0.162	0.176	1.00	0.0387	pCi/g	02/10/15 13:32	02/19/15 20:51	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.2		30 - 110	02/10/15 13:32	02/19/15 20:51	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH23-4

Lab Sample ID: 160-10348-15

Date Collected: 01/29/15 09:38
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.527		0.133	0.141	1.00	0.0812	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.539		0.131	0.138	1.00	0.0440	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.608		0.138	0.147	1.00	0.0379	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.1*		*30 - 110*	*02/10/15 13:32*	*02/18/15 14:09*	*1*

Client Sample ID: IHBH24-2

Lab Sample ID: 160-10348-16

Date Collected: 01/29/15 09:45
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.694		0.158	0.169	1.00	0.0785	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.665		0.152	0.162	1.00	0.0419	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.757		0.162	0.174	1.00	0.0366	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*83.8*		*30 - 110*	*02/10/15 13:32*	*02/18/15 14:09*	*1*

Client Sample ID: IHBH24-3

Lab Sample ID: 160-10348-17

Date Collected: 01/29/15 09:48
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.556		0.132	0.140	1.00	0.0727	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.540		0.127	0.135	1.00	0.0414	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.630		0.136	0.146	1.00	0.0435	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*101*		*30 - 110*	*02/10/15 13:32*	*02/18/15 14:09*	*1*

Client Sample ID: IHBH24-4

Lab Sample ID: 160-10348-18

Date Collected: 01/29/15 09:50
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.655		0.148	0.158	1.00	0.0803	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.615		0.141	0.150	1.00	0.0446	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.563		0.135	0.143	1.00	0.0530	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH24-4

Lab Sample ID: 160-10348-18

Date Collected: 01/29/15 09:50
Date Received: 02/03/15 13:50

Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.9		30 - 110	02/10/15 13:32	02/18/15 14:09	1

Client Sample ID: IHBH25-1

Lab Sample ID: 160-10348-19

Date Collected: 01/29/15 10:00
Date Received: 02/03/15 13:50

Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.761		0.164	0.176	1.00	0.0776	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.785		0.164	0.176	1.00	0.0256	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.654		0.149	0.159	1.00	0.0255	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.9		30 - 110	02/10/15 13:32	02/18/15 14:09	1

Client Sample ID: IHBH25-2

Lab Sample ID: 160-10348-20

Date Collected: 01/29/15 10:02
Date Received: 02/03/15 13:50

Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.694		0.163	0.173	1.00	0.0967	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.608		0.148	0.156	1.00	0.0406	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.682		0.157	0.167	1.00	0.0499	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.5		30 - 110	02/10/15 13:32	02/18/15 14:09	1

Client Sample ID: IHBH25-4

Lab Sample ID: 160-10348-21

Date Collected: 01/29/15 10:05
Date Received: 02/03/15 13:50

Matrix: Solid

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.602		0.141	0.150	1.00	0.0801	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.556		0.131	0.139	1.00	0.0232	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.682		0.145	0.156	1.00	0.0372	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.1		30 - 110	02/10/15 13:32	02/18/15 14:09	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH26-1

Lab Sample ID: 160-10348-22

Date Collected: 01/29/15 10:10
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.540		0.136	0.143	1.00	0.0741	pCi/g	02/10/15 13:32	02/19/15 20:51	1
Thorium-230	0.578		0.138	0.146	1.00	0.0395	pCi/g	02/10/15 13:32	02/19/15 20:51	1
Thorium-232	0.673		0.148	0.158	1.00	0.0345	pCi/g	02/10/15 13:32	02/19/15 20:51	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.1*		*30 - 110*	*02/10/15 13:32*	*02/19/15 20:51*	*1*

Client Sample ID: IHBH26-2

Lab Sample ID: 160-10348-23

Date Collected: 01/29/15 10:13
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.557		0.130	0.138	1.00	0.0642	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.672		0.142	0.153	1.00	0.0663	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.714		0.144	0.156	1.00	0.0406	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.5*		*30 - 110*	*02/10/15 13:32*	*02/18/15 14:09*	*1*

Client Sample ID: IHBH26-3

Lab Sample ID: 160-10348-24

Date Collected: 01/29/15 10:15
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.503		0.130	0.137	1.00	0.0760	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.598		0.138	0.147	1.00	0.0382	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.601		0.138	0.147	1.00	0.0440	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.2*		*30 - 110*	*02/10/15 13:32*	*02/18/15 14:09*	*1*

Client Sample ID: IHBH26-5

Lab Sample ID: 160-10348-25

Date Collected: 01/29/15 10:19
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.316		0.0978	0.101	1.00	0.0545	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-230	0.434		0.113	0.118	1.00	0.0352	pCi/g	02/10/15 13:32	02/18/15 14:09	1
Thorium-232	0.445		0.114	0.120	1.00	0.0405	pCi/g	02/10/15 13:32	02/18/15 14:09	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Client Sample ID: IHBH26-5
Date Collected: 01/29/15 10:19
Date Received: 02/03/15 13:50

Lab Sample ID: 160-10348-25
Matrix: Solid

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	103		30 - 110	02/10/15 13:32	02/18/15 14:09	1

QC Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-172717/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174868 — **Prep Batch: 172717**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.003719	U	0.0293	0.0293	1.00	0.0735	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.07739		0.0494	0.0499	1.00	0.0418	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.002700	U	0.0159	0.0159	1.00	0.0439	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*99.5*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Lab Sample ID: LCS 160-172717/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174869 — **Prep Batch: 172717**

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	23.15		2.28	1.00	0.0961	pCi/g	94	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*91.2*		*30 - 110*

Lab Sample ID: 160-10347-A-21-C DU — **Client Sample ID: Duplicate**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174871 — **Prep Batch: 172717**

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.698			0.6684		0.162	1.00	0.0875	pCi/g			0.09	1
Thorium-230	0.778			0.6307		0.153	1.00	0.0367	pCi/g			0.45	1
Thorium-232	0.692			0.7784		0.172	1.00	0.0452	pCi/g			0.26	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*91.4*		*30 - 110*

Lab Sample ID: MB 160-173066/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174608 — **Prep Batch: 173066**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.04455	U	0.0526	0.0527	1.00	0.0846	pCi/g	02/10/15 13:32	02/17/15 12:38	1
Thorium-230	0.1105		0.0583	0.0591	1.00	0.0365	pCi/g	02/10/15 13:32	02/17/15 12:38	1
Thorium-232	0.01039	U	0.0220	0.0220	1.00	0.0441	pCi/g	02/10/15 13:32	02/17/15 12:38	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.0*		*30 - 110*	*02/10/15 13:32*	*02/17/15 12:38*	*1*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-173066/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174609 — **Prep Batch: 173066**

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	25.61		2.50	1.00	0.0759	pCi/g	105	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*88.6*		*30 - 110*

Lab Sample ID: 160-10348-11 DU — **Client Sample ID: IHBH21-4**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174611 — **Prep Batch: 173066**

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.589			0.7284		0.163	1.00	0.0665	pCi/g			0.45	1
Thorium-230	0.552			0.5892		0.144	1.00	0.0620	pCi/g			0.13	1
Thorium-232	0.363			0.5492		0.137	1.00	0.0421	pCi/g			0.76	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*92.6*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Rad

Leach Batch: 172182

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10347-A-21-C DU	Duplicate	Total/NA	Solid	Dry and Grind	

Leach Batch: 172189

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10348-1	IHBH18-1	Total/NA	Solid	Dry and Grind	
160-10348-2	IHBH18-3	Total/NA	Solid	Dry and Grind	
160-10348-3	IHBH19-1	Total/NA	Solid	Dry and Grind	
160-10348-4	IHBH19-3	Total/NA	Solid	Dry and Grind	
160-10348-5	IHBH19-5	Total/NA	Solid	Dry and Grind	
160-10348-6	IHBH20-1	Total/NA	Solid	Dry and Grind	
160-10348-7	IHBH20-2	Total/NA	Solid	Dry and Grind	
160-10348-8	IHBH20-4	Total/NA	Solid	Dry and Grind	
160-10348-9	IHBH21-1	Total/NA	Solid	Dry and Grind	
160-10348-10	IHBH21-2	Total/NA	Solid	Dry and Grind	
160-10348-11	IHBH21-4	Total/NA	Solid	Dry and Grind	
160-10348-11 DU	IHBH21-4	Total/NA	Solid	Dry and Grind	
160-10348-12	IHBH22-3	Total/NA	Solid	Dry and Grind	
160-10348-13	IHBH22-5	Total/NA	Solid	Dry and Grind	
160-10348-14	IHBH23-2	Total/NA	Solid	Dry and Grind	
160-10348-15	IHBH23-4	Total/NA	Solid	Dry and Grind	
160-10348-16	IHBH24-2	Total/NA	Solid	Dry and Grind	
160-10348-17	IHBH24-3	Total/NA	Solid	Dry and Grind	
160-10348-18	IHBH24-4	Total/NA	Solid	Dry and Grind	
160-10348-19	IHBH25-1	Total/NA	Solid	Dry and Grind	
160-10348-20	IHBH25-2	Total/NA	Solid	Dry and Grind	
160-10348-21	IHBH25-4	Total/NA	Solid	Dry and Grind	
160-10348-22	IHBH26-1	Total/NA	Solid	Dry and Grind	
160-10348-23	IHBH26-2	Total/NA	Solid	Dry and Grind	
160-10348-24	IHBH26-3	Total/NA	Solid	Dry and Grind	
160-10348-25	IHBH26-5	Total/NA	Solid	Dry and Grind	

Prep Batch: 172717

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10347-A-21-C DU	Duplicate	Total/NA	Solid	ExtChrom	172182
160-10348-1	IHBH18-1	Total/NA	Solid	ExtChrom	172189
160-10348-2	IHBH18-3	Total/NA	Solid	ExtChrom	172189
160-10348-3	IHBH19-1	Total/NA	Solid	ExtChrom	172189
160-10348-4	IHBH19-3	Total/NA	Solid	ExtChrom	172189
160-10348-5	IHBH19-5	Total/NA	Solid	ExtChrom	172189
160-10348-6	IHBH20-1	Total/NA	Solid	ExtChrom	172189
160-10348-7	IHBH20-2	Total/NA	Solid	ExtChrom	172189
160-10348-8	IHBH20-4	Total/NA	Solid	ExtChrom	172189
160-10348-9	IHBH21-1	Total/NA	Solid	ExtChrom	172189
160-10348-10	IHBH21-2	Total/NA	Solid	ExtChrom	172189
LCS 160-172717/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-172717/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 173066

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10348-11	IHBH21-4	Total/NA	Solid	ExtChrom	172189
160-10348-11 DU	IHBH21-4	Total/NA	Solid	ExtChrom	172189

Rad (Continued)

Prep Batch: 173066 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10348-12	IHBH22-3	Total/NA	Solid	ExtChrom	172189
160-10348-13	IHBH22-5	Total/NA	Solid	ExtChrom	172189
160-10348-14	IHBH23-2	Total/NA	Solid	ExtChrom	172189
160-10348-15	IHBH23-4	Total/NA	Solid	ExtChrom	172189
160-10348-16	IHBH24-2	Total/NA	Solid	ExtChrom	172189
160-10348-17	IHBH24-3	Total/NA	Solid	ExtChrom	172189
160-10348-18	IHBH24-4	Total/NA	Solid	ExtChrom	172189
160-10348-19	IHBH25-1	Total/NA	Solid	ExtChrom	172189
160-10348-20	IHBH25-2	Total/NA	Solid	ExtChrom	172189
160-10348-21	IHBH25-4	Total/NA	Solid	ExtChrom	172189
160-10348-22	IHBH26-1	Total/NA	Solid	ExtChrom	172189
160-10348-23	IHBH26-2	Total/NA	Solid	ExtChrom	172189
160-10348-24	IHBH26-3	Total/NA	Solid	ExtChrom	172189
160-10348-25	IHBH26-5	Total/NA	Solid	ExtChrom	172189
LCS 160-173066/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-173066/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10348-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	**Client Sample ID**	**Th-229 (30-110)**						
160-10347-A-21-C DU	Duplicate	91.4						
160-10348-1	IHBH18-1	98.9						
160-10348-2	IHBH18-3	86.3						
160-10348-3	IHBH19-1	91.0						
160-10348-4	IHBH19-3	76.1						
160-10348-5	IHBH19-5	88.0						
160-10348-6	IHBH20-1	90.8						
160-10348-7	IHBH20-2	88.6						
160-10348-8	IHBH20-4	95.0						
160-10348-9	IHBH21-1	89.0						
160-10348-10	IHBH21-2	87.3						
160-10348-11	IHBH21-4	96.0						
160-10348-11 DU	IHBH21-4	92.6						
160-10348-12	IHBH22-3	87.5						
160-10348-13	IHBH22-5	80.0						
160-10348-14	IHBH23-2	90.2						
160-10348-15	IHBH23-4	93.1						
160-10348-16	IHBH24-2	83.8						
160-10348-17	IHBH24-3	101						
160-10348-18	IHBH24-4	88.9						
160-10348-19	IHBH25-1	83.9						
160-10348-20	IHBH25-2	83.5						
160-10348-21	IHBH25-4	92.1						
160-10348-22	IHBH26-1	89.1						
160-10348-23	IHBH26-2	96.5						
160-10348-24	IHBH26-3	90.2						
160-10348-25	IHBH26-5	103						
LCS 160-172717/2-A	Lab Control Sample	91.2						
LCS 160-173066/2-A	Lab Control Sample	88.6						
MB 160-172717/1-A	Method Blank	99.5						
MB 160-173066/1-A	Method Blank	95.0						

Tracer/Carrier Legend

Th-229 = Thorium-229

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
Tel: (314)298-8566

TestAmerica Job ID: 160-10347-1
Client Project/Site: Indian Head

For:
Aleut World Solutions
4300 B Street
Suite 402
Anchorage, Alaska 99503

Attn: Daniel Spicuzza

Authorized for release by:
2/26/2015 3:25:00 PM

Erika Gish, Project Manager II
(314)298-8566
erika.gish@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at: www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-10347-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Indian Head

Report Number: 160-10347-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-10347-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 2/3/2015 1:50 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 17.0º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHBH9-3 (160-10347-1), IHBH9-4 (160-10347-2), IHBH10-1 (160-10347-3), IHBH10-3 (160-10347-4), IHBH10-4 (160-10347-5), IHBH10-6 (160-10347-6), IHBH11-1 (160-10347-7), IHBH11-2 (160-10347-8), IHBH11-4 (160-10347-9), IHBH11-5 (160-10347-10), IHBH12-1 (160-10347-11), IHBH12-2 (160-10347-12), IHBH12-3 (160-10347-13), IHBH12-4 (160-10347-14), IHBH13-1 (160-10347-15), IHBH13-2 (160-10347-16), IHBH13-3 (160-10347-17), IHBH13-5 (160-10347-18), IHBH14-1 (160-10347-19), IHBH14-2 (160-10347-20), IHBH14-4 (160-10347-21), IHBH15-1 (160-10347-22), IHBH15-2 (160-10347-23), IHBH15-3 (160-10347-24), IHBH15-4 (160-10347-25), IHBH16-1 (160-10347-26), IHBH16-2 (160-10347-27), IHBH16-3 (160-10347-28), IHBH16-5 (160-10347-29) and IHBH17-2 (160-10347-30) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 02/04/2015, prepared on 02/06/2015 and analyzed on 02/13/2015, 02/14/2015, 02/17/2015, 02/19/2015 and 02/23/2015.

The following sample(s) could not be thoroughly homogenized before sub-sampling was performed due to sample matrix: (160-10347-1 DU), IHBH10-1 (160-10347-3), IHBH10-3 (160-10347-4), IHBH10-4 (160-10347-5), IHBH10-6 (160-10347-6), IHBH11-1 (160-10347-7), IHBH11-2 (160-10347-8), IHBH11-4 (160-10347-9), IHBH11-5 (160-10347-10), IHBH12-1 (160-10347-11), IHBH12-2 (160-10347-12), IHBH12-3 (160-10347-13), IHBH12-4 (160-10347-14), IHBH13-1 (160-10347-15), IHBH13-2 (160-10347-16), IHBH13-3 (160-10347-17), IHBH13-5 (160-10347-18), IHBH14-1 (160-10347-19), IHBH14-2 (160-10347-20), IHBH9-3 (160-10347-1), IHBH9-4 (160-10347-2), (160-10347-21 DU), IHBH14-4 (160-10347-21), IHBH15-1 (160-10347-22), IHBH15-2 (160-10347-23), IHBH15-3 (160-10347-24), IHBH15-4 (160-10347-25), IHBH16-1 (160-10347-26), IHBH16-2 (160-10347-27), IHBH16-3 (160-10347-28), IHBH16-5 (160-10347-29), IHBH17-2 (160-10347-30). The samples contain rocks.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

160-10347 Chain of Custody

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date: 1/27/2015	COC No: IH-2015-4
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	____ of ____ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH9-3	1/27/2015	1300	G	S	1	N	N	X	
IHBH9-4	1/27/2015	1305	G	S	1	N	N	X	
IHBH10-1	1/28/2015	0835	G	S	1	N	N	X	
IHBH10-3	1/28/2015	0840	G	S	1	N	N	X	
IHBH10-4	1/28/2015	0842	G	S	1	N	N	X	
IHBH10-6	1/28/2015	0846	G	S	1	N	N	X	
IHBH11-1	1/28/2015	0852	G	S	1	N	N	X	
IHBH11-2	1/28/2015	0855	G	S	1	N	N	X	
IHBH11-4	1/28/2015	0858	G	S	1	N	N	X	
IHBH11-5	1/28/2015	0902	G	S	1	N	N	X	
IHBH12-1	1/28/2015	0930	G	S	1	N	N	X	
IHBH12-2	1/28/2015	0932	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ Therm ID No.: _____

Relinquished by:	Company: AWS	Date/Time: 1/30/15 1350	Received by:	Company: TA STL	Date/Time: 2-3-15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:1/28/2015	COC No: IH-2015-5
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	____ of ____ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH12-3	1/28/2015	0935	G	S	1	N	N	X	
IHBH12-4	1/28/2015	0940	G	S	1	N	N	X	
IHBH13-1	1/28/2015	0947	G	S	1	N	N	X	
IHBH13-2	1/28/2015	0950	G	S	1	N	N	X	
IHBH13-3	1/28/2015	0952	G	S	1	N	N	X	
IHBH13-5	1/28/2015	0957	G	S	1	N	N	X	
IHBH14-1	1/28/2015	1007	G	S	1	N	N	X	
IHBH14-2	1/28/2015	1010	G	S	1	N	N	X	
IHBH14-4	1/28/2015	1013	G	S	1	N	N	X	
IHBH15-1	1/28/2015	1022	G	S	1	N	N	X	
IHBH15-2	1/28/2015	1025	G	S	1	N	N	X	
IHBH15-3	1/28/2015	1028	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other ____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:____ Corr'd:____ Therm ID No.:____

Relinquished by:	Company: AWS	Date/Time: 1/28/15 1080	Received by: Jeff Clarke	Company: TA STL	Date/Time: 2-3-15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:1/28/2015	COC No: IH-2015-6
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	____ of ____ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH15-4	1/28/2015	1120	G	S	1	N	N	X	
IHBH16-1	1/28/2015	1230	G	S	1	N	N	X	
IHBH16-2	1/28/2015	1235	G	S	1	N	N	X	
IHBH16-3	1/28/2015	1237	G	S	1	N	N	X	
IHBH16-5	1/28/2015	1239	G	S	1	N	N	X	
IHBH17-2	1/28/2015	1246	G	S	1	N	N	X	

N/A

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 1/28/15 1630	Received by: Jill Clarke	Company: TA STL	Date/Time: 2-3-15 1530
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-10347-1

Login Number: 10347

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10347-1	IHBH9-3	Solid	01/27/15 13:00	02/03/15 13:50
160-10347-2	IHBH9-4	Solid	01/27/15 13:05	02/03/15 13:50
160-10347-3	IHBH10-1	Solid	01/28/15 08:35	02/03/15 13:50
160-10347-4	IHBH10-3	Solid	01/28/15 08:40	02/03/15 13:50
160-10347-5	IHBH10-4	Solid	01/28/15 08:42	02/03/15 13:50
160-10347-6	IHBH10-6	Solid	01/28/15 08:46	02/03/15 13:50
160-10347-7	IHBH11-1	Solid	01/28/15 08:52	02/03/15 13:50
160-10347-8	IHBH11-2	Solid	01/28/15 08:55	02/03/15 13:50
160-10347-9	IHBH11-4	Solid	01/28/15 08:58	02/03/15 13:50
160-10347-10	IHBH11-5	Solid	01/28/15 09:02	02/03/15 13:50
160-10347-11	IHBH12-1	Solid	01/28/15 09:30	02/03/15 13:50
160-10347-12	IHBH12-2	Solid	01/28/15 09:32	02/03/15 13:50
160-10347-13	IHBH12-3	Solid	01/28/15 09:35	02/03/15 13:50
160-10347-14	IHBH12-4	Solid	01/28/15 09:40	02/03/15 13:50
160-10347-15	IHBH13-1	Solid	01/28/15 09:47	02/03/15 13:50
160-10347-16	IHBH13-2	Solid	01/28/15 09:50	02/03/15 13:50
160-10347-17	IHBH13-3	Solid	01/28/15 09:52	02/03/15 13:50
160-10347-18	IHBH13-5	Solid	01/28/15 09:57	02/03/15 13:50
160-10347-19	IHBH14-1	Solid	01/28/15 10:07	02/03/15 13:50
160-10347-20	IHBH14-2	Solid	01/28/15 10:10	02/03/15 13:50
160-10347-21	IHBH14-4	Solid	01/28/15 10:13	02/03/15 13:50
160-10347-22	IHBH15-1	Solid	01/28/15 10:22	02/03/15 13:50
160-10347-23	IHBH15-2	Solid	01/28/15 10:25	02/03/15 13:50
160-10347-24	IHBH15-3	Solid	01/28/15 10:28	02/03/15 13:50
160-10347-25	IHBH15-4	Solid	01/28/15 11:20	02/03/15 13:50
160-10347-26	IHBH16-1	Solid	01/28/15 12:30	02/03/15 13:50
160-10347-27	IHBH16-2	Solid	01/28/15 12:35	02/03/15 13:50
160-10347-28	IHBH16-3	Solid	01/28/15 12:37	02/03/15 13:50
160-10347-29	IHBH16-5	Solid	01/28/15 12:39	02/03/15 13:50
160-10347-30	IHBH17-2	Solid	01/28/15 12:46	02/03/15 13:50

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH9-3

Lab Sample ID: 160-10347-1

Date Collected: 01/27/15 13:00
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.463		0.121	0.128	1.00	0.0552	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-230	0.573		0.135	0.143	1.00	0.0529	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-232	0.338		0.102	0.106	1.00	0.0374	pCi/g	02/06/15 10:44	02/13/15 14:02	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.9*		*30 - 110*	*02/06/15 10:44*	*02/13/15 14:02*	*1*

Client Sample ID: IHBH9-4

Lab Sample ID: 160-10347-2

Date Collected: 01/27/15 13:05
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.443		0.0622	0.0725	1.00	0.0366	pCi/g	02/06/15 10:44	02/17/15 12:32	1
Thorium-230	0.503		0.0635	0.0763	1.00	0.0152	pCi/g	02/06/15 10:44	02/17/15 12:32	1
Thorium-232	0.381		0.0549	0.0635	1.00	0.00593	pCi/g	02/06/15 10:44	02/17/15 12:32	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.7*		*30 - 110*	*02/06/15 10:44*	*02/17/15 12:32*	*1*

Client Sample ID: IHBH10-1

Lab Sample ID: 160-10347-3

Date Collected: 01/28/15 08:35
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.454		0.119	0.125	1.00	0.0636	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-230	0.551		0.128	0.136	1.00	0.0224	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-232	0.576		0.131	0.140	1.00	0.0417	pCi/g	02/06/15 10:44	02/13/15 14:02	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*95.4*		*30 - 110*	*02/06/15 10:44*	*02/13/15 14:02*	*1*

Client Sample ID: IHBH10-3

Lab Sample ID: 160-10347-4

Date Collected: 01/28/15 08:40
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.369		0.113	0.117	1.00	0.0863	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-230	0.431		0.116	0.121	1.00	0.0372	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-232	0.355		0.105	0.109	1.00	0.0451	pCi/g	02/06/15 10:44	02/13/15 14:02	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH10-3

Lab Sample ID: 160-10347-4
Matrix: Solid
Date Collected: 01/28/15 08:40
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.0		30 - 110	02/06/15 10:44	02/13/15 14:02	1

Client Sample ID: IHBH10-4

Lab Sample ID: 160-10347-5
Matrix: Solid
Date Collected: 01/28/15 08:42
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.305		0.0994	0.103	1.00	0.0623	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-230	0.494		0.123	0.130	1.00	0.0369	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-232	0.407		0.112	0.117	1.00	0.0395	pCi/g	02/06/15 10:44	02/13/15 14:02	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.6		30 - 110	02/06/15 10:44	02/13/15 14:02	1

Client Sample ID: IHBH10-6

Lab Sample ID: 160-10347-6
Matrix: Solid
Date Collected: 01/28/15 08:46
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.326		0.107	0.111	1.00	0.0797	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-230	0.478		0.124	0.130	1.00	0.0443	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-232	0.343		0.105	0.109	1.00	0.0525	pCi/g	02/06/15 10:44	02/13/15 14:02	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.9		30 - 110	02/06/15 10:44	02/13/15 14:02	1

Client Sample ID: IHBH11-1

Lab Sample ID: 160-10347-7
Matrix: Solid
Date Collected: 01/28/15 08:52
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.521		0.132	0.139	1.00	0.0702	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-230	0.647		0.145	0.155	1.00	0.0627	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-232	0.602		0.139	0.148	1.00	0.0444	pCi/g	02/06/15 10:44	02/13/15 14:02	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.9		30 - 110	02/06/15 10:44	02/13/15 14:02	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH11-2

Lab Sample ID: 160-10347-8
Date Collected: 01/28/15 08:55
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.565		0.138	0.146	1.00	0.0867	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.464		0.121	0.127	1.00	0.0516	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.692		0.146	0.157	1.00	0.0231	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.6*		*30 - 110*	*02/06/15 10:44*	*02/14/15 15:41*	*1*

Client Sample ID: IHBH11-4

Lab Sample ID: 160-10347-9
Date Collected: 01/28/15 08:58
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.487		0.133	0.139	1.00	0.0878	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.482		0.126	0.133	1.00	0.0249	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.562		0.136	0.144	1.00	0.0248	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*85.0*		*30 - 110*	*02/06/15 10:44*	*02/14/15 15:41*	*1*

Client Sample ID: IHBH11-5

Lab Sample ID: 160-10347-10
Date Collected: 01/28/15 09:02
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.598		0.144	0.152	1.00	0.0804	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.491		0.127	0.134	1.00	0.0504	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.324		0.102	0.106	1.00	0.0243	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.0*		*30 - 110*	*02/06/15 10:44*	*02/14/15 15:41*	*1*

Client Sample ID: IHBH12-1

Lab Sample ID: 160-10347-11
Date Collected: 01/28/15 09:30
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.322		0.0599	0.0657	1.00	0.0464	pCi/g	02/06/15 10:44	02/17/15 12:32	1
Thorium-230	0.545		0.0719	0.0852	1.00	0.0180	pCi/g	02/06/15 10:44	02/17/15 12:32	1
Thorium-232	0.325		0.0559	0.0622	1.00	0.0224	pCi/g	02/06/15 10:44	02/17/15 12:32	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH12-1

Lab Sample ID: 160-10347-11
Matrix: Solid
Date Collected: 01/28/15 09:30
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	75.9		30 - 110	02/06/15 10:44	02/17/15 12:32	1

Client Sample ID: IHBH12-2

Lab Sample ID: 160-10347-12
Matrix: Solid
Date Collected: 01/28/15 09:32
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.324		0.107	0.111	1.00	0.0819	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.472		0.124	0.130	1.00	0.0595	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.431		0.118	0.123	1.00	0.0506	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.1		30 - 110	02/06/15 10:44	02/14/15 15:41	1

Client Sample ID: IHBH12-3

Lab Sample ID: 160-10347-13
Matrix: Solid
Date Collected: 01/28/15 09:35
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.538		0.137	0.144	1.00	0.0788	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.623		0.143	0.152	1.00	0.0396	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.578		0.137	0.146	1.00	0.0244	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.6		30 - 110	02/06/15 10:44	02/14/15 15:41	1

Client Sample ID: IHBH12-4

Lab Sample ID: 160-10347-14
Matrix: Solid
Date Collected: 01/28/15 09:40
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.460		0.122	0.128	1.00	0.0557	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.602		0.139	0.148	1.00	0.0534	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.512		0.127	0.134	1.00	0.0377	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.4		30 - 110	02/06/15 10:44	02/14/15 15:41	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH13-1

Lab Sample ID: 160-10347-15

Date Collected: 01/28/15 09:47
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.698		0.151	0.162	1.00	0.0831	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.578		0.135	0.143	1.00	0.0515	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.510		0.127	0.134	1.00	0.0576	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.3*		*30 - 110*	*02/06/15 10:44*	*02/14/15 15:41*	*1*

Client Sample ID: IHBH13-2

Lab Sample ID: 160-10347-16

Date Collected: 01/28/15 09:50
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.720		0.161	0.172	1.00	0.0844	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.691		0.155	0.165	1.00	0.0570	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.541		0.136	0.143	1.00	0.0411	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.1*		*30 - 110*	*02/06/15 10:44*	*02/14/15 15:41*	*1*

Client Sample ID: IHBH13-3

Lab Sample ID: 160-10347-17

Date Collected: 01/28/15 09:52
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.686		0.149	0.160	1.00	0.0666	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.736		0.152	0.164	1.00	0.0235	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.650		0.143	0.153	1.00	0.0436	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.4*		*30 - 110*	*02/06/15 10:44*	*02/14/15 15:41*	*1*

Client Sample ID: IHBH13-5

Lab Sample ID: 160-10347-18

Date Collected: 01/28/15 09:57
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.630		0.151	0.160	1.00	0.0943	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.544		0.136	0.143	1.00	0.0407	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.664		0.150	0.160	1.00	0.0492	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH13-5

Lab Sample ID: 160-10347-18
Date Collected: 01/28/15 09:57
Matrix: Solid
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	85.0		30 - 110	02/06/15 10:44	02/14/15 15:41	1

Client Sample ID: IHBH14-1

Lab Sample ID: 160-10347-19
Date Collected: 01/28/15 10:07
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.565		0.134	0.143	1.00	0.0633	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.594		0.136	0.145	1.00	0.0375	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.614		0.138	0.147	1.00	0.0400	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.8		30 - 110	02/06/15 10:44	02/14/15 15:41	1

Client Sample ID: IHBH14-2

Lab Sample ID: 160-10347-20
Date Collected: 01/28/15 10:10
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.661		0.152	0.162	1.00	0.0830	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-230	0.729		0.155	0.167	1.00	0.0461	pCi/g	02/06/15 10:44	02/14/15 15:41	1
Thorium-232	0.762		0.159	0.171	1.00	0.0547	pCi/g	02/06/15 10:44	02/14/15 15:41	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	86.3		30 - 110	02/06/15 10:44	02/14/15 15:41	1

Client Sample ID: IHBH14-4

Lab Sample ID: 160-10347-21
Date Collected: 01/28/15 10:13
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.698		0.155	0.166	1.00	0.0753	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.778		0.161	0.173	1.00	0.0248	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.692		0.151	0.162	1.00	0.0247	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	86.5		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH15-1

Lab Sample ID: 160-10347-22

Date Collected: 01/28/15 10:22
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.689		0.150	0.161	1.00	0.0803	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.596		0.136	0.145	1.00	0.0232	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.607		0.137	0.146	1.00	0.0373	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*92.5*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH15-2

Lab Sample ID: 160-10347-23

Date Collected: 01/28/15 10:25
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.834		0.159	0.173	1.00	0.0719	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.717		0.145	0.157	1.00	0.0408	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.675		0.140	0.151	1.00	0.0351	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.5*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH15-3

Lab Sample ID: 160-10347-24

Date Collected: 01/28/15 10:28
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.692		0.150	0.160	1.00	0.0594	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.695		0.149	0.160	1.00	0.0383	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.610		0.139	0.148	1.00	0.0441	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.0*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH15-4

Lab Sample ID: 160-10347-25

Date Collected: 01/28/15 11:20
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.714		0.152	0.164	1.00	0.0674	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.539		0.131	0.139	1.00	0.0441	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.543		0.131	0.139	1.00	0.0485	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH15-4

Lab Sample ID: 160-10347-25

Date Collected: 01/28/15 11:20
Matrix: Solid
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.4		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample ID: IHBH16-1

Lab Sample ID: 160-10347-26

Date Collected: 01/28/15 12:30
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.588		0.139	0.148	1.00	0.0698	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.782		0.157	0.170	1.00	0.0237	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.471		0.122	0.128	1.00	0.0334	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.8		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample ID: IHBH16-2

Lab Sample ID: 160-10347-27

Date Collected: 01/28/15 12:35
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.742		0.161	0.172	1.00	0.0785	pCi/g	02/06/15 14:40	02/23/15 16:22	1
Thorium-230	0.674		0.150	0.161	1.00	0.0404	pCi/g	02/06/15 14:40	02/23/15 16:22	1
Thorium-232	0.657		0.148	0.158	1.00	0.0402	pCi/g	02/06/15 14:40	02/23/15 16:22	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.9		30 - 110	02/06/15 14:40	02/23/15 16:22	1

Client Sample ID: IHBH16-3

Lab Sample ID: 160-10347-28

Date Collected: 01/28/15 12:37
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.745		0.160	0.172	1.00	0.0900	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.698		0.151	0.162	1.00	0.0536	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.606		0.139	0.148	1.00	0.0239	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	88.2		30 - 110	02/06/15 14:40	02/19/15 20:50	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Client Sample ID: IHBH16-5

Lab Sample ID: 160-10347-29

Date Collected: 01/28/15 12:39
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.449		0.131	0.136	1.00	0.0919	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.503		0.132	0.139	1.00	0.0261	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.363		0.112	0.116	1.00	0.0259	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*81.0*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Client Sample ID: IHBH17-2

Lab Sample ID: 160-10347-30

Date Collected: 01/28/15 12:46
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.646		0.146	0.156	1.00	0.0773	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.560		0.133	0.141	1.00	0.0484	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.616		0.139	0.148	1.00	0.0234	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.3*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-172569/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 173966 — **Prep Batch: 172569**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.007520	U	0.0307	0.0307	1.00	0.0794	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-230	0.1199		0.0643	0.0651	1.00	0.0577	pCi/g	02/06/15 10:44	02/13/15 14:02	1
Thorium-232	0.001036	U	0.0169	0.0169	1.00	0.0491	pCi/g	02/06/15 10:44	02/13/15 14:02	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.0*		*30 - 110*	*02/06/15 10:44*	*02/13/15 14:02*	*1*

Lab Sample ID: LCS 160-172569/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 173967 — **Prep Batch: 172569**

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	23.19		2.29	1.00	0.0757	pCi/g	95	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*93.7*		*30 - 110*

Lab Sample ID: 160-10347-1 DU — **Client Sample ID: IHBH9-3**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 173969 — **Prep Batch: 172569**

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.463			0.4906		0.144	1.00	0.0954	pCi/g			0.10	1
Thorium-230	0.573			0.5240		0.144	1.00	0.0547	pCi/g			0.17	1
Thorium-232	0.338			0.4657		0.136	1.00	0.0660	pCi/g			0.53	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*79.4*		*30 - 110*

Lab Sample ID: MB 160-172717/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174868 — **Prep Batch: 172717**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.003719	U	0.0293	0.0293	1.00	0.0735	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-230	0.07739		0.0494	0.0499	1.00	0.0418	pCi/g	02/06/15 14:40	02/19/15 20:50	1
Thorium-232	0.002700	U	0.0159	0.0159	1.00	0.0439	pCi/g	02/06/15 14:40	02/19/15 20:50	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*99.5*		*30 - 110*	*02/06/15 14:40*	*02/19/15 20:50*	*1*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: LCS 160-172717/2-A
Matrix: Solid
Analysis Batch: 174869

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 172717

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	23.15		2.28	1.00	0.0961	pCi/g	94	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*91.2*		*30 - 110*

Lab Sample ID: 160-10347-21 DU
Matrix: Solid
Analysis Batch: 174871

Client Sample ID: IHBH14-4
Prep Type: Total/NA
Prep Batch: 172717

Analyte	Sample Result	Sample Qual		DU Result	DU Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit			RER	RER Limit
Thorium-228	0.698			0.6684		0.162	1.00	0.0875	pCi/g			0.09	1
Thorium-230	0.778			0.6307		0.153	1.00	0.0367	pCi/g			0.45	1
Thorium-232	0.692			0.7784		0.172	1.00	0.0452	pCi/g			0.26	1

Tracer	*DU %Yield*	*DU Qualifier*	*Limits*
Thorium-229	*91.4*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Rad

Leach Batch: 172182

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10347-1	IHBH9-3	Total/NA	Solid	Dry and Grind	
160-10347-1 DU	IHBH9-3	Total/NA	Solid	Dry and Grind	
160-10347-2	IHBH9-4	Total/NA	Solid	Dry and Grind	
160-10347-3	IHBH10-1	Total/NA	Solid	Dry and Grind	
160-10347-4	IHBH10-3	Total/NA	Solid	Dry and Grind	
160-10347-5	IHBH10-4	Total/NA	Solid	Dry and Grind	
160-10347-6	IHBH10-6	Total/NA	Solid	Dry and Grind	
160-10347-7	IHBH11-1	Total/NA	Solid	Dry and Grind	
160-10347-8	IHBH11-2	Total/NA	Solid	Dry and Grind	
160-10347-9	IHBH11-4	Total/NA	Solid	Dry and Grind	
160-10347-10	IHBH11-5	Total/NA	Solid	Dry and Grind	
160-10347-11	IHBH12-1	Total/NA	Solid	Dry and Grind	
160-10347-12	IHBH12-2	Total/NA	Solid	Dry and Grind	
160-10347-13	IHBH12-3	Total/NA	Solid	Dry and Grind	
160-10347-14	IHBH12-4	Total/NA	Solid	Dry and Grind	
160-10347-15	IHBH13-1	Total/NA	Solid	Dry and Grind	
160-10347-16	IHBH13-2	Total/NA	Solid	Dry and Grind	
160-10347-17	IHBH13-3	Total/NA	Solid	Dry and Grind	
160-10347-18	IHBH13-5	Total/NA	Solid	Dry and Grind	
160-10347-19	IHBH14-1	Total/NA	Solid	Dry and Grind	
160-10347-20	IHBH14-2	Total/NA	Solid	Dry and Grind	
160-10347-21	IHBH14-4	Total/NA	Solid	Dry and Grind	
160-10347-21 DU	IHBH14-4	Total/NA	Solid	Dry and Grind	
160-10347-22	IHBH15-1	Total/NA	Solid	Dry and Grind	
160-10347-23	IHBH15-2	Total/NA	Solid	Dry and Grind	
160-10347-24	IHBH15-3	Total/NA	Solid	Dry and Grind	
160-10347-25	IHBH15-4	Total/NA	Solid	Dry and Grind	
160-10347-26	IHBH16-1	Total/NA	Solid	Dry and Grind	
160-10347-27	IHBH16-2	Total/NA	Solid	Dry and Grind	
160-10347-28	IHBH16-3	Total/NA	Solid	Dry and Grind	
160-10347-29	IHBH16-5	Total/NA	Solid	Dry and Grind	
160-10347-30	IHBH17-2	Total/NA	Solid	Dry and Grind	

Prep Batch: 172569

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10347-1	IHBH9-3	Total/NA	Solid	ExtChrom	172182
160-10347-1 DU	IHBH9-3	Total/NA	Solid	ExtChrom	172182
160-10347-2	IHBH9-4	Total/NA	Solid	ExtChrom	172182
160-10347-3	IHBH10-1	Total/NA	Solid	ExtChrom	172182
160-10347-4	IHBH10-3	Total/NA	Solid	ExtChrom	172182
160-10347-5	IHBH10-4	Total/NA	Solid	ExtChrom	172182
160-10347-6	IHBH10-6	Total/NA	Solid	ExtChrom	172182
160-10347-7	IHBH11-1	Total/NA	Solid	ExtChrom	172182
160-10347-8	IHBH11-2	Total/NA	Solid	ExtChrom	172182
160-10347-9	IHBH11-4	Total/NA	Solid	ExtChrom	172182
160-10347-10	IHBH11-5	Total/NA	Solid	ExtChrom	172182
160-10347-11	IHBH12-1	Total/NA	Solid	ExtChrom	172182
160-10347-12	IHBH12-2	Total/NA	Solid	ExtChrom	172182
160-10347-13	IHBH12-3	Total/NA	Solid	ExtChrom	172182
160-10347-14	IHBH12-4	Total/NA	Solid	ExtChrom	172182
160-10347-15	IHBH13-1	Total/NA	Solid	ExtChrom	172182

Rad (Continued)

Prep Batch: 172569 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10347-16	IHBH13-2	Total/NA	Solid	ExtChrom	172182
160-10347-17	IHBH13-3	Total/NA	Solid	ExtChrom	172182
160-10347-18	IHBH13-5	Total/NA	Solid	ExtChrom	172182
160-10347-19	IHBH14-1	Total/NA	Solid	ExtChrom	172182
160-10347-20	IHBH14-2	Total/NA	Solid	ExtChrom	172182
LCS 160-172569/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-172569/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 172717

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10347-21	IHBH14-4	Total/NA	Solid	ExtChrom	172182
160-10347-21 DU	IHBH14-4	Total/NA	Solid	ExtChrom	172182
160-10347-22	IHBH15-1	Total/NA	Solid	ExtChrom	172182
160-10347-23	IHBH15-2	Total/NA	Solid	ExtChrom	172182
160-10347-24	IHBH15-3	Total/NA	Solid	ExtChrom	172182
160-10347-25	IHBH15-4	Total/NA	Solid	ExtChrom	172182
160-10347-26	IHBH16-1	Total/NA	Solid	ExtChrom	172182
160-10347-27	IHBH16-2	Total/NA	Solid	ExtChrom	172182
160-10347-28	IHBH16-3	Total/NA	Solid	ExtChrom	172182
160-10347-29	IHBH16-5	Total/NA	Solid	ExtChrom	172182
160-10347-30	IHBH17-2	Total/NA	Solid	ExtChrom	172182
LCS 160-172717/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-172717/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10347-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
		Th-229						
Lab Sample ID	Client Sample ID	(30-110)						
160-10347-1	IHBH9-3	90.9						
160-10347-1 DU	IHBH9-3	79.4						
160-10347-2	IHBH9-4	89.7						
160-10347-3	IHBH10-1	95.4						
160-10347-4	IHBH10-3	93.0						
160-10347-5	IHBH10-4	92.6						
160-10347-6	IHBH10-6	90.9						
160-10347-7	IHBH11-1	88.9						
160-10347-8	IHBH11-2	92.6						
160-10347-9	IHBH11-4	85.0						
160-10347-10	IHBH11-5	90.0						
160-10347-11	IHBH12-1	75.9						
160-10347-12	IHBH12-2	93.1						
160-10347-13	IHBH12-3	90.6						
160-10347-14	IHBH12-4	91.4						
160-10347-15	IHBH13-1	91.3						
160-10347-16	IHBH13-2	86.1						
160-10347-17	IHBH13-3	92.4						
160-10347-18	IHBH13-5	85.0						
160-10347-19	IHBH14-1	89.8						
160-10347-20	IHBH14-2	86.3						
160-10347-21	IHBH14-4	86.5						
160-10347-21 DU	IHBH14-4	91.4						
160-10347-22	IHBH15-1	92.5						
160-10347-23	IHBH15-2	96.5						
160-10347-24	IHBH15-3	94.0						
160-10347-25	IHBH15-4	91.4						
160-10347-26	IHBH16-1	89.8						
160-10347-27	IHBH16-2	87.9						
160-10347-28	IHBH16-3	88.2						
160-10347-29	IHBH16-5	81.0						
160-10347-30	IHBH17-2	93.3						
LCS 160-172569/2-A	Lab Control Sample	93.7						
LCS 160-172717/2-A	Lab Control Sample	91.2						
MB 160-172569/1-A	Method Blank	96.0						
MB 160-172717/1-A	Method Blank	99.5						

Tracer/Carrier Legend

Th-229 = Thorium-229

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

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TestAmerica Job ID: 160-10346-1
Client Project/Site: Indian Head

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Attn: Daniel Spicuzza

Authorized for release by:
2/26/2015 3:26:10 PM

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This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Job ID: 160-10346-1

Laboratory: TestAmerica St. Louis

Narrative

CASE NARRATIVE

Client: Aleut World Solutions

Project: Indian Head

Report Number: 160-10346-1

With the exceptions noted as flags or footnotes, standard analytical protocols were followed in the analysis of the samples and no problems were encountered or anomalies observed. In addition all laboratory quality control samples were within established control limits, with any exceptions noted below. Each sample was analyzed to achieve the lowest possible reporting limit within the constraints of the method. In some cases, due to interference or analytes present at high concentrations, samples were diluted. For diluted samples, the reporting limits are adjusted relative to the dilution required.

TestAmerica St. Louis attests to the validity of the laboratory data generated by TestAmerica facilities reported herein. All analyses performed by TestAmerica facilities were done using established laboratory SOPs that incorporate QA/QC procedures described in the application methods. TestAmerica's operations groups have reviewed the data for compliance with the laboratory QA/QC plan, and data have been found to be compliant with laboratory protocols unless otherwise noted below.

The test results in this report meet all NELAP requirements for parameters for which accreditation is required or available. Any exceptions to NELAP requirements are noted in this report. Pursuant to NELAP, this report may not be reproduced, except in full, without the written approval of the laboratory.

Calculations are performed before rounding to avoid round-off errors in calculated results.

All holding times were met and proper preservation noted for the methods performed on these samples, unless otherwise detailed in the individual sections below.

All solid sample results for Chemistry analyses are reported on an "as received" basis unless otherwise indicated by the presence of a % solids value in the method header. All soil/sediment sample results for radiochemistry analyses are based upon sample as dried and disaggregated with the exception of tritium, carbon-14, and iodine-129 by gamma spectroscopy unless requested as wet weight by the client."

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt
Manual Integrations were performed only when necessary and are in compliance with the laboratory's standard operating procedure. Detailed information can be found in the raw data section of the level IV report.

The following clean-up methods for Organic analyses may have been used on the samples in this data set. Specific methods employed are documented on the batch extraction logs:

Method 3600C: Cleanup
Method 3620C: Florisil Cleanup
Method 3630C: Silica Gel Cleanup
Method 3640A: Gel-Permeation Cleanup
Method 3650B: Acid-Base Partition Cleanup
Method 3660B: Sulfur Cleanup
Method 3665A: Sulfuric Acid/Permanganate Cleanup

This laboratory report is confidential and is intended for the sole use of TestAmerica and its client.

Job ID: 160-10346-1 (Continued)

Laboratory: TestAmerica St. Louis (Continued)

RECEIPT

The samples were received on 2/3/2015 1:50 PM; the samples arrived in good condition, properly preserved. The temperature of the cooler at receipt was 17.0º C.

ISOTOPIC THORIUM (ALPHA SPECTROMETRY)

Samples IHBH1-2 (160-10346-1), IHBH1-3 (160-10346-2), IHBH1-4 (160-10346-3), IHBH1-5 (160-10346-4), IHBH1-6 (160-10346-5), IHBH2-1 (160-10346-6), IHBH2-2 (160-10346-7), IHBH2-3 (160-10346-8), IHBH2-4 (160-10346-9), IHBH2-5 (160-10346-10), IHBH2-6 (160-10346-11), IHBH3-2 (160-10346-12), IHBH3-3 (160-10346-13), IHBH3-5 (160-10346-14), IHBH4-1 (160-10346-15), IHBH4-3 (160-10346-16), IHBH4-5 (160-10346-17), IHBH5-2 (160-10346-18), IHBH5-4 (160-10346-19), IHBH5-6 (160-10346-20), IHBH6-1 (160-10346-21), IHBH6-3 (160-10346-22), IHBH6-6 (160-10346-23), IHBH7-1 (160-10346-24), IHBH7-2 (160-10346-25), IHBH7-4 (160-10346-26), IHBH8-2 (160-10346-27), IHBH8-3 (160-10346-28), IHBH8-4 (160-10346-29) and IHBH9-2 (160-10346-30) were analyzed for Isotopic Thorium (Alpha Spectrometry) in accordance with DOE A01R_Th. The samples were dried on 02/03/2015, prepared on 02/05/2015 and analyzed on 02/13/2015, 02/23/2015 and 02/24/2015.

The following sample(s) could not be thoroughly homogenized before sub-sampling was performed due to sample matrix: IHBH1-2 (160-10346-1), IHBH1-3 (160-10346-2), IHBH1-4 (160-10346-3), IHBH1-5 (160-10346-4), IHBH1-6 (160-10346-5), IHBH2-1 (160-10346-6), IHBH2-2 (160-10346-7), IHBH2-2 (160-10346-7 MS), IHBH2-2 (160-10346-7 MSD), IHBH2-3 (160-10346-8), IHBH2-4 (160-10346-9), IHBH2-5 (160-10346-10), IHBH2-6 (160-10346-11), IHBH3-2 (160-10346-12), IHBH3-3 (160-10346-13), IHBH3-5 (160-10346-14), IHBH4-1 (160-10346-15), IHBH4-3 (160-10346-16), IHBH4-5 (160-10346-17), IHBH5-2 (160-10346-18), IHBH5-4 (160-10346-19), IHBH5-4 (160-10346-19 MS), IHBH5-4 (160-10346-19 MSD), IHBH5-6 (160-10346-20), IHBH6-1 (160-10346-21), IHBH6-3 (160-10346-22), IHBH6-6 (160-10346-23), IHBH7-1 (160-10346-24), IHBH7-2 (160-10346-25), IHBH7-4 (160-10346-26), IHBH8-2 (160-10346-27), IHBH8-3 (160-10346-28), IHBH8-4 (160-10346-29), IHBH9-2 (160-10346-30). The samples contain rocks.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

TestAmerica St. Louis
13715 Rider Trail North
Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

160-10346 Chain of Custody

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:1/27/2015	COC No: IH-2015-1
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	____ of ____ COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH1-2	1/27/2015	0835	G	S	1	N	N	X	
IHBH1-3	1/27/2015	0845	G	S	1	N	N	X	
IHBH1-4	1/27/2015	0850	G	S	1	N	N	X	
IHBH1-5	1/27/2015	0900	G	S	1	N	N	X	
IHBH1-6	1/27/2015	0905	G	S	1	N	N	X	
IHBH2-1	1/27/2015	0930	G	S	1	N	N	X	
IHBH2-2	1/27/2015	0932	G	S	1	N	Y	X	
IHBH2-3	1/27/2015	0935	G	S	1	N	N	X	
IHBH2-4	1/27/2015	0940	G	S	1	N	N	X	
IHBH2-5	1/27/2015	0942	G	S	1	N	N	X	
IHBH2-6	1/27/2015	0945	G	S	1	N	N	X	
IHBH3-2	1/27/2015	0950	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 1/28/15 1130	Received by: Jill Clarke	Company: TA STL	Date/Time: 2-3-15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

TestAmerica St. Louis
13715 Rider Trail North

Earth City, MO 63045
phone 314.298.8566 fax 314.298.8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:1/27/2015	COC No: IH-2015-2
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	2 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH3-3	1/27/2015	0955	G	S	1	N	N	X	
IHBH3-5	1/27/2015	1000	G	S	1	N	N	X	
IHBH4-1	1/27/2015	1005	G	S	1	N	N	X	
IHBH4-3	1/27/2015	1010	G	S	1	N	N	X	
IHBH4-5	1/27/2015	1015	G	S	1	N	N	X	
IHBH5-2	1/27/2015	1045	G	S	1	N	N	X	
IHBH5-4	1/27/2015	1050	G	S	1	N	Y	X	
IHBH5-6	1/27/2015	1055	G	S	1	N	N	X	
IHBH6-1	1/27/2015	1100	G	S	1	N	N	X	
IHBH6-3	1/27/2015	1105	G	S	1	N	N	X	
IHBH6-6	1/27/2015	1110	G	S	1	N	N	X	
IHBH7-1	1/27/2015	1215	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 1/28/15 1300	Received by:	Company: TA STL	Date/Time: 2-3-15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

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Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☑ Other:

Client Contact	Project Manager: Daniel Spicuzza	Site Contact: Daniel Spicuzza	Date:1/27/2015	COC No: IH-2015-3
AWS, LLC	Tel/Fax: 412 848-7022/888 705-7408	Lab Contact: Erika Gish	Carrier: Fed Ex	3 of 3 COCs
615 E. 82nd. Ave. Suite 200	Analysis Turnaround Time			Sampler: William Wylie
Anchorage, AK 99518	☐ CALENDAR DAYS ☑ WORKING DAYS			
(907) 278-2311 Phone	TAT if different from Below 21			
(907) 278-2350 FAX	☐ 2 weeks			Lab Sampling:
Project Name: NSF Indian Head	☐ 1 week			
Site: NSF Indian Head IR Site 1	☐ 2 days			Job / SDG No.:USN 2014-058
Quote # 16001836	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Isotopic Thorium	Sample Specific Notes:
IHBH7-2	1/27/2015	1220	G	S	1	N	N	X	
IHBH7-4	1/27/2015	1222	G	S	1	N	N	X	
IHBH8-2	1/27/2015	1230	G	S	1	N	N	X	
IHBH8-3	1/27/2015	1235	G	S	1	N	N	X	
IHBH8-4	1/27/2015	1240	G	S	1	N	N	X	
IHBH9-2	1/27/2015	1255	G	S	1	N	N	X	

Preservation Used: 1= Ice, 2= HCl, 3= H_2SO_4, 4=HNO_3, 5=NaOH, 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☑ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☑ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments: QC Level II

Custody Seals Intact: ☑ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company: AWS	Date/Time: 1/28/15 1150	Received by:	Company: TA STL	Date/Time: 2-3-15 1350
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.2, dated 04/02/2013

Login Sample Receipt Checklist

Client: Aleut World Solutions

Job Number: 160-10346-1

Login Number: 10346

List Source: TestAmerica St. Louis

List Number: 1

Creator: Clarke, Jill C

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	N/A	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Definitions/Glossary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Qualifiers

Rad

Qualifier	Qualifier Description
U	Undetected at the Limit of Detection.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Method Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Method	Method Description	Protocol	Laboratory
A-01-R	Isotopic Thorium (Alpha Spectrometry)	DOE	TAL SL

Protocol References:

DOE = U.S. Department of Energy

Laboratory References:

TAL SL = TestAmerica St. Louis, 13715 Rider Trail North, Earth City, MO 63045, TEL (314)298-8566

Sample Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
160-10346-1	IHBH1-2	Solid	01/27/15 08:35	02/03/15 13:50
160-10346-2	IHBH1-3	Solid	01/27/15 08:45	02/03/15 13:50
160-10346-3	IHBH1-4	Solid	01/27/15 08:50	02/03/15 13:50
160-10346-4	IHBH1-5	Solid	01/27/15 09:00	02/03/15 13:50
160-10346-5	IHBH1-6	Solid	01/27/15 09:05	02/03/15 13:50
160-10346-6	IHBH2-1	Solid	01/27/15 09:30	02/03/15 13:50
160-10346-7	IHBH2-2	Solid	01/27/15 09:32	02/03/15 13:50
160-10346-8	IHBH2-3	Solid	01/27/15 09:35	02/03/15 13:50
160-10346-9	IHBH2-4	Solid	01/27/15 09:40	02/03/15 13:50
160-10346-10	IHBH2-5	Solid	01/27/15 09:42	02/03/15 13:50
160-10346-11	IHBH2-6	Solid	01/27/15 09:45	02/03/15 13:50
160-10346-12	IHBH3-2	Solid	01/27/15 09:50	02/03/15 13:50
160-10346-13	IHBH3-3	Solid	01/27/15 09:55	02/03/15 13:50
160-10346-14	IHBH3-5	Solid	01/27/15 10:00	02/03/15 13:50
160-10346-15	IHBH4-1	Solid	01/27/15 10:05	02/03/15 13:50
160-10346-16	IHBH4-3	Solid	01/27/15 10:10	02/03/15 13:50
160-10346-17	IHBH4-5	Solid	01/27/15 10:15	02/03/15 13:50
160-10346-18	IHBH5-2	Solid	01/27/15 10:45	02/03/15 13:50
160-10346-19	IHBH5-4	Solid	01/27/15 10:50	02/03/15 13:50
160-10346-20	IHBH5-6	Solid	01/27/15 10:55	02/03/15 13:50
160-10346-21	IHBH6-1	Solid	01/27/15 11:00	02/03/15 13:50
160-10346-22	IHBH6-3	Solid	01/27/15 11:05	02/03/15 13:50
160-10346-23	IHBH6-6	Solid	01/27/15 11:10	02/03/15 13:50
160-10346-24	IHBH7-1	Solid	01/27/15 12:15	02/03/15 13:50
160-10346-25	IHBH7-2	Solid	01/27/15 12:20	02/03/15 13:50
160-10346-26	IHBH7-4	Solid	01/27/15 12:22	02/03/15 13:50
160-10346-27	IHBH8-2	Solid	01/27/15 12:30	02/03/15 13:50
160-10346-28	IHBH8-3	Solid	01/27/15 12:35	02/03/15 13:50
160-10346-29	IHBH8-4	Solid	01/27/15 12:40	02/03/15 13:50
160-10346-30	IHBH9-2	Solid	01/27/15 12:55	02/03/15 13:50

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH1-2

Lab Sample ID: 160-10346-1

Date Collected: 01/27/15 08:35
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.582		0.138	0.146	1.00	0.0819	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.517		0.125	0.133	1.00	0.0228	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.488		0.122	0.129	1.00	0.0401	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*89.8*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH1-3

Lab Sample ID: 160-10346-2

Date Collected: 01/27/15 08:45
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.714		0.160	0.171	1.00	0.0858	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.702		0.155	0.165	1.00	0.0410	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.506		0.131	0.137	1.00	0.0253	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*84.0*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH1-4

Lab Sample ID: 160-10346-3

Date Collected: 01/27/15 08:50
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.536		0.140	0.147	1.00	0.0879	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.608		0.144	0.153	1.00	0.0476	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.427		0.121	0.126	1.00	0.0474	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*85.2*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH1-5

Lab Sample ID: 160-10346-4

Date Collected: 01/27/15 09:00
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.462		0.124	0.130	1.00	0.0694	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.403		0.113	0.118	1.00	0.0237	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.456		0.120	0.126	1.00	0.0236	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH1-5

Lab Sample ID: 160-10346-4
Matrix: Solid
Date Collected: 01/27/15 09:00
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	93.0		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample ID: IHBH1-6

Lab Sample ID: 160-10346-5
Matrix: Solid
Date Collected: 01/27/15 09:05
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.466		0.126	0.132	1.00	0.0817	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.423		0.116	0.122	1.00	0.0443	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.423		0.116	0.121	1.00	0.0381	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.0		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample ID: IHBH2-1

Lab Sample ID: 160-10346-6
Matrix: Solid
Date Collected: 01/27/15 09:30
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.02		0.179	0.198	1.00	0.0691	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.724		0.149	0.161	1.00	0.0369	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.932		0.168	0.185	1.00	0.0322	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	95.8		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample ID: IHBH2-2

Lab Sample ID: 160-10346-7
Matrix: Solid
Date Collected: 01/27/15 09:32
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	3.05		0.301	0.395	1.00	0.0724	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.746		0.148	0.161	1.00	0.0412	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	2.74		0.283	0.365	1.00	0.0433	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	101		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH2-3

Lab Sample ID: 160-10346-8
Matrix: Solid
Date Collected: 01/27/15 09:35
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.10		0.195	0.215	1.00	0.0863	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.724		0.155	0.167	1.00	0.0250	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	1.06		0.188	0.208	1.00	0.0401	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*86.5*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH2-4

Lab Sample ID: 160-10346-9
Matrix: Solid
Date Collected: 01/27/15 09:40
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.12		0.186	0.208	1.00	0.0742	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.545		0.129	0.136	1.00	0.0421	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	1.02		0.174	0.194	1.00	0.0362	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.0*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH2-5

Lab Sample ID: 160-10346-10
Matrix: Solid
Date Collected: 01/27/15 09:42
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.484		0.132	0.138	1.00	0.0807	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.418		0.118	0.124	1.00	0.0279	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.404		0.117	0.122	1.00	0.0467	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*85.4*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH2-6

Lab Sample ID: 160-10346-11
Matrix: Solid
Date Collected: 01/27/15 09:45
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.376		0.112	0.117	1.00	0.0607	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.419		0.117	0.122	1.00	0.0392	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.471		0.124	0.130	1.00	0.0451	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH2-6

Lab Sample ID: 160-10346-11
Date Collected: 01/27/15 09:45
Matrix: Solid
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.9		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample ID: IHBH3-2

Lab Sample ID: 160-10346-12
Date Collected: 01/27/15 09:50
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.600		0.139	0.148	1.00	0.0670	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.492		0.125	0.131	1.00	0.0438	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.656		0.144	0.154	1.00	0.0482	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.1		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample ID: IHBH3-3

Lab Sample ID: 160-10346-13
Date Collected: 01/27/15 09:55
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	1.03		0.181	0.200	1.00	0.0683	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.580		0.134	0.143	1.00	0.0232	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	1.06		0.181	0.202	1.00	0.0327	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.0		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample ID: IHBH3-5

Lab Sample ID: 160-10346-14
Date Collected: 01/27/15 10:00
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.609		0.144	0.153	1.00	0.0830	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.535		0.131	0.139	1.00	0.0388	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.459		0.122	0.128	1.00	0.0447	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	89.7		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH4-1

Lab Sample ID: 160-10346-15

Date Collected: 01/27/15 10:05
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.586		0.142	0.150	1.00	0.0889	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.500		0.127	0.134	1.00	0.0529	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.528		0.129	0.137	1.00	0.0237	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.3*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH4-3

Lab Sample ID: 160-10346-16

Date Collected: 01/27/15 10:10
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.693		0.151	0.162	1.00	0.0825	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.679		0.146	0.156	1.00	0.0234	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.567		0.133	0.141	1.00	0.0233	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*90.7*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH4-5

Lab Sample ID: 160-10346-17

Date Collected: 01/27/15 10:15
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.497		0.127	0.133	1.00	0.0749	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.336		0.102	0.106	1.00	0.0469	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.393		0.109	0.114	1.00	0.0227	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*96.1*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Client Sample ID: IHBH5-2

Lab Sample ID: 160-10346-18

Date Collected: 01/27/15 10:45
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.496		0.130	0.136	1.00	0.0782	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.543		0.132	0.140	1.00	0.0443	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.602		0.140	0.149	1.00	0.0621	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH5-2

Lab Sample ID: 160-10346-18
Matrix: Solid
Date Collected: 01/27/15 10:45
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.3		30 - 110	02/05/15 13:16	02/13/15 14:00	1

Client Sample ID: IHBH5-4

Lab Sample ID: 160-10346-19
Matrix: Solid
Date Collected: 01/27/15 10:50
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.606		0.144	0.153	1.00	0.0681	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.738		0.159	0.170	1.00	0.0681	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.649		0.148	0.158	1.00	0.0620	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	83.1		30 - 110	02/05/15 14:42	02/23/15 16:24	1

Client Sample ID: IHBH5-6

Lab Sample ID: 160-10346-20
Matrix: Solid
Date Collected: 01/27/15 10:55
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.480		0.122	0.128	1.00	0.0668	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.569		0.131	0.140	1.00	0.0579	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.529		0.125	0.133	1.00	0.0453	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	91.1		30 - 110	02/05/15 14:42	02/23/15 16:24	1

Client Sample ID: IHBH6-1

Lab Sample ID: 160-10346-21
Matrix: Solid
Date Collected: 01/27/15 11:00
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.645		0.144	0.153	1.00	0.0766	pCi/g	02/05/15 14:42	02/24/15 14:00	1
Thorium-230	0.538		0.129	0.136	1.00	0.0505	pCi/g	02/05/15 14:42	02/24/15 14:00	1
Thorium-232	0.528		0.126	0.134	1.00	0.0226	pCi/g	02/05/15 14:42	02/24/15 14:00	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	94.5		30 - 110	02/05/15 14:42	02/24/15 14:00	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH6-3

Lab Sample ID: 160-10346-22
Date Collected: 01/27/15 11:05
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.540		0.137	0.144	1.00	0.0865	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.600		0.140	0.149	1.00	0.0534	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.470		0.124	0.130	1.00	0.0532	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.0*		*30 - 110*	*02/05/15 14:42*	*02/23/15 16:24*	*1*

Client Sample ID: IHBH6-6

Lab Sample ID: 160-10346-23
Date Collected: 01/27/15 11:10
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.358		0.113	0.117	1.00	0.0796	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.509		0.129	0.136	1.00	0.0498	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.373		0.110	0.114	1.00	0.0449	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*88.6*		*30 - 110*	*02/05/15 14:42*	*02/23/15 16:24*	*1*

Client Sample ID: IHBH7-1

Lab Sample ID: 160-10346-24
Date Collected: 01/27/15 12:15
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.732		0.161	0.172	1.00	0.0849	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.609		0.144	0.152	1.00	0.0470	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.728		0.156	0.168	1.00	0.0404	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*87.1*		*30 - 110*	*02/05/15 14:42*	*02/23/15 16:24*	*1*

Client Sample ID: IHBH7-2

Lab Sample ID: 160-10346-25
Date Collected: 01/27/15 12:20
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.709		0.154	0.165	1.00	0.0755	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.463		0.124	0.130	1.00	0.0604	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.680		0.148	0.159	1.00	0.0388	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH7-2

Lab Sample ID: 160-10346-25
Date Collected: 01/27/15 12:20
Matrix: Solid
Date Received: 02/03/15 13:50

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	87.0		30 - 110	02/05/15 14:42	02/23/15 16:24	1

Client Sample ID: IHBH7-4

Lab Sample ID: 160-10346-26
Date Collected: 01/27/15 12:22
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.490		0.129	0.136	1.00	0.0785	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.639		0.144	0.153	1.00	0.0493	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.470		0.123	0.129	1.00	0.0490	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.2		30 - 110	02/05/15 14:42	02/23/15 16:24	1

Client Sample ID: IHBH8-2

Lab Sample ID: 160-10346-27
Date Collected: 01/27/15 12:30
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.448		0.122	0.128	1.00	0.0656	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.538		0.132	0.140	1.00	0.0495	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.541		0.132	0.140	1.00	0.0531	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	92.5		30 - 110	02/05/15 14:42	02/23/15 16:24	1

Client Sample ID: IHBH8-3

Lab Sample ID: 160-10346-28
Date Collected: 01/27/15 12:35
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.538		0.137	0.144	1.00	0.0881	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.460		0.123	0.129	1.00	0.0600	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.478		0.123	0.130	1.00	0.0239	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	%Yield	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Thorium-229	90.5		30 - 110	02/05/15 14:42	02/23/15 16:24	1

Client Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Client Sample ID: IHBH8-4

Lab Sample ID: 160-10346-29

Date Collected: 01/27/15 12:40
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.608		0.137	0.146	1.00	0.0564	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.505		0.124	0.131	1.00	0.0366	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.454		0.118	0.124	1.00	0.0441	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*94.6*		*30 - 110*	*02/05/15 14:42*	*02/23/15 16:24*	*1*

Client Sample ID: IHBH9-2

Lab Sample ID: 160-10346-30

Date Collected: 01/27/15 12:55
Matrix: Solid
Date Received: 02/03/15 13:50

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Analyte	Result	Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	0.424		0.121	0.126	1.00	0.0862	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.436		0.117	0.123	1.00	0.0378	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	0.527		0.128	0.136	1.00	0.0377	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	*%Yield*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*91.5*		*30 - 110*	*02/05/15 14:42*	*02/23/15 16:24*	*1*

QC Sample Results

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Lab Sample ID: MB 160-172328/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 173941 — **Prep Batch: 172328**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.01146	U	0.0310	0.0310	1.00	0.0825	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-230	0.05040		0.0411	0.0413	1.00	0.0428	pCi/g	02/05/15 13:16	02/13/15 14:00	1
Thorium-232	0.007606	U	0.0152	0.0152	1.00	0.0228	pCi/g	02/05/15 13:16	02/13/15 14:00	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*93.4*		*30 - 110*	*02/05/15 13:16*	*02/13/15 14:00*	*1*

Lab Sample ID: LCS 160-172328/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174593 — **Prep Batch: 172328**

Analyte	Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	24.5	24.12		2.37	1.00	0.0764	pCi/g	98	81 - 118

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*93.8*		*30 - 110*

Lab Sample ID: 160-10346-7 MS — **Client Sample ID: IHBH2-2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 174595 — **Prep Batch: 172328**

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits
Thorium-230	0.746		4.02	4.779		0.559	1.00	0.0442	pCi/g	100	76 - 115

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*92.0*		*30 - 110*

Lab Sample ID: 160-10346-7 MSD — **Client Sample ID: IHBH2-2**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 173951 — **Prep Batch: 172328**

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.746		4.02	5.087		0.595	1.00	0.0253	pCi/g	108	76 - 115	0.27	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*84.9*		*30 - 110*

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry) (Continued)

Lab Sample ID: MB 160-172345/1-A — **Client Sample ID: Method Blank**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 175455 — **Prep Batch: 172345**

Analyte	MB Result	MB Qualifier	Count Uncert. (2σ+/-)	Total Uncert. (2σ+/-)	RL	MDC	Unit	Prepared	Analyzed	Dil Fac
Thorium-228	-0.02374	U	0.0285	0.0286	1.00	0.0888	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-230	0.1235		0.0638	0.0646	1.00	0.0442	pCi/g	02/05/15 14:42	02/23/15 16:24	1
Thorium-232	-0.001969	U	0.00394	0.00394	1.00	0.0381	pCi/g	02/05/15 14:42	02/23/15 16:24	1

Tracer	*MB %Yield*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
Thorium-229	*87.6*		*30 - 110*	*02/05/15 14:42*	*02/23/15 16:24*	*1*

Lab Sample ID: LCS 160-172345/2-A — **Client Sample ID: Lab Control Sample**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 175456 — **Prep Batch: 172345**

Analyte			Spike Added	LCS Result	LCS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230			24.5	23.75		2.34	1.00	0.117	pCi/g	97	81 - 118		

Tracer	*LCS %Yield*	*LCS Qualifier*	*Limits*
Thorium-229	*92.7*		*30 - 110*

Lab Sample ID: 160-10346-19 MS — **Client Sample ID: IHBH5-4**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 175459 — **Prep Batch: 172345**

Analyte	Sample Result	Sample Qual	Spike Added	MS Result	MS Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits		
Thorium-230	0.738		4.03	4.975		0.586	1.00	0.0254	pCi/g	105	76 - 115		

Tracer	*MS %Yield*	*MS Qualifier*	*Limits*
Thorium-229	*87.3*		*30 - 110*

Lab Sample ID: 160-10346-19 MSD — **Client Sample ID: IHBH5-4**
Matrix: Solid — **Prep Type: Total/NA**
Analysis Batch: 175462 — **Prep Batch: 172345**

Analyte	Sample Result	Sample Qual	Spike Added	MSD Result	MSD Qual	Total Uncert. (2σ+/-)	RL	MDC	Unit	%Rec	%Rec. Limits	RER	RER Limit
Thorium-230	0.738		4.04	4.760		0.565	1.00	0.0251	pCi/g	100	76 - 115	0.19	1

Tracer	*MSD %Yield*	*MSD Qualifier*	*Limits*
Thorium-229	*84.7*		*30 - 110*

QC Association Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Rad

Leach Batch: 171868

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10346-1	IHBH1-2	Total/NA	Solid	Dry and Grind	
160-10346-2	IHBH1-3	Total/NA	Solid	Dry and Grind	
160-10346-3	IHBH1-4	Total/NA	Solid	Dry and Grind	
160-10346-4	IHBH1-5	Total/NA	Solid	Dry and Grind	
160-10346-5	IHBH1-6	Total/NA	Solid	Dry and Grind	
160-10346-6	IHBH2-1	Total/NA	Solid	Dry and Grind	
160-10346-7	IHBH2-2	Total/NA	Solid	Dry and Grind	
160-10346-7 MS	IHBH2-2	Total/NA	Solid	Dry and Grind	
160-10346-7 MSD	IHBH2-2	Total/NA	Solid	Dry and Grind	
160-10346-8	IHBH2-3	Total/NA	Solid	Dry and Grind	
160-10346-9	IHBH2-4	Total/NA	Solid	Dry and Grind	
160-10346-10	IHBH2-5	Total/NA	Solid	Dry and Grind	
160-10346-11	IHBH2-6	Total/NA	Solid	Dry and Grind	
160-10346-12	IHBH3-2	Total/NA	Solid	Dry and Grind	
160-10346-13	IHBH3-3	Total/NA	Solid	Dry and Grind	
160-10346-14	IHBH3-5	Total/NA	Solid	Dry and Grind	
160-10346-15	IHBH4-1	Total/NA	Solid	Dry and Grind	
160-10346-16	IHBH4-3	Total/NA	Solid	Dry and Grind	
160-10346-17	IHBH4-5	Total/NA	Solid	Dry and Grind	
160-10346-18	IHBH5-2	Total/NA	Solid	Dry and Grind	
160-10346-19	IHBH5-4	Total/NA	Solid	Dry and Grind	
160-10346-19 MS	IHBH5-4	Total/NA	Solid	Dry and Grind	
160-10346-19 MSD	IHBH5-4	Total/NA	Solid	Dry and Grind	
160-10346-20	IHBH5-6	Total/NA	Solid	Dry and Grind	
160-10346-21	IHBH6-1	Total/NA	Solid	Dry and Grind	
160-10346-22	IHBH6-3	Total/NA	Solid	Dry and Grind	
160-10346-23	IHBH6-6	Total/NA	Solid	Dry and Grind	
160-10346-24	IHBH7-1	Total/NA	Solid	Dry and Grind	
160-10346-25	IHBH7-2	Total/NA	Solid	Dry and Grind	
160-10346-26	IHBH7-4	Total/NA	Solid	Dry and Grind	
160-10346-27	IHBH8-2	Total/NA	Solid	Dry and Grind	
160-10346-28	IHBH8-3	Total/NA	Solid	Dry and Grind	
160-10346-29	IHBH8-4	Total/NA	Solid	Dry and Grind	
160-10346-30	IHBH9-2	Total/NA	Solid	Dry and Grind	

Prep Batch: 172328

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10346-1	IHBH1-2	Total/NA	Solid	ExtChrom	171868
160-10346-2	IHBH1-3	Total/NA	Solid	ExtChrom	171868
160-10346-3	IHBH1-4	Total/NA	Solid	ExtChrom	171868
160-10346-4	IHBH1-5	Total/NA	Solid	ExtChrom	171868
160-10346-5	IHBH1-6	Total/NA	Solid	ExtChrom	171868
160-10346-6	IHBH2-1	Total/NA	Solid	ExtChrom	171868
160-10346-7	IHBH2-2	Total/NA	Solid	ExtChrom	171868
160-10346-7 MS	IHBH2-2	Total/NA	Solid	ExtChrom	171868
160-10346-7 MSD	IHBH2-2	Total/NA	Solid	ExtChrom	171868
160-10346-8	IHBH2-3	Total/NA	Solid	ExtChrom	171868
160-10346-9	IHBH2-4	Total/NA	Solid	ExtChrom	171868
160-10346-10	IHBH2-5	Total/NA	Solid	ExtChrom	171868
160-10346-11	IHBH2-6	Total/NA	Solid	ExtChrom	171868
160-10346-12	IHBH3-2	Total/NA	Solid	ExtChrom	171868

Rad (Continued)

Prep Batch: 172328 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10346-13	IHBH3-3	Total/NA	Solid	ExtChrom	171868
160-10346-14	IHBH3-5	Total/NA	Solid	ExtChrom	171868
160-10346-15	IHBH4-1	Total/NA	Solid	ExtChrom	171868
160-10346-16	IHBH4-3	Total/NA	Solid	ExtChrom	171868
160-10346-17	IHBH4-5	Total/NA	Solid	ExtChrom	171868
160-10346-18	IHBH5-2	Total/NA	Solid	ExtChrom	171868
LCS 160-172328/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-172328/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Prep Batch: 172345

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
160-10346-19	IHBH5-4	Total/NA	Solid	ExtChrom	171868
160-10346-19 MS	IHBH5-4	Total/NA	Solid	ExtChrom	171868
160-10346-19 MSD	IHBH5-4	Total/NA	Solid	ExtChrom	171868
160-10346-20	IHBH5-6	Total/NA	Solid	ExtChrom	171868
160-10346-21	IHBH6-1	Total/NA	Solid	ExtChrom	171868
160-10346-22	IHBH6-3	Total/NA	Solid	ExtChrom	171868
160-10346-23	IHBH6-6	Total/NA	Solid	ExtChrom	171868
160-10346-24	IHBH7-1	Total/NA	Solid	ExtChrom	171868
160-10346-25	IHBH7-2	Total/NA	Solid	ExtChrom	171868
160-10346-26	IHBH7-4	Total/NA	Solid	ExtChrom	171868
160-10346-27	IHBH8-2	Total/NA	Solid	ExtChrom	171868
160-10346-28	IHBH8-3	Total/NA	Solid	ExtChrom	171868
160-10346-29	IHBH8-4	Total/NA	Solid	ExtChrom	171868
160-10346-30	IHBH9-2	Total/NA	Solid	ExtChrom	171868
LCS 160-172345/2-A	Lab Control Sample	Total/NA	Solid	ExtChrom	
MB 160-172345/1-A	Method Blank	Total/NA	Solid	ExtChrom	

Tracer/Carrier Summary

Client: Aleut World Solutions
Project/Site: Indian Head

TestAmerica Job ID: 160-10346-1

Method: A-01-R - Isotopic Thorium (Alpha Spectrometry)

Matrix: Solid **Prep Type: Total/NA**

		Percent Yield (Acceptance Limits)						
Lab Sample ID	Client Sample ID	Th-229 (30-110)						
160-10346-1	IHBH1-2	89.8						
160-10346-2	IHBH1-3	84.0						
160-10346-3	IHBH1-4	85.2						
160-10346-4	IHBH1-5	93.0						
160-10346-5	IHBH1-6	92.0						
160-10346-6	IHBH2-1	95.8						
160-10346-7	IHBH2-2	101						
160-10346-7 MS	IHBH2-2	92.0						
160-10346-7 MSD	IHBH2-2	84.9						
160-10346-8	IHBH2-3	86.5						
160-10346-9	IHBH2-4	93.0						
160-10346-10	IHBH2-5	85.4						
160-10346-11	IHBH2-6	92.9						
160-10346-12	IHBH3-2	92.1						
160-10346-13	IHBH3-3	92.0						
160-10346-14	IHBH3-5	89.7						
160-10346-15	IHBH4-1	90.3						
160-10346-16	IHBH4-3	90.7						
160-10346-17	IHBH4-5	96.1						
160-10346-18	IHBH5-2	92.3						
160-10346-19	IHBH5-4	83.1						
160-10346-19 MS	IHBH5-4	87.3						
160-10346-19 MSD	IHBH5-4	84.7						
160-10346-20	IHBH5-6	91.1						
160-10346-21	IHBH6-1	94.5						
160-10346-22	IHBH6-3	91.0						
160-10346-23	IHBH6-6	88.6						
160-10346-24	IHBH7-1	87.1						
160-10346-25	IHBH7-2	87.0						
160-10346-26	IHBH7-4	90.2						
160-10346-27	IHBH8-2	92.5						
160-10346-28	IHBH8-3	90.5						
160-10346-29	IHBH8-4	94.6						
160-10346-30	IHBH9-2	91.5						
LCS 160-172328/2-A	Lab Control Sample	93.8						
LCS 160-172345/2-A	Lab Control Sample	92.7						
MB 160-172328/1-A	Method Blank	93.4						
MB 160-172345/1-A	Method Blank	87.6						

Tracer/Carrier Legend

Th-229 = Thorium-229

Appendix G

Equipment Release Surveys

RADIATION/CONTAMINATION SURVEY FORM

DATE:	TIME:	INSTRUMENTATION USED						
1/29/2015	11:00	Model Inst/Det.	Serial Number	Calibration Due Date	Instrument % Efficiency	Total % Efficiency	MDC/MDA + (dpm/100cm^2)	Background + (dpm/100cm^2)
SURVEY NUMBER:	IHS1-022	2360	275827	4/15/2015	α 28.2%	α 7.1%	α 108.5	α 14.2
		43-93	335833		βγ 33.9%	βγ 8.5%	βγ 696.5	βγ 1710.9
LOCATION:	NSF Indian Head, IR Site 1	2929	79980	7/30/2015	α 67.5%	α 16.9%	α 15.3	α 1.2
					βγ 44.1%	βγ 11.0%	βγ 153.3	βγ 372.8
SURVEYOR:	Adolfo Matus Jr.							
DATE: 1/29/2015	TIME: 15:00 / Reviewed by: Daniel Spicuzza							
Isotopes of Concern: Th-232		Static Count Time: 1 Minutes						

Release Survey Of Bobcat Auger Bits

This is a release survey of bobcat and auger bits.

Comments:

Accessible areas were 100% alpha/beta-gamma scan surveyed.

Alpha results: 0-3 cpm.

Beta/gamma results: 100-160 cpm.

Routine (Daily / Weekly / Monthly) [ ] **Non-routine** [X]

(#)	denotes swipe location and fixed α/β readings
#	denotes G/A radiation readings
# / #	denotes contact / 1 meter radiation readings.
*	denotes highest radiation reading on contact
LAW	denotes large area masslinn wipe
Δ	denotes static location.
+	Unless Otherwise Noted
	All readings in microR/hr unless otherwise noted
	K = 1000

RADIATION/CONTAMINATION SURVEY SUPPLEMENT

SURVEY NUMBER: IHS1-022

SURVEYOR: Adolfo Matus Jr. | LOCATION: NSF Indian Head, IR Site 1

Location	Exposure Rate (μR/hr)		Fixed + Removable (NET)			Removable (NET)		Comments
	Contact	1 Meter	Gamma (cpm)	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	Alpha dpm/100cm^2	Beta/Gamma dpm/100cm^2	
1				14.2	70.8	1.8	17.2	Left Track
2				0.0	35.4	-1.2	26.3	Left Track
3				0.0	118.0	1.8	3.6	Right Track
4				-14.2	82.6	-1.2	17.2	Right Track
5				14.2	59.0	1.8	39.9	Auger Extension
6				0.0	-23.6	1.8	21.8	Auger Extension
7				0.0	47.2	1.8	26.3	Auger Bit
8				-14.2	82.6	-1.2	35.4	Auger Bit
9				0.0	35.4	-1.2	21.8	Shovel
10				0.0	-23.6	-1.2	35.4	Shovel
11				0.0	94.4	-1.2	21.8	Hand Trowel
2D						-1.2	17.2	Duplicate Swipe
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
N/A								
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Reviewer Daniel Spicuzza	Date: 1/29/2015 Time: 15:00	

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UNCONDITIONAL RELEASE OF EQUIPMENT OR MATERIALS FORM

Survey # IHS1-022	Date : 1/29/2015
Project Location : NSF Indian Head, IR Site 1	
Description of Equipment or Materials: Release Survey Of Bobcat Auger Bits	

Survey Equipment:

Model #	Serial #	Cal Due Date	Efficiency		Background	
2929	79980	7/30/2015	α	16.88%	α	1.19
			β	11.03%	β	372.79
2360 43-93	275827	4/15/2015	α	7.05%	α	14.18
			β	8.48%	β	1710.91

Contamination Levels:

14.2	dpm / 100cm^2	α	**Maximum Fixed**
118.0	dpm / 100cm^2	β	
1.8	dpm / 100cm^2	α	**Maximum Removable**
39.9	dpm / 100cm^2	β	

THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR MATERIALS HAS/HAVE BEEN SURVEYED AND BEEN FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.

Radiological Control Technician: Adolfo Matus Jr.	Date: 1/29/2015 Time: 1100
Disposition of Equipment or Materials: Free Release.	
Reviewed by: Daniel Spicuzza	Date: 1/29/2015 3:00:00 PM

Appendix BB
RESRAD Post Remediation Input/Output Data Files

Appendix BB
RESRAD Post Remediation Input/Output Data Files

Summary : RESRAD Default Parameters
File : C:\RESRAD_FAMILY\RESRAD\6.5\IH SITE 1.RAD

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Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(1)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(2)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(3)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(4)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(5)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(6)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(7)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(8)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(9)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(10)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(11)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(1)
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(2)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(3)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(1)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(2)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(3)
D-34	Food transfer factors:			
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(1,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(1,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(1,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(2,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(3,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(3,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(1,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(1,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(2,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(2,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(3,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(3,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	5.400E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.200E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	2.800E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.200E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Th-232	7.900E-01	0.000E+00	---	S1(3)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(3)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.630E-06	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.956E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.630E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	-1.000E+00	1.000E+00	-1 shows non-circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	1.500E+00	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	3.000E+00	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	4.500E+00	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	6.000E+00	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	7.500E+00	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	9.000E+00	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	1.050E+01	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	1.200E+01	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	1.350E+01	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	1.500E+01	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	1.650E+01	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	1.800E+01	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	1.000E+00	1.000E+00	---	FRACA(1)
R017	Ring 2	1.000E+00	2.732E-01	---	FRACA(2)
R017	Ring 3	1.000E+00	0.000E+00	---	FRACA(3)
R017	Ring 4	9.800E-01	0.000E+00	---	FRACA(4)
R017	Ring 5	1.000E+00	0.000E+00	---	FRACA(5)
R017	Ring 6	1.000E+00	0.000E+00	---	FRACA(6)
R017	Ring 7	8.700E-01	0.000E+00	---	FRACA(7)
R017	Ring 8	6.500E-01	0.000E+00	---	FRACA(8)
R017	Ring 9	5.400E-01	0.000E+00	---	FRACA(9)
R017	Ring 10	3.800E-01	0.000E+00	---	FRACA(10)
R017	Ring 11	1.200E-01	0.000E+00	---	FRACA(11)
R017	Ring 12	1.000E-02	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.270E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.270E-01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.270E-01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	540.00 square meters	Th-232	7.900E-01
Thickness:	1.20 meters		
Cover Depth:	0.00 meters		

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.200E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.843E-01	1.121E+00	2.449E+00	5.959E+00	8.597E+00	8.837E+00	8.828E+00	6.563E+00
M(t):	4.036E-02	9.345E-02	2.041E-01	4.966E-01	7.165E-01	7.365E-01	7.356E-01	5.470E-01

Maximum TDOSE(t): 8.838E+00 mrem/yr at t = 82.6 ± 0.2 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.259E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	6.485E+00	0.7337	7.384E-02	0.0084	0.000E+00	0.0000	2.208E+00	0.2499	6.273E-03	0.0007	7.331E-03	0.0008	5.731E-02	0.0065
Total	6.485E+00	0.7337	7.384E-02	0.0084	0.000E+00	0.0000	2.208E+00	0.2499	6.273E-03	0.0007	7.331E-03	0.0008	5.731E-02	0.0065

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 8.259E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.838E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.838E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	1.706E-01	0.3522	6.130E-02	0.1266	0.000E+00	0.0000	2.187E-01	0.4515	4.745E-04	0.0010	3.788E-04	0.0008	3.292E-02	0.0680
Total	1.706E-01	0.3522	6.130E-02	0.1266	0.000E+00	0.0000	2.187E-01	0.4515	4.745E-04	0.0010	3.788E-04	0.0008	3.292E-02	0.0680

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.843E-01	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.843E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	5.741E-01	0.5120	6.175E-02	0.0551	0.000E+00	0.0000	4.482E-01	0.3997	1.134E-03	0.0010	1.181E-03	0.0011	3.502E-02	0.0312
Total	5.741E-01	0.5120	6.175E-02	0.0551	0.000E+00	0.0000	4.482E-01	0.3997	1.134E-03	0.0010	1.181E-03	0.0011	3.502E-02	0.0312

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.121E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.121E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	1.508E+00	0.6158	6.329E-02	0.0258	0.000E+00	0.0000	8.337E-01	0.3404	2.262E-03	0.0009	2.537E-03	0.0010	3.912E-02	0.0160
Total	1.508E+00	0.6158	6.329E-02	0.0258	0.000E+00	0.0000	8.337E-01	0.3404	2.262E-03	0.0009	2.537E-03	0.0010	3.912E-02	0.0160

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.449E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.449E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	4.199E+00	0.7046	6.881E-02	0.0115	0.000E+00	0.0000	1.632E+00	0.2739	4.593E-03	0.0008	5.327E-03	0.0009	4.925E-02	0.0083
Total	4.199E+00	0.7046	6.881E-02	0.0115	0.000E+00	0.0000	1.632E+00	0.2739	4.593E-03	0.0008	5.327E-03	0.0009	4.925E-02	0.0083

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.959E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.959E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	6.293E+00	0.7319	7.343E-02	0.0085	0.000E+00	0.0000	2.161E+00	0.2514	6.135E-03	0.0007	7.167E-03	0.0008	5.664E-02	0.0066
Total	6.293E+00	0.7319	7.343E-02	0.0085	0.000E+00	0.0000	2.161E+00	0.2514	6.135E-03	0.0007	7.167E-03	0.0008	5.664E-02	0.0066

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.597E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.597E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	6.484E+00	0.7337	7.383E-02	0.0084	0.000E+00	0.0000	2.208E+00	0.2499	6.272E-03	0.0007	7.331E-03	0.0008	5.730E-02	0.0065
Total	6.484E+00	0.7337	7.383E-02	0.0084	0.000E+00	0.0000	2.208E+00	0.2499	6.272E-03	0.0007	7.331E-03	0.0008	5.730E-02	0.0065

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.837E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.837E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	6.478E+00	0.7338	7.376E-02	0.0084	0.000E+00	0.0000	2.205E+00	0.2498	6.265E-03	0.0007	7.321E-03	0.0008	5.725E-02	0.0065
Total	6.478E+00	0.7338	7.376E-02	0.0084	0.000E+00	0.0000	2.205E+00	0.2498	6.265E-03	0.0007	7.321E-03	0.0008	5.725E-02	0.0065

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.828E+00	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.828E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	5.940E+00	0.9050	7.353E-02	0.0112	0.000E+00	0.0000	4.877E-01	0.0743	2.299E-03	0.0004	2.695E-03	0.0004	5.707E-02	0.0087
Total	5.940E+00	0.9050	7.353E-02	0.0112	0.000E+00	0.0000	4.877E-01	0.0743	2.299E-03	0.0004	2.695E-03	0.0004	5.707E-02	0.0087

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Th-232	8.815E-31	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.563E+00	1.0000
Total	8.815E-31	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.563E+00	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	2.468E-01	2.468E-01	2.468E-01	2.468E-01	2.467E-01	2.467E-01	2.464E-01	1.462E-01
Th-232	Ra-228+D	1.000E+00	3.303E-01	9.552E-01	1.997E+00	4.140E+00	5.553E+00	5.679E+00	5.672E+00	3.476E+00
Th-232	Th-228+D	1.000E+00	3.600E-02	2.175E-01	8.567E-01	3.157E+00	5.083E+00	5.261E+00	5.256E+00	4.686E+00
Th-232	∑DSR(j)		6.130E-01	1.419E+00	3.100E+00	7.543E+00	1.088E+01	1.119E+01	1.117E+01	8.308E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.200E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	1.958E+01	8.454E+00	3.871E+00	1.591E+00	1.103E+00	1.073E+00	1.074E+00	1.444E+00

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 82.6 ± 0.2 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Th-232	7.900E-01	83.0 ± 0.2	1.119E+01	1.073E+00	1.119E+01	1.073E+00

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.949E-01	1.949E-01	1.949E-01	1.949E-01	1.949E-01	1.949E-01	1.946E-01	1.155E-01
Ra-228	Th-232	1.000E+00	2.609E-01	7.546E-01	1.578E+00	3.270E+00	4.387E+00	4.486E+00	4.481E+00	2.746E+00
Th-228	Th-232	1.000E+00	2.844E-02	1.718E-01	6.768E-01	2.494E+00	4.016E+00	4.156E+00	4.152E+00	3.702E+00

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	7.900E-01	7.900E-01	7.900E-01	7.900E-01	7.899E-01	7.896E-01	7.889E-01	7.864E-01
Ra-228	Th-232	1.000E+00	0.000E+00	8.954E-02	2.384E-01	5.446E-01	7.466E-01	7.646E-01	7.639E-01	7.614E-01
Th-228	Th-232	1.000E+00	0.000E+00	1.471E-02	9.782E-02	4.400E-01	7.370E-01	7.646E-01	7.639E-01	7.614E-01

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 4.32 seconds

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Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Ground

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	9.15247E+01	8.20830E+00		
1	8.86171E+01	8.20836E+00	-2.90758E+00	parabolic
2	8.15711E+01	8.20840E+00	-7.04604E+00	golden section
3	8.31651E+01	8.20841E+00	1.59397E+00	parabolic
4	8.37343E+01	8.20841E+00	5.69187E-01	parabolic
5	8.38704E+01	8.20841E+00	1.36106E-01	parabolic
6	8.35177E+01	8.20841E+00	-2.16541E-01	parabolic
7	8.36505E+01	8.20841E+00	-4.02184E-02	parabolic
8	8.37343E+01	8.20841E+00	0.00000E+00	direct

Notes:

1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Inhale (excluding Radon)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	7.01704E+01	9.34682E-02		
1	7.69976E+01	9.34673E-02	6.82724E+00	parabolic
2	6.73972E+01	9.34679E-02	-2.77315E+00	parabolic
3	7.10564E+01	9.34682E-02	8.86051E-01	parabolic
4	7.06134E+01	9.34682E-02	-4.43024E-01	parabolic
5	7.06840E+01	9.34682E-02	0.00000E+00	parabolic
6	7.04442E+01	9.34682E-02	-1.69220E-01	golden section
7	7.03737E+01	9.34682E-02	-7.04442E-02	parabolic
8	7.05146E+01	9.34682E-02	7.04442E-02	parabolic
9	7.04442E+01	9.34682E-02	0.00000E+00	direct

Notes:
1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Plant (water independent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	9.15247E+01	2.79547E+00		
1	8.54606E+01	2.79552E+00	-6.06409E+00	parabolic
2	7.96203E+01	2.79553E+00	-5.84036E+00	golden section
3	8.06521E+01	2.79553E+00	1.03182E+00	parabolic
4	8.12619E+01	2.79553E+00	6.09827E-01	parabolic
5	8.11807E+01	2.79553E+00	-4.32678E-02	parabolic
6	8.28657E+01	2.79553E+00	1.60377E+00	golden section
7	8.18745E+01	2.79553E+00	6.12585E-01	golden section
8	8.15276E+01	2.79553E+00	2.65663E-01	parabolic
9	8.13634E+01	2.79553E+00	1.01474E-01	golden section
10	8.14448E+01	2.79553E+00	8.13634E-02	parabolic

Notes:
1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Meat (water independent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	9.15247E+01	7.93987E-03		
1	8.57718E+01	7.93999E-03	-5.75295E+00	parabolic
2	7.98126E+01	7.94003E-03	-5.95920E+00	golden section
3	8.08734E+01	7.94003E-03	1.06083E+00	parabolic
4	8.15622E+01	7.94003E-03	6.88831E-01	parabolic
5	8.12178E+01	7.94003E-03	-3.44414E-01	parabolic
6	8.10863E+01	7.94003E-03	-1.31554E-01	golden section
7	8.10050E+01	7.94003E-03	-8.13053E-02	golden section

Notes:
1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Milk (water independent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	9.15247E+01	9.27954E-03		
1	8.60352E+01	9.27968E-03	-5.48951E+00	parabolic
2	7.99754E+01	9.27972E-03	-6.05983E+00	golden section
3	8.10879E+01	9.27973E-03	1.11250E+00	parabolic
4	8.17236E+01	9.27973E-03	6.35705E-01	parabolic
5	8.14057E+01	9.27973E-03	-3.17852E-01	parabolic
6	8.12843E+01	9.27973E-03	-1.21407E-01	golden section
7	8.12031E+01	9.27973E-03	-7.50340E-02	golden section

Notes:
1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Soil

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	7.01704E+01	7.25420E-02		
1	8.00914E+01	7.25427E-02	9.92103E+00	parabolic
2	7.78641E+01	7.25429E-02	-2.22732E+00	parabolic
3	7.68709E+01	7.25430E-02	-9.93218E-01	parabolic
4	7.58779E+01	7.25430E-02	-9.93021E-01	parabolic
5	7.61757E+01	7.25430E-02	2.97838E-01	parabolic
6	7.62519E+01	7.25430E-02	7.61757E-02	parabolic
7	7.64883E+01	7.25430E-02	2.36438E-01	golden section
8	7.66344E+01	7.25430E-02	1.46128E-01	golden section
9	7.67248E+01	7.25430E-02	9.03130E-02	golden section
10	7.66344E+01	7.25430E-02	0.00000E+00	direct

Notes:
1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Water

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	5.87802E+02	5.59709E-29		
1	4.04043E+02	0.00000E+00	-1.83759E+02	parabolic
2	5.97771E+02	5.33587E-29	9.96891E+00	parabolic
3	5.17612E+02	5.36692E-29	-7.01895E+01	golden section
4	5.57165E+02	6.13011E-29	-3.06369E+01	parabolic
5	5.55843E+02	6.13843E-29	-1.32159E+00	parabolic
6	5.47454E+02	6.15143E-29	-8.38945E+00	parabolic
7	5.36055E+02	6.03227E-29	-1.13985E+01	golden section
8	5.50061E+02	6.15568E-29	2.60726E+00	parabolic
9	5.50611E+02	6.15560E-29	1.78593E-01	parabolic
10	5.49511E+02	6.15543E-29	-5.50061E-01	parabolic
11	5.50061E+02	6.15568E-29	0.00000E+00	direct

Notes:

1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
Pathway: Plant (water dependent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	5.87802E+02	2.26273E-30		
1	3.83841E+02	0.00000E+00	-2.03961E+02	parabolic
2	5.09896E+02	1.76726E-30	-7.79060E+01	golden section
3	6.33519E+02	1.76009E-30	4.57174E+01	parabolic
4	5.71501E+02	2.38202E-30	-1.63008E+01	parabolic
5	5.63171E+02	2.41690E-30	-8.32976E+00	parabolic
6	5.42822E+02	2.38843E-30	-2.03494E+01	golden section
7	5.56587E+02	2.42770E-30	-6.58361E+00	parabolic
8	5.56031E+02	2.42784E-30	-4.22581E-01	parabolic
9	5.55475E+02	2.42784E-30	-5.56031E-01	parabolic
10	5.50642E+02	2.42213E-30	-4.83307E+00	golden section
11	5.54919E+02	2.42771E-30	-5.55475E-01	parabolic
12	5.55475E+02	2.42784E-30	0.00000E+00	direct

Notes:
1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Th-232 Dose/Source Ratio
All Pathways Summed

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	DSR(t) (mrem/yr)/(pCi/g)	Step Size (years)	Step Type
0	9.15247E+01	1.11870E+01		
1	8.78979E+01	1.11871E+01	-3.62686E+00	parabolic
2	8.11266E+01	1.11872E+01	-6.77130E+00	golden section
3	8.25409E+01	1.11872E+01	1.41437E+00	parabolic
4	8.31666E+01	1.11872E+01	6.25668E-01	parabolic
5	8.30835E+01	1.11872E+01	-7.60854E-02	parabolic
6	8.30004E+01	1.11872E+01	-8.30835E-02	parabolic
7	8.28249E+01	1.11872E+01	-1.75483E-01	golden section
8	8.29174E+01	1.11872E+01	-6.70288E-02	golden section
9	8.30004E+01	1.11872E+01	0.00000E+00	direct

Notes:

1) Step size always from t with current largest DSR(t) .
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but DSR(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Ground

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	9.15247E+01	6.48456E+00		
1	8.86190E+01	6.48461E+00	-2.90568E+00	parabolic
2	8.15723E+01	6.48464E+00	-7.04676E+00	golden section
3	8.31965E+01	6.48465E+00	1.62419E+00	parabolic
4	8.37441E+01	6.48465E+00	5.47641E-01	parabolic
5	8.34703E+01	6.48465E+00	-2.73819E-01	parabolic
6	8.33657E+01	6.48465E+00	-1.04590E-01	golden section
7	8.32823E+01	6.48465E+00	-6.46392E-02	golden section

Notes:
1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Inhale (excluding Radon)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	7.01704E+01	7.38399E-02		
1	7.69965E+01	7.38392E-02	6.82612E+00	parabolic
2	6.75047E+01	7.38396E-02	-2.66572E+00	parabolic
3	7.10617E+01	7.38399E-02	8.91345E-01	parabolic
4	7.06161E+01	7.38399E-02	-4.45671E-01	parabolic
5	7.06867E+01	7.38399E-02	0.00000E+00	parabolic
6	7.04458E+01	7.38399E-02	-1.70231E-01	golden section
7	7.05454E+01	7.38399E-02	-7.06161E-02	parabolic
8	7.06161E+01	7.38399E-02	0.00000E+00	direct

Notes:
1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Plant (water independent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	9.15247E+01	2.20842E+00		
1	8.54643E+01	2.20846E+00	-6.06043E+00	parabolic
2	7.96225E+01	2.20847E+00	-5.84176E+00	golden section
3	8.07074E+01	2.20847E+00	1.08483E+00	parabolic
4	8.13067E+01	2.20847E+00	5.99284E-01	parabolic
5	8.13880E+01	2.20847E+00	6.41750E-02	parabolic
6	8.14694E+01	2.20847E+00	8.13880E-02	parabolic
7	8.29953E+01	2.20847E+00	1.52593E+00	golden section
8	8.20522E+01	2.20847E+00	5.82854E-01	golden section
9	8.16920E+01	2.20847E+00	2.22631E-01	golden section
10	8.15544E+01	2.20847E+00	8.50384E-02	golden section
11	8.14694E+01	2.20847E+00	0.00000E+00	direct

Notes:

1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Meat (water independent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	9.15247E+01	6.27250E-03		
1	8.57721E+01	6.27260E-03	-5.75260E+00	parabolic
2	7.98128E+01	6.27262E-03	-5.95933E+00	golden section
3	8.09063E+01	6.27263E-03	1.09348E+00	parabolic
4	8.15930E+01	6.27263E-03	6.86680E-01	parabolic
5	8.12496E+01	6.27263E-03	-3.43342E-01	parabolic
6	8.11185E+01	6.27263E-03	-1.31146E-01	golden section
7	8.10374E+01	6.27263E-03	-8.10518E-02	golden section

Notes:
1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Milk (water independent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	9.15247E+01	7.33084E-03		
1	8.60355E+01	7.33095E-03	-5.48920E+00	parabolic
2	7.99756E+01	7.33098E-03	-6.05995E+00	golden section
3	8.10751E+01	7.33098E-03	1.09952E+00	parabolic
4	8.17223E+01	7.33098E-03	6.47170E-01	parabolic
5	8.13987E+01	7.33098E-03	-3.23586E-01	parabolic
6	8.12751E+01	7.33098E-03	-1.23599E-01	golden section
7	8.11938E+01	7.33098E-03	-7.63891E-02	golden section

Notes:
1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Soil

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	7.01704E+01	5.73082E-02		
1	8.00902E+01	5.73088E-02	9.91982E+00	parabolic
2	7.78639E+01	5.73089E-02	-2.22636E+00	parabolic
3	7.68766E+01	5.73090E-02	-9.87220E-01	parabolic
4	7.59944E+01	5.73090E-02	-8.82239E-01	parabolic
5	7.61262E+01	5.73090E-02	1.31758E-01	parabolic
6	7.62023E+01	5.73090E-02	7.61262E-02	parabolic
7	7.64599E+01	5.73090E-02	2.57581E-01	golden section
8	7.66191E+01	5.73090E-02	1.59192E-01	golden section
9	7.67174E+01	5.73090E-02	9.83853E-02	golden section
10	7.67942E+01	5.73090E-02	6.08041E-02	golden section
11	7.67174E+01	5.73090E-02	0.00000E+00	direct

Notes:

1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Water

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	5.87802E+02	4.42170E-29		
1	4.04043E+02	0.00000E+00	-1.83759E+02	parabolic
2	5.97771E+02	4.21534E-29	9.96891E+00	parabolic
3	5.17612E+02	4.23987E-29	-7.01895E+01	golden section
4	5.57165E+02	4.84279E-29	-3.06369E+01	parabolic
5	5.55843E+02	4.84936E-29	-1.32159E+00	parabolic
6	5.47454E+02	4.85964E-29	-8.38937E+00	parabolic
7	5.36055E+02	4.76549E-29	-1.13985E+01	golden section
8	5.50060E+02	4.86298E-29	2.60597E+00	parabolic
9	5.50610E+02	4.86292E-29	1.77056E-01	parabolic
10	5.49510E+02	4.86279E-29	-5.50060E-01	parabolic
11	5.50060E+02	4.86298E-29	0.00000E+00	direct

Notes:

1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
Pathway: Plant (water dependent)

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	5.87802E+02	1.78756E-30		
1	3.83841E+02	0.00000E+00	-2.03961E+02	parabolic
2	5.09896E+02	1.39614E-30	-7.79060E+01	golden section
3	6.33519E+02	1.39047E-30	4.57175E+01	parabolic
4	5.71501E+02	1.88179E-30	-1.63008E+01	parabolic
5	5.63171E+02	1.90935E-30	-8.32974E+00	parabolic
6	5.42822E+02	1.88686E-30	-2.03494E+01	golden section
7	5.56587E+02	1.91789E-30	-6.58362E+00	parabolic
8	5.56031E+02	1.91799E-30	-4.22587E-01	parabolic
9	5.55475E+02	1.91799E-30	-5.56031E-01	parabolic
10	5.50642E+02	1.91348E-30	-4.83307E+00	golden section
11	5.54919E+02	1.91789E-30	-5.55475E-01	parabolic
12	5.55475E+02	1.91799E-30	0.00000E+00	direct

Notes:
1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Iteration Log for Computation of the Time of Maximum Total Dose
All Pathways Summed

Tolerance for tmax = 1.0E-03 (fractional accuracy)

Iteration Number	t (years)	TDOSE(t) (mrem/yr)	Step Size (years)	Step Type
0	9.15247E+01	8.83772E+00		
1	8.78989E+01	8.83781E+00	-3.62583E+00	parabolic
2	8.11272E+01	8.83785E+00	-6.77169E+00	golden section
3	8.24635E+01	8.83786E+00	1.33632E+00	parabolic
4	8.31338E+01	8.83786E+00	6.70231E-01	parabolic
5	8.27987E+01	8.83786E+00	-3.35114E-01	parabolic
6	8.26707E+01	8.83786E+00	-1.28002E-01	golden section
7	8.25880E+01	8.83786E+00	-7.91110E-02	golden section

Notes:
1) Step size always from t with current largest TDOSE(t).
2) Parabolic step based on parabola maximum through the current best triplet.
3) Golden section step, 0.5*(3-SQRT(5)) of larger interval bracketing maximum, taken only if trial parabolic step fails.
4) Direct step to a previous t only on last iteration and only if prior iteration met convergence test but TDOSE(t) was smaller than the previous value.

Source Factors for Ingrowth and Decay
Radioactivity Factors Only
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	ID(j,t) = THF(j)*S1(j,t)/S1(i,0) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	1.136E-01	3.035E-01	7.004E-01	9.731E-01	1.000E+00	1.000E+00	1.000E+00
Th-232	Th-228+D	1.000E+00	0.000E+00	1.864E-02	1.243E-01	5.644E-01	9.597E-01	1.000E+00	1.000E+00	1.000E+00

Source Factors for Ingrowth and Decay
Combined Radioactivity and Leaching Factors
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	SF(j,t) = THF(j)*S1(j,t)/S1(i,0) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.999E-01	9.995E-01	9.986E-01	9.954E-01
Th-232	Ra-228+D	1.000E+00	0.000E+00	1.133E-01	3.018E-01	6.894E-01	9.450E-01	9.678E-01	9.669E-01	9.638E-01
Th-232	Th-228+D	1.000E+00	0.000E+00	1.862E-02	1.238E-01	5.570E-01	9.329E-01	9.678E-01	9.669E-01	9.638E-01

The effect of volatilization was also considered when computing the source factors for H-3 and C-14.

Parameters Used for Calculating Cover Depth and Contaminated Zone Thicknesses

Cover Erosion rate (vcv): 0.001000 m/yr
Contaminated Zone Erosion rate (vcz): 0.001000 m/yr
Water Table Drop rate (vwt): 0.001000 m/yr
Precipitation rate (Pr): 1.000000 m/yr
Cover Removal Time (Tc): 0.000E+00 yr
Overhead irrigation rate (Irr): 0.200 m/yr
Runoff coefficient (Cr): 0.200
Evapotranspiration coeff. (Ce): 0.500
Infiltration rate (In): 0.500 m/yr
Bulk soil density (rhob): 1.500 g/cm**3
Effective porosity (pe): 0.000

Radio-nuclide (i)	Distribution Coefficient Kd(i),cm**3/g	Leaching Ratio q(i)
Ra-228	7.000000E+01	3.047E-03
Th-228	6.000000E+04	3.566E-06
Th-232	6.000000E+04	3.566E-06

Time Dependence of Source Geometry

Time Dependence of Cover Depth [Cd(i,t)]

Nuclide (i)	Cd(i,t) (meters) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Th-228	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
Th-232	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Time Dependence of Contaminated Zone Thicknesses [T(i,t)]

Nuclide (i)	T(i,t) (meters) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	1.2000E+00	1.1990E+00	1.1970E+00	1.1900E+00	1.1700E+00	1.1000E+00	9.0000E-01	2.0000E-01
Th-228	1.2000E+00	1.1990E+00	1.1970E+00	1.1900E+00	1.1700E+00	1.1000E+00	9.0000E-01	2.0000E-01
Th-232	1.2000E+00	1.1990E+00	1.1970E+00	1.1900E+00	1.1700E+00	1.1000E+00	9.0000E-01	2.0000E-01

Occupancy, Cover/Depth, and Area Factors for Ground Pathway

Occupancy Factor (FO1): 0.600
Area (A): 540. sq. meters
Initial cover depth (Cd): 0.000 meters
Initial contaminated zone thickness (T): 1.200 meters

Time Dependence of Cover/Depth Factor [FCTR_COV_DEPTH(i,t)]

Nuclide	FCTR_COV_DEPTH(i,t) (dimensionless)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-228	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.246E-01
Bi-212	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.298E-01
Pb-212	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.818E-01
Po-212	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-216	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.346E-01
Ra-224	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.791E-01
Ra-228	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Rn-220	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.496E-01
Th-228	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.915E-01
Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.984E-01
Tl-208	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.998E-01	8.634E-01

Time Dependence of Area Factor [FCTR_AREA(i,t)]

Nuclide	FCTR_AREA(i,t) (dimensionless)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-228	8.726E-01	8.726E-01	8.726E-01	8.726E-01	8.726E-01	8.726E-01	8.726E-01	8.991E-01
Bi-212	8.685E-01	8.685E-01	8.685E-01	8.685E-01	8.685E-01	8.685E-01	8.685E-01	8.985E-01
Pb-212	8.947E-01	8.947E-01	8.947E-01	8.947E-01	8.947E-01	8.947E-01	8.947E-01	9.142E-01
Po-212	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Po-216	8.697E-01	8.697E-01	8.697E-01	8.697E-01	8.697E-01	8.697E-01	8.697E-01	8.992E-01
Ra-224	8.939E-01	8.939E-01	8.939E-01	8.939E-01	8.939E-01	8.939E-01	8.939E-01	9.152E-01
Ra-228	9.998E-01	9.998E-01	9.998E-01	9.998E-01	9.998E-01	9.998E-01	9.998E-01	9.998E-01
Rn-220	8.673E-01	8.673E-01	8.673E-01	8.673E-01	8.673E-01	8.673E-01	8.673E-01	9.035E-01
Th-228	9.002E-01	9.002E-01	9.002E-01	9.002E-01	9.002E-01	9.002E-01	9.002E-01	9.164E-01
Th-232	9.073E-01	9.073E-01	9.073E-01	9.073E-01	9.073E-01	9.073E-01	9.073E-01	9.164E-01
Tl-208	8.740E-01	8.740E-01	8.740E-01	8.740E-01	8.740E-01	8.740E-01	8.740E-01	8.942E-01

Dose Conversion and Environmental Transport Factors for the Ground Pathway (p=1)

Nuclide	DCF(i,1)*	ETFG(i,t) At Time in Years (dimensionless)							
(i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-228	5.978E+00	5.235E-01	5.235E-01	5.235E-01	5.235E-01	5.235E-01	5.235E-01	5.235E-01	4.988E-01
Bi-212	1.171E+00	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.012E-01
Pb-212	7.043E-01	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.385E-01
Po-212	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-216	1.042E-04	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.042E-01
Ra-224	5.119E-02	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.376E-01
Ra-228	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Dose Conversion and Environmental Transport Factors for the Ground Pathway (p=1)

Nuclide (i)	DCF(i,1)*	ETFG(i,t) At Time in Years (dimensionless) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Rn-220	2.298E-03	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.148E-01
Th-228	7.940E-03	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.452E-01
Th-232	5.212E-04	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.490E-01
Tl-208	2.298E+01	5.244E-01	5.244E-01	5.244E-01	5.244E-01	5.244E-01	5.244E-01	5.243E-01	4.633E-01

* - Units are (mrem/yr)/(pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Dose/Source Ratios for External Radiation from the Ground (p=1)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,1,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	2.837E-04	2.837E-04	2.837E-04	2.837E-04	2.837E-04	2.836E-04	2.833E-04	2.848E-04
Th-232	Ra-228+D	1.000E+00	1.811E-01	5.146E-01	1.069E+00	2.210E+00	2.962E+00	3.029E+00	3.026E+00	2.872E+00
Th-232	Th-228+D	1.000E+00	3.456E-02	2.118E-01	8.398E-01	3.105E+00	5.003E+00	5.179E+00	5.173E+00	4.647E+00
Th-232	∑DSR(j)		2.159E-01	7.267E-01	1.909E+00	5.315E+00	7.966E+00	8.208E+00	8.200E+00	7.519E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Inhalation Pathway, Excluding Radon (p=2)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,2,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	7.747E-02	7.747E-02	7.747E-02	7.747E-02	7.746E-02	7.744E-02	7.737E-02	7.712E-02
Th-232	Ra-228+D	1.000E+00	1.388E-05	3.944E-05	8.194E-05	1.694E-04	2.270E-04	2.322E-04	2.319E-04	2.312E-04
Th-232	Th-228+D	1.000E+00	1.054E-04	6.458E-04	2.560E-03	9.466E-03	1.525E-02	1.579E-02	1.577E-02	1.572E-02
Th-232	∑DSR(j)		7.759E-02	7.816E-02	8.011E-02	8.710E-02	9.294E-02	9.346E-02	9.337E-02	9.307E-02

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Pathway Factors for the Inhalation Pathway (radon excluded)

Area (A): 5.4000E+02 m**2 Occupancy Factor (FO2): 4.5000E-01
Area Factor (FA2): 1.2497E-01 Annual Air Intake (F12): 8.4000E+03 m**3/yr
Cover Depth [Cd(0)]: 0.0000E+00 m Mass Loading (ASR2): 1.0000E-04 g/m**3
Contaminated Zone Thickness [T(0)]: 1.2000E+00 m FA2 * FO2 * F12 * ASR2: 4.7240E-02 g/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
	Depth Factor [FD(i,2,t)] (dimensionless)							
Th-232	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00

Dose Conversion and Environmental Transport Factors for the Inhalation Pathway, Excluding Radon (p=2)

Parent (i)	Product (j)	DCF(j,2)*	ETF(j,2,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.640E+00	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02
Th-232	Ra-228+D	5.078E-03	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02
Th-232	Th-228+D	3.454E-01	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02	4.724E-02

* - The dose conversion factor units are mrem/pCi.

Parameters Used for Calculating Indoor and Outdoor Radon Flux

	*Floor Material	Cover Material	Contaminated Zone
Radon Diffusion Coefficient (m**2/s)	3.000E-07	2.000E-06	2.000E-06
Total Porosity	1.000E-01	4.000E-01	4.000E-01
Volumetric Water Content	3.000E-02	5.000E-02	3.209E-01
Bulk Density (g/cm**3)	2.400E+00	1.500E+00	1.500E+00
Rn-220 Emanation Coefficient	1.500E-01	1.500E-01	1.500E-01
Initial Thickness (m)	1.500E-01	0.000E+00	1.200E+00

Building Depth Below Ground Surface *(DMFL): -1.000E+00 (m)
Negative DMFL shows building depth adjusted (if necessary) for no penetration
of contaminated zone. Actual values used *(DMFLACT), m:

t=	0.0000E+00	1.0000E+00	3.0000E+00	1.0000E+01	3.0000E+01	1.0000E+02	3.0000E+02	1.0000E+03
DMFLACT=	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Building indoor area factor *(FAI): 0.000E+00
FAI <= 0.0 shows calculated time-dependent value based on amount of wall area
extending into the contaminated zone. Actual values used *(FAIACT):

t=	0.0000E+00	1.0000E+00	3.0000E+00	1.0000E+01	3.0000E+01	1.0000E+02	3.0000E+02	1.0000E+03
FAIACT =	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

* - Parameters are used only for indoor radon flux

Time Dependence of Outdoor Radon Flux [FLUXO(i,t)]

Nuclide	FLUXO(i,t) (pCi/m**2/s)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Time Dependence of Indoor Radon Flux [FLUXI(i,t)]

Nuclide	FLUXI(i,t) (pCi/m**2/s)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Parameters Used for Calculating Indoor and Outdoor Radon Concentration

Radon Vertical Dimension of Mixing (HMIX):	2.000E+00	(m)
Average Annual Wind Speed (WIND):	2.000E+00	(m/sec)
Building Room Height (HRM):	2.500E+00	(m)
Building Air Exchange Rate (REXG):	5.000E-01	(1/hr)

Time Dependence of Outdoor Radon Concentration [CRNO(i,t)]

Nuclide	CRNO(i,t) (pCi/m**3)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Time Dependence of Indoor Radon Concentration [HCONC(i,r)]

Nuclide	HCONC(i,t) (pCi/m**3)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Outdoor Working Levels of Radon [WLOTD(i,t)]

Nuclide	WLOTD(i,t) (WL)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Indoor Working Levels of Radon [WLIND(i,t)]

Nuclide	WLIND(i,t) (WL)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Fraction of Time Spent Outdoors (FOTD): 2.500E-01
Fraction of Time Spent Indoors (FIND): 5.000E-01

Dose/Source Ratios for Radon Pathway (p=9)
Subpathway: Outdoor and Indoor Radon Flux
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,9,t) - DSRRNW(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Radon Pathway (p=9)
Subpathway: Indoor Radon from Water Usage
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSRRNW(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Transport Time Parameters for Unsaturated Zone Stratum No. 1

Stratum thickness [h(1)]:	4.000000 m
Bulk soil material density [rhob(1)]:	1.500000 g/cm**3
Effective porosity [peuz(1)]:	0.200000
Hydraulic conductivity [Khuz(1)]:	10.000000 m/yr
Total porosity [ptuz(1)]:	0.400000
Soil specific b parameter [buz(1)]:	5.300000
Saturation ratio [sruz(1)]:	0.802299

Radio-nuclide (i)	Distribution Coefficient Kduz(i,1), cm**3/g	Retardation Factor Rduz(i,1)	Transport Time Dtuz(i,1), yr
Ra-228	7.0000E+01	3.2818E+02	4.2128E+02
Th-228	6.0000E+04	2.8045E+05	3.6000E+05
Th-232	6.0000E+04	2.8045E+05	3.6000E+05

Transport Time Parameters for Unsaturated Zone created by the Falling Water Table

Water table drop rate [vwt]:	0.001000 m/yr
Bulk soil material density [rhobaq]:	1.500000 g/cm**3
Effective porosity [peaq]:	0.200000
Hydraulic conductivity [Khaq]:	100.000000 m/yr
Total porosity [ptaq]:	0.400000
Soil specific b parameter [baq]:	5.300000
Saturation ratio [sruaq]:	0.677340

Radio-nuclide (i)	Distribution Coefficient Kdaq(i), cm**3/g	Retardation Factor Rduaq(i)	Minimum Transport Time Dtuaq(i), yr
Ra-228	7.0000E+01	3.8855E+02	4.9567E+01
Th-228	6.0000E+04	3.3218E+05	Infinite
Th-232	6.0000E+04	3.3218E+05	Infinite

Dilution Factor and Rise Time Parameters for Nondispersion (ND) Model

Aquifer contamination depth at well (z):	7.00000E+00	m
Depth of water intake below water table (dw):	1.00000E+01	m
Infiltration rate (In):	5.00000E-01	m/yr
Aquifer water flow rate (Vwfr):	2.00000E+00	m/yr
Hydraulic gradient (J):	2.00000E-02	
Hydraulic conductivity of aquifer (Kszh):	1.00000E+02	m/yr
Contaminated zone extent parallel to gradient (l):	2.80000E+01	m
Distance below contaminated zone to water table (h):	0.40000E+01	m
Initial thickness of uncontaminated cover (Cd):	0.00000E+00	m
Initial thickness of contaminated zone (T):	0.12000E+01	m
Effective porosity of saturated zone (pesz):	0.20000E+00	

Radio-nuclide (i)	Dilution Factor f(i)	Retardation Factor Rdsz(i)	Horizontal Transport Time	Onsite Tauh(i), yr	Rise Time dt(i), yr	Decay Time Parameter 1/lamda(i),yr
Ra-228	7.000E-01	2.635E+02		7.378E+02	7.378E+02	8.295E+00
Th-228	7.000E-01	2.250E+05		6.300E+05	6.300E+05	2.760E+00
Th-232	7.000E-01	2.250E+05		6.300E+05	6.300E+05	2.027E+10

Primary Parameters Used for Calculating Water/Soil
Concentration Ratios for Groundwater Pathway Segment

Model used: Nondispersion (ND)
Bulk soil density in contaminated zone (rhob): 1.500 g/cm**3

Radio-nuclide (i)	Dilution Factor f(i)	Retardation Factor Rdcz(i)	Breakthrough Time Chain year	Single Nuclide Dt(i), yr	Rise Time dt(i), yr
Ra-228	7.000E-01	3.282E+02	4.709E+02	4.709E+02	7.378E+02
Th-228	7.000E-01	2.804E+05	4.709E+02	Infinite	6.300E+05
Th-232	7.000E-01	2.804E+05	Infinite	Infinite	6.300E+05

Water/Soil Concentration Ratios [WSR(j,1,t)] for Groundwater Pathway Segment

Parent (i)	Product (j)	Thread Fraction	WSR(j,1,t) At Time in Years (pCi/L)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.526E-30
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.781E-33

Water/Soil Concentration Ratios [WSR(j,2,t)] for Surface Water Pathway Segment

Watershed Area (Aw) = 1.0000E+06 m**2
Contaminated Zone Area (A) = 5.4000E+02 m**2
Dilution Factor (f') = 5.4000E-04
Soil Density (rhob) = 1.5000E+00 kg/m**3

Parent (i)	Product (j)	Thread Fraction	WSR(j,2,t) At Time in Years (pCi/L)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.177E-33
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.374E-36

Storage Times For Contaminated Foodstuffs

k	Food Item	STOR_T(k), days
1	non-leafy plants	14.
2	leafy plants	1.
3	milk	1.
4	meat	20.
5	fish	7.
6	crustacea	7.
7	well water	1.
8	surface water	1.
9	livestock fodder	45.

Storage Time Ingrowth and Decay Factors

Storage Time for k'th Foodstuff: t = STOR_T(k), days

Parent (i)	Product (j)	Thread Fraction	STOR_ID(i,j,t) = CONCE(i,j,t)/CONCE(i,i,0) t= 1.400E+01	1.000E+00	1.000E+00	2.000E+01	7.000E+00	7.000E+00	1.000E+00	1.000E+00	4.500E+01
Ra-228	Ra-228	1.000E+00	9.954E-01	9.997E-01	9.997E-01	9.934E-01	9.977E-01	9.977E-01	9.997E-01	9.997E-01	9.853E-01
Ra-228	Th-228	1.000E+00	1.376E-02	9.913E-04	9.913E-04	1.958E-02	6.912E-03	6.912E-03	9.913E-04	9.913E-04	4.333E-02
Th-228	Th-228	1.000E+00	9.862E-01	9.990E-01	9.990E-01	9.804E-01	9.931E-01	9.931E-01	9.990E-01	9.990E-01	9.563E-01
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228	1.000E+00	4.610E-03	3.300E-04	3.300E-04	6.579E-03	2.308E-03	2.308E-03	3.300E-04	3.300E-04	1.474E-02
Th-232	Th-228	1.000E+00	3.189E-05	1.636E-07	1.636E-07	6.490E-05	7.996E-06	7.996E-06	1.636E-07	1.636E-07	3.250E-04

CONCE(i,j,t)/CONCE(i,i,0) is the concentration ratio of Product(j) at time t to Parent(i) at start of storage time.

Storage Time Correction Factors
Drinking Water from Well and/or Surface
Harvest Time = t - 2.74E-03 yr; Consumption Time = t yr

Parent (i)	Product (j)	Thread Fraction	CFWW(j,t,1)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.848E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors
Irrigation Water for Nonleafy Plants from Well and/or Surface
Harvest Time = t - 4.11E-02 yr; Consumption Time = t - 3.83E-02 yr

Parent (i)	Product (j)	Thread Fraction	CFWW(j,t,2)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.848E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors
Irrigation Water for Leafy Plants from Well and/or Surface
Harvest Time = t - 5.48E-03 yr; Consumption Time = t - 2.74E-03 yr

Parent (i)	Product (j)	Thread Fraction	CFWW(j,t,3)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.848E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors
Irrigation Water for Livestock (Milk) Fodder from Well and/or Surface
Harvest Time = t - 1.29E-01 yr; Consumption Time = t - 1.26E-01 yr

Parent (i)	Product (j)	Thread Fraction	CFWW(j,t,5)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.848E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors
Irrigation Water for Livestock (Meat) Fodder from Well and/or Surface
Harvest Time = t - 1.81E-01 yr; Consumption Time = t - 1.78E-01 yr

Parent (i)	Product (j)	Thread Fraction	CFWW(j,t,7)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.848E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors
Livestock (Milk) Water from Well and/or Surface
Harvest Time = t - 5.48E-03 yr; Consumption Time = t - 2.74E-03 yr

Parent (i)	Product (j)	Thread Fraction	CFWW(j,t,4)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.848E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors
Livestock (Meat) Water from Well and/or Surface
Harvest Time = t - 5.75E-02 yr; Consumption Time = t - 5.48E-02 yr

Parent (i)	Product (j)	Thread Fraction	CFWW(j,t,6)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.848E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors for Nonleafy Plants
Harvest Time = t - 3.83E-02 yr; Consumption Time = t yr

Parent (i)	Product (j)	Thread Fraction	CF3(j,1,t)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.954E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	7.444E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors for Leafy Plants
Harvest Time = t - 2.74E-03 yr; Consumption Time = t yr

Parent (i)	Product (j)	Thread Fraction	CF3(j,2,t)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.460E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors for Livestock (Meat) Fodder
Harvest Time = t - 1.78E-01 yr; Consumption Time = t - 5.48E-02 yr

Parent (i)	Product (j)	Thread Fraction	CFLF(j,1,t)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	9.892E-01	9.865E-01	9.858E-01	9.856E-01	9.856E-01	9.856E-01	9.856E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.355E+01	5.365E+00	3.109E+00	2.707E+00	2.684E+00	2.684E+00	2.663E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors for Livestock (Milk) Fodder
Harvest Time = t - 1.26E-01 yr; Consumption Time = t - 2.74E-03 yr

Parent (i)	Product (j)	Thread Fraction	CFLF(j,2,t)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	9.890E-01	9.865E-01	9.858E-01	9.856E-01	9.856E-01	9.856E-01	9.856E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.286E+01	5.305E+00	3.105E+00	2.707E+00	2.684E+00	2.684E+00	2.663E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors for Meat
Harvest Time = t - 5.48E-02 yr; Consumption Time = t yr

Parent (i)	Product (j)	Thread Fraction	CF45(j,1,t)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	9.946E-01	9.938E-01	9.936E-01	9.935E-01	9.935E-01	9.935E-01	9.937E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	3.936E+00	2.755E+00	2.063E+00	1.902E+00	1.892E+00	1.892E+00	1.377E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors for Milk
Harvest Time = t - 2.74E-03 yr; Consumption Time = t yr

Parent (i)	Product (j)	Thread Fraction	CF45(j,2,t)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	9.997E-01	9.997E-01	9.997E-01	9.997E-01	9.997E-01	9.997E-01	9.997E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	3.773E+00	2.621E+00	1.972E+00	1.824E+00	1.815E+00	1.815E+00	1.364E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Storage Time Correction Factors for Fish & Crustacea
Harvest Time = t - 1.92E-02 yr; Consumption Time = t yr

Parent (i)	Product (j)	Thread Fraction	CFF(j,1,t)# At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Th-232	Ra-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.977E-01
Th-232	Th-228+D	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	3.954E+00

#Correction factor = (concentration in media at consumption time)/(concentration at harvest time).

Area and Depth Factors for Plant (p=3), Meat (p=4), and Milk (p=5) Pathways
Root Uptake from Contaminated Soil (q=1)

Area Factor for Plant Foods [FA(3)] = 0.27

Nuclide	Depth Factor FD(i,1,t) (dimensionless)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	2.2222E-01
Th-228	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	2.2222E-01
Th-232	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	2.2222E-01

Area and Depth Factors for Plant (p=3), Meat (p=4), and Milk (p=5) Pathways
Foliar Uptake from Contaminated Dust (q=2)

Area Factor for Plant Foods [FA(3)] = 0.27

Nuclide	Depth Factor FD(i,2,t) (dimensionless)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
Th-228	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
Th-232	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00

Area and Depth Factors for Plant (p=3), Meat (p=4), and Milk (p=5) Pathways
Ditch Irrigation (q=3)

Area Factor for Plant Foods [FA(3)] = 0.27

Nuclide	Depth Factor FD(i,3,t) (dimensionless)							
(i) t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ra-228	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
Th-228	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
Th-232	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00

Area and Depth Factors for Plant (p=3), Meat (p=4), and Milk (p=5) Pathways
Overhead Irrigation (q=4)

Area Factor for Plant Foods [FA(3)] = 0.27

The Depth Factor Value
FD(i,p,q,t) = 1.0000E+00
is applicable for all radionuclides(i) and times(t).

Area and Depth Factors for Meat (p=4) and Milk (p=5) Pathways
Transfer from Livestock Water (q=5) and Soil (q=6) Intake

Area Factor for Meat and Milk [FA(p),p=4,5] = 0.03

The livestock water subpathway (q=5) and livestock soil intake subpathway (q=6)
occur only for the meat (p=4) and milk (p=5) pathways.

Dose Conversion and Environmental Transport Factors for the Plant Food Pathway (p=3)
Subpathway: Root Uptake from Contaminated Soil (q=1)

Parent (i)	Product (j)	DCF(j,3)*	ETF(j,3,1,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	4.698E+01	4.698E+01	4.698E+01	4.698E+01	4.697E+01	4.696E+01	4.691E+01	1.039E+01
Th-232	Ra-228+D	1.442E-03	0.000E+00	2.052E+02	5.594E+02	1.288E+03	1.768E+03	1.811E+03	1.809E+03	4.009E+02
Th-232	Th-228+D	8.086E-04	0.000E+00	3.424E+00	1.278E+01	4.222E+01	6.587E+01	6.805E+01	6.798E+01	1.506E+01

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Plant Food Pathway (p=3)
Subpathway: Foliar Uptake from Contaminated Dust (q=2)

Parent (i)	Product (j)	DCF(j,3)*	ETF(j,3,2,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	4.180E-02	4.180E-02	4.180E-02	4.180E-02	4.180E-02	4.178E-02	4.175E-02	4.161E-02
Th-232	Ra-228+D	1.442E-03	0.000E+00	4.739E-03	1.262E-02	2.882E-02	3.951E-02	4.046E-02	4.043E-02	4.029E-02
Th-232	Th-228+D	8.086E-04	0.000E+00	7.785E-04	5.176E-03	2.329E-02	3.900E-02	4.046E-02	4.042E-02	4.029E-02

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Plant Food Pathway (p=3)
Subpathway: Ditch Irrigation (q=3)

Parent (i)	Product (j)	DCF(j,3)*	ETF(j,3,3,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.357E-31
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.165E-33

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Plant Food Pathway (p=3)
Subpathway: Overhead Irrigation (q=4)

Parent (i)	Product (j)	DCF(j,3)*	ETF(j,3,4,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.219E-29
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.915E-31

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Meat Pathway (p=4)
Subpathway: Fodder Root Uptake from Contaminated Soil (q=1)

Parent (i)	Product (j)	DCF(j,4)*	ETF(j,4,1,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	1.157E-02	1.157E-02	1.157E-02	1.157E-02	1.157E-02	1.156E-02	1.155E-02	2.561E-03
Th-232	Ra-228+D	1.442E-03	0.000E+00	4.283E-01	1.301E+00	3.096E+00	4.279E+00	4.385E+00	4.380E+00	9.712E-01
Th-232	Th-228+D	8.086E-04	0.000E+00	1.044E-02	3.250E-02	8.039E-02	1.130E-01	1.159E-01	1.158E-01	2.568E-02

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Meat Pathway (p=4)
Subpathway: Fodder Foliar Uptake from Contaminated Dust (q=2)

Parent (i)	Product (j)	DCF(j,4)*	ETF(j,4,2,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	4.143E-05	4.143E-05	4.143E-05	4.143E-05	4.142E-05	4.141E-05	4.137E-05	4.124E-05
Th-232	Ra-228+D	1.442E-03	0.000E+00	4.453E-05	1.227E-04	2.834E-04	3.893E-04	3.988E-04	3.984E-04	3.971E-04
Th-232	Th-228+D	8.086E-04	0.000E+00	1.557E-06	7.301E-06	2.810E-05	4.555E-05	4.716E-05	4.712E-05	4.697E-05

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Meat Pathway (p=4)
Subpathway: Ditch Irrigation (q=3)

Parent (i)	Product (j)	DCF(j,4)*	ETF(j,4,3,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.683E-34
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.859E-36

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Meat Pathway (p=4)
Subpathway: Overhead Irrigation (q=4)

Parent (i)	Product (j)	DCF(j,4)*	ETF(j,4,4,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.132E-31
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.597E-33

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Meat Pathway (p=4)
Subpathway: Livestock Water (q=5)

Parent (i)	Product (j)	DCF(j,4)*	ETF(j,4,5,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.289E-31
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.568E-33

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Milk Pathway (p=5)
Subpathway: Fodder Root Uptake from Contaminated Soil (q=1)

Parent (i)	Product (j)	DCF(j,5)*	ETF(j,5,1,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	6.831E-04	6.831E-04	6.831E-04	6.831E-04	6.830E-04	6.828E-04	6.822E-04	1.512E-04
Th-232	Ra-228+D	1.442E-03	0.000E+00	5.394E-01	1.570E+00	3.689E+00	5.087E+00	5.211E+00	5.206E+00	1.154E+00
Th-232	Th-228+D	8.086E-04	0.000E+00	6.626E-04	1.977E-03	4.828E-03	6.770E-03	6.944E-03	6.938E-03	1.538E-03

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Milk Pathway (p=5)
Subpathway: Fodder Foliar Uptake from Contaminated Dust (q=2)

Parent (i)	Product (j)	DCF(j,5)*	ETF(j,5,2,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	2.447E-06	2.447E-06	2.447E-06	2.447E-06	2.446E-06	2.445E-06	2.443E-06	2.435E-06
Th-232	Ra-228+D	1.442E-03	0.000E+00	5.533E-05	1.476E-04	3.374E-04	4.625E-04	4.736E-04	4.732E-04	4.717E-04
Th-232	Th-228+D	8.086E-04	0.000E+00	1.001E-07	4.486E-07	1.696E-06	2.739E-06	2.835E-06	2.833E-06	2.823E-06

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Milk Pathway (p=5)
Subpathway: Ditch Irrigation (q=3)

Parent (i)	Product (j)	DCF(j,5)*	ETF(j,5,3,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.378E-34
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.305E-37

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Milk Pathway (p=5)
Subpathway: Overhead Irrigation (q=4)

Parent (i)	Product (j)	DCF(j,5)*	ETF(j,5,4,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.723E-31
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.549E-34

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Milk Pathway (p=5)
Subpathway: Livestock Water (q=5)

Parent (i)	Product (j)	DCF(j,5)*	ETF(j,5,5,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.062E-31
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.076E-34

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Fish Pathway (p=6)

Parent (i)	Product (j)	DCF(j,6)*	ETF(j,6,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.907E-31
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.689E-33

* - The dose conversion factor units are mrem/pCi.

Dose Conversion and Environmental Transport Factors for the Drinking Water Pathway (p=7)

Parent (i)	Product (j)	DCF(j,7)*	ETF(j,7,t) * SF(j,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.442E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.781E-28
Th-232	Th-228+D	8.086E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.679E-30

* - The dose conversion factor units are mrem/pCi.

Dose/Source Ratios for Internal Radiation from Ingestion of Plant Foods (p=3)
Subpathway: Root Uptake from Contaminated Soil (q=1)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,3,1t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.283E-01	1.283E-01	1.283E-01	1.282E-01	1.282E-01	1.282E-01	1.280E-01	2.830E-02
Th-232	Ra-228+D	1.000E+00	1.472E-01	4.344E-01	9.146E-01	1.903E+00	2.554E+00	2.612E+00	2.608E+00	5.767E-01
Th-232	Th-228+D	1.000E+00	1.244E-03	4.533E-03	1.235E-02	3.533E-02	5.337E-02	5.502E-02	5.494E-02	1.215E-02
Th-232	∑DSR(j)		2.767E-01	5.672E-01	1.055E+00	2.066E+00	2.736E+00	2.795E+00	2.791E+00	6.171E-01

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Plant Foods (p=3)
Subpathway: Foliar Uptake from Contaminated Dust (q=2)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,3,2t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.141E-04	1.141E-04	1.141E-04	1.141E-04	1.141E-04	1.141E-04	1.140E-04	1.136E-04
Th-232	Ra-228+D	1.000E+00	3.488E-06	9.914E-06	2.060E-05	4.257E-05	5.706E-05	5.835E-05	5.830E-05	5.811E-05
Th-232	Th-228+D	1.000E+00	2.184E-07	1.338E-06	5.305E-06	1.961E-05	3.161E-05	3.271E-05	3.268E-05	3.258E-05
Th-232	∑DSR(j)		1.178E-04	1.254E-04	1.400E-04	1.763E-04	2.028E-04	2.051E-04	2.050E-04	2.043E-04

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Plant Foods (p=3)
Subpathway: Ditch Irrigation (q=3)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,3,3t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.814E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.349E-36
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.848E-34

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Plant Foods (p=3)
Subpathway: Overhead Irrigation (q=4)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,3,4t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.616E-32
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.149E-34
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.648E-32

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Plant Foods (p=3)
Total for All Subpathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,3,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.284E-01	1.284E-01	1.284E-01	1.284E-01	1.284E-01	1.283E-01	1.281E-01	2.842E-02
Th-232	Ra-228+D	1.000E+00	1.472E-01	4.344E-01	9.146E-01	1.903E+00	2.554E+00	2.612E+00	2.608E+00	5.767E-01
Th-232	Th-228+D	1.000E+00	1.244E-03	4.534E-03	1.235E-02	3.535E-02	5.340E-02	5.505E-02	5.497E-02	1.218E-02
Th-232	∑DSR(j)		2.768E-01	5.673E-01	1.055E+00	2.066E+00	2.736E+00	2.795E+00	2.791E+00	6.173E-01

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Meat (p=4)
Subpathway: Fodder Root Uptake from Contaminated Soil (q=1)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,4,1t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	3.158E-05	3.158E-05	3.158E-05	3.158E-05	3.157E-05	3.156E-05	3.152E-05	6.974E-06
Th-232	Ra-228+D	1.000E+00	2.674E-04	9.587E-04	2.142E-03	4.575E-03	6.180E-03	6.323E-03	6.315E-03	1.397E-03
Th-232	Th-228+D	1.000E+00	3.522E-06	1.320E-05	3.015E-05	6.670E-05	9.152E-05	9.374E-05	9.362E-05	2.071E-05
Th-232	∑DSR(j)		3.025E-04	1.004E-03	2.204E-03	4.674E-03	6.303E-03	6.448E-03	6.440E-03	1.425E-03

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Meat (p=4)
Subpathway: Fodder Foliar Uptake from Contaminated Dust (q=2)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,4,2t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.131E-07	1.131E-07	1.131E-07	1.131E-07	1.131E-07	1.130E-07	1.129E-07	1.126E-07
Th-232	Ra-228+D	1.000E+00	3.156E-08	9.476E-08	2.007E-07	4.186E-07	5.623E-07	5.751E-07	5.746E-07	5.727E-07
Th-232	Th-228+D	1.000E+00	5.195E-10	2.265E-09	7.249E-09	2.359E-08	3.691E-08	3.813E-08	3.810E-08	3.798E-08
Th-232	∑DSR(j)		1.452E-07	2.101E-07	3.210E-07	5.553E-07	7.123E-07	7.263E-07	7.256E-07	7.233E-07

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Meat (p=4)
Subpathway: Ditch Irrigation (q=3)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,4,3t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.282E-37
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.123E-39
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.353E-37

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Meat (p=4)
Subpathway: Overhead Irrigation (q=4)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,4,4t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.492E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.108E-36
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.553E-34

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Meat (p=4)
Subpathway: Livestock Water (q=5)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,4,5t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.848E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.065E-36
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.869E-34

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Meat (p=4)
Total for All Subpathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,4,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	2.639E-04	2.639E-04	2.639E-04	2.639E-04	2.638E-04	2.638E-04	2.635E-04	2.382E-04
Th-232	Ra-228+D	1.000E+00	3.322E-04	1.153E-03	2.554E-03	5.435E-03	7.334E-03	7.504E-03	7.495E-03	2.573E-03
Th-232	Th-228+D	1.000E+00	4.589E-06	1.785E-05	4.503E-05	1.152E-04	1.673E-04	1.721E-04	1.719E-04	9.871E-05
Th-232	∑DSR(j)		6.007E-04	1.435E-03	2.863E-03	5.814E-03	7.766E-03	7.940E-03	7.930E-03	2.910E-03

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Milk (p=5)
Subpathway: Fodder Root Uptake from Contaminated Soil (q=1)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,5,1t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.865E-06	1.865E-06	1.865E-06	1.865E-06	1.865E-06	1.864E-06	1.861E-06	4.117E-07
Th-232	Ra-228+D	1.000E+00	3.572E-04	1.181E-03	2.578E-03	5.452E-03	7.346E-03	7.515E-03	7.505E-03	1.660E-03
Th-232	Th-228+D	1.000E+00	2.381E-07	8.196E-07	1.829E-06	4.006E-06	5.483E-06	5.615E-06	5.607E-06	1.240E-06
Th-232	∑DSR(j)		3.593E-04	1.183E-03	2.581E-03	5.457E-03	7.354E-03	7.523E-03	7.513E-03	1.662E-03

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Milk (p=5)
Subpathway: Fodder Foliar Uptake from Contaminated Dust (q=2)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,5,2t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	6.679E-09	6.679E-09	6.679E-09	6.679E-09	6.678E-09	6.676E-09	6.670E-09	6.648E-09
Th-232	Ra-228+D	1.000E+00	4.064E-08	1.159E-07	2.409E-07	4.983E-07	6.680E-07	6.831E-07	6.824E-07	6.802E-07
Th-232	Th-228+D	1.000E+00	3.477E-11	1.424E-10	4.438E-10	1.423E-09	2.219E-09	2.292E-09	2.290E-09	2.283E-09
Th-232	∑DSR(j)		4.736E-08	1.227E-07	2.481E-07	5.064E-07	6.768E-07	6.920E-07	6.914E-07	6.892E-07

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Milk (p=5)
Subpathway: Ditch Irrigation (q=3)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,5,3t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.278E-37
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.265E-40
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.283E-37

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Milk (p=5)
Subpathway: Overhead Irrigation (q=4)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,5,4t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.339E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.658E-37
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.343E-34

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Milk (p=5)
Subpathway: Livestock Water (q=5)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,5,5t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.693E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.886E-37
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.698E-34

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from Ingestion of Milk (p=5)
Total for All Subpathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,5,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	1.882E-05	1.882E-05	1.882E-05	1.882E-05	1.882E-05	1.882E-05	1.880E-05	1.729E-05
Th-232	Ra-228+D	1.000E+00	4.603E-04	1.475E-03	3.189E-03	6.716E-03	9.042E-03	9.249E-03	9.237E-03	3.386E-03
Th-232	Th-228+D	1.000E+00	3.263E-07	1.181E-06	2.956E-06	7.620E-06	1.112E-05	1.144E-05	1.142E-05	7.036E-06
Th-232	∑DSR(j)		4.795E-04	1.495E-03	3.211E-03	6.743E-03	9.072E-03	9.279E-03	9.267E-03	3.411E-03

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from the Ingestion of Fish (p=6)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,6,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.169E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.164E-36
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.191E-34

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose/Source Ratios for Internal Radiation from the Ingestion of Drinking Water (p=7)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,7,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.116E-30
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.352E-33
Th-232	∑DSR(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.117E-30

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Plant/Air and Plant/Water Concentration Ratios

Mass loading [ASR(3)]: 1.000E-04 g/m**3
Area Factor for Mass Loading [FA(2)]: 1.250E-01

Nuclide (i)	FAR(i,3,2,1) m**3/g	FAR(i,3,2,2) m**3/g	FWR(i,3,3,1) L/g	FWR(i,3,3,2) L/g	FWR(i,3,4,1) L/g	FWR(i,3,4,2) L/g
Ra-228	5.4545E-02	2.6156E-01	4.5319E-06	6.6633E-06	3.4522E-04	1.6554E-03
Th-228	5.4545E-02	2.6156E-01	1.1158E-07	1.6308E-07	3.4522E-04	1.6554E-03
Th-232	5.4545E-02	2.6156E-01	1.1158E-07	1.6308E-07	3.4522E-04	1.6554E-03

FAR(i,p,q,k) is the plant/air concentration ratio for airborne contaminated dust,
and FWR(i,p,q,k) is the plant/water concentration ratio. See groundwater displays
for water/soil concentration ratios.

Plant/Soil Concentration Ratios, FSR(i,3,q,k,t)

Root Uptake (q=1) and Foliar Dust Deposition (q=2)
Nonleafy (k=1) and/or Leafy (k=2) Vegetables

Nuclide(i) Parent	Product	FSR(i,3,1,k)	FSR(i,3,2,1)	FSR(i,3,2,2)
Th-232	Th-232	1.0000E-03	6.8167E-07	3.2688E-06
Th-232	Ra-228+D	4.0000E-02	6.8167E-07	3.2688E-06
Th-232	Th-228+D	1.0000E-03	6.8167E-07	3.2688E-06

Plant/Soil Concentration Ratio, FSR(j,3,q,k,t)
Ditch Irrigation (q=3)

Parent (i)	Product (j)	Thread Fraction	FSR(j,3,3,k,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.914E-36
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.673E-40

Plant/Soil Concentration Ratio, FSR(j,3,q,k,t)
Overhead Irrigation (q=4) and Nonleafy Vegetables (k=1)

Parent (i)	Product (j)	Thread Fraction	FSR(j,3,4,1,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.267E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.136E-36

Plant/Soil Concentration Ratio, FSR(j,3,q,k,t)
Overhead Irrigation (q=4) and Leafy Vegetables (k=2)

Parent (i)	Product (j)	Thread Fraction	FSR(j,3,4,2,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.526E-33
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.450E-36

Meat/Fodder, Milk/Fodder, Fodder/Air and Fodder/Water Concentration Ratios

FI(4,q):	68.0 kg/day	FI(5,q):	55.0 kg/day	q=1,2,3,4
FI(4,q):	50.0 L/day	FI(5,q):	160.0 L/day	q=5
FI(4,q):	0.5 kg/day	FI(5,q):		

Nuclide (i)	FQR(i,4) d/kg	FQR(i,5) d/kg	FAR(i,3,2,3) m**3/g	FWR(i,3,3,3) L/g	FWR(i,3,4,3) L/g
Ra-228	1.0000E-03	1.0000E-03	2.8659E-01	2.1330E-06	1.8139E-03
Th-228	1.0000E-04	5.0000E-06	2.8659E-01	5.1499E-08	1.8139E-03
Th-232	1.0000E-04	5.0000E-06	2.8659E-01	5.1499E-08	1.8139E-03

FI(p,q) are the fodder (q=1,2,3,4), livestock water (q=5) and soil (q=6) intake rates;
FQR(i,p) are the transfer coefficients from contaminated fodder of livestock
water to meat (p=4) or milk (p=5). FAR(i,3,2,3) are the fodder/air
concentration ratios, and FWR(i,3,3,3) and FWR(i,3,4,3) are the fodder/
water concentration ratios for ditch and overhead irrigation, respectively.

Fodder/Soil Concentration Ratios, QSR(i,p,q,t), for Meat and Milk Pathways
Root Uptake (q=1) and Foliar Dust Deposition (q=2)

Nuclide(i) Parent	Product	QSR(i,p,1)	QSR(i,p,2)
Th-232	Th-232	1.0000E-03	3.5816E-06
Th-232	Ra-228+D	4.0000E-02	3.5816E-06
Th-232	Th-228+D	1.0000E-03	3.5816E-06

Fodder/Soil Concentration Ratio, QSR(j,p,q,t),for Meat and Milk Pathways
Ditch Irrigation (q=3)

Parent (i)	Product (j)	Thread Fraction	QSR(j,p,3,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.253E-36
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.695E-40

Fodder/Soil Concentration Ratio, QSR(j,p,q,t),for Meat and Milk Pathways
Overhead Irrigation (q=4)

Parent (i)	Product (j)	Thread Fraction	QSR(j,p,4,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.767E-33
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.970E-36

Fodder/Soil Concentration Ratio, QSR(j,p,q,t),for Meat and Milk Pathways
Livestock Water (q=5)

Parent (i)	Product (j)	Thread Fraction	QSR(j,p,5,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.526E-33
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.292E-36

Meat/Soil Concentration Ratios, FSR(i,4,q,t)
Root Uptake (q=1) and Foliar Dust Deposition (q=2)

Nuclide(i) Parent	Product	FSR(i,4,1)	FSR(i,4,2)
Th-232	Th-232	6.8000E-06	2.4355E-08
Th-232	Ra-228+D	0.0000E+00	0.0000E+00
Th-232	Th-228+D	0.0000E+00	0.0000E+00

Meat/Soil Concentration Ratio, FSR(j,4,q,t)
Ditch Irrigation (q=3)

Parent (i)	Product (j)	Thread Fraction	FSR(j,4,3,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.180E-37
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.597E-40

Meat/Soil Concentration Ratio, FSR(j,4,q,t)
Overhead Irrigation (q=4)

Parent (i)	Product (j)	Thread Fraction	FSR(j,4,4,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.854E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.540E-37

Meat/Soil Concentration Ratio, FSR(j,4,q,t)
Livestock Water (q=5)

Parent (i)	Product (j)	Thread Fraction	FSR(j,4,5,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.628E-35
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.646E-38

Milk/Soil Concentration Ratios, FSR(i,5,q,t)
Root Uptake (q=1) and Foliar Dust Deposition (q=2)

Nuclide(i) Parent	Product	FSR(i,5,1)	FSR(i,5,2)
Th-232	Th-232	2.7500E-07	9.8495E-10
Th-232	Ra-228+D	0.0000E+00	0.0000E+00
Th-232	Th-228+D	0.0000E+00	0.0000E+00

Milk/Soil Concentration Ratio, FSR(j,5,q,t)
Ditch Irrigation (q=3)

Parent (i)	Product (j)	Thread Fraction	FSR(j,5,3,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.763E-37
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.881E-41

Milk/Soil Concentration Ratio, FSR(j,5,q,t)
Overhead Irrigation (q=4)

Parent (i)	Product (j)	Thread Fraction	FSR(j,5,4,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.499E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.454E-38

Milk/Soil Concentration Ratio, FSR(j,5,q,t)
Livestock Water (q=5)

Parent (i)	Product (j)	Thread Fraction	FSR(j,5,5,t) * SF(j,t) At Time in Years 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.441E-34
Th-232	Th-228+D	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.634E-39

Dose/Source Ratios for Soil Ingestion Pathway (p=8)
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,8,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	1.000E+00	4.036E-02	4.036E-02	4.036E-02	4.035E-02	4.035E-02	4.034E-02	4.030E-02	4.017E-02
Th-232	Ra-228+D	1.000E+00	1.233E-03	3.505E-03	7.282E-03	1.505E-02	2.018E-02	2.063E-02	2.061E-02	2.055E-02
Th-232	Th-228+D	1.000E+00	7.720E-05	4.731E-04	1.876E-03	6.935E-03	1.118E-02	1.157E-02	1.156E-02	1.152E-02
Th-232	∑DSR(j)		4.167E-02	4.433E-02	4.951E-02	6.234E-02	7.170E-02	7.254E-02	7.247E-02	7.224E-02

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Dose Conversion and Environmental Transport Factors for the Soil Ingestion Pathway (p=8)

Parent (i)	Product (j)	DCF(j,8)*	ETF(j,8,t) At Time in Years (g/yr) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Th-232	Th-232	2.730E-03	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01
Th-232	Ra-228+D	1.442E-03	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01
Th-232	Th-228+D	8.086E-04	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01	1.478E+01

* - The dose conversion factor units are mrem/pCi.

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Cancer Risk Slope Factors Summary Table
Risk Library: FGR 13 Morbidity

Menu	Parameter	Current Value	Base Case*	Parameter Name
Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
Sf-1	Ra-228+D	4.53E-06	0.00E+00	SLPF(1,1)
Sf-1	Th-228+D	7.76E-06	5.59E-09	SLPF(2,1)
Sf-1	Th-232	3.42E-10	3.42E-10	SLPF(3,1)
Sf-2	Inhalation, slope factors, 1/(pCi):			
Sf-2	Ra-228+D	4.37E-08	4.37E-08	SLPF(1,2)
Sf-2	Th-228+D	1.44E-07	1.32E-07	SLPF(2,2)
Sf-2	Th-232	4.33E-08	4.33E-08	SLPF(3,2)
Sf-3	Food ingestion, slope factors, 1/(pCi):			
Sf-3	Ra-228+D	1.43E-09	1.43E-09	SLPF(1,3)
Sf-3	Th-228+D	4.22E-10	1.48E-10	SLPF(2,3)
Sf-3	Th-232	1.33E-10	1.33E-10	SLPF(3,3)
Sf-3	Water ingestion, slope factors, 1/(pCi):			
Sf-3	Ra-228+D	1.04E-09	1.04E-09	SLPF(1,4)
Sf-3	Th-228+D	2.99E-10	1.07E-10	SLPF(2,4)
Sf-3	Th-232	1.01E-10	1.01E-10	SLPF(3,4)
Sf-3	Soil ingestion, slope factors, 1/(pCi):			
Sf-3	Ra-228+D	1.43E-09	1.43E-09	SLPF(1,5)
Sf-3	Th-228+D	4.22E-10	1.48E-10	SLPF(2,5)
Sf-3	Th-232	1.33E-10	1.33E-10	SLPF(3,5)
Sf-Rn	Radon Inhalation slope factors, 1/(pCi):			
Sf-Rn	Rn-220Inhalation slope factors, 1/(pCi):	1.90E-13	1.90E-13	SLPFRN(2,1)
Sf-Rn	Po-216Inhalation slope factors, 1/(pCi):	3.00E-15	3.00E-15	SLPFRN(2,2)
Sf-Rn	Pb-212Inhalation slope factors, 1/(pCi):	3.90E-11	3.90E-11	SLPFRN(2,3)
Sf-Rn	Bi-212Inhalation slope factors, 1/(pCi):	3.70E-11	3.70E-11	SLPFRN(2,4)
Sf-Rn	Radon K factors, (mrem/WLM):			
Sf-Rn	Rn-220 Indoor	1.50E+02	1.50E+02	KFACTR(2,1)
Sf-Rn	Rn-220 Outdoor	2.50E+02	2.50E+02	KFACTR(2,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Risk Slope and Environmental Transport Factors for the Ground Pathway

Nuclide (i)	Slope(i)*	ETFG(i,t) At Time in Years (dimensionless) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-228	4.530E-06	5.235E-01	5.235E-01	5.235E-01	5.235E-01	5.235E-01	5.235E-01	5.235E-01	4.988E-01
Bi-212	8.870E-07	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.211E-01	5.012E-01
Pb-212	5.090E-07	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.368E-01	5.385E-01
Po-212	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Po-216	7.870E-11	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.218E-01	5.042E-01
Ra-224	3.720E-08	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.364E-01	5.376E-01
Ra-228	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Rn-220	1.700E-09	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.204E-01	5.148E-01
Th-228	5.590E-09	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.401E-01	5.452E-01
Th-232	3.420E-10	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.444E-01	5.490E-01
Tl-208	1.760E-05	5.244E-01	5.244E-01	5.244E-01	5.244E-01	5.244E-01	5.244E-01	5.243E-01	4.633E-01

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 0.000E+00 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	3.732E-02	3.715E+01	7.636E-02	5.447E-03	1.168E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.891E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 0.000E+00 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	4.019E-05	0.2715	3.503E-08	0.0002	4.539E-05	0.3066	1.298E-07	0.0009	1.603E-07	0.0011	3.590E-07	0.0024
Th-228	6.084E-05	0.4111	1.016E-07	0.0007	4.633E-07	0.0031	1.486E-09	0.0000	9.852E-11	0.0000	9.322E-08	0.0006
Th-232	4.412E-09	0.0000	4.847E-08	0.0003	1.482E-07	0.0010	3.047E-10	0.0000	2.173E-11	0.0000	4.659E-08	0.0003
Total	1.010E-04	0.6826	1.851E-07	0.0013	4.600E-05	0.3108	1.316E-07	0.0009	1.604E-07	0.0011	4.988E-07	0.0034

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.627E-05	0.5828
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.150E-05	0.4155
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.480E-07	0.0017
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.480E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 0.000E+00 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.010E-04	0.6826	1.851E-07	0.0013	0.000E+00	0.0000	4.600E-05	0.3108	1.316E-07	0.0009	1.604E-07	0.0011	4.988E-07	0.0034
Total	1.010E-04	0.6826	1.851E-07	0.0013	0.000E+00	0.0000	4.600E-05	0.3108	1.316E-07	0.0009	1.604E-07	0.0011	4.988E-07	0.0034

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.480E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.480E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+00 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	4.230E-03	1.621E+02	4.106E-01	5.370E-01	1.324E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.644E+02
Th-228	6.949E-04	2.706E+00	1.077E-02	7.243E-04	2.174E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.935E+00
Th-232	3.732E-02	3.715E+01	7.636E-02	5.447E-03	1.168E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.891E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+00 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	4.186E-05	0.2708	3.648E-08	0.0002	4.727E-05	0.3058	1.352E-07	0.0009	1.670E-07	0.0011	3.738E-07	0.0024
Th-228	6.381E-05	0.4128	1.065E-07	0.0007	4.847E-07	0.0031	1.552E-09	0.0000	1.029E-10	0.0000	9.777E-08	0.0006
Th-232	4.412E-09	0.0000	4.847E-08	0.0003	1.482E-07	0.0010	3.047E-10	0.0000	2.173E-11	0.0000	4.659E-08	0.0003
Total	1.057E-04	0.6836	1.915E-07	0.0012	4.790E-05	0.3098	1.370E-07	0.0009	1.671E-07	0.0011	5.182E-07	0.0034

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.984E-05	0.5811
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.450E-05	0.4173
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.480E-07	0.0016
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.546E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+00 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.057E-04	0.6836	1.915E-07	0.0012	0.000E+00	0.0000	4.790E-05	0.3098	1.370E-07	0.0009	1.671E-07	0.0011	5.182E-07	0.0034
Total	1.057E-04	0.6836	1.915E-07	0.0012	0.000E+00	0.0000	4.790E-05	0.3098	1.370E-07	0.0009	1.671E-07	0.0011	5.182E-07	0.0034

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.546E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.546E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 3.000E+00 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	1.126E-02	4.419E+02	1.227E+00	1.536E+00	3.524E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.482E+02
Th-228	4.621E-03	1.010E+01	3.752E-02	2.461E-03	1.446E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.159E+01
Th-232	3.732E-02	3.715E+01	7.636E-02	5.447E-03	1.168E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.891E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 3.000E+00 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	4.459E-05	0.2682	3.886E-08	0.0002	5.037E-05	0.3030	1.442E-07	0.0009	1.780E-07	0.0011	3.983E-07	0.0024
Th-228	6.954E-05	0.4183	1.161E-07	0.0007	5.240E-07	0.0032	1.671E-09	0.0000	1.108E-10	0.0000	1.065E-07	0.0006
Th-232	4.412E-09	0.0000	4.847E-08	0.0003	1.482E-07	0.0009	3.047E-10	0.0000	2.173E-11	0.0000	4.659E-08	0.0003
Total	1.141E-04	0.6865	2.034E-07	0.0012	5.104E-05	0.3070	1.462E-07	0.0009	1.782E-07	0.0011	5.514E-07	0.0033

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.572E-05	0.5757
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.029E-05	0.4228
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.480E-07	0.0015
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.663E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 3.000E+00 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.141E-04	0.6865	2.034E-07	0.0012	0.000E+00	0.0000	5.104E-05	0.3070	1.462E-07	0.0009	1.782E-07	0.0011	5.514E-07	0.0033
Total	1.141E-04	0.6865	2.034E-07	0.0012	0.000E+00	0.0000	5.104E-05	0.3070	1.462E-07	0.0009	1.782E-07	0.0011	5.514E-07	0.0033

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.663E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.663E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+01 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	2.573E-02	1.017E+03	2.905E+00	3.591E+00	8.051E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.032E+03
Th-228	2.079E-02	3.337E+01	1.091E-01	7.215E-03	6.505E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.999E+01
Th-232	3.732E-02	3.715E+01	7.636E-02	5.447E-03	1.168E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.890E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+01 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	5.031E-05	0.2620	4.384E-08	0.0002	5.686E-05	0.2961	1.631E-07	0.0008	2.012E-07	0.0010	4.493E-07	0.0023
Th-228	8.289E-05	0.4316	1.384E-07	0.0007	6.129E-07	0.0032	1.933E-09	0.0000	1.283E-10	0.0000	1.270E-07	0.0007
Th-232	4.412E-09	0.0000	4.847E-08	0.0003	1.482E-07	0.0008	3.046E-10	0.0000	2.173E-11	0.0000	4.659E-08	0.0002
Total	1.332E-04	0.6936	2.307E-07	0.0012	5.762E-05	0.3000	1.654E-07	0.0009	2.014E-07	0.0010	6.229E-07	0.0032

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.080E-04	0.5625
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.377E-05	0.4362
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.480E-07	0.0013
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.920E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+01 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.332E-04	0.6936	2.307E-07	0.0012	0.000E+00	0.0000	5.762E-05	0.3000	1.654E-07	0.0009	2.014E-07	0.0010	6.229E-07	0.0032
Total	1.332E-04	0.6936	2.307E-07	0.0012	0.000E+00	0.0000	5.762E-05	0.3000	1.654E-07	0.0009	2.014E-07	0.0010	6.229E-07	0.0032

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.920E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.920E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 3.000E+01 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	3.527E-02	1.397E+03	4.012E+00	4.946E+00	1.104E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.417E+03
Th-228	3.482E-02	5.207E+01	1.632E-01	1.084E-02	1.089E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.314E+01
Th-232	3.731E-02	3.714E+01	7.635E-02	5.447E-03	1.168E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.890E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 3.000E+01 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	5.407E-05	0.2575	4.712E-08	0.0002	6.114E-05	0.2912	1.756E-07	0.0008	2.165E-07	0.0010	4.829E-07	0.0023
Th-228	9.261E-05	0.4411	1.546E-07	0.0007	6.760E-07	0.0032	2.114E-09	0.0000	1.405E-10	0.0000	1.419E-07	0.0007
Th-232	4.411E-09	0.0000	4.847E-08	0.0002	1.482E-07	0.0007	3.046E-10	0.0000	2.173E-11	0.0000	4.659E-08	0.0002
Total	1.467E-04	0.6986	2.502E-07	0.0012	6.196E-05	0.2951	1.780E-07	0.0008	2.166E-07	0.0010	6.714E-07	0.0032

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.161E-04	0.5531
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.359E-05	0.4457
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.480E-07	0.0012
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.100E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 3.000E+01 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.467E-04	0.6986	2.502E-07	0.0012	0.000E+00	0.0000	6.196E-05	0.2951	1.780E-07	0.0008	2.166E-07	0.0010	6.714E-07	0.0032
Total	1.467E-04	0.6986	2.502E-07	0.0012	0.000E+00	0.0000	6.196E-05	0.2951	1.780E-07	0.0008	2.166E-07	0.0010	6.714E-07	0.0032

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.100E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.100E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+02 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	3.612E-02	1.431E+03	4.111E+00	5.067E+00	1.130E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.451E+03
Th-228	3.612E-02	5.379E+01	1.681E-01	1.117E-02	1.130E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.527E+01
Th-232	3.730E-02	3.713E+01	7.632E-02	5.445E-03	1.167E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.888E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+02 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	5.440E-05	0.2572	4.740E-08	0.0002	6.150E-05	0.2908	1.767E-07	0.0008	2.178E-07	0.0010	4.858E-07	0.0023
Th-228	9.347E-05	0.4419	1.560E-07	0.0007	6.815E-07	0.0032	2.130E-09	0.0000	1.416E-10	0.0000	1.432E-07	0.0007
Th-232	4.410E-09	0.0000	4.845E-08	0.0002	1.481E-07	0.0007	3.045E-10	0.0000	2.172E-11	0.0000	4.657E-08	0.0002
Total	1.479E-04	0.6991	2.519E-07	0.0012	6.233E-05	0.2947	1.791E-07	0.0008	2.179E-07	0.0010	6.756E-07	0.0032

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.168E-04	0.5523
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.446E-05	0.4465
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.479E-07	0.0012
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.115E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+02 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.479E-04	0.6991	2.519E-07	0.0012	0.000E+00	0.0000	6.233E-05	0.2947	1.791E-07	0.0008	2.179E-07	0.0010	6.756E-07	0.0032
Total	1.479E-04	0.6991	2.519E-07	0.0012	0.000E+00	0.0000	6.233E-05	0.2947	1.791E-07	0.0008	2.179E-07	0.0010	6.756E-07	0.0032

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.115E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.115E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 3.000E+02 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	3.608E-02	1.430E+03	4.107E+00	5.062E+00	1.129E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.450E+03
Th-228	3.608E-02	5.374E+01	1.680E-01	1.116E-02	1.129E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.521E+01
Th-232	3.727E-02	3.710E+01	7.625E-02	5.440E-03	1.166E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.884E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 3.000E+02 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	5.434E-05	0.2584	4.736E-08	0.0002	6.042E-05	0.2874	1.741E-07	0.0008	2.147E-07	0.0010	4.854E-07	0.0023
Th-228	9.337E-05	0.4440	1.559E-07	0.0007	6.696E-07	0.0032	2.109E-09	0.0000	1.403E-10	0.0000	1.431E-07	0.0007
Th-232	4.406E-09	0.0000	4.841E-08	0.0002	1.455E-07	0.0007	3.036E-10	0.0000	2.167E-11	0.0000	4.653E-08	0.0002
Total	1.477E-04	0.7025	2.517E-07	0.0012	6.124E-05	0.2912	1.765E-07	0.0008	2.148E-07	0.0010	6.750E-07	0.0032

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.157E-04	0.5502
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.434E-05	0.4487
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.452E-07	0.0012
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.103E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 3.000E+02 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.477E-04	0.7025	2.517E-07	0.0012	0.000E+00	0.0000	6.124E-05	0.2912	1.765E-07	0.0008	2.148E-07	0.0010	6.750E-07	0.0032
Total	1.477E-04	0.7025	2.517E-07	0.0012	0.000E+00	0.0000	6.124E-05	0.2912	1.765E-07	0.0008	2.148E-07	0.0010	6.750E-07	0.0032

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.103E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.103E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+03 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
Ra-228	3.597E-02	3.167E+02	1.411E+00	1.857E+00	1.126E+01	6.147E-28	0.000E+00	2.543E-29	0.000E+00	0.000E+00	3.312E+02
Th-228	3.597E-02	1.193E+01	9.649E-02	6.878E-03	1.126E+01	1.326E-30	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.329E+01
Th-232	3.715E-02	8.244E+00	6.893E-02	5.005E-03	1.162E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.994E+01

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Amount of Intake Quantities QINT9(irn,i,t) and QINT9W(irn,i,t) for Inhalation of
Radon and its Decay Products as pCi/yr at t= 1.000E+03 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	5.079E-05	0.3461	4.720E-08	0.0003	1.259E-05	0.0858	5.819E-08	0.0004	7.690E-08	0.0005	4.838E-07	0.0033
Th-228	8.210E-05	0.5596	1.554E-07	0.0011	1.399E-07	0.0010	1.203E-09	0.0000	8.600E-11	0.0000	1.426E-07	0.0010
Th-232	4.426E-09	0.0000	4.825E-08	0.0003	3.043E-08	0.0002	2.744E-10	0.0000	1.993E-11	0.0000	4.638E-08	0.0003
Total	1.329E-04	0.9058	2.509E-07	0.0017	1.276E-05	0.0870	5.967E-08	0.0004	7.700E-08	0.0005	6.728E-07	0.0046

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.405E-05	0.4365
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.254E-05	0.5626
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.298E-07	0.0009
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.467E-04	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS9(irn,i,t) and CNRS9W(irn,i,t) for Inhalation of
Radon and its Decay Products at t= 1.000E+03 years

Radon	Radionuclides							
Pathway	Rn-222	Po-218	Pb-214	Bi-214	Rn-220	Po-216	Pb-212	Bi-212
Water-ind.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Water-dep.	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Water-ind. == Water-independent Water-dep. == Water-dependent

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	1.329E-04	0.9058	2.509E-07	0.0017	0.000E+00	0.0000	1.276E-05	0.0870	5.967E-08	0.0004	7.700E-08	0.0005	6.728E-07	0.0046
Total	1.329E-04	0.9058	2.509E-07	0.0017	0.000E+00	0.0000	1.276E-05	0.0870	5.967E-08	0.0004	7.700E-08	0.0005	6.728E-07	0.0046

Total Excess Cancer Risk CNRS(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.467E-04	1.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.467E-04	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

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