

DRAFT

Work Plan

Marine Sediment Sampling

for

Former Derecktor Shipyard Naval Station Newport Newport, Rhode Island



Engineering Field Activity Northeast Naval Facility Engineering Command

Contract Number N62472-03-D-0057

Contract Task Order 008

July 2004



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Project Number N1611

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Reference: CLEAN Contract No. N62472-03-D-0057
Contract Task Order No. 008

Subject: Draft Work Plan
Sediment Evaluation, Former Robert E. Derecktor Shipyard
Naval Station Newport, Newport Rhode Island

Dear Mr. Frye:

Enclosed for your records, you will find three electronic copies and one paper copy of the Draft Work Plan for the site referenced above. In accordance with the task order, copies of this work plan have been provided to the persons on the distribution list below for their information.

You will recall that this sediment evaluation is being conducted to update information available for the Coddington Cove area near the former Derecktor Shipyard. Please be advised that we anticipate conducting field work in mid August, 2004.

If you have any questions regarding this material, please do not hesitate to contact me.

Very truly yours,

Stephen S. Parker, LSP
Project Manager

SSP/rp

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WORK PLAN
MARINE SEDIMENT SAMPLING
FOR
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND
COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION - NAVY (CLEAN) CONTRACT

Submitted to:
Engineering Field Activity Northeast
Environmental Branch (Code EV2)
Naval Facilities Engineering Command
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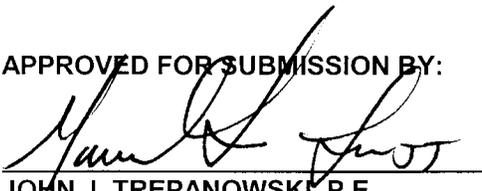

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ABBREVIATIONS AND ACRONYMS

AVS	acid volatile sulfides
ASTM	American Society for Testing and Materials
bgs	below ground surface
BPRGs	baseline preliminary remediation goals
BN	benthic
CD	compact disk
COD	chemical oxygen demand
CNESS	chord-normalized expected species shared
DI	deionized
dGPS	Differential Global Positioning System
DIUF	deionized ultrafiltered
DO	dissolved oxygen
DQO	data quality objective
DUP	duplicate
EDD	electronic data deliverables
FB	field blank
FOL	Field Operations Leader
G&A	
GIS	Geographic Information System
IATA	International Air Transportation Association
ICOC	indicator constituents of concern
ID	identification
IDW	investigation-derived waste
LCS	laboratory control standard
LEL	lower explosive limit
LQAP	Laboratory Quality Assurance Plan
LTMP	Long-term monitoring Plan
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NAVSTA	Naval Station
ND	not determined
NELAC	National Environmental Laboratory Accreditation Conference
NFESC	Naval Facilities Engineering Service Center
NOAA	National Oceanic and Atmospheric Administration
NORTHDIV	Northern Division
NR	not reported
NS&T	National Status and Trends
NSN	Naval Station Newport

ABBREVIATIONS AND ACRONYMS (cont.)

O&M	operation and maintenance
ORP	oxidation-reduction potential
OSI	organism-sediment index
PAH	polycyclic aromatic hydrocarbons
PARCC	precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyls
PE	performance evaluation
PID	photoionization detector
PPE	personal protective equipment
ppt	parts per thousand
PRG	Preliminary Remediation Goals
PTW	potable water
PVC	polyvinyl chloride
PW	porewater
QA	quality assurance
QA/QC	quality assurance/quality control
QAO	quality assurance officer
QC	quality control
QL	quantitation limits
RCRA	Resource Conservation and Recovery Act
RIDEM	Rhode Island Department of Environmental Management
ROD	Record of Decision
RPD	relative percent difference or redox potential discontinuity
RPRGs	recommended preliminary remediation goals
SAIC	Science Applications International Corporation
SEM	simultaneously extractable metals
SLN	sample location number
SOP	standard operating procedure
SPI	sediment profile imaging
SVOC	semivolatile organic compound
TAL	target analyte list
TBD	to be determined
TCL	target compound list
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSA	Technical Systems Audit
TSD	treatment, storage, and disposal
U.S.	EPA United States Environmental Protection Agency
µg/kg	microgram per kilogram
VOA	volatile organic analysis
VOC	volatile organic compound

1.0 INTRODUCTION

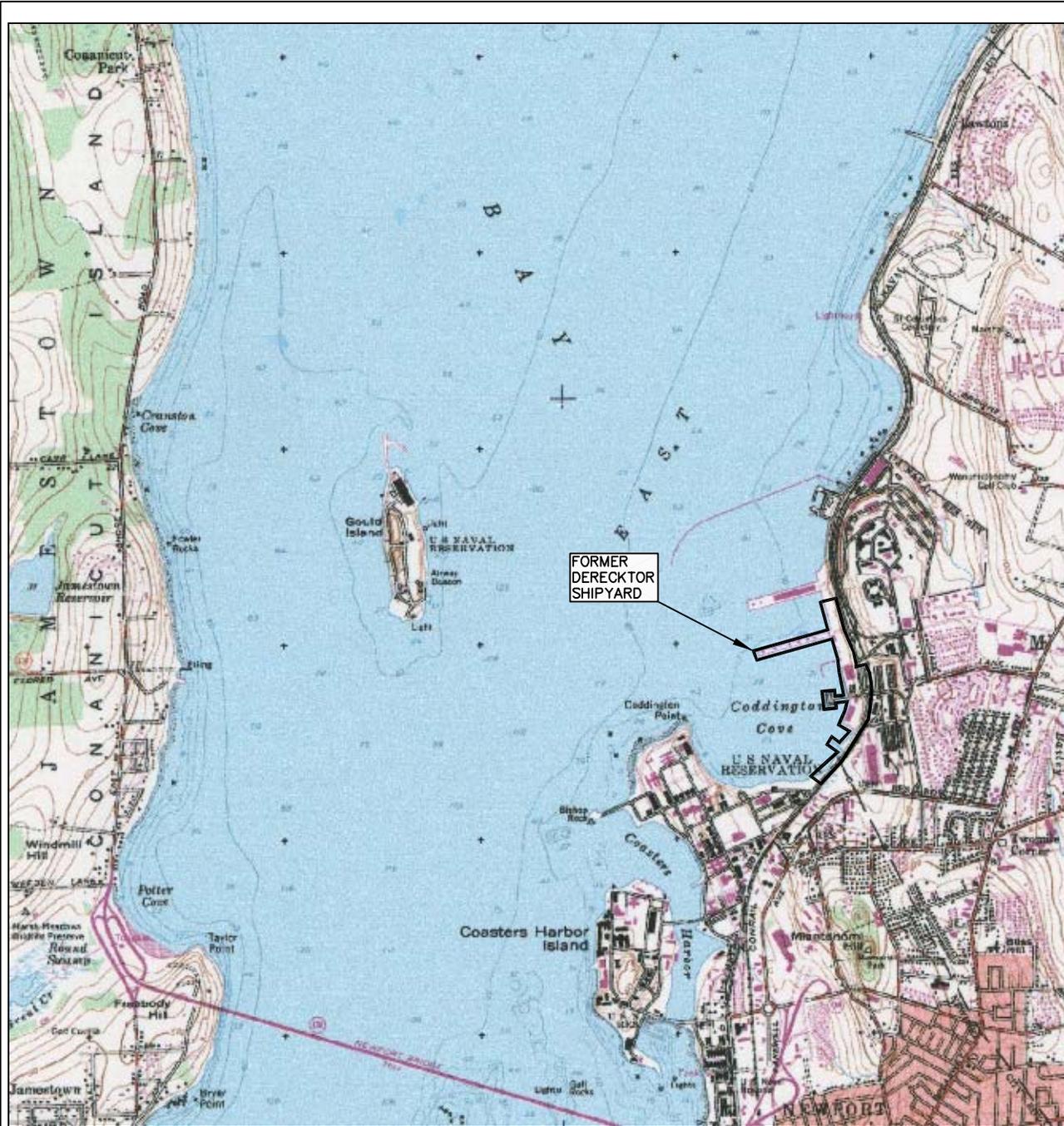
At the request of the US Navy (“the Navy”), Tetra Tech NUS Inc. has completed a Work Plan (WP) for the marine portion of the Former Robert E. Derecktor Shipyard - Site 19 (the site), located at Naval Station Newport (NSN) Newport in Newport, Rhode Island. The WP was prepared under the Navy’s Installation Restoration Program (IRP) in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). This work is being conducted under Contract Number N62472-03-D-0057 for the Engineering Field Activity, Northeast (EFANE) Naval Facilities Engineering Command located in Lester, Pennsylvania.

The Federal Facilities Agreement (FFA) describes and defines Study Area 19 as a part of the Naval Education and Training Center (NETC). Although the name reference has been changed in 1998 to NSN, the requirements of the FFA follow accordingly.

This work plan was developed to address marine sediment contamination issues at the site. Previously, studies have been conducted to ascertain whether site activities had resulted in contamination of marine sediments near the site. Results of these studies were presented in the *(Final) Marine Ecological Risk Assessment Report, Former Robert E. Derecktor Shipyard* (prepared by Science Applications International Corporation (SAIC) and the University of Rhode Island (URI, May 1997) (Marine ERA); the *(Draft Final) Site Assessment Screening Evaluation (SASE) Report* (B&R Environmental, 1997); the *Human Health Risk Assessment for Off Shore Areas of the Derecktor Shipyard (HHRA)* (B&R Environmental, June 1998), and the *Feasibility Study (FS)* (Tetra Tech NUS, Inc., July 1999). This document summarizes the results of these studies and their conclusions pertinent to the media of concern for this WP.

The Navy is performing this investigation in order to better understand the nature of the contamination in the offshore marine sediments near the former Derecktor Shipyard site (Figure 1-1). In particular, this study is intended to address the following uncertainties:

1. Sediments were previously evaluated in the 1995-1997 period, no data is available since that time. New data is needed to confirm presence and distribution of contaminants previously found in this area.



BASE MAP IS A PORTION OF THE FOLLOWING 7.5 X 15 MINUTE U.S.G.S. QUADRANGLE:
PRUDENCE ISLAND, RHODE ISLAND, 1955, PHOTOREVISED 1970 AND 1975



QUADRANGLE LOCATION

SITE LOCUS

FIGURE 1-1

FORMER DERECKTOR SHIPYARD
NAVSTA NEWPORT, RHODE ISLAND



TETRA TECH NUS, INC.

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	S. PARKER	DATE:	JUNE 4, 2004
SCALE:	AS NOTED	ACAD NAME:	DWG\1611\0421\FIG_1-1.DWG

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2. It is necessary to have a clear knowledge of the source of hydrocarbon contaminants that are present prior to undertaking potential remedial actions at the site. As the Navy moves towards remedial action, it is important to understand if the source of the hydrocarbon contaminants are from the site itself or from any other source that will not be controlled by any site-specific remedial actions.

To resolve these uncertainties, a new round of sediment sampling will be conducted in the marine sediments at the site. This round of sampling involves collection of additional sediment samples for bulk sediment chemistry analysis as was previously done (see Section 2), and collection of sediment samples for forensic type analysis in order to “fingerprint” the hydrocarbon components that are present in the high ecological risk areas.

Data from this investigation will be used to confirm the concentrations of contaminants in sediment, determine if changes have occurred in contaminant levels over time, and to confirm the extent of the area exceeding Preliminary Remediation Goals (PRGs). The PRGs were calculated as presented in the Feasibility Study for Former Robert E. Drecktor Shipyard (FS) (TtNUS, July, 1999).

This Work Plan includes four sections: this Introduction; the Site Background, including a brief summary of existing data and the sampling and analysis program design; the Field Sampling Plan; and the Quality Assurance/Quality Control Plan. Appendix A presents Standard Operating Procedures (SOPs) for the field investigation work. Appendix B contains samples of forms to be used for documentation during this investigation.

The tasks described in this Work Plan include:

- collection of surface sediment samples in and around previously identified areas exceeding the PRGs of poly chlorinated biphenyls (PCBs), total petroleum hydrocarbons/polycyclic aromatic hydrocarbons (TPH/PAH) and metals contaminants,
- analysis of sediment samples to determine whether concentrations of PCBs, TPH/PAHs and metals exceed Preliminary Remediation Goals (PRGs) for sediment defined in the Feasibility Study for the site,
- analysis of sediment samples using forensic techniques (TPH fingerprinting and extended PAH analysis) to identify probable hydrocarbon contaminant sources,
- monitoring of surface water turbidity over time at specific target areas,
- preparation and submittal of draft and final reports describing the findings of these investigations.

2.0 BACKGROUND INFORMATION

This section presents background information for the marine portions of former Robert E. Derecktor Shipyard site, including a site description, site history, a brief summary of previous investigations, a summary of the sampling and analysis program design, and a discussion of the project data quality objectives.

2.1 SITE LOCATION AND DESCRIPTION

The NSN is located approximately 60 miles southwest of Boston, Massachusetts, and 25 miles south of Providence, Rhode Island. It occupies approximately 1,063 acres, with portions of the facility located in the City of Newport and Towns of Middletown and Portsmouth, Rhode Island. The facility layout is long and narrow, following the western shoreline of Aquidneck Island for nearly 6 miles facing the east passage of Narragansett Bay.

The Robert E. Derecktor Shipyard Site is located in Coddington Cove at the central portion of the NSN (Figure 1-1). The site is comprised of approximately 41 acres of shoreline land and improvements, which was leased to the Rhode Island Port Authority and Economic Development Corporation (RIPAEDC) by the Navy. RIPAEDC, in turn, leased this parcel to Robert E. Derecktor Shipyards of Rhode Island, Inc. This lease commenced January 1, 1979, and ran until the Derecktor Corporation filed for bankruptcy protection in January 1992. A general conditions map of the Coddington Cove study area is provided as Figure 2-1.

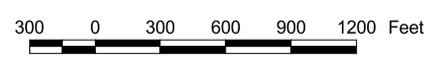
2.2 SITE HISTORY

The NSN facility has been in use by the Navy since the Civil War era. During World Wars I and II, military activities at the facility increased significantly and the base provided housing for many servicemen. In subsequent peacetime years, use of on-site facilities was slowly phased out until Newport became the headquarters of the Commander Cruiser-Destroyer Force Atlantic in 1962. In April 1973, the Shore Establishment Realignment (SER) Program resulted in the reorganization of naval forces, and activity again declined. This reorganization resulted in the Navy excessing 1,629 of its former 2,420 acres. Portions of the facility are currently leased by the Navy to the RIPAEDC. Some of these areas are, in turn, subleased to private enterprises.

NSN was listed on the US Environmental Protection Agency (EPA) National Priorities List (NPL) of abandoned or uncontrolled hazardous waste sites in November 1989. The NPL identifies those sites that pose a significant threat to the public health and the environment.



Source:
1997 aerial photograph, Rhode Island Department of Administration, Division of Planning



FORMER SEDIMENT SAMPLE STATIONS	
FORMER DERECKTOR SHIPYARD WORK PLAN	
NAVSTA NEWPORT - NEWPORT, RHODE ISLAND	
DRAWN BY: L. SEYDEWITZ	DATE: JUNE 4, 2004
CHECKED BY: S. PARKER	G:\...CTO 842\FormerDerecktor2004wp

FIGURE 2-1

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A Federal Facilities Interagency Agreement (FFA) for NSN was signed by the Navy, the State of Rhode Island, and the EPA on March 23, 1992. The FFA outlines response action requirements under the Installation Restoration Program (IRP) at NSN. The IRP is similar to the EPA's Superfund Program authorized under CERCLA in 1980, as amended by SARA in 1986. The FFA was developed, in part, to ensure that environmental impacts associated with past and present activities at NSN are thoroughly investigated and remediated, as necessary. While the Derecktor Shipyard site was not originally on the list of IRP sites in the FFA, it was added in 1994 as a "Study Area".

The shoreline of Coddington Cove was acquired in 1940 for use as a Navy supply station. Prior to this time, the Coddington Cove area was farm land with few buildings. During World War II, the Coddington Cove area experienced major development, including construction of barracks, warehouse space, and hundreds of Quonset huts. Although naval activity diminished following the end of World War II, some construction at Coddington Cove continued. In 1955, Pier 1 was completed to replace pier space lost in 1954 during Hurricane Carol. The adjacent Pier 2 was added in 1957.

In 1962, Newport became headquarters to the Commander Cruiser-Destroyer Force Atlantic. Dozens of naval warships and auxiliary support ships were home-ported at Newport. A 1962 aerial photograph of the Coddington Cove area shows 18 naval warships moored at Pier 1.

The Navy's use of the Coddington Cove area continued until April 1973, when the Navy announced the SER program. The SER resulted in a reorganization of naval forces at Newport and the transfer of ships and activities to other naval stations. The SER also directed transferring or excessing non-essential land and facilities.

During the period between 1973 and 1979, Building 40 was leased to Coddington Yachts Inc., and Building 234 was used by the Newport Shipyard, Inc. Building 42 was used by the Newport Seafood Group as a fish processing plant. In 1979, the Navy leased 41 acres to the RIPAEDC, which in turn subleased the property to Robert E. Derecktor Shipyards of Rhode Island Inc.

During the lease period, Derecktor dismantled Buildings 40 and 41, removed them from their original location south of Building 42, and re-assembled them in four sections near Pier 1. These are referred to as Huts 1-4. Derecktor also constructed a large addition to Building 234, which was used as a setup area so that ships could be constructed inside.

The site was used by Derecktor to repair, maintain, and construct private and military ships. Repair and maintenance operations were concentrated around Pier 1. These operations largely consisted of sandblasting and painting, hull inspections, and other on-board ship repairs. Two floating dry docks were

moored at Pier 1, and a large ferry, known as the Greenport Ferry, was moored between Buildings A18 and 234 for use as work space.

Derecktor also constructed new ships under contract to the US Coast Guard and the US Army. These ships had steel structures, and were used as cutters and tugboats. Construction included cutting and welding steel, sandblasting, priming and painting the structure, and assembling the ship. Ship assembly was primarily conducted in Building 234. Supporting the ship maintenance and construction operations were an engineering department (Buildings 6 and A-18), an electrical and pipe shop (Building 6), a vehicle maintenance shop (Huts 1 and 2), as well as small storage (Huts 3 and 4). In 1992, the Derecktor corporation filed for bankruptcy protection.

2.3 PREVIOUS STUDIES

Because there was a possibility of hazardous materials releases at the site, and since The Derecktor corporation had filed for bankruptcy, the Navy performed a Preliminary Assessment (PA) of the site. This was completed in May 1993; the following conclusions were drawn:

- Shipyard operations generated large quantities of hazardous wastes, including waste oil, paints, solvents, thinners, concentrated bases, and other waste solids and liquids.
- Housekeeping practices and hazardous material handling practices at the facility were poor.
- Waste materials, including spent sandblast grit and oily liquids from the dry dock, were known to be disposed of on the property.
- Sand blast grit and metals-contaminated marine sediments are present around Pier 1.
- Releases of hazardous material are suspected in the waterfront areas and around Building 6.
- Interiors of Buildings 42, 234, 6, and 40 require cleaning prior to re-use.
- Numerous unlabeled 55-gallon drums containing unknown liquids were present.
- Asbestos-containing materials were suspected in some buildings.
- Releases to the ground surface at the site would most likely cause contaminants to pass to the marine environment through groundwater flow or via storm drain systems.

Based on these findings, the Navy added the site to the FFA list as a Study Area (SA-19). In 1995 and 1996, more thorough investigations were performed and environmental cleanup actions were performed. The Site Assessment Screening Evaluation (SASE) (B&R Environmental, June 1997) was performed to identify and characterize contaminants in the on-shore portions of the site. A Marine Ecological Risk Assessment (ERA) (SAIC and URI, May 1997) was performed to characterize the risk posed by contaminants in the marine sediment to ecological receptors near the site. The Human Health Risk Assessment report (HHRA) (B&R Environmental, June 1998) was prepared using data collected as a part of the ERA to identify increased risks to humans from the contaminants in the marine environment. Finally, the Feasibility Study was prepared to evaluate remedial alternatives for the marine portions of the site.

Between the publication of the PA report and the FS, other construction and site restoration activities occurred. Building 234 was removed in 1993, and the old transit shed was removed in 1997, leaving the slab foundations. Huts 3 and 4 were removed in 1993. Huts 1 and 2 were removed in 1997. The dry docks were removed from Pier 1 and the Greenport Ferry was removed in 1993. Building A-18 on the T-Wharf south of Pier 1 was demolished in 1997; the wharf piling has since deteriorated substantially.

NSN Public Works Department (PWD) performed a preliminary removal at the site in 1994 that consisted of removing remaining debris, surface cleaning grossly contaminated concrete, and closing and removing storage tanks.

In 1996, NSN PWD contracted a removal of sand blast grit that was present on the ground to the north and east of Building 42. OHM Corporation removed approximately 16,600 cubic yards of this material and covered the ground with a crushed stone/gravel mix. Sandblast grit was transported and disposed of at McAllister Point Landfill.

In 1997, the soil berm located to the south of the site was removed and sorted. This material was found to contain excavated soils and debris from construction and expansion of Building 234. Some of this material was transported to Tank Farm Four for fill material in the imploded fuel oil bunkers. The remainder was disposed of at Rhode Island landfills.

Another removal action addressed soil contamination under Building 42 and to the northeast of Building 6. These removal actions and their objectives are described in the FS report (B&R Environmental, 1999).

2.4 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

This section summarizes the regional and area physical and hydrological features. This information is based on the information gathered as a part of the SASE and the ERA and supporting studies.

2.4.1 Regional Geology and Hydrogeology

The NSN site is located at the southeastern end of the Narragansett Basin. The rocks of the Narragansett Basin are non-marine sedimentary rocks of Pennsylvanian age. The bedrock at the NSN facility is almost entirely of the Rhode Island Formation. A few areas of thick conglomerates are present within the Rhode Island Formation. They consist of pebbles, cobbles, and boulders inter-bedded with sandstone and graywacke. Overlying the Pennsylvanian rocks of the Narragansett Basin are surficial deposits of Pleistocene sediments. These unconsolidated, glacial sediments range in thickness from 1 to 150 feet and consist of till, sand, gravel, and silt.

Many areas on Aquidneck Island, on which the NSN is located, obtain potable water from wells. Groundwater is obtained from the unconsolidated glacial till and outwash deposits, and from the underlying Pennsylvanian bedrock. The average depth to groundwater is 14 feet. In the NSN area, glacial till deposits are typically less than 20 feet thick. Well yields in these materials range from 1 to 120 gallons per minute. Although till is considered an unconsolidated deposit, the upper limit of this well yield is likely from an outwash deposit that is well sorted and stratified. Till wells typically yield a few hundred gallons of water per day or less than 1 gallon per minute. Bedrock well yields range from less than 1 to as much as 55 gallons per minute and are highly dependent on the presence of joints and fractures. Most groundwater is soft or moderately hard. In scattered locations, pumping has led to salt water intrusion.

2.4.2 Marine Hydrographics

A hydrographic survey was performed by the University of Rhode Island in 1995 to measure current velocity and water column profiling of conductivity, temperature, and depth to determine patterns of water circulation within the study area. This study evaluated the area during several different wind and tidal pattern cycles, but did not account for seasonal variation of wind patterns and effect of winter storms. The complete results are reported in the Ecological Risk Assessment for Derecktor Shipyard Coddington Cove, (URJ, SAIC, July 1996).

The hydrographic surveys showed that the characteristic flow pattern occurs as a net counter-clockwise circulation within the interior of Coddington Cove. On average, maximum bottom velocities were found to be highest at the mouth of the cove and decreased in a counterclockwise manner following a general

circulation pattern around the cove. Flow was such that, in general, the water column appeared well mixed vertically. High bottom velocities extending into the southeastern section of the cove were expected to prevent deposition of silt-sized particles, while the interior sections of the region between the piers and the northeastern region were generally sluggish and expected to be depositional zones (except nearshore and/or shallow areas that may be strongly affected by wave energy or propeller wash).

This study did not account for the localized disturbance of sediments from ship activity at the piers and bulkheads. It is recognized that propeller wash from ships maneuvering to and from the piers will disturb sediments in and around these areas, and that some of the sediments could become resuspended during such activity. Later data assessments were performed to identify expected areas of high energy and low energy, based on anticipated high traffic areas and on projected future use of the property. High energy areas are those areas of the cove where there is a possibility for deposited sediment to be resuspended either through natural wave action or shipping traffic. These include areas along the piers and bulkheads at the waterfront.

2.4.3 Geophysics and Bathymetry of Coddington Cove

Side-scan sonar, sub-bottom profiling sonar, and sediment vibracore surveys were undertaken to determine the characteristics of both surface and underlying sediments within the Derecktor Shipyard/Coddington Cove study area; this combination of techniques provides more complete information than surface and core samples alone. The complete results are reported in the Ecological Risk Assessment for Derecktor Shipyard Coddington Cove, (July 1996).

The results indicated that sediments in the Derecktor Shipyard/Coddington Cove study area were predominantly fine-grained at some stations (less than 40 percent sand content) and predominantly sandy (sand greater than 70 percent) at others. Surface sediments in Coddington Cove tended to be finer-grained (contained more silt and clay) than underlying sandy sediments, probably due to the significantly decreased bottom energy and increased likelihood of fine-grained sediment deposition resulting from construction of the Coddington Cove breakwater in 1957. A "sub-bottom reflector", which is a second reflection of the sonar pulse reflected off something below the surface of the sediment, was observed in some of the geophysical profiles. These second reflectors may delineate different lithologic units. In other locations, no strong sub-bottom reflectors were observed, indicating a likely uniform lithology vertically.

Figure 2-1 summarizes of the grain size characteristics of Coddington Cove surface sediments inferred from the geotechnical and geophysical investigations performed at the site.

To attempt to locate any significant deposits of sandblast grit, a limited investigation focused on the pier areas, using vibracore techniques to determine sediment characteristics at depth. The analysis of these cores was performed by URI and is presented in Appendix D1 of the ERA report.

While some possible sandblast material was noted in some of the cores, no large deposits of this material were found during this investigation program. However, due to the observed presence of minor amounts of sandblast grit observed by the field crew, selected samples were analyzed by a laboratory. Petroleum odors were noted in cores collected at three locations near Pier 1.

The evaluation of the cores confirmed the findings of the geophysical investigation. From 10-foot penetrations, there was high sand content and a lower silt content north of and between the piers. Southwest of Pier 1, there was a higher silt content, as well as along locations that were placed along both sides of Pier 1.

2.5 NATURE AND EXTENT OF CONTAMINATION

The findings of the investigations are presented in recent documents prepared for the Navy, including the SASE and the marine ERA. This section summarizes the results of the studies pertinent to marine sediment within Coddington Cove. Station locations discussed are presented as Figure 2-2.

2.5.1 Marine Sediment

Sediment samples were collected as a part of the marine ecological risk assessment for this site. Surface sediment samples were collected from the 0-18 cm interval, and core sediments were collected from selected locations and depths, within 1 meter of the surface. In addition, elutriate was prepared from sediment and seawater collected at selected locations to evaluate contaminants in resuspended sediment. Elutriate samples are prepared using a 4:1 dilution of water to sediment.

Measurements of bulk sediment concentrations of nine metals was performed at 15 Coddington Cove stations and two reference locations as a part of the marine ecological risk assessment. These measurements were made as a means of assessing the degree of sediment contamination by trace metals and the potential availability/toxicity of the metals to biota. Ranges of concentrations (mg/kg dry wt.) observed at the site were as follows: arsenic - 3.0 to 12.5; cadmium - 0.1-1.5; chromium - 24-112; copper - 1.5 to 180; lead - 13 to 193; mercury - 0.02-1.1; nickel - 5-78; silver - 0.2-1.8; and zinc - 28-547.

Concentrations of organic contaminants at some subtidal stations in the Coddington Cove study area were found to exceed NOAA Effects Range-Low (ER-L) or Effects Range-Medium (ER-M) guidelines,

indicating potential adverse impacts. Concentrations of total PCBs at all stations except DSY-35 and DSY-41 exceeded the ER-L benchmark value, while total PCB concentrations at stations DSY-27, DSY-29, DSY-30, DSY-31, and DSY-32 exceeded the ER-M benchmark value of 180 ug/kg.

Concentrations of total PAHs exceeded the ER-L benchmark of 4,022 ug/kg at approximately half of the Derecktor Shipyard/Coddington Cove stations, and the concentration of 46,400 ug/kg at station DSY-29 (field duplicate sample) exceeded the ER-M value. Concentrations of tributyltin (TBT) exceeded 5 ug Sn/kg, a level considered indicative of a degraded ecological condition, at six stations (DSY-27, DSY-28, DSY-29, DSY-30, DSY-31, and DSY-36).

TBT values ranged from non-detected (less than 1 ug Sn/kg) to 228 ug Sn/kg at station DSY-31. Concentrations of the pesticide p,p'-DDE exceeded the ER-L benchmark value of 2.2 ug/kg at five stations; overall values ranged from 0.1 ug/kg at stations DSY-35 and DSY-41 to slightly less than 7.0 ug/kg at stations DSY-27 and DSY-29 (including the field duplicate sample).

The mixtures of individual PCB congeners and PAH analytes in sediments in the Coddington Cove study area suggest certain substances as the main contributors of the contamination. The major PCB congeners were the 3- to 6-chlorine compounds (congeners 66, 101, 118, 153, and 138), which probably derived from Aroclor 1254, the major Aroclor formulation found in Narragansett Bay surface sediments. Major sources of PCBs to Narragansett Bay include rivers, combined sewer overflows/sewage discharges, and atmospheric deposition.

In general, it is presumed that the presence of these Aroclors in Coddington Cove sediments is also likely to be a result of past industrial and shipping activities which included storage and transfer of PCB transformers. However, the PCB composition at Coddington Cove station DSY-29 FD was different from that at the other stations, with congener 209 (decachlorobiphenyl) accounting for approximately 60 percent of the total congeners measured in the sample. Congener 206 was present in relatively large concentrations. This unique distribution of congeners is presumed to be indicative of the presence of a rare compound known in the chemical industry as "Deka". This compound is used as an ingredient in investment casting wax, and also may be the result of past activities at Derecktor Shipyard.

Concentrations of four- and five-ring pyrogenic PAH compounds (fluoranthene, pyrene, and benzo(b,j,k)fluoranthene) were consistently the highest PAH concentrations observed at stations in the Derecktor Shipyard/Coddington Cove study area. Sources of these compounds include combustion products used in motor oil, atmospheric deposition, creosote/coal tar and asphalt from local activities, terrestrial runoff, and sewage effluent and overflows. There was no evidence of fresh (unweathered) fuel oil in any of the samples, as indicated by qualitative measurements of total petroleum hydrocarbons.

Analyses of elutriate samples showed the presence of PCBs, PAHs, and small amounts of p,p'-DDE. Elutriate from Station DSY-25 had the highest concentration of both total PAHs and total PCBs; in addition, several other stations showed elevated levels of one or both contaminants relative to reference station values (stations DSY-27, DSY-29, DSY-31 for PCBs; DSY-25, DSY-27, DSY-29, DSY-32, DSY-33, and DSY-40 for PAHs). Additionally, eight of the elutriate samples exceeded the EPA marine chronic criterion (30 ng/L) for total PCBs, including Jamestown Potter Cove reference station JPC-1.

2.6 ECOLOGICAL RISK ASSESSMENT

The marine ERA conducted by SAIC and URI, under contract to B&R Environmental, evaluated the ecological risks to the marine environment within Coddington Cove. It was presumed that contaminants in the sediments near the Derecktor site were present from activities formerly occurring at that site before and during the Derecktor Inc. lease. The conclusions of the marine ERA are summarized below. Detailed information on the methodology, results, and conclusions are presented in the (Final) Marine Ecological Assessment Report (SAIC/URI, June 1997).

- Stations DYS-27 and DYS-29 were determined to pose a high probability of risk to fish, shellfish, and seabirds from shipyard-related contaminants including PCBs, PAHs, tributyltin, copper, lead, and zinc. Plausible exposure-response relationships were observed for benthic community structure possibly affected by PAHs in sediment, and indigenous mussel condition possibly affected by PCBs in sediment.
- Stations DSY-24, -25, -26, -28, -31, -33, -40, and -41, as well as the reference station CHC-1, were determined to pose an intermediate probability of risk to ecological receptors. Intermediate risk was assigned to these stations due to suggested but not quantifiable exposure response relationships. In general, the same receptors and COCs were observed at intermediate and high risk stations. However, in addition, elevated levels of PAHs were observed in mussels at stations DYS-25 and -26, north of the shipyard, and elevated tributyltin was present in sediment at station DYS-31. Seabirds may be at risk from PCBs in fish at station DYS-28.

2.7 DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) for this project were developed in accordance with the EPA Guidance for Data Quality Objectives (EPA G4 document). The G4 document suggests seven steps be followed to develop project DQOs. The intended use of the data resulting from a field investigation is the primary determining factor in defining the DQOs for that data. To be certain that the data are consistent with the goals of the investigation, the seven steps of defining DQOs are presented in this section.

DQO development was completed for this project to meet data objectives of comparability with the original data collected identifying different components of risk.

2.7.1 Statement of the Problem

As detailed elsewhere in this section, the Derecktor Shipyard was used as a material transfer station, and ship construction area between the 1940s and 1992. Three separate problems were derived from this situation:

1. Contaminants are presumed to have been released to the sediments by direct discharge wastes overland, off piers and ships, or through storm drain systems. These contaminants were identified as providing an elevated probability of ecological risk to the local ecological communities.
2. The Ecological risk assessment identified not only deposited sediments could pose a risk to ecological receptors (bedded sediment) but sediment coming into suspension through water action could also pose risk to ecological receptors, if provided in the appropriate concentrations.

The proposed sediment characterization effort will address a number of data endpoints that were used to 1) predict risk, and 2) evaluate possibility of resuspension of the sediments over time. The data endpoints will focus on the contaminants for which RPRGs were established in the FS, but will also include contaminants detected in previous sampling efforts and attempt to identify the sources of some of these contaminant groups. The Data endpoints that the sediment characterization will address are summarized in Table 2-1.

2.7.2 Identification of the Decision

After completion of the characterization effort, the data will be evaluated in concert with historical data collected at these stations to determine if conditions have changed. Changes to the contaminants present will be considered as a possibility of sediment movement or covering through additional sedimentation. In addition, the PAH signatures found in the sediment will be compared with those against known formulations in order to identify possible sources.

**TABLE 2-1
DATA COLLECTION AND MEASUREMENT ENDPOINTS
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

BASIS OF MEASUREMENT	OBJECTIVE	MEASUREMENT ENDPOINT⁽¹⁾	SUCCESS CRITERIA ⁽²⁾
Sediment contaminants exceed PRGs for ecological risk	Exceeds PRGs for sediment established in the FS?	Sediment PRGS: Lead – 168 mg/kg Benzo(a)pyrene–539 ug/kg HMW PAHs – 13,903 ug/kg Total PCBs – 1060 ug/kg	Concentrations remain below PRGs
Turbidity of seawater during ship movement	Determine if the sediment becoming resuspended continuously during ship traffic	Turbidity of seawater near the piers, compared with that evaluated in water samples collected.	Comparable turbidity readings from continuous recording instruments and from water taken and analyzed ex situ.
Components of the PAH contamination – Identification of the sources.	Source of PAHs in different areas from former / continuing ship fuel spills or from urban runoff?	Forensic fingerprinting of PAHs and fuel related contaminants in the sediments near the piers and other areas of Coddington Cove and Reference stations.	Clear identification of sources of PAH contamination based on multiparameter analysis.

Notes:

- (1) BPRGs – Baseline Preliminary Remediation Goals, as identified in the Feasibility Study for McAllister Point Landfill Marine Sediment and Management of Migration (TtNUS February 1999).
- (2) RPRGs – Recommended Preliminary Remediation Goals, as identified in the Feasibility Study for McAllister Point Landfill Marine Sediment and Management of Migration (TtNUS February 1999).

2.7.3 Inputs to the Decision

Inputs to the decision are the elements used in the decision process. Inputs to the decisions as stated in Section 2.6.2 are as follows:

- concentrations of contaminants present in sediment.
- Suspension of sediments during ship movement within the cove.
- Components of the PAH contamination and oils present in the sediments.

2.7.4 **Definition of the Study Boundaries**

The areas to be monitored are those identified in the Feasibility Study – those areas which were originally found to exceed the PRGs (TtNUS July 1999), and other areas of interest. These are specific locations described in Section 3.

2.7.5 **Decision Rule**

The decision rule is a clear statement defining the requirements of the investigation based on the possible outcomes of the study. For this sediment characterization effort, the decision rules shall be as follows:

Contaminants concentrations comparable to those found during the 1996 and 1997 studies at Coddington Cove will indicate a consistent sediment condition without excessive movement of those contaminants within the cove or the bay, under normal ship traffic to and from Pier 2.

2.7.6 **Limits on Decision Errors**

The limits of decision errors are set to quantify the potential for false negative and false positive decisions. This study was designed to result in equal possibility of low potential for a false negative decision, as there is no fixed decision point on an outcome of the analysis. Data that is believed to be comparable using comparable sample collection and analysis methods will be presumed to meet the hypothesis, that the conditions are comparable to those measured in the previous studies. In this evaluation, there is no need for conservativeness in the decision process. Such an equality is set by limiting the locations samples to those previously sampled, and using similar methods for collection and analysis.

2.7.7 **Design for Obtaining Data**

The DQO process described in the G4 DQO document describes the use of various statistical approaches for developing a database. These approaches are based on the representativeness of the data that is required. A statistical approach was not used for development of the sampling plan, rather as detailed in this section, this plan is based on revisiting stations previously identified as potentially impacted by the industrial activities within the cove. Specifics on the precision, accuracy, etc. of the data collected are described in the Quality Assurance/Quality Control Plan, presented in Section 4 of this work plan.

Statistical analyses may be necessary to evaluate trends in data collected over time, in order to determine the improving or deteriorating conditions. However, those analyses are best selected based on the data that is available and the determination that needs to be made.

3.0 FIELD SAMPLING PLAN

This section presents a description of the field sampling activities that are planned to update the marine sediment characterization. The activities for this program include; marine sediment sampling and continuous automated turbidity monitoring for the former Derecktor Shipyard site at Naval Station Newport, in Newport, Rhode Island.

As stated in Section 1 of the work plan, the objective for the marine sediment characterization is to provide data to confirm or document any changes in the contaminant concentrations in the marine sediments in the Coddington Cove area of the former shipyard and to perform a preliminary investigation of continuous automated turbidity monitoring in the vicinity of ships docked at Pier 1.

The following sections describe the methods for conducting the field activities to be performed at the former Derecktor Shipyard. This section discusses sampling, sampling locations, field methods, sampling procedures, laboratory analysis, decontamination procedures for field equipment, and management of investigation-derived waste (IDW). The general investigation approach for the sediment investigation is described in Section 2.0.

The following sections detail the marine sediment sampling activities described under this work plan. The proposed sampling locations are depicted in Figures 3-1 and 3-2 (Coddington Cove and reference sediment stations).

Activities associated with the monitoring investigations include:

1. Mobilization/demobilization activities;
2. collection of sediment samples to characterize the existing conditions and confirm or document changes in contaminant concentrations and compare against previous data collected;
3. laboratory analysis of sediment samples collected; and
4. continuous automated turbidity monitoring near ships docked at Pier 1.

3.1 MOBILIZATION/DEMOBILIZATION

Mobilization activities will include efforts for preparation of the field investigations. These efforts include:

- preparation of technical specifications for sample collection and analysis subcontracts,
- ordering and mobilizing required field equipment and supplies to the site,

- field team members' review of site control and planning documents including Work Plan, the Health and Safety Plan (provided under separate cover), applicable Standard Operating Procedures (SOPs, included as Appendix A), and applicable subcontract specifications,
- field team orientation meeting(s) to familiarize the field team and subcontractor personnel with site investigations objectives and procedures, equipment, access and health and safety requirements appropriate for the scope of the field activities.

3.2 SEDIMENT SAMPLE COLLECTION

Surface sediment samples will be collected for chemical analyses at 20 sediment stations in Coddington Cove. In addition, two samples each will be collected from three reference areas (Cranston Cove Jamestown, Castle Hill Cove Newport, and Potters Cove in Jamestown, Rhode Island (for a total of six reference stations). The 26 sediment samples will be analyzed for TAL metals, TPH/PAH forensic analyses, PCB congeners, total organic carbon (TOC), and Simultaneously extracted metals/acid volatile sulfide (SEM/AVS). The sample station locations are presented on Figures 3-1 and 3-2. Table 3-1 provides sample station identification and rationale for selection of the proposed stations.

It is anticipated that the sampling will be conducted from an open work boat. A subcontractor will provide access to sample stations by boat under the supervision of a TtNUS field representative.

A real time portable differential Global Positioning System (dGPS) will be used to define longitudinal and latitudinal coordinates for each sampling location. Prior to using the dGPS, the instrument will be checked against a reference location (i.e., building corner, pier, monitoring well). If real time dGPS reception is not possible, all positions will be data logged and differentially corrected. Acceptable dGPS performance readings will be based on the reported accuracy of the instrument. Each sampling location will be identified by dGPS coordinates and a unique sample identification number. Sample stations will be found through GPS navigation to within 3 meters of stations selected in the work plan. All samples (except reference stations) will be collected from locations that were sampled during the Ecological Risk Assessment or Pre-design studies. Any new station sampled will be located to within 3 meters through GPS so that data can be mapped within the NAVSTA EGIS. Water depth will be measured, referenced to tide stage, and the sample station will be photographed for the record.

Sediment samples will be collected at each station from the 0.0- to 0.5-foot interval using a petite ponar or Smith-MacIntyre grab sampler (or equivalent) sediment sample collection device capable of providing adequate quantities of sediment from that interval and can be opened from the top. A minimum of three

grabs will be collected from each sample location. Sample locations are presented on Figures 3-1 and 3-2.

**TABLE 3-1
MARINE SEDIMENT SAMPLE STATION LOCATIONS AND SELECTION RATIONALE
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

Station ID ⁽¹⁾	Media ⁽¹⁾	Northing ⁽²⁾	Easting ⁽²⁾	Selection Rationale
DSY-02	SD	161970.0004	379187.8919	Exceeded PRGs in FS ⁽³⁾
DSY-03	SD	160683.0321	379663.5170	Exceeded PRGs in FS ⁽³⁾
DSY-20	SD	162571.5082	378488.4468	Exceeded PRGs in FS ⁽³⁾
DSY-27	SD	162811.2058	378879.6320	Exceeded PRGs in FS ⁽³⁾
DSY-28	SD	161822.3980	379127.5417	Exceeded PRGs in FS ⁽³⁾
DSY-29	SD	160754.6217	379568.9951	Exceeded PRGs in FS ⁽³⁾
DSY-04	SD	162375.6731	379047.9972	(4)
DSY-05	SD	161746.1692	378502.4418	(4)
DSY-06	SD	161550.3329	378964.0705	(4)
DSY-08	SD	161997.9551	377956.8713	(4)
DSY-11	SD	162473.5859	378390.5257	(4)
DSY-31	SD	162447.0871	378512.4679	(4)
DSY-07	SD	160123.4797	379173.9121	Near stormwater outfall
DSY-09	SD	160095.5047	379593.5792	Near stormwater outfall
DSY-26	SD	163661.1441	378785.5856	Area north of Pier 2
DSY-32	SD	163483.9485	377710.2586	Area north of Pier 2
DSY-101	SD	161728.1800	377770.6000	New location end of Pier 1 ⁽⁵⁾
DSY-102	SD	162709.0612	377576.0500	New location end of Pier 2 ⁽⁵⁾
DSY-103	SD	16222.6700	379205.4100	New location (north of Pier 1) ⁽⁶⁾
DSY-104	SD	161963.2700	378897.3700	New location (south of Pier 1) ⁽⁶⁾
DSY-CHC-01	SD	TBD	TBD	Castle Hill Cove – Ref.
DSY-CHC-02	SD	TBD	TBD	Castle Hill Cove – Ref.
DSY-JCC-01	SD	166468.0769	365509.4855	Cranston Cove - reference
DSY-JCC--02	SD	166544.1773	365468.9143	Cranston Cove – Ref.
DSY-JPC-01	SD	157083.9320	365399.7248	Potters Cove – Ref.
DSY-JPC-02	SD	156422.7760	365508.3308	Potters Cove – Ref.

Notes:

SD – Sediment

¹ See the FS for sample point descriptions

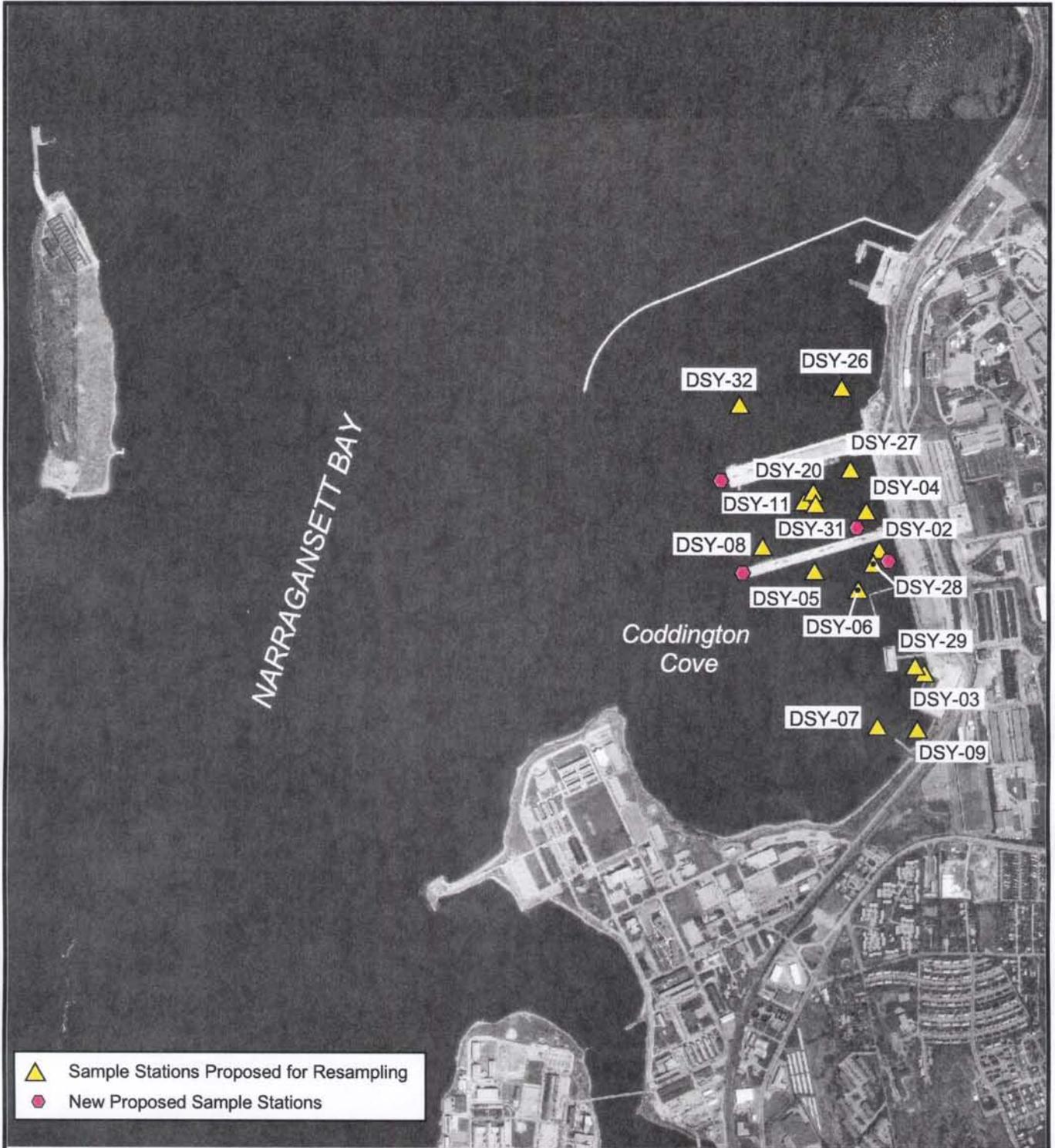
² Coordinate System: NAD 1983, U.S. State Plane - Rhode Island

³ Offshore location estimated to pose a high probability for ecological risk to ecological receptors

⁴ Area between piers, near docked aircraft carriers

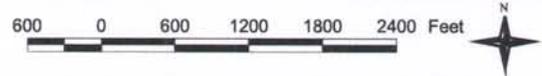
⁵ New location located off the end of pier per RIDEM request

⁶ New location at landward end of Pier 1 per RIDEM request



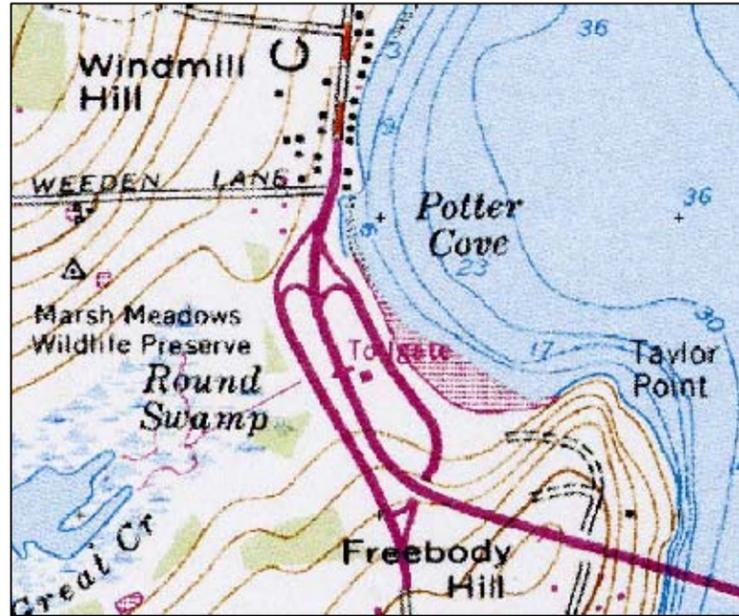
 Sample Stations Proposed for Resampling
 New Proposed Sample Stations

SOURCE:
1997 AERIAL PHOTOGRAPH, RHODE ISLAND DEPARTMENT OF ADMINISTRATION,
DIVISION OF PLANNING

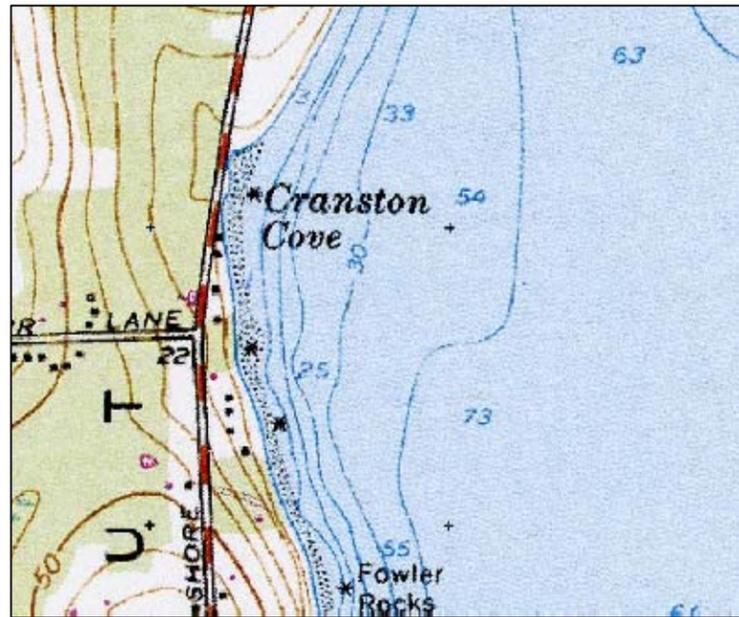


PROPOSED SEDIMENT SAMPLE STATIONS		FIGURE 3-1	
FORMER DERECKTOR SHIPYARD WORK PLAN		 TETRA TECH NUS, INC. 55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899	
NAVSTA NEWPORT - NEWPORT, RHODE ISLAND			
DRAWN BY: L. SEYDEWITZ	DATE: JUNE 10, 2004		
CHECKED BY: S. PARKER	FILE: G:\...CTO 842\FormerDerecktor2004wp		

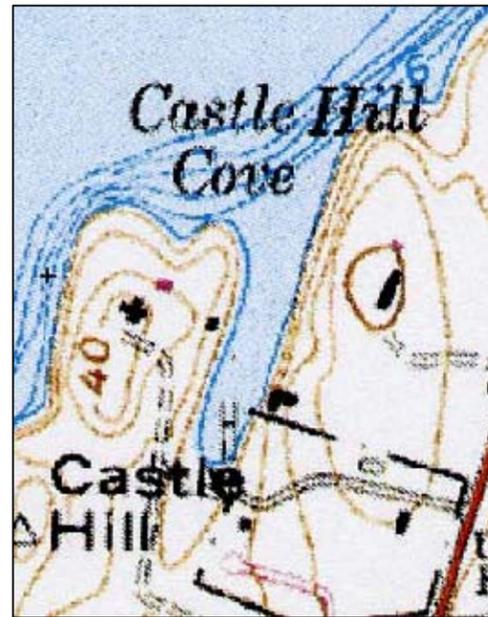
JAMESTOWN POTTER COVE (JPC)
REFERNECE AREA



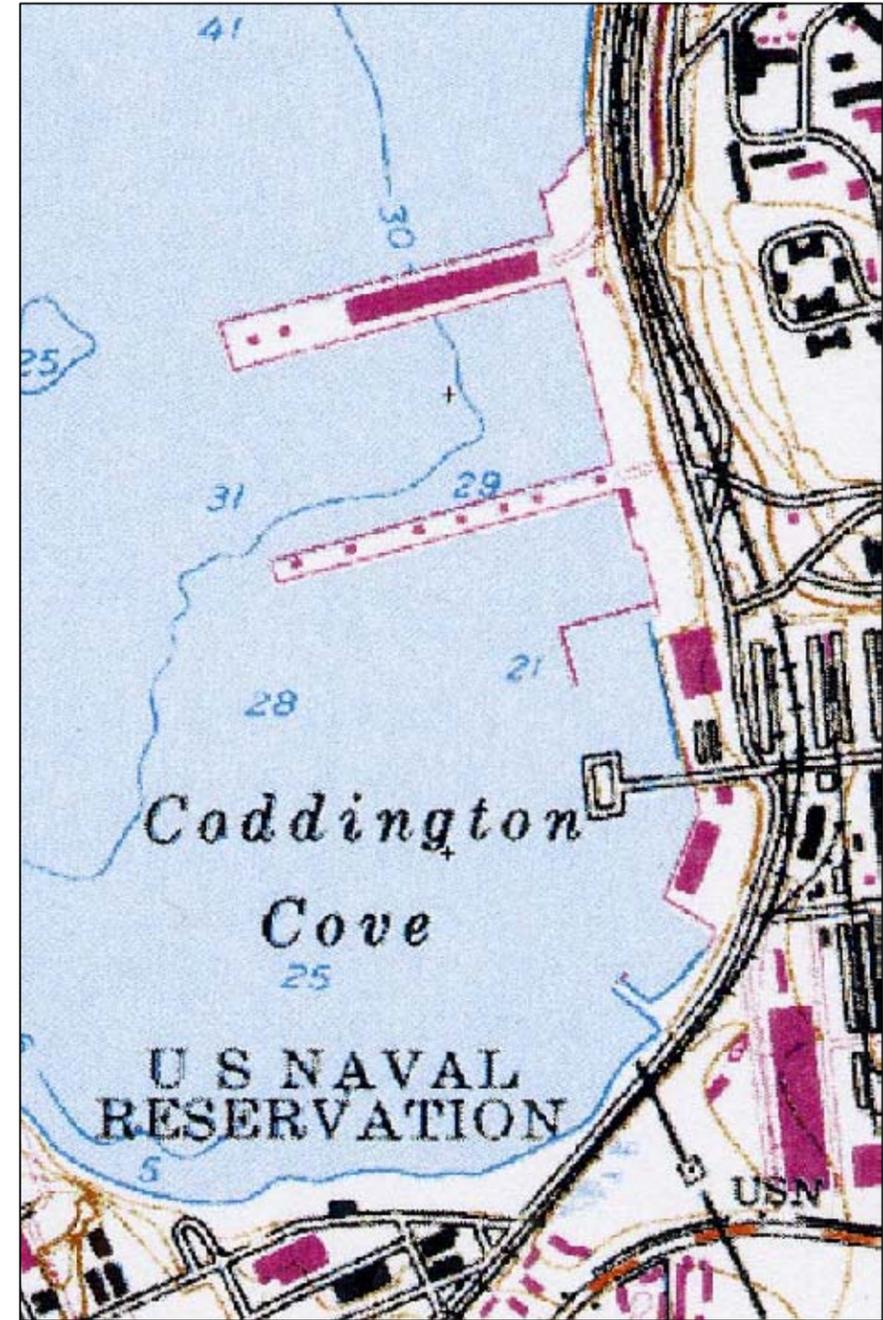
JAMESTOWN CRANSTON COVE (JCC)
REFERNECE AREA



CASTLE HILL COVE (CHC)
REFERNECE AREA



DEREKTOR SHIPYARD (DSY)
REFERNECE AREA



SOURCE:

THE BASE MAP IS A PORTION OF THE FOLLOWING 7.5 X 15 MINUTE U. S. G. S. QUADRANGLE:
PRUDENCE ISLAND, RHODE ISLAND, 1955, PHOTOREVISED 1970 AND 1975
AND NEWPORT, RHODE ISLAND, 1957, PHOTOREVISED 1970, PHOTOINSPECTED 1975

PROPOSED REFERENCE SEDIMENT SAMPLE STATIONS	
FORMER DEREKTOR SHIPYARD	
NAVSTA NEWPORT, RHODE ISLAND	
DRAWN BY: D.W. MACDOUGALL	REV.: 0
CHECKED BY: S. PARKER	DATE: JUNE 4, 2004
SCALE: NOT TO SCALE	FILE NO.: DWG\1611\0421\FIG_2-1.DWG

FIGURE 3-2

TT TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

As each grab sample is brought to the surface, any standing water in the sampler will be slowly decanted (or suctioned off). The SEM/AVS portion of the sediment samples will be collected first, from the surface (0- to 1-inch) of retrieved sediment. The 0- to 1-inch portion of sediment will be removed from each grab using a clean scoop and placed directly into the sample bottle for SEM/AVS analysis. The SEM/AVS sample bottle will be filled to the top to have minimum air-space. The remaining portion from each grab will be removed from the sampler and placed in a chemically-cleaned, stainless steel mixing bowl to form a single composite sample for each sampling location. Large stones and pieces of shell will be removed during the mixing process. For each sampling location, when a sufficient volume of sediment has been collected in the bowl, it will be mixed until homogenous, and then apportioned to appropriate sample containers for shipment to the laboratory(s). Any excess water in the sample jars will be carefully decanted after the sample is placed in the jar.

The date and time of collection, sample location number, dGPS coordinates, depth of the water column, soil description, and any observations associated with the sampling at that location will be entered on the field sample log sheet. Photographs also will be taken of each sediment sample to visually record observations.

Chemistry testing samples will be analyzed by a Navy certified/approved laboratory in accordance with the CLEAN quality assurance program guidelines. All non-disposable sampling equipment will be decontaminated in accordance with the procedures identified in Section 3.5.

Table 3-2 presents the chemical analyses methods, container requirements, preservatives, and holding times and Table 3-3 presents a summary of field and QC samples.

3.3 CONTINUOUS AUTOMATED SURFACE WATER TURBIDITY MONITORING

A preliminary investigation of surface water turbidity will be conducted at two monitoring stations. This investigation will be conducted to determine if ship storage/docking at the piers and/or other area related activities are disturbing the sediments during tidal changes, wave action, etc. Turbidity will be continuously monitored for approximately 30 days using direct read instruments. One monitoring station will be located at Pier 1 and the second monitoring station will be located at Pier 2 (Figure 3-1). In this study, turbidity measurements are being used as a surrogate methodology to determine if there are changes in suspended sediment levels occurring at the monitoring stations and is not being used as an estimate of suspended sediment concentrations.

The monitoring period will be selected to coincide with expected ship movement from Pier 2, which has regular activity. Pier 1 is not active.

**TABLE 3-2
ANALYTICAL METHODS, SAMPLE CONTAINER, PRESERVATIVE, AND HOLDING TIME REQUIREMENTS
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

SAMPLE MEDIUM	ANALYSIS⁽²⁾	SAMPLE CONTAINER⁽¹⁾	PRESERVATIVE	HOLDING TIME
Sediment	TPH/PAHs forensic analyses ⁽³⁾	125-mL glass amber jar	Cool to 4°C	14 Days (Extraction) / 40 Days (Analyze)
	TAL Metals, US EPA 6010B, 7470	8 oz wide mouth jar	Cool to 4°C	180 days Mercury 6 months ICP Metals (Analyze)
	PAHs, SW846 8270C SIM	8 - oz.wide mouth amber jar	Cool to 4°C	14 Days (Extraction) / 40 Days (Analyze)
	PCB Congeners, US EPA 680 ⁽⁴⁾	2 oz wide mouth jar	Cool to 4°C	14 Days (Extraction) / 40 Days (Analyze)
	TOC, Lloyd Kahn Method	2 oz jar with Teflon lined septa	Cool to 4°C	14 Days (Analyze)
	AVS/SEM, Allen and Fu Method (AVS) and US EPA 6010B, 7470 (SEM)	8 oz wide mouth jar	Cool to 4°C	14 Days (Analyze)

Notes:

- (1) Triple volume needed for organic laboratory QC, and double volume needed for metal laboratory QC, at a rate of one per 20 field samples. Also, actual volumes and bottle requirements needed for all analyses will be verified with the selected analytical laboratory prior to initiation of sampling event.
- (2) Method detection limits adequate for determining PRG exceedances, as discussed in Section 2.5.3.
- (3) High resolution hydrocarbon fingerprint (GC/FID), Diagnostic PAH and Alkylated PAH (GC/MS/SIM, Biomarker Fingerprints (GC/MS/SIM) (Battelle, 2002).
- (4) NOAA status and trends 18 congeners.

AVS/SEM = Acid Volatile Sulfide/Simultaneously Extracted Metals (see Appendix C for details).

**TABLE 3-3
FIELD AND QUALITY CONTROL SAMPLE SUMMARY
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

SAMPLE TYPE	ANALYSIS	FIELD SAMPLES	FIELD (AMBIENT) BLANKS⁽¹⁾	RINSATE (EQUIPMENT) BLANKS⁽²⁾	FIELD DUPLICATES⁽²⁾	TOTAL
Sediment	TPH/PAHs, Forensic Analyses ⁽³⁾	26	1	0	3	30
	TAL Metals, US EPA 6010B, 7470	26	1	3	3	33
	TOC, Lloyd Khan Method	26	NR	NR	3	29
	PAHs, SW846 (8270C SIM)	26	1	3	3	33
	PCB Congeners, US EPA 680	26	1	3	3	33
	AVS/SEM, Allen and Fu Method (AVS) and US EPA 6010B, 7470 (SEM)	26	NR	NR	3	29

Notes:

- (1) One per sampling event.
- (2) Collect 1 per 10 field samples.
- (3) Appendix C - High Resolution Hydrocarbon Fingerprint (GC/FID), Diagnostic PAH and Alkylated PAH (GC/MS/SIM, Biomarker Fingerprints (GC/MS/SIM).

NR = not required

SIM = Selective Ion Monitoring

AVS/SEM = Acid Volatile Sulfide/Simultaneously Extracted Metals

After collection, the turbidity data will be correlated with the recorded ship traffic in the area, to determine what, if any, affect ship movements have on recorded turbidity. The turbidity data will also be correlated to weather data to determine if wind and tide affect measured turbidity.

The following equipment and supplies will be used for continuous automated turbidity monitoring:

- In-Situ Troll 9000 (or equivalent) continuous recording multiparameter meter
- Hach 2100P or LaMotte 2020 Turbidity Meter (or equivalent)
- Calibration standards
- Logbook and calibration forms

Installation and Maintenance

Key requirements for collecting good turbidity data are proper mounting and housing of the sensor, selecting a sensor with a reliable mechanical wiper, regular inspection of the data, and maintenance of the equipment.

A site reconnaissance will be conducted to identify locations and techniques for practical installation of sensors. The sensor will be mounted to the pier or dock location that allows accessibility at all times for maintenance, cleaning, etc. Generally, it is expected the sensors will be mounted along piers using 4-inch schedule 40-PVC pipe supported by either signpost rails or "U" brackets. At the landward end of the pipe there will be a PVC fitting which allows for easy retrieval of the sensor and protection of the "Y" connector with a locking 4-inch well cap which allows for easy retrieval of the sensor. The communication cable is run through the 45-degree sweep to the "Y" connector, through a reduced 2-inch length of flexible conduit to a secure storage box for the meter unit (see Figure 3-3). The submerged pipe will be open ended with a peg set across the bottom of the PVC that positions the turbidity optic flush with the end of the pipe. The sensor will be set at approximately 12 inches from the sediment surface. In addition 1 and 1/8 inch holes will be drilled at regular intervals in the area of the sensor to form an open screen (see Figure 3-5). The sensor is retrieved by opening the secured cap at the landward end of the PVC and pulling the cable connected to the sensor unit. The sensors may be mounted on angled PVC or boom (or other device) at some locations permitting routine access and proper placement near sampling points of interest (e.g. ship hull).

Previous experience with the mechanical wipers on turbidity instruments has shown they can only prevent fouling from small contaminants such as fine organics, sediment, algae, and macroinvertebrates for a short period of time (Figure 3-4). Larger debris must be manually removed. Eventually, the wipers themselves become fouled and fail or work inefficiently resulting in erroneous data. Weekly cleaning and recalibration is necessary to provide useful, accurate data.

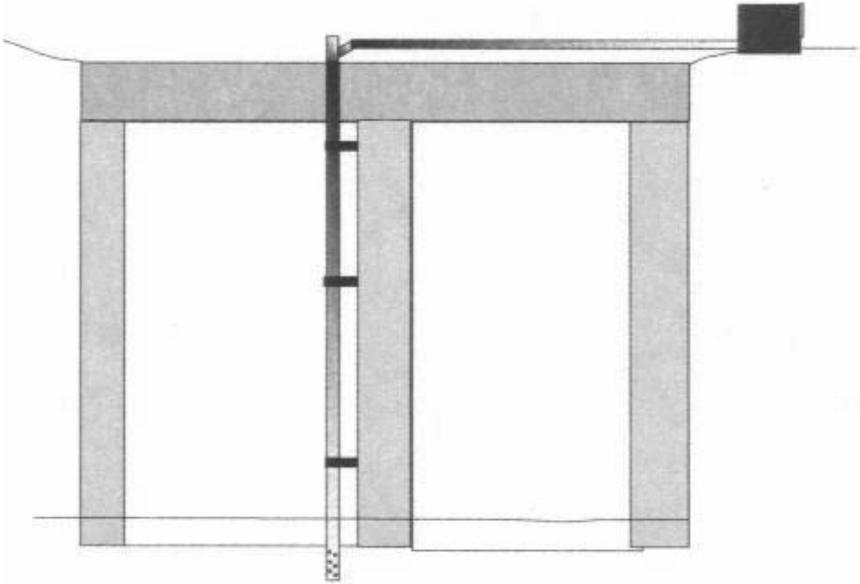


Figure 3-3 Proposed Turbidity sensor installation diagram

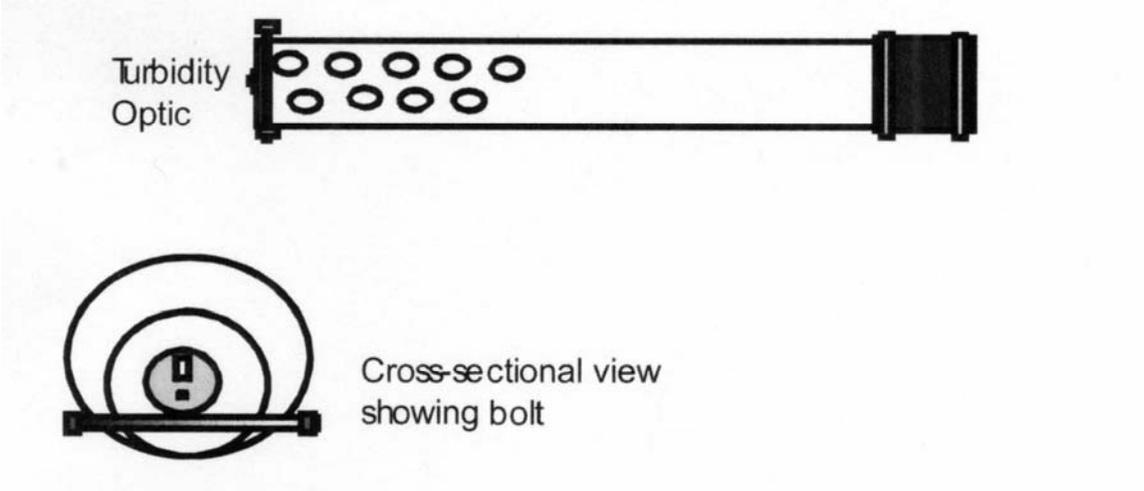


Figure 3-4 View of submerged portion PVC pipe with sensor installation

Routine sensor and site maintenance related to the turbidity sensor includes:

1. inspecting the sensor and removing debris or cleaning as necessary
2. downloading and plotting the data to ensure the sensor is functioning properly
3. recording detailed field notes, including the times of any disturbances or manipulations of the unit
4. conducting a calibration check in the field using appropriate turbidity standards
5. comparing the sensor turbidity readings to a LaMotte 2020 (or equivalent) manual samples collected from the same time and depth and adjusting the calibration offset if necessary (see the manufacturers instrument calibration instructions)

Calibration

At a minimum a two point calibration will be conducted on the sensor in accordance with manufactures instructions before deployment. Calibration standards will bracket the expected turbidity range. In addition, a calibration check will be conducted during each maintenance visit to assure proper instrument function. In situ readings will be compared to samples and standards collected and analyzed with the LaMotte 2020 for comparison purposes.

3.4 LABORATORY ANALYSIS OF SAMPLES COLLECTED

Table 3-2 presents the analytical methods, volume and preservatives required, and summary of field and QC samples.

3.5 DECONTAMINATION PROCEDURES

All non-disposable sampling equipment that comes in contact with the sample medium will be decontaminated to prevent cross-contamination between sampling points. This includes equipment such as sediment sampling spatulas, stainless steel bowls, scoops, split spoons, ponar samplers, etc. The following decontamination sequence will be employed:

- remove gross contamination by scrubbing with potable water
- scrub with potable water/liquinox
- rinse with potable water
- rinse with deionized water
- rinse with 2-propanol
- air dry (to extent possible)
- wrap with aluminum foil, dull side toward equipment.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

This section provides technical guidelines and procedures for maintaining an appropriate level of quality for data collected during fieldwork performed. This QA/QC section includes information on: project quality objectives, project action limits, measurement performance criteria, sample collection documentation requirements, the sample identification system, sample handling and custody procedures, analytical method requirements, sampling and analytical quality control requirements, analytical documentation and data management, data validation and verification requirements and procedures, and QA assessment and management efforts.

Achieving the study objectives for this monitoring program requires that the data collected from the field conform to an appropriate level of quality, adequate to be used for comparison against previously established criteria as described in Section 2. The quality of a data set is measured by certain characteristics of the data, which are described in this section.

This section references the TtNUS Standard Operating Procedures (SOPs) for specific protocols for procedures discussed in Section 3.0. Pertinent SOPs and ASTM methods for fieldwork are included in this work plan as Appendix A. These SOPs include, but are not limited to:

<u>SOP</u>	<u>DESCRIPTION</u>
CT-04	Sample Nomenclature
CT-05	Database Records and Quality Assurance
SA-1.2	Surface Water and Sediment Sampling
SA-6.1	Non-Radiological Sample Handling
SA-6.3	Field Documentation
SA-7.1	Decontamination of Field Equipment and Waste Handling

4.1 PROJECT QUALITY OBJECTIVES

The main objective of the long-term environmental sampling is to provide sufficient data, when evaluated with existing data, to address off-shore sediment contamination issues at the site. The data quality objectives (DQOs) and methods for sampling and laboratory analysis described in this Work Plan are selected to provide adequate data to be used for comparison against previously established criteria as described in Section 2. If the data meet the quality objectives, they will be used for this endpoint. This section describes how project data will be reconciled with the project quality objectives, how data quality issues will be addressed, and how limitations on the use of the data will be reported and handled. TtNUS will perform data quality assessment including:

- Review of the DQOs and sampling design, review of the proper validation level.
- Review of the data validation criteria, measurement performance criteria, and method QC/QL requirements.
- Correlation of data to expected values, comparison to available historical data (as applicable).

Achieving this objective requires that the data collected from the field conform to an appropriate level of quality. The quality of a data set is measured by certain characteristics of the data, namely the precision and accuracy, representativeness, completeness, and comparability (PARCC) parameters. Some of the parameters are expressed quantitatively, while others are expressed qualitatively. The PARCC goals for a particular project are determined by the intended use of the data, defined as a part of the Data Quality Objectives (DQOs). DQOs are discussed in Section 2.10; the PARCC parameters are discussed below.

Precision

Precision quantifies the repeatability of a given measurement. Field duplicated sample results, laboratory duplicate results, instrument variation, sampling techniques, as well as possible sample transport problems, sample matrix problems, and sample heterogeneity will be assessed to determine the overall data precision. Precision is estimated by calculating the relative percent difference (RPD) of field duplicates, as shown in the following equation:

$$\text{RPD (\%)} = \frac{|\text{Result} - \text{Duplicate Result}|}{(\text{Result} + \text{Duplicate Result}/2)} \times 100$$

The laboratory will review the QC samples to ensure that internal QC data lies within the limits of acceptability. Any suspect trends will be investigated and corrective actions taken. The analytical precision acceptability limits for this project are $\leq 50\%$ for sediment. If the project goals for precision are not met, the potential need for re-sampling will be evaluated.

Accuracy

During data validation, the data validator evaluates the accuracy of the analytical data using the laboratory and field blanks, laboratory control samples, and check standards. The laboratory and field blanks will indicate accuracy and potential contamination bias of the analytical data results. The analytical accuracy and bias will be evaluated based on the analysis of check standards, matrix spike recoveries, surrogate recoveries, laboratory control samples, calibration linearity, and calibration verification results.

Accuracy refers to the percentage of a known amount of analyte recovered from a given matrix. Percent recoveries are estimated using the following equation and can be calculated for the project-specific matrix (i.e., water and solids).

Recovery LCS and Surrogate Internal Standard (SIS) (%) =

$$\frac{\text{Amount Spike Recovered} - \text{Added Spike}}{\text{Amount Spike Added}} \times 100$$

Recovery Matrix Spike/Matrix Spike Duplicate (MS/MSD) (%) =

$$\frac{(\text{Spiked Sample Result}) - (\text{Sample Result})}{(\text{Spike Added})} \times 100$$

Sample Representativeness

Representativeness describes the degree to which analytical data accurately and precisely define the population being measured. Several elements of the sampling and sample handling process must be controlled to maximize the representativeness of the analytical data (appropriate number of samples collected, physical state of the samples, site-specific factors, sampling equipment, containers, sample preservation and storage, holding times, sample identity, and chain of custody will be defined to ensure that the samples analyzed represent the population being measured). The sampling program is designed to provide analytical data that are representative of the existing contaminant levels.

Representativeness of data is also affected by sampling techniques. Errors or cross-contamination during the sampling could affect the laboratory analytical results. However, every effort will be made during sample collection to minimize the introduction of errors or cross-contamination by following the sample techniques described in Section 3.0, and in the TtNUS Standard Operating Procedures (SOPs) included in Appendix A.

The required quantitation limits to meet the project action limits specified in Section 4.2 will be evaluated. The sample quantitation limits, the low point instrument calibration standard, matrix interferences, and sample dilutions will be evaluated to assess if the sensitivity goals were met. The specific sensitivity of the data packages results will be evaluated for each medium in order to clearly differentiate between usable and unusable data for the various data users.

The overall and specific sampling group representativeness for the samples for each media will be evaluated. If the data are not usable to address and answer the environmental questions and or to support the project decision making requirements due to problems with sampling techniques, sampling preservation, analytical holding times, or field duplicate results, the need for additional sampling will be evaluated. Such evaluations will be held internally, and then with the project group as necessary.

Completeness

Completeness describes the amount of data generated that meets the objectives for precision, accuracy, and representativeness versus the amount of data expected to be obtained. For relatively clean, homogeneous matrices (such as water), 100 percent completeness is expected. However, as matrix complexity and heterogeneity increase (such as for sediment), completeness may decrease. Where analysis is precluded or where data quality objectives are compromised, effects on the overall investigation must be considered. Whether or not any particular sample is critical to the investigation will be evaluated in terms of the sample location, the parameter in question, the intended data use, and the risk associated with the error.

Completeness refers to the percentage of valid data received from actual testing done in the laboratory. Completeness is calculated as shown in the following equation. The target completeness goal for all compounds is 90%. The goal by holding times will be 100%.

$$\text{Completeness (\%)} = \frac{\text{Number of Measurements Judged Valid} \times 100}{\text{Total Number of Measurements}}$$

The data validator performs a Completeness Evidence Audit. During this audit, the validator checks that the laboratory has provided all of the documentation required to support the reported analytical results. If any documentation is missing from the data package, the data validator contacts the laboratory and requests a resubmittal. If the laboratory fails to resubmit a requested document, the data validator notes this on an internal Inventory Sheet and in the data validation cover letter. The Lead Chemist determines if the missing information makes the data unusable. The Project Manager and data user determine if any missing data is crucial to achieve the data quality objectives.

Comparability

Comparability is the degree to which one data set can be compared to another. To ensure comparability, samples will be collected at specified intervals and in a similar manner, and will be analyzed within the required holding times by accepted and comparable methods, as standard methods of sample collection

and analysis is expected to produce comparable data. All data and units used in reporting for this project will be consistent with accepted conventions for environmental matrix analyses. Data from each matrix collected at the Site will be compared with historical and expected analytical results. Limitation of the data use by matrix and/or specific sampling locations will be identified to ensure direct comparability between the results from this project and the results from other projects using the methods presented in this Work Plan. Analytical methods for this work are presented in Table 3-2; SOPs appear in Appendix A.

4.2 PROJECT ACTION LIMITS

Project Action Limits are provided in this section for laboratory analytical data to be collected during the sampling at the former Derecktor Shipyard. The project action limits for marine sediment have been established based on the Preliminary Remediation Goals (PRGs) provided in the Feasibility Study for the Former Robert E. Derecktor Shipyard (TtNUS July, 1999). To assure that the detection limits for the analytical parameters are set below the actual PRGs, a value of one tenth of the PRG has been selected for the monitoring Project Action Limit.

Table 4-1 presents the Project Action Limits for marine sediment. This table also presents the detection limits and quantitation limits achievable through the methods specified in Section 3 of this work plan.

4.3 MEASUREMENT AND PERFORMANCE CRITERIA

Two types of QC checks and samples will be utilized for this project. Batch-specific QC will include QC samples that are handled, prepared and analyzed concurrently with the environmental samples. This data will be used to ensure that the procedures used to collect, transport, and analyze a batch of samples was performed properly and under known, well-defined conditions. Examples of batch-specific QC are equipment blanks, laboratory control samples, and calibration checks. Sample-specific QC will be used to evaluate potential sources of error in the collection, transport and analysis of individual samples. Examples of sample-specific QC are matrix spikes and sample duplicates.

4.3.1 Sample Quality Control

The field QC samples will be assigned unique sample numbers and will be submitted to the analytical laboratory. If abnormalities are detected in field QC samples, the data associated with the QC samples will be flagged and appropriate actions will be taken to rectify issues.

**TABLE 4-1
PROJECT ACTION LIMITS FOR SEDIMENT SAMPLING
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

ANALYTES*	CAS NUMBER	PROJECT ACTION LIMIT ⁽¹⁾	PROJECT QUANTITATION LIMIT ⁽²⁾	Achievable Laboratory Limits	
				MDLs (ug/kg)	QLs (ug/kg)
Lead	7439-92-1	168 mg/Kg	17 mg/Kg	TBD	TBD
Benzo(a)pyrene	50-32-8	539 ug/Kg	54 ug/Kg	TBD	TBD
HMW PAHs	NA	13,903 ug/Kg	1390 ug/Kg	TBD	TBD
Total PCBs	NA	1,060 ug/Kg	106 ug/Kg	TBD	TBD

Notes:

TBD = To be determined, based on fixed laboratory.

*Analytes are limited to selected PRGs and Contaminants of Concern from FS

- (1) Project Action limits are set as the lowest calculated RPRG values for sediment determined in the Feasibility Study for Former Robert E. Derecktor Shipyard (TtNUS, July 1999)
- (2) Project Quantitation Limits are set as 10% of the project action limits to account for variability in the laboratory quantitation limits during analysis of sediment.

NA = not applicable for PAHs or total PCBs

HMW PAHs - High Molecular Weight Polycyclic Aromatic Hydrocarbons

- (3) Total PCBs as determined by congener analysis, NOAA status and trends.

QC samples to be used during the sampling effort are identified below, and include field duplicates or replicates, laboratory duplicates or replicates, rinsate blanks, field blanks, and source blanks. Each type of field quality control sample defined below will undergo the same preservation, holding times, etc., as the field samples. Table 3-3 presents a summary of the QC samples to be collected during this sampling event.

Field Duplicates

Field duplicates provide precision information regarding homogeneity, handling, shipping, storing, preparation, and analysis. Field duplicates will be submitted at the rate of one for every ten samples per matrix. Field personnel will note on the sample summary form and in the logbook which samples are field duplicates. Duplicate samples will be shipped blind to the laboratories, and shipping paperwork will be completed accordingly. Field duplicates are collected by mixing a double or triple portion of the required volume of sample and dividing it into two sample containers.

Rinsate Blanks

Equipment rinsate blanks will be collected daily during sediment sampling to ensure that nondedicated sampling devices have been decontaminated effectively. Equipment rinsate blanks will consist of the rinsewater used in the final step of the sampling equipment decontamination procedure.

Rinsate samples will be collected at a frequency of one per sampling day during events. Equipment rinsate samples will be analyzed for TAL metals, PCB congeners, and PAHs. Rinsate blanks are obtained under representative field conditions by running analyte-free deionized water through sample collection equipment after decontamination, immediately before sampling and placing it in the appropriate sample containers for analysis.

Field Blanks

Field blanks will consist of the source water used in decontamination (includes analyte-free deionized water, potable water from each source, and other waters used in decontamination operations). Field blanks will be prepared at the rate of one per source of water per sampling event.

Matrix Spike/Matrix Spike Duplicates

MS and MSD samples are designed to check the precision and accuracy of the analytical methods through the analysis of a field sample with a known amount of analyte added. Additional sample volume

for MS and MSD samples is collected in the field in the same manner as field duplicate samples. In the laboratory, two portions of the sample are spiked with a standard solution of target analytes. MS and MSD samples are analyzed for the same parameters as the field samples, and analytical results will be evaluated for precision and accuracy of the laboratory process and effects of the sample matrix. The number of MS and MSD collected from the field samples will be chemical dependent. A minimum of 1 MS/MSD will be analyzed each day that field samples are analyzed, at a rate of 1 per 20 field samples or 1 per batch, whichever is more frequent.

Samples for matrix spike analyses and laboratory duplicate analysis are collected in double volumes for sediment.

4.3.2 Analytical Quality Control

The sediment analyses to be performed under this project will comply with the requirements and quality control procedures specified in the analytical methods.

4.4 **SAMPLE DESIGNATION AND CUSTODY**

This section describes the sample designation and chain-of-custody requirements for all environmental and quality control samples.

Environmental Samples

Each sample collected will be given a unique sample ID. The sample ID is project specific. A record of all sample IDs will be kept with the field records as well as recorded on a chain-of-custody form. The sample ID will consist of alpha-numeric characters identifying the site, sample medium, sample station ID (see Table 3-1), and sample date.

The alpha-numeric coding to be used in the sample system is detailed below and in the subsequent definitions.

AAA - AA - (NNN) - (NNNNNN)
(Site ID) - (Medium) - (sample station ID) - (Sample Date)

Site identifier: "DSY" for Derecktor Shipyard

Medium identifier: "SD" for sediment samples;

Sample location identifier: each sample location has been predetermined as a previous sample station, and will retain the sample station designation number.

Date: This portion of the sample tracking number will represent the date in which the sample was collected, e.g., a sample collected on June 30, 2004 will be designated by "063004".

Examples:

A sediment sample collected on June 30, 2004 from sample station DSY-103 (refer to Table 3-1) will be identified as: DSY-SD-103-063004.

Quality Control (QC) Samples

This section specifies the QA/QC objectives to determine the quantity and quality of the data required to support project decisions. The QC procedures as well as the associated field sampling procedures for this project will be focused on achieving these QA/QC objectives in a timely, cost effective, and safe manner. Deviations from the QA/QC objectives will require defining the cause or causes for noncompliance and will initiate the process of determining whether additional sampling and analyses will be required to attain project goals.

Field quality control (QC) samples will use the same coding system as for environmental samples. Field QC sample types are described in Section 4.1.2.

Blind duplicate samples will be designated such that the location designation will be replaced with a chronological number. The sample log sheet will note which sample location the duplicate was collected from:

Duplicates: DSY-DUP##

Field blanks will be designated such that they can clearly be identified as field blanks. The designation must be able to be referenced to the source, i.e. DIUF water, potable water (PTW), etc., using the field sample data forms.

Field Blanks: DSY-DIUF-FB## - 063004
 DSY-PTW-FB## - 063004

Rinsate blanks will be identified using the code for the sample for which the sampling device or tool was last used, the identifier (RB), and its chronological number.

Rinsate Blanks: DSY-SD-404-RB## - 063004

Matrix spike samples have no separate sample identifier codes, but are noted on the chain-of-custody record and sample logsheet.

4.5 SAMPLE HANDLING, TRACKING, AND CUSTODY REQUIREMENTS

Custody of samples must be maintained and documented at all times. To ensure the integrity of a sample from collection through analysis, an accurate written record is necessary to trace the possession and handling of the sample. This documentation is referred to as the "chain of custody". Chain of custody begins when samples are collected in the field, and is maintained by storing the samples in secure areas until custody can be passed on. All samples will be accompanied by a chain-of-custody form that will describe the sample identifiers, the analytical parameters, and the persons who are responsible for the sample integrity.

Following collection, samples will be placed on ice in a secure cooler and attended by TtNUS personnel or placed in locked vehicles or designated storage areas until analysis or shipment to an off-site laboratory. Chain-of-custody procedures are described in further detail in the following SOPs (presented in Appendix A).

SA-6.3 Field Documentation

SA-6.1 Non-Radiological Sample Handling

Custody of the samples will be maintained at all times and documented in the chain-of-custody forms to ensure the integrity of a sample from collection through analysis. The chain of custody begins at the time the sample is collected. Custody will be maintained by TtNUS prior to sample shipment by ensuring that the sample is in the physical possession or view of an authorized person, or the sample is in a secure area, restricted to authorized personnel only.

The samples will be shipped to the laboratories in coolers packed with ice and vermiculite, or equivalent packing material, to cushion the samples to prevent breakage and to maintain the required temperature for the samples. A container filled with water and labeled "Temperature Blank" will be included in each cooler. The temperature of this blank will be measured by the laboratory upon sample receipt to verify acceptable cooling of samples. The coolers will be taped and sealed with a signed custody seal to

ensure the chain of custody is maintained. The chain-of-custody forms are shipped to the laboratory with the samples.

Samples will be shipped to the laboratories by an overnight courier (Federal Express) to ensure that maximum sample holding times are not exceeded. The maximum allowable sample holding times before sample extraction, digestion, or analysis are presented in Table 3-2. Saturday deliveries will be coordinated with the laboratory. This table also lists the sample containers and preservatives used to maintain the integrity of the sample.

Each sample collected will be assigned a unique sampling tracking number, as described in Section 4.4. The sample number, sample collection date and time, person collecting the sample and a list of the analytes that sample is to be analyzed for will be recorded on each container, and also on the chain-of-custody form. The chain-of-custody form is a two-part form, the original accompanies the samples to the analytical laboratory, and the copy is retained by the sampling staff until it is turned over to the data validators.

All samples collected will be logged onto a chain-of-custody form in the field prior to shipment or pickup by the laboratory. The chain-of-custody form will be signed by the individual responsible for custody of the sample containers, and the original will accompany the samples to the laboratory. One copy of the chain-of-custody form will be kept by the project manager and included in the project files. Information to be recorded on the chain-of-custody form should include:

- Project name and number
- Sample matrix
- Sample collector's name
- Dates/times of sample collection
- Sample identification numbers
- Number and type of containers for each sample aliquot
- Type of preservation
- Quality control (QC) sample designation
- Analysis method
- Special handling instructions
- Destination of samples
- Name, date, time, and signature of each individual releasing the shipping container.

4.6 DOCUMENTATION OF FIELD ACTIVITIES

The following sections outline the procedures that will be used by field personnel to document project and sample collection activities at the Site. Detailed and accurate documentation is necessary in order to ensure data integrity.

4.6.1 Field Notes

Field Log Book

A project-specific field logbook will be used to provide daily records of significant events, observations, and measurements during field investigations. The field logbook also will be used to document all sampling activities. All logbook entries will be made with indelible ink to provide a permanent record. All pages of the logbook will be numbered sequentially and observations will be recorded with indelible ink. Field logbooks will be maintained according to TtNUS SOP No. SA-6.3 (Appendix A). Logbooks will be kept in the possession of the field team leader during the on-site work and all members of the field team will have access to the notebook. These notebooks will be maintained as permanent records. Any errors found in the logbook will be verified, crossed-through, and initialed by the person discovering the error.

The field notebooks are intended to provide sufficient data and observations to reconstruct events that occurred during field activities. Field logbooks should be permanently bound and pre-paginated; the use of designated forms should be used whenever possible to ensure that field records are complete. The following items are examples of information that may be included in a field logbook:

- Name, date, and time of entry
- Names and responsibilities of field crew members
- Name and titles of any site visitors
- Descriptions of field procedures, and problems encountered
- Number and amount of samples taken at each location
- Details of sampling location, including sampling coordinates
- Sample identification numbers of all samples collected
- Date and time of collection
- Sample collector
- Sample collection method
- Decontamination procedures
- Field instrument calibration and maintenance

- Field measurements (e.g., DO, ORP, temperature, pH, and conductivity) and general observations.
- Weather conditions
- Activities involved with the sampling
- Subcontractor information
- Site observations
- Site sketches
- Visitors
- Health & Safety issues including Personal Protective Equipment (PPE)
- Log of photographs

Sample Log Sheets

Field sample log sheets will be used to document sample collection details, while other observations and activities will be recorded in the field logbook. Instrument calibration logs will be used to record the daily instrument calibration. The following sections outline the information that will be documented in the field according to the media to be sampled and the activities to be performed.

Sediment Logsheets

Sediment Sample Log Sheets will be used to document each sediment and porewater sample collected. The following information will be recorded:

- Personnel performing the sampling
- Diagram sampling locations
- Date and time of sample collection
- Sample location identification
- Depth interval of sample collection
- Depth of water if applicable
- Parameters to be analyzed
- Description of sampling procedures
- Description of visual observations of soil or sediment properties (type, color, odors, etc.)
- General observations
- Identification and description of any duplicate samples

4.6.2 Field Documentation Management

After the investigation is completed, the field sampling log sheets will be organized by date and media and filed in the project files. The field logbooks for this project will be used only for this Site, and will also be categorized and maintained in the project files after the completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity.

4.6.3 Calibration Procedures and Documentation

Methods for calibration of field instruments will follow the specific instrument manufacturers' recommendations. All field instruments will be calibrated before each day of use; and a calibration check at the end of the day will be performed to verify that the instrument remained in good working condition throughout the day. If the calibration check at the end of the day does not meet acceptance criteria, then that day's data will be flagged and the instrument calibration checks will increase to the operator's satisfaction that the instrument remains true to the initial calibration.

A log will be kept on site, documenting the periodic calibration results for each field instrument. For field measurements, if the final calibration check on any of the field sampling equipment is outside acceptable limits, then the associated data collected that day will be flagged. On the following day, a single point continuing calibration check will be run after every five measurements to determine how long the calibration holds. Calibration frequencies will be adjusted accordingly.

Field instrument maintenance will be documented in the field logbook for each field instrument used during field activities. Field equipment will be maintained when routine inspections indicate the need for maintenance. In the event that a piece of equipment needs repair, a list of the field equipment manufacturers' addresses, telephone numbers, and points of contact will be maintained on site during field activities. Field equipment routine maintenance may include the following:

- Calibrating equipment according to manufacturers' directions
- Removing surface dirt and debris
- Replacing/cleaning filters when needed
- Ensuring proper storage of equipment
- Inspecting instruments prior to use
- Charging battery packs when not in use
- Maintaining spare and replacement parts in field to minimize downtime.

Calibration procedures for laboratory equipment used in the analysis of environmental samples will be performed in accordance with NFESC requirements and contract requirements under the contract specifications.

4.7 FIXED LABORATORY ANALYTICAL METHOD REQUIREMENTS

This section of the work plan describes the analytical techniques that will be used by the fixed laboratory to generate definitive data for the project. It documents the fixed laboratory analytical methods and SOPs that will be used to meet measurement performance criteria and achieve project-required quantitation limits for the COCs and other target compounds.

4.7.1 Fixed Laboratory Analytical Methods and SOPs

Contract laboratories, to be solicited at a later date, will perform sediment analytes. Analytical methods, instrument maintenance, instrument calibration, quality control samples, and acceptable limits will be specified in the subcontract specifications. However, the laboratories selected will be required to meet the project action limits as described in Section 4.2 of this Work Plan.

4.7.2 Fixed Laboratory Internal Quality Control

Laboratory QC is addressed through the analysis of laboratory QC samples, documented internal and external laboratory QC practices, and laboratory audits. The types of laboratory QC samples will include laboratory control samples, laboratory duplicates, matrix spikes (MSs), surrogate standards, internal standards, method blanks, and instrument blanks. MSs, matrix spike duplicates (MSDs), and a laboratory control standard (LCS) are analyzed for every batch of up to 20 samples and serve as a measure of analytical accuracy. Surrogate standards are added to all samples, blanks, MSs, MSDs, and LCSs which are analyzed for organic compounds in order to evaluate the method's accuracy and to help determine matrix interferences. Definitions of each type of laboratory QC sample are listed in the following subsections. For laboratory measurements, if any of the QC checks are outside the acceptance criteria, corrective actions will be taken based on procedures outlined in the LQAP. The laboratory QC checks, acceptance criteria, and corrective actions are listed in the U.S. EPA Methods 680 and 8270C, 6010B, 7470, and other specific methods cited in Table 3-3. Additional quality control is established by the analytical laboratories selected.

Section 4.3.1 discussed the types and frequency of quality control samples that will be prepared during the field investigation activities for those samples that undergo laboratory analysis. The quantities of

various types of QC samples are shown in Table 3-3. Laboratory analysis will follow the QC criteria described in the analytical procedures.

4.7.3 Fixed Laboratory Instrument/Equipment Maintenance, Testing, and Inspection Requirements

The specific laboratory equipment maintenance and calibration procedures are set by the laboratories, specific to the equipment used. Generalized procedures likely to be required of these subcontracted laboratories to ensure that the laboratory instruments are available and in working order to meet the required turn-around time of these analyses provided in Table 4-2.

The subcontracted laboratories will check the instruments used for the analyses as described in Table 4-2 of this Work Plan. The instruments shall be monitored on a daily basis for potential failure. The analysis of blanks and control standards at the start and at the end of the day provides real-time information to the analyst on the conditions of the instruments. Records of equipment maintenance logs are maintained for all instruments used.

The subcontract laboratories will perform instrument/equipment maintenance and inspection as required in the laboratory specifications.

4.7.4 Fixed Laboratory Inspection and Acceptance Requirements for Supplies

All supplies used by the subcontract laboratories will be free of contaminants of concern, other target compounds, and interferences. Method blanks will be performed at the rate specified in each method to ensure that reagents and equipment are free of contamination. The corrective actions specified in the Master Agreements and laboratory specifications will be followed if laboratory contamination is detected.

4.8 DATA DOCUMENTATION AND RECORDS MANAGEMENT

This section describes how all project information will be managed, organized, and maintained for efficient use by the project personnel. The information management process is outlined from the point of data generation to ultimate storage.

**TABLE 4-2
GENERAL LABORATORY INSTRUMENT MAINTENANCE AND CALIBRATION
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

INSTRUMENT	ACTIVITY	LIST MAINTENANCE, TESTING AND INSPECTION ACTIVITIES	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA
GC/MS	PCB congeners/TPH/PAHs Forensic Analyses and PAHs SW846	Instruments are monitored on a daily basis by the bench analyst for any potential failure. The analysis of blanks and control standards at the start of the day and as analysis continues helps to provide real time feedback to the analyst on the condition of the instruments. Routine maintenance for the (1) mass spec, (2) sample introduction system, and (3) GC are presented below.	Prior to sample analysis	%RSD \leq 30% for all "Standard" compounds and %RSD \leq 40% for all "Non-standard" compounds	Correct problem then repeat initial calibration curve	Analyst
ICP	Metals	Clean torch assembly and spray chamber when discolored or when degradation in data quality, clean nebulizer, check argon, replace peristaltic pump tubing.	ICAL – At the beginning of each day or if QC does not meet criteria	90 - 110%	Recalibrate	Analyst/Supervisor
			ICV – Immediately after every ICAL	90 – 110%	Recalibrate or reanalyze affected data	Analyst/Supervisor
			CCV – Every 10 samples or every two hours	90 – 110%	Recalibrate or reanalyze affected data	Analyst/Supervisor
CVAA	Mercury	Replace peristaltic pump tubing, replace mercury lamp as necessary, clean optical cell, clean liquid/gas separator as needed.	ICAL – At the beginning of each day or if QC does not meet criteria	90 – 110%	Recalibrate	Analyst/Supervisor
			ICV – Immediately after every ICAL	90 – 110%	Recalibrate or reanalyze affected data	Analyst/Supervisor
			CCV – Every 10 samples or every two hours	90 – 110%	Recalibrate or reanalyze affected data	Analyst/Supervisor

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**TABLE 4-2 (CONT.)
GENERAL LABORATORY INSTRUMENT MAINTENANCE AND CALIBRATION
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND
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1) Mass Spectrometers

- Daily check of vacuum ion gauge (Increase in ion count indicates a potential leak)
- Daily (every 24 hours) autotune check with BFB
- Cleaning of ion source on quarterly basis or as needed
- The oil level and quality is visually checked on a monthly basis to insure proper vacuum pump function, and oil is changed every 6 months.

2) Sample Introduction System

- The mass flow controller used for sample introduction is sent for off-site calibration against a NIST-certifiable source once every two years.
- To ensure a clean sample introduction system, if necessary, the lines and trap are "steam-cleaned" by analyzing a humidified system blank. This takes place every day following standards (i.e., CCV) analysis. Humidified system blanks are also analyzed after saturation-level detections in samples.

3) Gas Chromatograph

Basic maintenance includes the following: (Every 6 months or more frequently if needed)

- Clip 3 feet off the front end of the capillary column, and if necessary, the back end as well.
- Replace the injection port liner. The liner is replaced by removing the inlet cap using a wrench and releasing the liner from the inlet body using a pair of tweezers. Care should be taken not to get finger prints on any inside surface.
- Once per week change septa on the GC and once per day change the septa on the valve syringe interface (injection port). Always use Supelco Thermogreen septa and take care not to leave finger prints on any inside heated surface. Wear a pair of white cotton gloves or use tweezers to handle the septa. Lower the oven temperature to 40° C. Remove the inlet cap with a wrench, remove the old septa with a pair of tweezers and insert the new septa.
- The column is replaced when chromatography peak shape or resolution degrades. Similarly, if the column bleed profile rises with age then the column needs replacing. Use new black graphite ferrules each time and clip off approximately 1" of column after inserting it through the ferrule. This will remove any graphite particles that may have scraped off into the column. Tighten the column nut and ferrule finger tight and one quarter turn with a wrench. Tightening any more only crushes the ferrule and may damage the column.
- The branch analyst will document any routine or major maintenance in the bound instrument logbook assigned to each instrument. The date of the maintenance, what work was performed and analyst initials are included.

4.8.1 Project Documentation and Records

A summary of Site records and documentation to be generated and stored in the TtNUS project files is provided in Table 4-3.

**TABLE 4-3
PROJECT DOCUMENTATION AND RECORDS
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

SAMPLE COLLECTION AND OTHER FIELD RECORDS	FIXED LABORATORY RECORDS	DATA ASSESSMENT RECORDS
Field Logbooks	Sample Receipt, Custody and Tracking Records	Field Sampling Audit Check Lists
Sample Log Sheets-Solid Phase	Standards Traceability Logs	Fixed Laboratory Check Lists
Telephone Logs	Equipment Maintenance and Testing Logs	Telephone Logs
Field Modification Records	Corrective Action Forms	
Field Instrument Calibration Logs	Data Results Forms	
Chain-Of Custody Records	Reported Results for Standards, QC Checks, and QC Samples	
Air Bills	Instrument Print-outs for Samples and Standards	
Custody Seals	Data Verification Check List	
	Sample Disposal Records	
	Telephone Logs	
	Records required by laboratory's specific quality assurance programs	

4.8.2 Field Screening Data Management

The only field screening analyses are PID and/or FID breathing zone readings for safety purposes. Breathing zone readings for health and safety purposes will be recorded on field sampling sheets, boring logs, or in the field logbooks.

4.8.3 Fixed Laboratory Data Package Deliverables

A turn-around time of 21 days will be requested for all the laboratory analysis. Typical itemized data package deliverables for the laboratory analyses are presented in Table 4-4. Lab electronic deliverables formatted according to the requirements of the laboratory specifications will be provided by the contract laboratories.

4.8.4 Data Reporting Formats

Field data will be recorded in the field log books and field forms. All log book and log sheet entries must be made in indelible ink (black pen is preferred). No erasures or liquid paper/white out are permitted. If an incorrect entry is made, the data will be crossed out with a single strike mark, and initialed and dated. The field personnel will sign and date the log book pages and field forms. Examples of the forms to be used in the field are presented in Appendix B of this Work Plan.

4.8.5 Data Handling and Management

The data handling procedures to be followed by the laboratories will meet the requirements of the subcontracts. The purpose of the data management section of this work plan is to describe the procedures that will be used to maintain data quality throughout the project. These operations include, but may not be limited to, data recording, data reduction, and data reporting.

4.8.6 Data Tracking and Control

Data Tracking. Data is tracked from its generation to its archiving in the TtNUS project specific files. The TtNUS Project Manager is responsible for tracking the data generated for the project. The Lead Chemist is responsible for tracking the samples collected and shipped to the contract laboratories. In addition, the Lead Chemist receives the data packages and oversees the data validation effort.

**TABLE 4-4
LABORATORY DATA PACKAGE ELEMENTS
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

DATA PACKAGE ELEMENTS	PAH	PCB	Metals
◆ INVENTORY SHEET (Org. and Inorg. DC-2 Form)	X	X	X
◆ NARRATIVE (Org. Narrative, Inorg. Cover Page)	X	X	X
◆ EPA SHIPPING/RECEIVING DOCUMENTS AND INTERNAL LABORATORY COC RECORDS:			
- Airbills	X	X	X
- Chain-of-Custody Records/Forms (Traffic Report)	X	X	X
- Sample Log-In Sheet (Org. and Inorg. DC-1 Form)	X	X	X
- Miscellaneous Shipping/Receiving Records	X	X	X
- Internal Lab. Sample Transfer Records and Tracking Sheets	X	X	X
◆ SAMPLE DATA:			
- Tabulated Summary Form for Field Sample and PE Sample Results (Org. and Inorg. Form I)	X	X	X
- Reconstructed Total Ion Chromatogram (RIC) for each sample	X	X	
- Raw spectra of target compound and background subtracted spectrum of target compound for each sample	X	X	
- GC Integration report or data system printouts and calibration plots for each sample	X	X	X
- PCB Identification Tabulated Summary Form (Org. Form X)		X	
- GPC sample chromatograms	X	X	
- Manual worksheets	X	X	X
- Sample preparation/extraction/digestion log (Inorg. Form XIII) and logbook pages	X	X	X
- Sample analysis run log (Inorg. Form XIV) and logbook pages	X	X	X
- ICP Raw Data			X
- Mercury Raw Data			X
- Other Analytical Raw Data	X	X	X
◆ STANDARDS DATA:			
- Method Detection Limit Study Tabulated Summary Form			
- Initial Calibration Tabulated Summary Form (Org. Form VI, Inorg. Form IIA)	X	X	X
- Continuing Calibration Tabulated Summary Form (Org. Form VII, Inorg. Form IIA)	X	X	X
- RICs and Quan Reports for all GC/MS standards	X		
- GPC Calibration Tabulated Summary Form (Org. Form IX, Pest-2)	X	X	
- Florisil Cartridge Check Tabulated Summary Form (Org. Form IX, Pest-1)	X	X	
- Instrument Detection Limits Tabulated Summary Form (Inorg. Form X)			X

**TABLE 4-4 (cont.)
 LABORATORY DATA PACKAGE ELEMENTS
 DRAFT WORK PLAN
 FORMER DERECKTOR SHIPYARD
 NAVAL STATION NEWPORT
 NEWPORT, RHODE ISLAND
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DATA PACKAGE ELEMENTS	SVOC	PCB	Metals
◆ STANDARDS DATA (cont.):			
- ICP Interelement Correction Factors Tabulated Summary Form (Inorg. Form XIA and XIB)			X
- ICP Linear Ranges Tabulated Summary Form (Inorg. Form XII)			X
- CRDL Standards for AA and ICP Tabulated Summary Form (Inorg. Form IIB)			X
- Standards preparation logbook pages	X	X	X
◆ QC DATA:			
- Tuning and Mass Calibration Tabulated Summary Form (Org. Form V)	X		
- Surrogate Percent Recovery Tabulated Summary Form (Org. Form II)	X	X	
- MS/MSD Recovery Tabulated Summary Form (Org. Form III)	X	X	
- Method Blank Tabulated Summary Form (Org. Form IV and Inorg. Form III)	X	X	X
- Internal Standard Area and RT Tabulated Summary Form (Org. Form VIII)	X	X	
- QC Raw Data – RICs, Chromatograms, Quan Reports, Integration Reports, Mass Spectra, etc.	X	X	X
- Spike Sample Recovery Tabulated Summary Form (Inorg. Form IV)			X
- Duplicates Tabulated Summary Form (Inorg. Form VI)			X
- Internal Laboratory Control Sample Tabulated Summary Form (Inorg. Form VII)			X
- Continuing Calibration Tabulated Summary Form (Org. Form VII, Inorg. Form IIA)	X	X	X
- Standard Addition Results Tabulated Summary Form (Inorg. Form VIII)			X
- ICP Serial Dilutions Tabulated Summary Form (Inorg. Form IV)			X
- QC Raw Data – ICP, Furnace, Mercury computer printouts, etc.			X
- QC sample preparation logbook pages	X	X	X
◆ MISCELLANEOUS DATA:			
- Original preparation and analysis forms or copies of preparation and analysis logbook pages	X	X	X
- Screening records	X	X	X
- All instrument output, including strip charts from screening activities	X	X	X
- Preparation Logs Raw Data	X	X	X
- Percent Solids Determination Log	X	X	X
- Other Records (ex. Telephone Communication Log)	X	X	X

Notes:

- PAH = Polycyclic aromatic Hydrocarbons
 PCB = polychlorinated biphenyls
 () = Form Number

Data Storage, Archiving, and Retrieval. The data packages received from the subcontract laboratories are tracked in the data validation log book. After the data is validated, the data packages are entered into the TiNUS Doc-u-log system and archived in secure files.

The field records including field log books, sample logs, chain-of-custody records, and field calibration logs will be submitted by the FOL to be entered into the Doc-u-log system prior to archiving in secure project files. The project files are audited for accuracy and completeness. At the completion of the Navy contract the records are stored by TtNUS.

Data Security. Data security is the responsibility of the Project Manager. The TtNUS project files are restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The TtNUS Data Manager maintains the electronic data files. Access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

4.9 VERIFICATION AND VALIDATION PROCEDURES

This section describes the procedures that will be followed to meet the data verification and validation requirements for this project.

4.9.1 Verification

The data verification process for this project includes the maintenance and periodic review of field documentation, including:

- Site Logbooks
- Instrument Calibration Logs
- Chain of Custody Forms
- Field Summary Reports
- Field Modification Records

Field audits and laboratory internal data reviews are important elements of the data verification process. Each of these elements is discussed in detail in Table 4-5.

4.9.2 Validation

Under this subtask, data collected as described in this plan will be validated using a Tier II validation, in accordance with “National Functional Guidelines for Organic/Inorganic Data Review”, revised 1994 and 1993. Data validation memoranda will be prepared, and the data sets will be arranged into database structure for inclusion into the EGIS, as described under Subtask 7.3. The data validation reports will be distributed to the TtNUS Project Manager, TtNUS Lead Chemist, and project file.

All project data will be reviewed to determine if the qualitative parameters of representativeness and comparability have been achieved. In general, the review will be accomplished by comparing the chain of custody and field notebook entries with the data for the sample. If the reported concentrations of a field sample from a specific location do not reflect historical data, then efforts will be made to determine if the data reflect an actual change in environmental conditions at that sampling point, or if the integrity of the sample was compromised during collection, preservation, shipping, or analysis. Conversely, if some level of analyte historically present in samples from a specific location is no longer present, then similar efforts will be made to confirm that change in concentration. QA/QC requirements that bracket questionable data will be reviewed to confirm the performance of instrumentation during the time when questionable data were generated. Any deviations will be documented, and corrective actions will be taken to determine if the data meet project goals. If the data do not meet project goals, then the need for additional sampling and analysis will be determined.

The laboratory that generates the analytical data will have the primary responsibility for the correctness and completeness of the data. Before releasing any analytical data, the laboratory will review and verify that the data has met all of the method criteria and is scientifically correct. Data reviews include the evaluation of information, as presented by the analyst or staff member, for accurate representation of the samples submitted.

All data will be subjected to a tiered review process before it is released from the laboratory. First, the analysts will review the quality of their work based on established guidelines. This includes reviewing and performing the following activities:

- Calibrations, tunes, blanks, and any other instrument QC criteria were met during the analysis reported;
- Calculations of individual analytes and detection limits were met;
- Verify that holding times or extraction times were met; and,
- Make notes or footnotes on the report if abnormalities occurred during the analysis or any other QA/QC problems associated with the sample occurred.

**TABLE 4-5
 VERIFICATION TASKS AND PROCEDURES
 DRAFT WORK PLAN
 FORMER DERECKTOR SHIPYARD
 NAVAL STATION NEWPORT
 NEWPORT, RHODE ISLAND**

Verification Task	Description	I – INTERNAL E - EXTERNAL	Responsible for Verification (Name, Organization)
Site Logbook	The site logbook is a hardbound, paginated, controlled-distribution record book. Entries are made for every day that onsite activities take place. Upon completion of the fieldwork, the site logbook becomes part of the project’s central file. All logbook, notebook, and log sheet entries are made in indelible ink. No erasures are permitted. If an incorrect entry is made, the data is crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used are signed and dated. The Field Operations Leader signs the site logbook at the end of each day.	I	Field Operations Leader, TtNUS
Instrument Calibration Log	Field team members calibrate or check the calibration of monitoring instruments in accordance with the SOPs. The field team member completes a calibration logsheet, initials it, and dates it. Equipment, which does not calibrate properly, is taken out of service. The FOL collects and submits the calibration logsheets to the project file.	I	Field Team Members, TtNUS
Chain-of-Custody Form	The FOL designates one field team member as shipment coordinator. The shipment coordinator organizes the samples into Sample Delivery Groups by matrix, analysis, and destination and fills out the C-O-C and airbill for each SDG. The samplers sign the C-O-C. The shipping coordinator assigns each SDG to a field team member for packing in coolers. The packer checks each cooler’s contents against the C-O-C before sealing it. The original C-O-C is shipped with the samples. The FOL provides a copy of the C-O-C to the Data Validators and submits a copy to the project file. The Data Validators use the C-O-C to track the progress of the shipment.	I	Field Team Members, TtNUS
Field Modification Record	Changes in field operating procedures may be necessary as a result of changed field conditions or unanticipated events. If a substantial change is required, the FOL or designee notifies the TtNUS Project Manager of the need for the change. If necessary, the Project Manager will discuss the change with pertinent individuals, e.g., the Navy RPM, and will provide verbal approval or denial to the FOL or assistant FOL for the proposed change. The FOL will document the change on a Field Modification Record form and forward the form to the TtNUS Project Manager at the earliest convenient time. The Project Manager will sign the form and distribute copies to the TtNUS Program Manager, Navy RPM, and others as needed. A copy of the completed Field Modification Record form will also be attached to the field copy of the work plan.	I	Field Operations Leader, TtNUS

**TABLE 4-5 (cont.)
 VERIFICATION TASKS AND PROCEDURES
 DRAFT WORK PLAN
 FORMER DERECKTOR SHIPYARD
 NAVAL STATION NEWPORT
 NEWPORT, RHODE ISLAND
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Verification Task	Description	I – INTERNAL E - EXTERNAL	Responsible for Verification (Name, Organization)
Field Audit	<p>The Quality Assurance Manager or designated representative audits fieldwork according to audit checklists or audit guides. The QA Manager immediately informs the FOL and Project Manager of any findings that require immediate corrective action. The audits verify adherence to the QAPP and all applicable SOPs. The QA Manager records each finding of nonconformance on a Quality Notice report and submits it to the Project Manager. The QA Manager prepares an audit report summarizing the findings, which is distributed to the CLEAN Program Manager, the Project Manager, the FOL, and the Program and Project QA/QC files.</p>	I	Quality Assurance Officer, TtNUS
Laboratory Internal Data Review	<p>There are five categories of review performed in the laboratory:</p> <ol style="list-style-type: none"> 1. Analytical review performed by the bench chemist. It includes a review of raw data, verification of all method- and project-specific QC requirements, the addition of data qualifier flags when needed, and documentation of any unusual circumstances. 2. Technical review performed by team leader or QA-approved peer. 3. QA review performed by a quality assurance specialist emphasizing overall quality of the data. 4. Data report review by the Reporting Manager, Team Leader, or approved peer to ensure the accuracy of the final report. 5. Electronic deliverable review to ensure the accuracy of the final electronic report. 	I	Contracted Laboratory Manager or designee
Laboratory Internal Data Review	<p>All data packages are verified internally by the laboratory according to the applicable laboratory master agreement and or TtNUS technical specifications. The laboratory completes DC-2 forms documenting the organization and completeness of each data package.</p>	I	Laboratory Manager or designee

The next step is performed by a supervisor or data review specialist whose function is to provide an independent review of data packages. This person will verify that all dates, sample identification, detection limits, reported analyte values, concentration units, header information, and footnotes or comments were transcribed accurately. This person will also check to ensure that data that do not meet project DQOs will be flagged with the appropriate data qualifiers. All information on the final report that can be verified against the chain of custody will be checked for errors and completeness.

The third step is done by the Laboratory Director or other designee who will sign the final reports. This person spot-checks activities associated with the log-in, tracking, extraction, sample analysis, and final reporting for technical and scientific soundness.

The Laboratory QA Manager then will review 10% of all data packages to ensure that all QA requirements have been met. This person will ensure that the data package is consistent and complies with project requirements.

The data generated for a project will be reviewed and verified by the Contractor's QAO and then validated by an independent outside reviewer. Data verification involves the process of generating qualitative and quantitative sample information through observations, field procedures, analytical measurements and calculations. The data verification and reporting process for the field data involves ensuring that calibration of instruments, field blanks, and field duplicates defined in this plan are within the acceptance criteria. The verification process for the laboratory data involves ensuring that the holding times, precision, accuracy, laboratory blanks, and detection limits are within the acceptance criteria outlined in the project-specific data quality plan.

Hard copies of the data reports received from the laboratories will be filed chronologically and will be stored separately from the electronic files. Hard copies of data signed by a representative of the analytical laboratory will be compared to any electronic versions of the data to confirm that the conversion process has not modified the reported results. Any additional reporting formats will be completed and electronic and hard copies will be stored in different locations.

1. The field and laboratory personnel will provide the contractor QAO with all the data. The contractor QAO will be responsible for overall review of the data verification results, for compliance with the specified DQOs. After this QC procedure is complete, the contractor's Project Manager will incorporate the verified data into the site reports.

4.10 QA MANAGEMENT REPORTS

This section presents the activities that will be performed to keep management updated on the project status. Open communication pathways will benefit the project, by allowing all appropriate personnel to be aware of activities and have the ability to provide input in a timely manner. Input from these parties will be used to make necessary corrective actions to ensure project quality objectives are met.

4.10.1 Report Documentation

The information to be included in each of the QA Management Reports listed in Table 4-6 is summarized as follows.

Verbal Status Reports

The Lead Chemist, FOL, and project personnel will give verbal status reports to the Project Manager on a daily basis or more frequently if needed. The status reports will include the field activities completed for the day, the personnel who completed each activity, the anticipated activities to be completed during the next day, and any issues or problems identified.

Field Audit Report

Quality assurance audits will be performed by the Quality Assurance Officer (QAO) or QA Representative during field investigations. The audits will include checks on adherence to the QAPP and all applicable SOPs. The QAO will then prepare an audit report summarizing the findings. Nonconformance Quality Notices will be issued to document each observation, deficiency, or concern discovered during the audit. This report is distributed to the CLEAN Program Manager, the Project Manager, the FOL, and the Program and Project QA/QC files. Any findings that require immediate corrective action will be communicated immediately to the FOL and to the Project Manager.

4.10.2 Assessments and Response Actions

Assessment activities ensure that the resultant data quality is adequate for its intended use and that appropriate corrective actions are implemented to address non-conformances and deviations from the Work Plan. The assessments planned for this project are discussed below.

**TABLE 4-6
QA MANAGEMENT REPORTS
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

Type of Report	Frequency	Project Delivery Date	Person Responsible for Report Preparation	Report Recipients
Verbal Status Reports	Daily during field activities	At the end of every day of field activities or as needed	TtNUS Field personnel TtNUS FOL: K. O'Neill TtNUS Lead Chemist: Kelly Johnson-Carper	TtNUS PM: S. Parker
Field Audit Reports	At discretion of QA Officer during field activities	10 days after audit	TtNUS CLEAN QA Officer Paul Frank	TtNUS PM: S. Parker Program Manager: J. Trepanowski
Data Validation Reports	One per data package	3 weeks after date received	Data Validators	Project File Data Management Group TtNUS PM: S. Parker Lead Chemist: L. Guzman

Field Audit

The TtNUS Project Manager will be responsible for this field investigation. The Project Manager will communicate daily with the Field Operation Leader. In addition, field scientists will technically oversee the field tasks. The Project Manager will keep the Navy RPM up to date on the field activities and the progress of the investigation.

Quality assurance audits will be performed by the QAO or QA Representative during field investigations. The audits will include checks on adherence to the Work Plan and all applicable SOPs. The QAO will prepare audit checklists or audit guides. The depth and scope of the audit will be determined and incorporated into the checklist or guidelines. As a minimum, the audit will cover the following items:

- Adherence to sample collection as detailed in the Work Plan and SOPs
- Chain of custody
- Documentation of field activities consistent with the Work Plan and SOPs
- Equipment maintenance and calibration
- Training requirements for site workers

Assessment Findings and Corrective Action Responses

Assessment findings that require corrective action initiate a sequence of events that include documentation of deficiencies, notification of findings, request for corrective action, implementation of corrective action, and follow-up assessment of the corrective action effectiveness. Table 4-7 describes which individuals will be responsible for deviations and project deficiencies, which are identified through the planned project assessments.

Corrective actions may be initiated by any of the participants of the data generation (field technician or laboratory analyst), reporting (laboratory director or field team leader), and validation process (Project Manager or Quality Assurance Officer [QAO]). Note that it is important to generate corrective actions early in the process so that the problem has a greater chance of being resolved in a timely and cost-effective manner.

For field measurements, if the final calibration check is outside acceptable limits, then the associated data collected that day will be flagged. On the following day, a single point continuing calibration check will be run after every five wells monitored (or samples analyzed) to determine how long the initial calibration holds. Calibration frequencies will be adjusted accordingly.

**TABLE 4-7
PROJECT ASSESSMENT
DRAFT WORK PLAN
FORMER DERECKTOR SHIPYARD
NAVAL STATION NEWPORT
NEWPORT, RHODE ISLAND**

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) responsible for performing assessment, title and organizational affiliation	Person(s) responsible for responding to assessment findings, title and organizational affiliation	Person(s) responsible for identifying and implementing corrective actions (CA), title and organizational affiliation	Person(s) responsible for monitoring effectiveness of CA, title and organizational affiliation
Project Oversight	Continuously	I	TtNUS	TtNUS PM: S. Parker	TtNUS Field Personnel	TtNUS Field Personnel	TtNUS CLEAN Program Manager: J. Trepanowski
Field Audit	Once during field activities	I	TtNUS	TtNUS QAO: Paul Frank	TtNUS PM: S. Parker	TtNUS FOL: K. O'Neill	TtNUS QAO: Paul Frank
Lab Blank Samples	Periodic	I	Subcontract Laboratory	Laboratory Manager	Laboratory Manager	TtNUS Data Validator	TtNUS Data Validator

For laboratory measurements, if any of the QC checks (MS, MSD, laboratory control samples, or laboratory blank) are outside the acceptance criteria (for accuracy, precision, and cross contamination); the laboratory will follow the corrective actions that are outlined in the LQAP. The QA program will enable problems to be identified, controlled, and corrected. Potential problems may involve non-conformance with the SOPs and/or analytical procedures established for the project, or other unforeseen difficulties. Any person identifying an unacceptable condition will notify the FOL and the PM. The PM, with the assistance of the Quality Assurance Manager and the project QA/QC officer, will be responsible for developing and initiating appropriate corrective action and verifying that the corrective action has been effective.

Corrective actions may include re-sampling and/or re-analysis of samples or modifying project procedures. If warranted by the severity of the problem (for example, if a change in the approved work plan is required), the Navy will be notified in writing and their approval will be obtained prior to implementing any change. Additional work that depends on a nonconforming activity will not be performed until the source of the problem has been addressed.

Additional Work Plan Non-conformances

Deviations from the Work Plan noted by project personnel outside of the formal assessment process will be documented and resolved using the procedures and personnel that were detailed for the planned assessments.

4.11 PERFORMANCE AND SYSTEM AUDITS

Technical Systems Audits (TSAs) of the analytical laboratory may be conducted to assess compliance with quality assurance (QA) procedures and SOPs. Results of any TSAs will be reported in an audit report to the laboratory manager. Technical systems audits and audits of data quality will be conducted periodically, if required, during field activities. In addition, the contractor will conduct regular audits of the field and laboratory data as they are generated as well as data/sample collection procedures.

Routine QA/QC checks will ensure that data quality issues are identified early, rather than at the end of the investigation.

If significant variances are found during an audit, additional audits should be conducted. Additional audits may include a visit to the laboratory, if required and if determined to be necessary. For those audits resulting in variances, the Project Team Leader or the laboratory coordinator will submit a response in writing to the contractor.

Magnetic tape audits involve the examination of the electronic media used in the analytical laboratory to acquire, report, and store data. These audits are used to assess the authenticity of the data generated, and assess the implementation of good automated laboratory practices. The contractor may perform magnetic tape audits of the off-site laboratory when warranted by project performance evaluation (PE) sample results, or by other circumstances.

System audits will be performed as appropriate to ensure that the work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner.

- The TtNUS Field Operations Leader (FOL) will supervise and on a daily basis check to ensure that the equipment is properly decontaminated, samples are collected and handled properly, and the fieldwork is accurately and neatly documented.
- The data reviewer(s) will review the data to ensure they were obtained through the approved methodology, and that the appropriate level of QC effort and reporting were conducted. The data review effort will be supervised by the TtNUS CLEAN Quality Assurance Manager or designee.
- The Project Manager (PM) will oversee the FOL and data reviewer, and check that management of the acquired data proceeds in an organized and expeditious manner.

4.12 PREVENTATIVE MAINTENANCE

The primary objective of a preventive maintenance program is to help ensure the timely and effective completion of a measurement effort by minimizing the downtime of crucial equipment due to expected or unexpected component failure.

TtNUS has established a field equipment maintenance program to ensure the availability of equipment in good working order when and where it is needed. This program consists of the following elements:

- The equipment manager maintains an inventory of the equipment by model and serial number, quantity, and condition. Each item of equipment is signed out when in use and its operating condition and cleanliness is checked upon return.
- The equipment manager conducts routine checks on the status of equipment and is responsible for stocking spare parts and for equipment readiness.

- The equipment manager maintains the equipment manual library and trains field personnel in the proper use and care of equipment.
- The FOL is responsible for working with the equipment manager to ensure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the job site.
- While the equipment is in the field, the FOL or designee is responsible for the equipment, maintains calibration records, and performs maintenance operations and checks.

4.13 DATA ASSESSMENT PROCEDURES

Data collected during the field efforts will be reconciled with the project DQOs by preparing summary tables, charts, figures, or performing other types of data analyses that facilitate direct comparison of data collected through the entire extent of the project. Comparisons will be made on a parameter-specific basis, concentrating on the contaminants of concern. Comparisons also will facilitate an analysis of contaminant concentration trends through time and space.

The following paragraphs describe the procedures used to evaluate data prior to inclusion in deliverable reports.

4.13.1 Representativeness, Accuracy, and Precision

All laboratory data generated in the investigation will be assessed for representativeness, accuracy, and precision, as described in Section 4.1. The completeness of the data will also be assessed by comparing the acquired data to the project objectives to see that these objectives are being addressed and met.

Qualified TtNUS personnel will conduct the PARCC parameter assessment. Determining if the data are consistent with known or anticipated chemical conditions and accepted principles will assess the representativeness of the data.

Field measurements will be checked for completeness of procedures and documentation of procedures and results.

Precision and accuracy will be determined using duplicate samples, and blank and spiked samples, respectively. PARCC parameters are addressed in more detail in Section 4.1.

4.13.2 Analytical Data Review

An analytical data review process that includes the following tasks will be carried out:

- Check data for completeness to determine if all samples were analyzed and reported for the parameters requested in the chain-of-custody form.
- Check data report for accuracy of sample identification, sample location, collection date, and units.
- Organize the data tables by sample matrix, sample location, and calculate and report the average of field duplicate results. Consolidate results of two sample dilutions into one set of results.
- Check large positive hits against the raw data to avoid false positive results.
- Submit the data review results with a summary of problems and resolutions in writing.

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APPENDIX A
STANDARD OPERATING PROCEDURES



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

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Effective Date	09/03	Revision	1
Applicability	Tetra Tech NUS, Inc.		
Prepared	Risk Assessment Department		
Approved	D. Senovich <i>ds</i>		

Subject
SAMPLE NOMENCLATURE

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1.0 PURPOSE

The purpose of this document is to specify a consistent sample nomenclature system that will facilitate subsequent data management in a cost-effective manner. The sample nomenclature system has been devised such that the following objectives can be attained:

- Sorting of data by matrix.
- Sorting of data by depth.
- Maintenance of consistency (field, laboratory, and data base sample numbers).
- Accommodation of all project-specific requirements.
- Accommodation of laboratory sample number length constraints (maximum of 20 characters).

2.0 SCOPE

The methods described in this procedure shall be used consistently for all projects requiring electronic data.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Program Manager - It shall be the responsibility of the Program Manager (or designee) to inform contract-specific Project Managers of the existence and requirements of this Standard Operating Procedure.

Project Manager - It shall be the responsibility of the Project Manager to determine the applicability of this Standard Operating Procedure based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the sample nomenclature is thoroughly specified in the relevant project planning document (e.g., sampling and analysis plan) and is consistent with this Standard Operating Procedure if relevant. It shall be the responsibility of the project manager to ensure that the Field Operations Leader is familiar with the sample nomenclature system.

Field Operations Leader - It shall be the responsibility of the Field Operations Leader to ensure that all field technicians or sampling personnel are thoroughly familiar with this Standard Operating Procedure and the project-specific sample nomenclature system. It shall be the responsibility of the Field Operations Leader to ensure that the sample nomenclature system is used during all project-specific sampling efforts.

5.0 PROCEDURES

5.1 Introduction

The sample identification (ID) system can consist of as few as 8 but not more than 20 distinct alphanumeric characters. The sample ID will be provided to the laboratory on the sample labels and chain-of-custody forms. The basic sample ID provided to the lab has three segments and shall be as follows where "A" indicates "alpha," and "N" indicates "numeric":

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters
Site Identifier	Sample Type	Sample Location

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Additional segments may be added as needed. For example:

(1) Soil and Sediment Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	NNNN 4-Characters
Site Identifier	Sample Type	Sample Location	Sample Depth

(2) Aqueous (groundwater or surface water) Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	NN 2-Characters	-A
Site Identifier	Sample type	Sample Location	Round Number	Filtered Sample only

(3) Biota Sample ID

A or N 3- or 4-Characters	AAA 2- or 3-Characters	A or N 3- to 6-Characters	AA 2-Characters	NNN 3-Characters
Site Identifier	Sample Type	Sample Location	Species Identifier	Sample Group Number

5.2 Sample Identification Field Requirements

The various fields in the sample ID will include but are not limited to the following:

- Site Identifier
- Sample Type
- Sample Location
- Sample Depth
- Sampling Round Number
- Filtered
- Species Identifier
- Sample Group Number

The site identifier must be a three- or four-character field (numeric characters, alpha characters, or a mixture of alpha and numeric characters may be used). A site number is necessary since many facilities/sites have multiple individual sites, SWMUs, operable units, etc. Several examples are presented in Section 5.3 of this SOP.

The sample type must be a two- or three-character alpha field. Suggested codes are provided in Section 5.3 of this SOP.

The sample location must be at least a three-character field but may have up to six-characters (alpha, numeric, or a mixture). The six-characters may be useful in identifying a monitoring well to be sampled or describing a grid location.

The sample depth field is used to note the depth below ground surface (bgs) at which a soil or sediment sample is collected. The first two numbers of the four-number code specify the top interval, and the third and fourth specify the bottom interval in feet bgs of the sample. If the sample depth is equal to or greater than 100, then only the top interval would be represented and the sampling depth would be truncated to

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three-characters. The depths will be noted in whole numbers only; further detail, if needed, will be recorded on the sample log sheet, boring log, logbook, etc.

A two-digit round number will be used to track the number of aqueous samples taken from a particular aqueous sample location. The first sample collected from a location will be assigned the round identifier 01, the second 02, etc. This applies to both existing and proposed monitoring wells and surface water locations.

Aqueous samples that are field filtered (dissolved analysis) will be identified with an "-F" in the last field segment. No entry in this segment signifies an unfiltered (total) sample.

The species identifier must be a two-character alpha field. Several suggested codes are provided in Section 5.3 of this SOP.

The three digit sample group number will be used to track the number of biota sample groups (a particular group size may be determined by sample technique, media type, the number of individual caught, weight issues, time, etc.) by species and location. The first sample group of a particular species collected from a given location will be assigned the sample group number 001 and the second sample group of the same species collected from the same location will be assigned the sample group number 002.

5.3 Example Sample Field Designations

Examples of each of the fields are as follows:

Site Identifier - Examples of site numbers/designations are as follows:

- A01 - Area of Concern Number 1
- 125 - Solid Waste Management Unit Number 125
- 000 - Base or Facility Wide Sample (e.g., upgradient well)
- BBG - Base Background

The examples cited are only suggestions. Each Project Manager (or designee) must designate appropriate (and consistent) site designations for their individual project.

Sample Type - Examples of sample types are as follows:

- AH - Ash Sample
- AS - Air Sample
- BM - Building Material Sample
- BSB - Biota Sample Full Body
- BSF - Biota Sample Fillet
- CP - Composite Sample
- CS - Chip Sample
- DS - Drum Sample
- DU - Dust Sample
- FP - Free Product
- IDW - Investigation Derived Waste Sample
- LT - Leachate Sample
- MW - Monitoring Well Groundwater Sample
- OF - Outfall Sample
- RW - Residential Well Sample
- SB - Soil Boring Sample
- SD - Sediment Sample
- SC - Scrape Sample

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- SG - Soil Gas Sample
- SL - Sludge Sample
- SP - Seep Sample
- SS - Surface Soil Sample
- ST - Storm Sewer Water Sample
- SW - Surface Water Sample
- TP - Test Pit Sample
- TW - Temporary Well Sample
- WC - Well Construction Material Sample
- WP - Wipe Sample
- WS - Waste/Solid Sample
- WW - Wastewater Sample

Sample Location - Examples of the location field are as follows:

- 001 - Monitoring Well 1
- N32E92 - Grid location 32 North and 92 East
- D096 - Investigation derived waste drum number 96

Species Identifier - Examples of species identifier are as follows:

- BC - Blue Crab
- GB - Blue Gill
- CO - Corn
- SB - Soybean

5.4 Examples of Sample Nomenclature

The first round monitoring well groundwater sample collected from existing monitoring well 001 at SWMU 16 for a filtered sample would be designated as 016MW00101-F.

The second round monitoring well groundwater sample collected from existing monitoring well C20P2 at Site 23 for an unfiltered sample would be designated as 023MWC20P202.

The second surface water sample collected from point 01 at SWMU 130 for an unfiltered sample would be designated as 130SW00102.

A surface soil sample collected from grid location 32 North and 92 East at Site 32 at the 0- to 2-foot interval would be designated as 032SSN32E920002.

A subsurface soil sample from soil boring 03 at SWMU 32 at an interval of 4 to 5 feet bgs would be designated as 032SB0030405.

A sediment sample collected at SWMU 19 from 0 to 6 inches at location 14 would be designated as 019SD0140001. The sample data sheet would reflect the precise depth at which this sample was collected.

During biota sampling for full body analysis the first time a minnow trap was checked at grid location A25 of SWMU 1415 three small blue gills were captured, collected and designated with the sample ID of 1415BSBA25BG001. The second time blue gill were collected at the same location (grid location A25 at SWMU 1415) the sample ID designation given was 1415BSBA25BG002.

Note: No dash (-) or spacing is used between the segments with the exception of the filtered segment. The "F" used for a filtered aqueous sample is preceded by a dash "-F".

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5.5 Field Quality Assurance/Quality Control (QA/QC) Sample Nomenclature

Field QA/QC will be designated using a different coding system. The QC code will consist of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AA	NNNNNN	NN	-F
QC Type	Date	Sequence Number (per day)	Filtered (aqueous only, if needed)

The QC types are identified as:

TB = Trip Blank
 RB = Rinsate Blank (Equipment Blank)
 FD = Field Duplicate
 AB = Ambient Conditions Blank
 WB = Source Water Blank

The sampling time recorded on the Chain-of-Custody Form, labels, and tags for duplicate samples will be 0000 so that the samples are "blind" to the laboratory. Notes detailing the sample number, time, date, and type will be recorded on the routine sample log sheets and will document the location of the duplicate sample (sample log sheets are not provided to the laboratory). Documentation for all other QC types (TB, RB, AB, and WB) will be recorded on the QC Sample Log sheet (see SOP on Field Documentation).

5.6 Examples of Field QA/QC Sample Nomenclature

The first duplicate of the day for a filtered ground water sample collected on June 3, 2000 would be designated as FD06030001-F.

The third duplicate of the day taken of a subsurface soil sample collected on November 17, 2003 would be designated as FD11170303.

The first trip blank associated with samples collected on October 12, 2000 would be designated as TB10120001.

The only rinsate blank collected on November 17, 2001 would be designated as RB11170101.

6.0 **DEVIATIONS**

Any deviation from this SOP must be addressed in detail in the site specific planning documents.



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

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Effective Date	01/29/01	Revision	2
Applicability	Tetra Tech NUS, Inc.		
Prepared	Management Information Systems Department		
Approved	D. Senovich <i>[Signature]</i>		

Subject
DATABASE RECORDS AND QUALITY ASSURANCE

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1.0 PURPOSE

The purpose of this document is to specify a consistent procedure for the quality assurance review of electronic and hard copy databases. This SOP outlines the requirements for establishment of a Database Record File, Quality Assurance review procedures, and documentation of the Quality Assurance Review Process.

2.0 SCOPE

The methods described in this Standard Operating Procedure (SOP) shall be used consistently for all projects managed by Tetra Tech NUS (TtNUS).

3.0 GLOSSARY

Chain-of-Custody Form - A Chain-of-Custody Form is a printed form that accompanies a sample or a group of samples from the time of sample collection to the laboratory. The Chain-of-Custody Form is retained with the samples during transfer of samples from one custodian to another. The Chain-of-Custody Form is a controlled document that becomes part of the permanent project file. Chain-of-Custody and field documentation requirements are addressed in SOP SA-6.1.

Electronic Database - A database provided on a compact laser disk (CD). Such electronic databases will generally be prepared using public domain software such as DBase, RBase, Oracle, Visual FoxPro, Microsoft Access, Paradox, etc.

Hardcopy Database - A printed copy of a database prepared using the software discussed under the definition of an electronic database.

Form I - A printed copy of the analytical results for each sample.

Sample Tracking Summary - A printed record of sample information including the date the samples were collected, the number of samples collected, the sample matrix, the laboratory to which the samples were shipped, the associated analytical requirements for the samples, the date the analytical data were received from the laboratory, and the date that validation of the sample data was completed.

4.0 RESPONSIBILITIES

Database Records Custodian - It shall be the responsibility of the Database Records Custodian to update and file the Sample Tracking Summaries for all active projects on a weekly basis. It shall be the responsibility of the Database Records Custodian to ensure that the most recent copies of the Sample Tracking Summaries are placed in the Database Records file. It shall be the responsibility of the Database Records Custodian to ensure that a copy of all validation deliverables is provided to the Project Manager (for placement in the project file). It shall be the responsibility of the Database Records Custodian to ensure that photocopies of all validation deliverables and historical data and reports (as applicable) are placed in the Database Records file.

Data Validation Coordinator - It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that the Sample Tracking Summaries are maintained by the Database Records Custodian. It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that photocopies of all data validation deliverables are placed in the applicable Database Records file by the Database Records Custodian.

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Earth Sciences Department Manager - It shall be the responsibility of the Earth Sciences Department Manager (or equivalent) to ensure that all field personnel are familiar with the requirements of this Standard Operating Procedure (specifically Section 5.5).

FOL - It shall be the responsibility of the FOL (FOL) of each project to ensure that all field technicians or sampling personnel are thoroughly familiar with this SOP, specifically regarding provision of the Chain-of-Custody Forms to the Database Records Custodian. Other responsibilities of the FOL are described in Sections 5.4 and 5.5.

Management Information Systems (MIS) Manager - It shall be the responsibility of the MIS Manager to ensure that copies of original electronic deliverables (CDs) are placed in both the project files and the Database Records File. It shall be the responsibility of the MIS Manager (or designee) to verify the completeness of the database (presence of all samples) in both electronic and hardcopy form in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that Quality Assurance Reviews are completed and are attested to by Quality Assurance Reviewers. It shall be the responsibility of the MIS Manager to ensure that records of the Quality Assurance review process are placed in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that both electronic and hardcopy forms of the final database are placed in both the project and the Database Record File. It shall be the responsibility of the MIS Manager to ensure that data validation qualifiers are entered in the database.

Furthermore, it shall be the responsibility of the MIS Manager to participate in project planning at the request of the Project Manager, specifically with respect to the generation of level of effort and schedule estimates. To support the project planning effort, the MIS Manager shall provide a copy of the MIS Request Form included as Attachment A to the project manager. It shall be the responsibility of the MIS Manager to generate level of effort and budget estimates at the time database support is requested if a budget does not exist at the time of the request. The MIS Request Form shall be provided to the Project Manager at the time of any such requests. It shall be the responsibility of the MIS Manager to notify the Project Manager of any anticipated level of effort overruns or schedule noncompliances as soon as such problems arise along with full justification for any deviations from the budget estimates (provided they were generated by the MIS Manager). It shall be the responsibility of the MIS Manager to document any changes to the scope of work dictated by the Project Manager, along with an estimate of the impact of the change on the level of effort and the schedule.

Program/Department Managers - It shall be the responsibility of the Department and/or Program Managers (or designees) to inform their respective department's Project Managers of the existence and requirements of this SOP.

Project Manager - It shall be the responsibility of each Project Manager to determine the applicability of this SOP based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the FOL is familiar with the requirements regarding Chain-of-Custody Form provision to the Database Records Custodian. It shall be the responsibility of the Project Manager (or designee) to determine which, if any, historical data are relevant and to ensure that such data (including all relevant information such as originating entity, sample locations, sampling dates, etc.) are provided to the Database Records Custodian for inclusion in the Database Records File. It shall be the responsibility of the Project Manager to obtain project planning input regarding the level of effort and schedule from the MIS Manager. It shall be the responsibility of the Project Manager to complete the database checklist (Attachment A) to support the level of effort and schedule estimate and to facilitate database preparation and subroutine execution.

Risk Assessment Department Manager - It shall be the responsibility of the Risk Assessment Department Manager to monitor compliance with this Standard Operating Procedure, to modify this SOP as necessary, and to take corrective action if necessary. Monitoring of the process shall be completed on a quarterly basis.

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Quality Assurance Reviewers - It shall be the responsibility of the Quality Assurance Reviewers to verify the completeness of the sample results via review of the Chain-of-Custody Forms and Sample Tracking Summaries. It shall be the responsibility of the Quality Assurance Reviewers to ensure the correctness of the database via direct comparison of the hardcopy printout of the database and the hardcopy summaries of the original analytical data (e.g., Form Is provided in data validation deliverables). Correctness includes the presence of all relevant sample information (all sample information fields), agreement of the laboratory and database analytical results, and the presence of data validation qualifiers.

Quality Manager - It shall be the responsibility of the Quality Manager to monitor compliance with this Standard Operating Procedure via routine audits.

5.0 PROCEDURES

5.1 Introduction

Verification of the accuracy and completeness of an electronic database can only be accomplished via comparison of a hardcopy of the database with hardcopy of all relevant sample information. The primary purposes of this SOP are to ensure that 1) all necessary hardcopy information is readily available to Quality Assurance Reviewers; 2) ensure that the Quality Assurance review is completed in a consistent and comprehensive manner, and; 3) ensure that documentation of the Quality Assurance review process is maintained in the project file.

5.2 File Establishment

A Database Record file shall be established for a specific project at the discretion of the Project Manager. Initiation of the filing procedure will commence upon receipt of the first set of Chain-of-Custody documents from a FOL or sampling technician. The Database Record Custodian shall establish a project-specific file for placement in the Database Record File. Each file in the Database Record File shall consist of standard components placed in the file as the project progresses. Each file shall be clearly labeled with the project number, which shall be placed on the front of the file drawer and on each and every hanging file folder relevant to the project. The following constitute the minimum components of a completed file:

- Electronic Deliverables
- Sample Tracking Forms
- Chain-of-Custody Forms
- Data Validation Letters
- Quality Assurance Records

5.3 Electronic Deliverables

The format of electronic deliverables shall be specified in the laboratory procurement specification and shall be provided by the laboratory. The integrity of all original electronic data deliverables shall be maintained. This shall be accomplished via the generation of copies of each electronic deliverable provided by the laboratory. The original electronic deliverable shall be provided to the project manager for inclusion in the project file. A copy of the original electronic deliverable shall be placed in the Database Record File. The second copy shall be maintained by the MIS Manager (or designee) to be used as a working copy.

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5.4 Sample Tracking Forms

Updated versions of the sample tracking form for each relevant project shall be maintained by the Database Record Custodian. The Sample Tracking Forms shall be updated any time additional Chain-of-Custody Forms are received from a FOL or sampling technician, or at any time that data are received from a laboratory, or at any time that validation of a given data package (sample delivery group) is completed. The Data Validation Coordinator shall inform the Database Record Custodian of the receipt of any data packages from the laboratory and of completion of validation of a given data package to facilitate updating of the Sample Tracking Form. The Database Record Custodian shall place a revised copy of the Sample Tracking Form in the Database Record File anytime it has been updated. Copies of the updated Sample Tracking Form shall also be provided to the project manager to apprise the project manager of sample package receipt, completion of validation, etc.

5.5 Chain-of-Custody Forms

The Chain-of-Custody Forms for all sampling efforts will be used as the basis for (1) updating the Sample Tracking Form, and (2) confirming that all required samples and associated analyses have been completed. It shall be the responsibility of the FOL (or sample technician) to provide a photocopy of all Chain-of-Custody Forms to the Database Record Custodian immediately upon completion of a sampling effort. The Database Record Custodian shall then place the copies of the Chain-of-Custody Form(s) in the Database Record File. Upon receipt of a sample data package from an analytical laboratory, the Data Validation Coordinator shall provide a copy of the laboratory Chain-of-Custody Form to the Database Record Custodian. The Database Record Custodian shall use this copy to update the Sample Tracking Summary and shall place the copy of the laboratory-provided Chain-of-Custody Form in the Database Record File. The photocopy of the laboratory-provided Chain-of-Custody Form shall be stapled to the previously filed field copy. Upon receipt of all analytical data, two copies of the Chain-of-Custody will therefore be in the file. Review of the Chain-of-Custody Forms will therefore be a simple mechanism to determine if all data have been received. Chain-of-Custody is addressed in SOP SA-6.1.

5.6 Data Validation Letters

All data validation deliverables (or raw data summaries if validation is not conducted) shall be provided for inclusion in both the Database Record File and the project file. If USEPA regional- or client-specific requirements are such that Form Is (or similar analytical results) need not be provided with the validation deliverable, copies of such results must be appended to the deliverable. It is preferable, although not essential that the validation qualifiers be hand-written directly on the data summary forms. The data validation deliverables (and attendant analytical summaries) will provide the basis for direct comparison of the database printout and the raw data and qualifiers.

5.7 Historical Data

At the direction of the Project Manager, historical data may also be included in a project-specific analytical database. In the event that historical data are germane to the project, hardcopy of the historical data must be included in the Database Record File. Historical data may be maintained in the form of final reports or as raw data. The information contained in the historical data file must be sufficient to identify its origin, its collection date, the sample location, the matrix, and any and all other pertinent information. All available analytical data, Chain-of-Custody Forms, boring logs, well construction logs, sample location maps, shall be photocopied by the Project Manager (or designee) and placed in one or more 3-ring binders. All information shall be organized chronologically by matrix. It shall be the responsibility of the Project Manager (or designee) to ensure that all inconsistencies between analytical data, Chain-of-Custody Forms, boring logs, sample log sheets, and field logbooks are identified and corrected. The Project Manager (or designee) shall decide which nomenclature is appropriate and edit, initial and date all relevant forms. Data entry may only be performed on information that has undergone the aforementioned

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editing process, thereby having a direct correlation between hardcopy information and what will become the electronic database.

6.0 RECORDS

Records regarding database preparation and quality assurance review include all those identified in the previous section. Upon completion of the database task, records from the file will be forwarded to the Project Manager for inclusion in the project file, or will be placed in bankers boxes (or equivalent) for storage. The final records for storage shall include the following minimum information on placards placed on both the top and end of the storage box:

Database Record File
PROJECT NUMBER: _____
SITE NAME: _____
DATE FILED: __/__/__
SUMMARY OF CONTENTS ENCLOSED
BOX _ OF _

Project- or program-specific record keeping requirements shall take precedence over the record keeping requirements of this SOP.

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ATTACHMENT A



MIS REQUEST FORM

Tetra Tech NUS, Inc.

Project Name:	Request Date:
CTO:	Date Data Available for Production:
Project Manager:	Request in Support of:
Requestor:	Database Lead:
Program/Client:	GIS Lead:
State/EPA Region:	Statistics Lead:
	Risk Lead:
Site Name(s) (Area, OU, etc.):	
Sampling Date(s):	
Matrix: <input type="checkbox"/> GW <input type="checkbox"/> SO <input type="checkbox"/> SD <input type="checkbox"/> SW <input type="checkbox"/> Other:	
Labels:	<input type="checkbox"/> Labels needed for an upcoming sampling event _____ Total # of Samples
Estimated Hours _____	Additional Instructions: _____
Due Date _____	
Complete ETS Charge No. _____	
FOL _____	
Data Entry:	
<input type="checkbox"/> Chemical data needs to be entered from hardcopy _____ Estimated # of Samples	
<input type="checkbox"/> Chemical data needs to be formatted electronically _____	
<input type="checkbox"/> Field analytical data needs to be entered from hardcopy _____	
<input type="checkbox"/> Geologic data needs to be entered from hardcopy _____	
<input checked="" type="checkbox"/> Hydrology data needs to be entered from hardcopy _____	
Estimated Hours _____	Additional Instructions: _____
Due Date _____	
Complete ETS Charge No. _____	
Tables:	
<input type="checkbox"/> Full Data Printout _____	
<input type="checkbox"/> Summary of Positive Hits _____	
<input type="checkbox"/> Occurance and Distribution _____ <input type="checkbox"/> with criteria	
<input type="checkbox"/> Sampling Analytical Summary: _____	
<input type="checkbox"/> Other: _____	
Estimated Hours _____	Additional Instructions: _____
Due Date _____	
Complete ETS Charge No. _____	
GIS:	
<input type="checkbox"/> General Facility Location _____	
<input type="checkbox"/> Site Location _____	
<input type="checkbox"/> Potentiometric Contours/Groundwater Flow _____	
<input type="checkbox"/> Sample Location Proposed _____	
<input type="checkbox"/> Sample Location Existing _____	
<input type="checkbox"/> Tag Map Single Round _____	
<input type="checkbox"/> Tag Map Multiple Round _____	
<input type="checkbox"/> Isoconcentrations _____	
<input checked="" type="checkbox"/> Chart Map _____	
<input type="checkbox"/> 3D Visualization _____	
<input type="checkbox"/> EGIS CD _____	
<input type="checkbox"/> Other: _____	
Estimated Hours _____	Additional Instructions: _____
Due Date _____	
Complete ETS Charge No. _____	
Statistics:	
<input type="checkbox"/> Yes _____	
Estimated Hours _____	Additional Instructions: _____
Due Date _____	
Complete ETS Charge No. _____	
Geostatistics:	
<input type="checkbox"/> Yes _____	
Estimated Hours _____	Additional Instructions: _____
Due Date _____	
Complete ETS Charge No. _____	



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

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Applicability	Tetra Tech NUS, Inc.		
Prepared	Earth Sciences Department		
Approved	D. Senovich <i>ds</i>		

Subject
SURFACE WATER AND SEDIMENT SAMPLING

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1.0 PURPOSE

This procedure describes methods and equipment commonly used for collecting environmental samples of surface water and aquatic sediment for either onsite examination and chemical testing, or for subsequent laboratory analysis.

2.0 SCOPE

The information presented in this guideline is generally applicable to all environmental sampling of surface waters (Section 5.3) and aquatic sediments (Section 5.5), except where the analyte(s) may interact with the sampling equipment. The collection of concentrated sludges or hazardous waste samples from disposal or process lagoons often requires methods, precautions and equipment different from those described herein.

3.0 GLOSSARY

Environmental Sample - a sample containing (or suspected to contain) low-level concentrations of contaminants, which does not require special handling or transport considerations as detailed in SOP SA-6.1.

Hazardous Waste Sample - a sample containing (or suspected to contain) higher concentrations of contaminants thus requiring special handling and/or transport considerations per SOP SA-6.1.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager has the overall responsibility for seeing that all surface water and sediment sampling activities are properly conducted by appropriately trained personnel.

Field Operations Leader - The Field Operations Leader (FOL) is responsible for the supervision of onsite water quality analyses, ensuring proper sample collection, handling, and the completion and accuracy of all field documentation, and making sure that custody of all samples obtained is maintained according to proper procedures.

5.0 PROCEDURES

5.1 Introduction

Collecting a representative sample from surface water or sediments is difficult because of water movement, stratification, or patchiness. To collect representative samples, one must standardize sampling bias related to site selection, sampling frequency, sample collection, sampling devices, and sample handling, preservation, and identification.

Representativeness is a qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important characteristic not only of assessment and quantification of environmental threats posed by the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a truly representative sample has been taken. Regardless of quality control applied during laboratory analyses and subsequent scrutiny of analytical data packages, reported data are no better than the confidence that can be placed in the representativeness of the samples.

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5.2 Defining the Sampling Program

Many factors must be considered in developing a sampling program for surface water or sediments including study objectives, accessibility, site topography, physical characteristics of the water body (such as flow and mixing), point and diffuse sources of contamination, and personnel and equipment available to conduct the study. For waterborne constituents, dispersion depends on the vertical and lateral mixing within the body of water. For sediments, dispersion depends on bottom current or flow characteristics, sediment characteristics (density, size) and geochemical properties (which affect adsorption/desorption). The hydrogeologist developing the sampling plan must therefore know not only the mixing characteristics of streams and lakes, but also must understand the role of fluvial-sediment transport, deposition, and chemical sorption.

5.2.1 Sampling Program Objectives

The objective of surface water sampling is to determine the surface water quality entering, leaving or remaining within the site. The scope of the sampling program must consider the sources and potential pathways for transport of contamination to or within a surface water body. Sources may include point sources (leaky tanks, outfalls, etc.) or nonpoint sources (e.g., spills). The major pathways for surface water contamination (not including airborne deposition) are overland runoff, leachate influx to the waterbody, direct waste disposal (solid or liquid) into the water body; and groundwater flow influx from upgradient. The relative importance of these pathways, and therefore the design of the sampling program, is controlled by the physiographic and hydrologic features of the site, the drainage basin(s) which encompass the site, and the history of site activities.

Physiographic and hydrologic features to be considered include slopes and runoff direction, areas of temporary flooding or pooling, tidal effects, artificial surface runoff controls such as berms or drainage ditches (and when they were constructed relative to site operation), and locations of springs, seeps, marshes, etc. In addition, the obvious considerations such as the location of man-made discharge points to the nearest stream (intermittent or flowing), pond, lake, estuary, etc., shall be considered.

A more subtle consideration in designing the sampling program is the potential for dispersion of dissolved or sediment-associated contaminants away from the source. The dispersion could lead to a more homogeneous distribution of contamination at low or possibly non-detectable concentrations. Such dispersion does not, however, always readily occur. For example, obtaining a representative sample of contamination from a main stream immediately below an outfall or a tributary is difficult because the inflow frequently follows a stream bank with little lateral mixing for some distance. Sampling alternatives to overcome this situation are: (1) move the site far enough downstream to allow for adequate mixing, or (2) collect integrated samples in a cross section. Also, nonhomogeneous distribution is a particular problem with regard to sediment-associated contaminants, which may accumulate in low-energy environments (coves, river bends, deep spots, or even behind boulders) near or distant from the source while higher-energy areas (main stream channels) near the source may show no contaminant accumulation.

The distribution of particulates within a sample itself is an important consideration. Many organic compounds are only slightly water soluble and tend to adsorb onto particulate matter. Nitrogen, phosphorus, and the heavy metals may also be transported by particulates. Samples must be collected with a representative amount of suspended material; transfer from the sampling device shall include transferring a proportionate amount of the suspended material.

5.2.2 Location of Sampling Stations

Accessibility is the primary factor affecting sampling costs. The desirability and utility of a sample for analysis and consideration of site conditions must be balanced against the costs of collection as controlled

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by accessibility. Bridges or piers are the first choice for locating a sampling station on a stream, because bridges provide ready access and also permit the sampling technician to sample any point across the stream. A boat or pontoon (with an associated increase in cost) may be needed to sample locations on lakes and reservoirs, as well as those on larger rivers. Frequently, however, a boat will take longer to cross a water body and will hinder manipulation of the sampling equipment. Wading for samples is not recommended unless it is known that contaminant levels are low so that skin contact will not produce adverse health effects. This provides a built in margin of safety in the event that wading boots or other protective equipment should fail to function properly. If it is necessary to wade into the water body to obtain a sample, the sampler shall be careful to minimize disturbance of bottom sediments and must enter the water body downstream of the sampling location. If necessary, the sampling technician shall wait for the sediments to settle before taking a sample.

Sampling in marshes or tidal areas may require the use of an all-terrain vehicle (ATV). The same precautions mentioned above with regard to sediment disturbance apply.

Under ideal and uniform contaminant dispersion conditions in a flowing stream, the same concentrations of each would occur at all points along the cross section. This situation is most likely downstream of areas of high turbulence. Careful site selection is needed in order to ensure, as nearly as possible, that samples are taken where uniform flow or deposition and good mixing conditions exist.

The availability of streamflow and sediment discharge records can be an important consideration in choosing sampling sites in streams. Streamflow data in association with contaminant concentration data are essential for estimating the total contaminant loads carried by the stream. If a gaging station is not conveniently located on a selected stream, the project hydrogeologist shall explore the possibility of obtaining streamflow data by direct or indirect methods.

5.2.3 Frequency of Sampling

The sampling frequency and the objectives of the sampling event will be defined by the project plan documents. For single-event site or area characterization sampling, both bottom material and overlying water samples shall be collected at the specified sampling stations. If valid data are available on the distribution of the contaminant between the solid and aqueous phases, it may be appropriate to sample only one phase, although this is not often recommended. If samples are collected primarily for monitoring purposes (i.e., consisting of repetitive, continuing measurements to define variations and trends at a given location), water samples shall be collected at a pre-established and constant interval as specified in the project plans (often monthly or quarterly, and during droughts and floods). Samples of bottom material shall be collected from fresh deposits at least yearly, and preferably seasonally, during both spring and fall.

The variability in available water-quality data shall be evaluated before determining the number and collection frequency of samples required to maintain an effective monitoring program.

5.3 Surface Water Sample Collection

5.3.1 Streams, Rivers, Outfalls and Drainage Features (Ditches, Culverts)

Methods for sampling streams, rivers, outfalls, and drainage features at a single point vary from the simplest of hand-sampling procedures to the more sophisticated multi-point sampling techniques known as the equal-width-increment (EWI) method or the equal-discharge-increment (EDI) methods (see below).

Samples from different depths or cross-sectional locations in the watercourse taken during the same sampling episode, shall be composited. However, samples collected along the length of the watercourse or at different times may reflect differing inputs or dilutions and therefore shall not be composited.

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Generally, the number and type of samples to be taken depend on the river's width, depth, discharge and on the suspended sediment the stream or river transports. The greater the number of individual points that are sampled, the more likely that the composite sample will truly represent the overall characteristics of the water.

In small streams less than about 20 feet wide, a sampling site can generally be found where the water is well mixed. In such cases, a single grab sample taken at mid-depth in the center of the channel is adequate to represent the entire cross section.

For larger streams, at least one vertical composite shall be taken with one sample each from just below the surface, at mid-depth, and just above the bottom. The measurement of DO, pH, temperature, conductivity, etc., shall be made on each aliquot of the vertical composite and on the composite itself. For rivers, several vertical composites shall be collected, as directed in the project plan documents.

5.3.2 Lakes, Ponds and Reservoirs

Lakes, ponds, and reservoirs have a much greater tendency to stratify than rivers and streams. The relative lack of mixing requires that more samples be obtained.

The number of water sampling sites on a lake, pond, or impoundment will vary with the size and shape of the basin. In ponds and small lakes, a single vertical composite at the deepest point may be sufficient. Similarly, the measurement of DO, pH, temperature, etc., is to be conducted on each aliquot of the vertical composite and on the composite itself. In naturally-formed ponds, the deepest point may have to be determined empirically; in impoundments, the deepest point is usually near the dam.

In lakes and larger reservoirs, several vertical composites shall be composited to form a single sample. These verticals are often taken along a transect or grid. In some cases, it may be of interest to form separate composites of epilimnetic and hypolimnetic zones. In a stratified lake, the epilimnion is the thermocline which is exposed to the atmosphere. The hypolimnion is the lower, "confined" layer which is only mixed with the epilimnion and vented to the atmosphere during seasonal "overturn" (when density stratification disappears). These two zones may thus have very different concentrations of contaminants if input is only to one zone, if the contaminants are volatile (and therefore vented from the epilimnion but not the hypolimnion), or if the epilimnion only is involved in short-term flushing (i.e., inflow from or outflow to shallow streams). Normally, however, a composite consists of several verticals with samples collected at various depths.

In lakes with irregular shape and with bays and coves that are protected from the wind, separate composite samples may be needed to adequately represent water quality since it is likely that only poor mixing will occur. Similarly, additional samples are recommended where discharges, tributaries, land use characteristics, and other such factors are suspected of influencing water quality.

Many lake measurements are now made in-situ using sensors and automatic readout or recording devices. Single and multi-parameter instruments are available for measuring temperature, depth, pH, oxidation-reduction potential (ORP), specific conductance, dissolved oxygen, some cations and anions, and light penetration.

5.3.3 Estuaries

Estuarine areas are by definition, zones where inland freshwaters (both surface and ground) mix with oceanic saline waters. Estuaries are generally categorized into three types dependent upon freshwater inflow and mixing properties. Knowledge of the estuary type is necessary to determine sampling locations. Each type of estuarine area is described below:

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- Mixed Estuary - characterized by the absence of a vertical halocline (gradual or no marked increase in salinity in the water column) and a gradual increase in salinity seaward. Typically this type of estuary is shallow and is found in major freshwater sheetflow areas. Being well mixed, the sampling locations are not critical in this type of estuary.
- Salt Wedge Estuary - characterized by a sharp vertical increase in salinity and stratified freshwater flow along the surface. In these estuaries, the vertical mixing forces cannot override the density differential between fresh and saline waters. In effect, a salt wedge tapering inland moves horizontally, back and forth, with the tidal phase. If contamination is being introduced into the estuary from upstream, water sampling from the salt wedge may miss it entirely.
- Oceanic Estuary - characterized by salinities approaching full-strength oceanic waters. Seasonally, freshwater inflow is small with the preponderance of the fresh-saline water mixing occurring near, or at, the shore line.

Sampling in estuarine areas is normally based upon the tidal phases, with samples collected on successive slack tides (i.e., when the tide turns). Estuarine sampling programs shall include vertical salinity measurements at 1- to 5-foot increments, coupled with vertical dissolved oxygen and temperature profiles.

5.3.4 Surface Water Sampling Equipment

The selection of sampling equipment depends on the site conditions and sample type to be acquired. The most frequently used samplers are:

- Open tube.
- Dip sampler.
- Weighted bottle.
- Hand pump.
- Kemmerer.
- Depth-Integrating Sampler.

The dip sampler and the weighted bottle sampler are used most often, and detailed discussions for these devices only (and the Kemmerer sampler) are addressed subsequently in this section.

The criteria for selecting a sampler include:

1. Disposability and/or easy decontamination.
2. Inexpensive cost (if the item is to be disposed).
3. Ease of operation.
4. Nonreactive/noncontaminating properties - Teflon-coated, glass, stainless-steel or PVC sample chambers are preferred (in that order).

As specified above, each sample (grab or each aliquot collected for compositing) shall be measured for but not limited to:

- Specific conductance.
- Temperature.
- pH.
- Dissolved oxygen (optional).

Sample measurements shall be conducted as soon as the sample is acquired. Measurement techniques described in SOP SA-1.1 shall be followed. All pertinent data and results shall be recorded in a field

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notebook or on sample logsheets (see Attachment A). These analyses will provide information on water mixing/stratification and potential contamination.

Dip Sampling

Water is often sampled by filling a container either attached to a pole or held directly, from just beneath the surface of the water (a dip or grab sample). Constituents measured in grab samples are only indicative of conditions near the surface of the water and may not be a true representation of the total concentration that is distributed throughout the water column and in the cross section. Therefore, whenever possible, it is recommended to augment dip samples with samples that represent both dissolved and suspended constituents and both vertical and horizontal distributions.

Weighted Bottle Sampling

A grab sample can also be taken using a weighted holder that allows a bottle to be lowered to any desired depth, opened for filling, closed, and returned to the surface. This allows discrete sampling with depth. Several of these samples can be combined to provide a vertical composite. Alternatively, an open bottle can be lowered to the bottom and raised to the surface at a uniform rate so that the bottle collects sample throughout the total depth and is just filled on reaching the surface. The resulting sample using either method will roughly approach what is known as a depth-integrated sample.

A closed weighted bottle sampler consists of a stopped glass or plastic bottle, a weight and/or holding device, and lines to open the stopper and lower or raise the bottle. The procedure for sampling with this device is:

- Gently lower the sampler to the desired depth so as not to remove the stopper prematurely (watch for bubbles).
- Pull out the stopper with a sharp jerk of the stopper line.
- Allow the bottle to fill completely, as evidenced by the absence of air bubbles.
- Raise the sampler and cap the bottle.
- Decontaminate the outside of the bottle. This bottle can be used as the sample container as long as the bottle is an approved container type.

Kemmerer

If samples are desired at a specific depth, and the parameters to be measured do not require a Teflon coated sampler, a standard Kemmerer sampler may be used. The Kemmerer sampler is a brass, stainless-steel or acrylic cylinder, with rubber stoppers that leave the ends open while being lowered in a vertical position (thus allowing free passage of water through the cylinder). A "messenger" is sent down the line when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised. Water is removed through a valve to fill sample bottles.

5.3.5 Surface Water Sampling Techniques

Most samples taken during site investigations are grab samples. Typically, surface water sampling involves immersing the sample container in the body of water; however, the following suggestions are made to help ensure that the samples obtained are representative of site conditions:

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- The most representative samples are obtained from mid-channel at a 0.6 foot stream depth in a well-mixed stream.
- Even though the containers used to obtain the samples are previously laboratory cleaned, it is suggested that the sample container be rinsed at least once with the water to be sampled before the sample is taken. This is not applicable when sample containers are provided "pre-preserved."
- For sampling moving water, it is suggested that the farthest downstream sample be obtained first, and that subsequent samples be taken as one works upstream. In general, work from zones suspected of low contamination to zones of high contamination.
- To sample a pond or other standing body of water, the surface area may be divided into grids. A series of samples taken from each grid node is combined into one sample, or several grid nodes are selected at random.
- Care should be taken to avoid excessive agitation of the water, as loss of volatile constituents could result.
- When obtaining samples in 40 mL septum vials for volatile organics analysis, it is important to exclude any air space in the top of the bottle and to be sure that the Teflon liner of the septum faces in after the vial is filled and capped. The vial can be turned upside down to check for air bubbles.
- Do not sample at the surface, unless sampling specifically for a known constituent which is immiscible and on top of the water. Instead, the sample container should be inverted, lowered to the approximate depth, and held at about a 45-degree angle with the mouth of the bottle facing upstream. When sample containers are provided "pre-preserved," use a dedicated, clean, un-preserved bottle for sampling and transfer to an appropriately-preserved container.

5.4 Onsite Water Quality Testing

Onsite water quality testing shall be conducted as described in SOP SA-1.1.

5.5 Sediment Sampling

5.5.1 General

Sediment samples are usually collected at the same verticals at which water samples were collected. If only one sediment sample is to be collected, the sampling location shall be approximately at the center of the water body.

Generally, the coarser grained sediments are deposited near the headwaters of the reservoir. Bed sediments near the center of a water body will be composed of fine-grained materials which may, because of their lower porosity and greater surface area available for adsorption, contain greater concentrations of contaminants. The shape, flow pattern, bathymetry (i.e., depth distribution), and water circulation patterns must all be considered when selecting sediment sampling sites. In streams, areas likely to have sediment accumulation (e.g., bends, behind islands or boulders, quiet shallow areas or very deep, low-velocity areas) shall be sampled while areas likely to show net erosion (i.e., high-velocity, turbulent areas) and suspension of fine solid materials, shall be avoided.

Chemical constituents associated with bottom material may reflect an integration of chemical and biological processes. Bottom samples reflect the historical input to streams, lakes, and estuaries with respect to time, application of chemicals, and land use. Bottom sediments (especially fine-grained material) may act as a sink or reservoir for adsorbed heavy metals and organic contaminants (even if

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water column concentrations are below detection limits). Therefore, it is important to minimize the loss of low-density "fines" during any sampling process.

All relevant information pertaining to sediment sampling shall be documented as applicably described in SOP SA-6.3 and Attachment B.

5.5.2 Sampling Equipment and Techniques

A bottom-material sample may consist of a single scoop or core, or may be a composite of several individual samples in the cross section. Sediment samples may be obtained using onshore or offshore techniques.

The following health and safety provisions apply when working on/over/near water.

Size of Work Team:

- 1) Never less than 2 persons [who are wearing USCG approved Personal Flotation Devices (PFDs)]
- 2) A minimum of 3 persons if any of the following conditions are anticipated or observed:
 - Depth is greater than 3 feet
 - Involves a waterway that is turbulent or swift
 - The underwater walking surface (e.g., stream/river bed) is suspected or observed to involve conditions that increase the potential for a worker to fall into the water. Examples would include large/uneven rocks or boulders, dense mud or sediment that could entrap worker's feet, etc.)
 - Waterway is tidal, and conditions such as those listed above could change

The third person in the above condition must be equipped and prepared to render emergency support [e.g., lifeline, tethered PFD (life saver), skiff, means to contact external emergency response support, etc.]

The following samplers may be used to collect bottom materials:

- Scoop sampler.
- Dredge samplers.

Each type of sampler is discussed subsequently.

Scoop Sampler

A scoop sampler consists of a pole to which a jar or scoop is attached. The pole may be made of bamboo, wood, PVC, or aluminum and be either telescoping or of fixed length. The scoop or jar at the end of the pole is usually attached using a clamp.

If the water body can be sampled from the shore or if it can be waded, the easiest and best way to collect a sediment sample is to use a scoop sampler. This reduces the potential for cross-contamination. This method is accomplished by reaching over or wading into the water body and, while facing upstream (into the current), scooping the sampler along the bottom in an upstream direction. It is very difficult not to disturb fine-grained materials of the sediment-water interface when using this method.

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Dredges

Dredges are generally used to sample sediments which cannot easily be obtained using coring devices (i.e., coarse-grained or partially-cemented materials) or when large quantities of sample are required. Dredges generally consist of a clam shell arrangement of two buckets. The buckets may either close upon impact or be activated by use of a "messenger". Some dredges are heavy and may require use of a winch and crane assembly for sample retrieval. There are three major types of dredges: Peterson, Eckman and Ponar dredges.

The Peterson dredge is used when the bottom is rocky, in very deep water, or when the flow velocity is high. The Peterson dredge shall be lowered very slowly as it approaches bottom, because it can force out and miss lighter materials if allowed to drop freely.

The Eckman dredge has only limited usefulness. It performs well where bottom material is unusually soft, as when covered with organic sludge or light mud. It is unsuitable, however, for sandy, rocky, and hard bottoms and is too light for use in streams with high flow velocities.

The Ponar dredge is a Peterson dredge modified by the addition of side plates and a screen on the top of the sample compartment. The screen over the sample compartment permits water to pass through the sampler as it descends thus reducing the "shock wave". The Ponar dredge is easily operated by one person in the same fashion as the Peterson dredge. The Ponar dredge is one of the most effective samplers for general use on all types of substrates.

6.0 REFERENCES

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**ATTACHMENT B
SOIL & SEDIMENT SAMPLE LOG SHEET**



Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: _____	Sample ID No.: _____
Project No.: _____	Sample Location: _____
<input type="checkbox"/> Surface Soil	Sampled By: _____
<input type="checkbox"/> Subsurface Soil	C.O.C. No.: _____
<input type="checkbox"/> Sediment	Type of Sample:
<input type="checkbox"/> Other: _____	<input type="checkbox"/> Low Concentration
<input type="checkbox"/> QA Sample Type: _____	<input type="checkbox"/> High Concentration

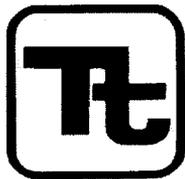
GRAB SAMPLE DATA:			
Date:	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: _____			
Method: _____			
Monitor Reading (ppm): _____			

COMPOSITE SAMPLE DATA:				
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method: _____				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:			
Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:	MAP:

Circle if Applicable:	Signature(s):
MS/MSD Duplicate ID No.: _____	



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Approved	D. Senovich <i>[Signature]</i>		

Subject
NON-RADIOLOGICAL SAMPLE HANDLING

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

2.0 SCOPE

This procedure:

- Describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.
- Provides instruction for sample packaging and shipping in accordance with current U.S. Department of Transportation (DOT) and International Air Transportation Association (IATA) regulations. IATA regulates transportation of hazardous materials by air (which is the mode of transportation used for shipping nearly all samples derived during TtNUS projects).

3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173. With slight modifications, IATA has adopted DOT "hazardous materials" as IATA "Dangerous Goods."

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (y261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (y261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

ORM - Other regulated material (see DOT 49 CFR 173.144).

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

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Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H₂SO₄
- Nitric Acid - HNO₃
- Sodium Hydroxide - NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - Na₂S₂O₃

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent.

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the shipper.

5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of sample container orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded. Because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused

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containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples, high-hazard organic samples, and some gas samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO₃, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not cooled.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	Dilution	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCl)	1 part concentrated HCl: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H ₂ SO ₄)	1 part concentrated H ₂ SO ₄ : 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO ₃)	Undiluted concentrated HNO ₃	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample. This assumes that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required. Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

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- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.
- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).
- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

Continue with proper base preservation of the sample as described above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

The sample pH is then raised to 9 using the NaOH preservative.

- Sodium thiosulfate must be added to remove residual chlorine from a sample. To test the sample for residual chlorine use a field test kit specially made for this purpose.

If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

Continue with proper acidification of the sample as described above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory before sampling begins.

5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

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- To perform filtration, thread the tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration. Run approximately 100 ml of sample through the filter prior to sample collection.
- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

5.4 **Sample Packaging and Shipping**

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)
- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental and hazardous material samples are outlined in the remainder of this section.

5.4.1 **Environmental Samples**

Environmental samples are packaged as follows:

- Place properly identified sample container, with lid securely fastened, in a plastic bag (e.g. Ziploc baggie), and seal the bag.
- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic (e.g. "garbage" bag). Drain plugs on coolers must be taped shut.
- Pack with enough noncombustible, absorbent, cushioning materials such as vermiculite (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.
- If cooling is required (see Attachments A and B), double-bag ice in Ziploc baggies and place around sample container shoulders, and on top of absorbent packing material (minimum of 8 pounds of ice for a medium-size cooler).
- Seal (i.e., tape or tie top in knot) large liner bag.
- The original (top, signed copy) and extra carbonless copies of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment.
- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

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Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

5.4.2 Hazardous Material Samples

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

NOTE: Packaging and shipping of hazardous materials can only be performed by personnel who have participated in the TtNUS training course "Shipping Hazardous Materials" (or equivalent training approved by Health Sciences).

5.4.2.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table (49 CFR 172.101) or the IATA List of Dangerous Goods Table (IATA Dangerous Goods Regulations). DOT Guide for shippers can be found in Attachment D of this document.

To determine the proper shipping name, use the following steps to help locate the shipping name on the Hazardous Materials Table, DOT 49 CFR 172.101.

1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is listed as tetrachloroethylene (listed 172.101). It may be useful to consult Health Sciences or a chemist for all possible technical names a material can have. If your material is not listed by its technical name, then . . .
2. Look for the chemical family name. For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed, then . . .
3. Look for a generic name based on end use. For example, Paint, n.o.s. If a generic name based on end use is not listed, then . . .
4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then . . .
5. You will have to use the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s. or Oxidizer, n.o.s.

If you have any doubt regarding the proper shipping name, contact Health Sciences in Pittsburgh, Pennsylvania for assistance.

5.4.2.2 Unknown Substances

For samples of hazardous substances that are not listed on the Hazardous Materials Table, or are of unknown content, the shipper is required to:

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1. Determine that the substance is not forbidden for shipment. Items forbidden include explosives (solid and liquid), substances liable to produce a dangerous evolution of heat or gas, and listed "unusual" compounds (which TtNUS fortunately does not typically handle). If the substance is in any way atypical of routine shipments, contact Health Sciences for further information on determining if the substance is forbidden.
2. Classify the substance by assessing whether it is anticipated to exhibit any unusual physical properties as defined by DOT (flammability, explosivity, etc.). If the substance has more than one hazard, follow the hazardous materials classification scheme identified in Attachment C of this SOP.
3. Use the generic or "n.o.s." proper shipping name that most accurately describes the article or substance. There are two types of general proper shipping names:
 - Generic, e.g., Alcohols, n.o.s. *
 - Hazard description, e.g., Flammable liquid, n.o.s. *

Generic or n.o.s. proper shipping names marked with an "*" require the addition of the technical name in parenthesis () immediately following the proper shipping name. For example, most of our instrument calibration gases are not listed by name and must be declared under the most accurately descriptive name, which is "Compressed Gas, n.o.s. (Mixture Nitrogen and Oxygen)".

The correct shipping classification for an unknown sample is therefore selected through a process of elimination as described above (and detailed in 49 CFR 172.101(c)(11)). By using the provisions in this paragraph, the proper shipping name and description will be determined. A step-by-step guide is provided by the DOT and can be found in Attachment D of this SOP. Again, if you have any doubt regarding the proper shipping name, contact Health Sciences for assistance.

5.4.3 Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)

5.4.3.1 Packaging

Applying the word "flammable" to a sample does not necessarily mean that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations and classification schemes. The DOT defines flammable liquids as substances with a flash point less than 140°F (60°C). For shipping purposes, liquids with a flash point exceeding 95°F (35°C) need not be considered as flammable liquids if they are miscible solutions and have a water content of more than 90% by weight. For solutions classified as flammable liquids:

1. Containerize sample as required (see Attachments A and B). To prevent leakage, fill container no more than 90 percent full. Seal lid with teflon tape or wire.
2. Complete sample label and attach securely to sample container.
3. Seal container and place in 2-mil-thick (or thicker) polyethylene bag (e.g., Ziploc baggie), one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.
4. For soil jars, place sealed bag inside metal can (available from laboratory or laboratory supplier) and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.3.4.2, below. Single 1-gallon bottles do not need to be placed in metal cans.

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5. Place one or more metal cans (or a single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans (or bottle) with noncombustible, absorbent cushioning materials for stability during transport. The absorbent material should be able to absorb the entire contents of the container. Mark container as indicated in Paragraph 2 below.

5.4.3.2 Marking/Labeling

1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):
 - Laboratory name and address.
 - Proper shipping name from the hazardous materials table (DOT Regulation CFR 49 172.101). Example: "Flammable Liquid, n.o.s. (with the technical name in parentheses).
2. Determine packing group. The packing group must be included on the shipping papers in the description section. Packaging groups are classified as follows:

Group I.	Most Hazardous
Group II.	Medium Hazard
Group III.	Least Hazardous

The packing group will be listed in the hazardous materials table, column 5.
3. Place the following information on outside shipping container per the instructions provided in the "Shipping Hazardous Materials" course:
 - Proper shipping name
 - UN or NA number
 - Proper label(s)
 - Addressee and sender

For flammable liquids, the following are the proper labels to be placed on the outside shipping container:

- DOT "Flammable liquid" label
- Package orientation label (arrows pointing upward) on at least two opposite sides of the package
- "Cargo Aircraft Only" label if shipping more than 30L of flammable liquids in the package.

5.4.3.3 Shipping Papers

Principally because of limitations in sample holding times, TtNUS almost exclusively uses air transportation to ship hazardous materials and other environmental samples. The "Dangerous Goods Airbill" is the shipping paper used to document the information associated with the shipment. As identified previously, only personnel who have participated in "Shipping Hazardous Materials" training (or equivalent course) are authorized to prepare hazardous materials for shipment - including preparation of associated shipping papers. Included in this training are instructions on what specific information is to be provided on the Airbill for hazardous materials typically shipped by TtNUS. Refer to the training course Student Manual or contact Health Sciences for this information.

The properly executed Chain-of-Custody Report must be included in the container. Use custody seals.

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Using the Airbill of our common carrier (i.e., Federal Express) as an example, the following instructions apply to the information to be provided under "Transport Details", "Nature and Quantity of Dangerous Goods", and other associated fields.

a) Transport Details

- Select "Passenger and Cargo" or "Cargo Aircraft Only" (This is based on the type and quantity of dangerous goods you are shipping). X-out the non-applicable selection.
- Airport of Departure - Enter the full name of the airport or city of departure.
- Airport of Destination - Enter the full name of the airport or city of destination.

b) Shipment Type – Delete the option that does not apply (Non-Radioactive/Radioactive)

c) Nature and Quantity of Dangerous Goods

1. Dangerous Goods Identification

- Proper Shipping Name - List the proper shipping name (this is the name as it appears on the List of Dangerous Goods Table and NOT the product or trade name), and if applicable, the technical name in parenthesis.
- Class or Division - List the class or division number and, if applicable, compatibility group.
- UN or ID No - List the UN or I.D. number, preceded with "UN" or "I.D." This selection may change when shipping in accordance with 49 CFR regulations that permit the shipment under NA (North American Continental Shipments) designations for certain substances.
- Packing Group – List the appropriate packing group, if applicable. This is the level of anticipated hazard of the shipment. It does not apply for all shipments. When no information is available, leave the space blank.
- Subsidiary Risk – List the class or division number of the subsidiary risk, if applicable. The subsidiary risk is any additional hazard beyond the most significant (or primary) hazard. This information is obtained from the List of Dangerous Goods Table.

2. Quantity and Type of Packaging – List the number of packages, the type of package, and the net quantity in each package. The type of packaging you are shipping the hazardous material in is presented first, followed by the amount (Kg, L, etc.). For example, "1 fiberboard box X 2 Kg". When no outer packaging is identified, the packaging selected must provide limited protection of the inner packaging by securing and cushioning during shipment. NOTE: Always use the package that the hazardous material was shipped to the site in. If it is not available, contact the Health Sciences Department in Pittsburgh for further instruction.

3. Packing Instructions – Enter the Packing Instruction number. These instructions are provided in Section 5 of the IATA Dangerous Goods Regulations. They provide the exact type of packaging required by the industry for various hazard classes. When no addition packaging considerations are given, the shipper may use their best judgment for the shipment of an identified substance and/or article.

4. Authorization – List the words " Limited Quantity," if applicable; list any special provision(s) or approval(s) if applicable. This section provides for exceptions to this transportation regulation and the conditions for those exceptions.

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- d) Additional handling Information - Enter any required special handling information.
- e) Prepared for Air Transport according to: Check the ICAO/IATA box.
- f) Emergency Telephone Number - Enter the 24-hour emergency contact number. This number is required of all US Origin or Destination Shipments. List the number for InfoTRAC (1-800-535-5053). InfoTRAC is a company retained by TtNUS to provide 24-Hour Emergency Hotline service for dangerous goods shipment. This company has MSDSs for the substances routinely shipped by TtNUS. They provide information to FedEx or any other emergency responders, should situations arise with one of our shipments. In addition, they have telephone numbers of certain Tetra Tech NUS Health Science Department personnel in the Pittsburgh Office in the event of an emergency.
- g) Name/Title of the Signatory - Enter name and job title (Field Operations Leader, Geologist, Health & Safety Specialist, etc.)
- h) Place and date - Enter the city and date of shipment
- i) Signature - Sign the form (must be a complete signature). All alterations must be signed with the same signature used to sign the declaration.

5.4.3.4 Transportation

1. The majority of unknown hazardous substance samples will be classified as flammable liquids. The samples will be transported by rented or common carrier truck, railroad, or express overnight package services. Do not transport samples on any passenger-carrying air transport system, even if the system has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that carry only cargo. If unsure of what mode of transportation to use, consult Health Sciences.¹
2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be followed.
3. Use the hazardous materials shipping check list (Attachment E) as a guidance to ensure that all sample-handling requirements are satisfied.
4. In some cases, various materials may react if they break during shipment. To determine if you are shipping such materials, refer to the DOT compatibility chart in Attachment F.

5.5 Shipment of Lithium Batteries

Monitoring well data are analyzed using either the Hermit SE 1000 or the Hermit SE 2000 environmental data logger. These instruments are typically powered by lithium batteries in sufficient quantity to make the unit subject to hazardous material shipping requirements. The DOT determined that lithium batteries are to be shipped using the following information:

1 Note: If you are unsure as how to ship the sample (hazardous or environmental sample), contact Health Sciences so that a decision can be made as to the proper shipping practices. The DOT and IATA penalties for improper shipment of a hazardous material are stringent and may include a prison term for intentional violations.

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- Product Designation
 - Hermit SE 1000
 - Hermit SE 2000
- Proper Shipping Name
 - Lithium batteries, contained in equipment, UN3091
- UN No - UN-3091
- Classification or Division
 - Class 9

Shipment of equipment containing lithium batteries must be accompanied by shipping papers completed as indicated in Attachment G. The instrument will be shipped by Federal Express as a Hazardous Material. Place the instrument in the same container in which it was received. This container or case is a DOT-approved shipping container. For Federal Express procedures to ship hazardous materials, call 1-800-238-5355, extension 922-1666. In most cases, the return shipping papers and DOT labels will be shipped to you from the company warehouse or the vendor. An example of the types of labels used for shipment and the wording are shown in Attachment G. These labels will be attached to the outside container and include all the information noted under Section 5.4.3.2. Instead of the Flammable Liquid information, however, the following will be presented with the following wording:

- Lithium Batteries Contained in Equipment
 - UN-3091
- DOT Miscellaneous Hazardous Materials (Class 9) label
- "Cargo Aircraft Only" label

6.0 REFERENCES

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ATTACHMENT A

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample Type and Concentration	Container ⁽¹⁾	Sample Size	Preservation ⁽²⁾	Holding Time ⁽²⁾
-------------------------------	--------------------------	-------------	-----------------------------	-----------------------------

WATER

Organics (GC&GC/MS)	VOC	Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days ⁽⁹⁾
	Extractables SVOCs and pesticide/PCBs)	(Low	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction; 40 days after extraction
	Extractables SVOCs and pesticide/PCBs)	(Medium	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction
Inorganics	Metals	Low	High-density polyethylene	1 L	HNO ₃ to pH ≤2	6 months (Hg-28 days)
		Medium	Wide-mouth glass	16 oz.	None	6 months
	Cyanide	Low	High-density polyethylene	1 L	NaOH to pH>12	14 days
	Cyanide	Medium	Wide-mouth glass	16 oz.	None	14 days
Organic/ Inorganic	High Hazard		Wide-mouth glass	8 oz.	None	14 days

SOIL

Organics (GC&GC/MS)	VOC		Wide-mouth glass with teflon liner	2 x 4 oz.	Cool to 4°C	14 days
	Extractables SVOCs and pesticides/PCBs)	(Low	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
	Extractables SVOCs and pesticides/PCBs)	(Medium	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium		Wide-mouth glass	8 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)
Organic/Inorga nic	High Hazard		Wide-mouth glass	8 oz.	None	NA
Dioxin/Furan	All		Wide-mouth glass	4 oz.	None	7 days until extraction; 40 days after extraction
TCLP	All		Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction

AIR

Volatile Organics	Low/Medium		Charcoal tube -- 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	5 days recommended
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1 All glass containers should have Teflon cap liners or septa.

2 See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

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ATTACHMENT B

ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container ⁽¹⁾	Preservation ⁽²⁾⁽³⁾	Maximum Holding Time ⁽⁴⁾
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INORGANIC TESTS:

Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia - Nitrogen	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Chloride	P, G	None required	28 days
Chlorine, Total Residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid ⁽⁵⁾	14 days ⁽⁶⁾
Fluoride	P	None required	28 days
Hardness	P, G	HNO ₃ to pH 2; H ₂ SO ₄ to pH 2	6 months
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H ₂ SO ₄ to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours
Phenols	G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4°C; H ₂ SO ₄ to pH 2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days

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**ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES,
AND HOLDING TIMES
PAGE TWO**

Parameter Number/Name	Container ⁽¹⁾	Preservation ⁽²⁾⁽³⁾	Maximum Holding Time ⁽⁴⁾
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INORGANIC TESTS (Cont'd):

Sulfide	P, G	Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours

METALS:⁽⁷⁾

Chromium VI (Hexachrome)	P, G	Cool, 4°C	24 hours
Mercury (Hg)	P, G	HNO ₃ to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO ₃ to pH 2	6 months

ORGANIC TESTS:⁽⁸⁾

Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ HCl to pH 2 ⁽⁹⁾	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ adjust pH to 4-5 ⁽¹⁰⁾	14 days
Phenols ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction
Benzidines ^{(11), (12)}	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction ⁽¹³⁾
Phthalate esters ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitrosamines ^{(11), (14)}	G, Teflon-lined cap	Cool, 4°C; store in dark; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction
PCBs ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitroaromatics & Isophorone ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ ; store in dark	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons (PAHs) ^{(11), (14)}	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾ ; store in dark	7 days until extraction; 40 days after extraction
Haloethers ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction
Dioxin/Furan (TCDD/TCDF) ⁽¹¹⁾	G, Teflon-lined cap	Cool, 4°C; 0.008% Na ₂ S ₂ O ₃ ⁽⁵⁾	7 days until extraction; 40 days after extraction

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**ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES,
AND HOLDING TIMES
PAGE THREE**

- (1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.
- (2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
- (3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
- (4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.
- (5) Should only be used in the presence of residual chlorine.
- (6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
- (7) Samples should be filtered immediately on site before adding preservative for dissolved metals.
- (8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
- (9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
- (10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
- (11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).
- (12) If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.
- (13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
- (14) For the analysis of diphenylnitrosamine, add 0.008% Na₂S₂O₃ and adjust pH to 7-10 with NaOH within 24 hours of sampling.
- (15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% Na₂S₂O₃.

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ATTACHMENT C

**DOT HAZARDOUS MATERIAL CLASSIFICATION
(49 CFR 173.2a)**

1. Radioactive material (except a limited quantity)
2. Division 2.3, Poisonous Gases
3. Division 2.1, Flammable Gas
4. Division 2.2, Nonflammable gas
5. Division 6.1, Poisonous Liquids, Packing Group 1 (poison by inhalation only)
6. Division 4.2, Pyrophoric Material
7. Division 4.1, Self-Reactive Material
8. Class 3, Flammable Liquids*
9. Class 8, Corrosive Material
10. Division 4.1, Flammable Solid*
11. Division 4.2, Spontaneously Combustible Materials*
12. Division 4.3, Dangerous When Wet Materials*
13. Division 5.1, Oxidizers*
14. Division 6.1, Poisonous Liquids or Solids (other than Packing Group 1)*
15. Combustible liquid
16. Class 9, Miscellaneous Hazardous Materials

* If a material has or meets the criteria for more than one hazard class, use the precedence of hazardous table on the following page for Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1. The following table ranks those materials that meet the definition of Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1.

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ATTACHMENT C (Continued)

**DOT HAZARDOUS MATERIAL CLASSIFICATION
(49 CFR 173.2a)**

Class	Packing Group	4.2	4.3	5.1 I ^(a)	5.1 II ^(a)	5.1 III ^(a)	6.1 I (Dermal)	6.1 I (Oral)	6.1 II	6.1 III	8 I (Liquid)	8 I (Solid)	8 II (Liquid)	8 II (Solid)	8 III (Liquid)	8 III (Solid)
3	I						3	3	3	3	3	(c)	3	(c)	3	(c)
3	II						3	3	3	3	8	(c)	3	(c)	3	(c)
3	III						6.1	6.1	6.1	3 ^(d)	8	(c)	8	(c)	3	(c)
4.1	II ^b	4.2	4.3	5.1	4.1	4.1	6.1	6.1	4.1	4.1	(c)	8	(c)	4.1	(c)	4.1
4.1	III ^b	4.2	4.3	5.1	4.1	4.1	6.1	6.1	6.1	4.1	(c)	8	(c)	8	(c)	4.1
4.2	II		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	(c)	8	(c)	4.2	(c)	4.2
4.2	III		4.3	5.1	4.2	4.2	6.1	6.1	6.1	4.2	(c)	8	(c)	8	(c)	4.2
4.3	I			5.1	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3	II			5.1	4.3	4.3	6.1	4.3	4.3	4.3	8	8	8	4.3	4.3	4.3
4.3	III			5.1	4.3	4.3	6.1	6.1	6.1	4.3	8	8	8	8	4.3	4.3
5.1	I ^a						5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
5.1	II ^a						6.1	5.1	5.1	5.1	8	8	8	5.1	5.1	5.1
5.1	III ^a						6.1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1	I, Dermal										8	6.1	6.1	6.1	6.1	6.1
6.1	I, Oral										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Inhalation										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Dermal										8	6.1	8	6.1	6.1	6.1
6.1	II, Oral										8	8	8	6.1	6.1	6.1
6.1	III										8	8	8	8	8	8

(a) There are at present no established criteria for determining Packing Groups for liquids in Division 5.1. At present, the degree of hazard is to be assessed by analogy with listed substances, allocating the substances to Packing Group I, Great; Group II, Medium; or Group III, Minor Danger.

(b) Substances of Division 4.1 other than self-reactive substances.

(c) Denotes an impossible combination.

(d) For pesticides only, where a material has the hazards of Class 3, Packing Group III, and Division 6.1, Packing Group III, the primary hazard is Division 6.1, Packing Group III.

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ATTACHMENT D

GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

USE OF GUIDE - This guide is presented as an aid to shippers of hazardous materials. It does not contain or refer to all of the DOT requirements for shipping hazardous materials. For specific details, refer to all of the DOT requirements for shipping hazardous materials, as provided in the Code of Federal Regulations (CFR), Title 49, Transportation, Parts 100-199.

The following is offered as a step-by-step procedure to aid in compliance with the applicable DOT regulations.

STEP 1 - DETERMINE THE PROPER SHIPPING NAME. The shipper must determine the proper shipping name of the materials as listed in the Hazardous Materials Table, 49 CFR 172.101, Column (2).

STEP 2 - DETERMINE THE HAZARD CLASS OR CLASSES.

- a. Refer to the Table, 49 CFR 172.101, Column (3), and locate the hazard class of the material.
- b. If more than one class is shown for the proper shipping name, determine the proper class by definition.
- c. If the materials have more than one hazard, classify the material based on the order of hazards in 49 CFR 173.2.

STEP 3 - SELECT THE PROPER IDENTIFICATION NUMBERS.

- a. Refer to the Table, 49 CFR 172.101, Column (3a), and select the Identification Number (ID) that corresponds to the proper shipping name and hazard class.
- b. Enter the ID number(s) on the shipping papers and display them, as required, on packagings, placards and/or orange panels.

STEP 4 - DETERMINE THE MODE(S) OF TRANSPORT TO ULTIMATE DESTINATION.

- a. As a shipper, you must assure yourself that the shipment complies with various modal requirements.
- b. The modal requirements may affect the following: (1) Packaging; (2) Quantity per Package; (3) Marking; (4) Labeling; (5) Shipping Papers; and (6) Certification.

STEP 5 - SELECT THE PROPER LABEL(S) AND APPLY AS REQUIRED.

- a. Refer to the Table, 49 CFR 172.101, Column (4) for required labels.
- b. For details on labeling refer to (1) Additional Labels, 49 CFR 172.402; (2) Placement of Labels, 49 CFR 172.406; (3) Packagings (Mixed or Consolidated), 49 CFR 172.404(a) and (h); (4) Packages Containing Samples, 49 CFR 172.402(h); (5) Radioactive Materials, 49 CFR 172.403; and (6) Authorized Label Modifications, 49 CFR 172.405.

STEP 6 - DETERMINE AND SELECT THE PROPER PACKAGES.

- a. Refer to the Table, 49 CFR 172.101, Column (5a) for exceptions and Column (5b) for specification packagings. Consider the following when selecting an authorized package: Quantity per Package; Cushioning Material, if required; Proper Closure and Reinforcement; Proper Pressure; Outage; etc., as required.
- b. If packaged by a prior shipper, make sure the packaging is correct and in proper condition for transportation.

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**ATTACHMENT D (Continued)
GUIDE FOR HAZARDOUS MATERIALS SHIPPERS**

STEP 7 - MARK THE PACKAGING (INCLUDING OVERPACKS).

- a. Apply the required markings (49 CFR 172.300); Proper shipping name and ID number, when required (49 CFR 172.301); Name and address of Consignee or Consignor (49 CFR 172.306).
- b. For details and other required markings, see 49 CFR 172.300 through 172.338.

STEP 8 - PREPARE THE SHIPPING PAPERS.

- a. The basic requirements for preparing shipping papers include Proper Shipping Name; Hazard Class; ID Number; Total Quantity; Shipper's Certification; and Emergency Response Telephone Number.
- b. Make all entries on the shipping papers using the information required and in proper sequence (49 CFR 172.202).

STEP 9 - CERTIFICATION.

- a. Each shipper must certify by printing (manually or mechanically) on the shipping papers that the materials being offered for shipment are properly classified, described, packaged, marked and labeled, and in proper condition for transportation according to the applicable DOT Regulations (49 CFR 172.202).

STEP 10 - LOADING, BLOCKING, AND BRACING. When hazardous materials are loaded into the transport vehicle or freight container, each package must be loaded, blocked, and braced in accordance with the requirements for mode of transport.

- a. If the shipper loads the freight container or transport vehicle, the shipper is responsible for the proper loading, blocking, and bracing of the materials.
- b. If the carrier does the loading, the carrier is responsible.

STEP 11 - DETERMINE THE PROPER PLACARD(S). Each person who offers hazardous materials for transportation must determine that the placarding requirements have been met.

- a. For Highway, unless the vehicle is already correctly placarded, the shipper must provide the required placard(s) and required ID number(s) (49 CFR 172.506).
- b. For Rail, if loaded by the shipper, the shipper must placard the rail car if placards are required (49 CFR 172.508).
- c. For Air and Water shipments, the shipper has the responsibility to apply the proper placards.

STEP 12 - HAZARDOUS WASTE/HAZARDOUS SUBSTANCE.

- a. If the material is classed as a hazardous waste or hazardous substance, most of the above steps will be applicable.
- b. Pertinent Environmental Protection Agency regulations are found in the Code of Federal Regulations, Title 40, Part 262.

As a final check and before offering the shipment for transportation, visually inspect the shipment. The shipper should ensure that emergency response information is on the vehicle for transportation of hazardous materials.

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Revised March 1995.

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ATTACHMENT E

HAZARDOUS MATERIALS SHIPPING CHECK LIST

PACKAGING

1. Check DOT 173.24 for appropriate type of package for hazardous substance.
2. Check for container integrity, especially the closure.
3. Check for sufficient absorbent material in package.
4. Check for sample tags and log sheets for each sample and for chain-of-custody record.

SHIPPING PAPERS

1. Check that entries contain only approved DOT abbreviations.
2. Check that entries are in English.
3. Check that hazardous material entries are specially marked to differentiate them from any nonhazardous materials being sent using same shipping paper.
4. Be careful that all hazardous classes are shown for multiclass materials.
5. Check total amounts by weight, quantity, or other measures used.
6. Check that any limited-quantity exemptions are so designated on the shipping paper.
7. Check that certification is signed by shipper.
8. Make certain driver signs for shipment.

RCRA MANIFEST

1. Check that approved state/federal manifests are prepared.
2. Check that transporter has the following: valid EPA identification number, valid driver's license, valid vehicle registration, insurance protection, and proper DOT labels for materials being shipped.
3. Check that destination address is correct.
4. Check that driver knows where shipment is going.
5. Check that the driver is aware of emergency procedures for spills and accidents.
6. Make certain driver signs for shipment.
7. Make certain one copy of executed manifest and shipping document is retained by shipper.

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**ATTACHMENT F
DOT SEGREGATION AND SEPARATON CHART**

Class or Division	Notes	1.1-1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas Zone A*	2.3 gas Zone B*	3	4.1	4.2	4.3	5.1	5.2	6.1 liquids PG-I Zone A*	7	8 liquids only	
Explosives... 1.1 and 1.2	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Explosives..... 1.3		*	*	*	*	*	X		X	X	X		X	X	X	X	X			X
Explosives..... 1.4		*	*	*	*	*	O		O	O	O		O				O			O
Very insensitive explosives 1.5	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely insensitive explosives 1.6		*	*	*	*	*														
Flammable gases 2.1		X	X	O	X				X	O							O	O		
Non-toxic, non-flammable gases 2.2		X			X															
Poisonous gas - Zone A** 2.3		X	X	O	X		X				X	X	X	X	X	X				X
Poisonous gas - Zone B** 2.3		X	X	O	X		O				O	O	O	O	O	O				O
Flammable liquids..... 3		X	X	O	X				X	O					O		X			
Flammable solids..... 4.1		X			X				X	O							X			O
Spontaneously combustible materials 4.2		X	X	O	X				X	O							X			X
Dangerous-when-wet materials 4.3		X	X		X				X	O							X			O
Oxidizers 5.1	A	X	X		X				X	O	O						X			O
Organic peroxides..... 5.2		X	X		X				X	O							X			O
Poisonous liquids PG I - Zone A** 6.1		X	X	O	X		O				X	X	X	X	X	X				X
Radioactive materials . 7		X			X		O													
Corrosive liquids 8		X	X	O	X				X	O		O	X	O	O	O	X			

- No entry means that the materials are compatible (have no restrictions).
- X These materials may not be loaded, transported, or stored together in the same vehicle or facility.
- O The materials may not be loaded, transported, or stored together in the same vehicle or facility unless they are separated for 4 feet on all sides.
- * Check the explosives compatibility chart in 49 CFR 179.848(f).
- A Ammonium nitrate fertilizers may be stored with Division 1.1 materials.
- ** Denotes inhalation hazardous for poisons; consult field team leader or project manager if you encounter a material in this class 1 before shipment.

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Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS					
This shipment is within the limitations prescribed for: (delete non applicable)	Airport of Departure				
<table border="1"> <tr> <td>HAZARDOUS</td> <td>CARGO AIRCRAFT ONLY</td> </tr> <tr> <td>XXXXXXXX</td> <td></td> </tr> </table>	HAZARDOUS	CARGO AIRCRAFT ONLY	XXXXXXXX		
HAZARDOUS	CARGO AIRCRAFT ONLY				
XXXXXXXX					
Airport of Destination: 19CYS					

Shipment type: (delete non-applicable)

NON-RADIOACTIVE	RADIOACTIVE
-----------------	------------------------

NATURE AND QUANTITY OF DANGEROUS GOODS						
Dangerous Goods Identification				Quantity and type of packing	Packing Inst.	Authorization
Proper Shipping Name	Class or Division	UN or ID No.	Subsidiary Risk			
LITHIUM BATTERIES CONTAINED IN EQUIPMENT	9	UN3091		1 PLASTIC BOX X 55 GRAMS	912 II	PER CA-9206009

FOR SHIPMENTS TO USA, AK, AND HI ONLY

Additional Handling Information

1 HERMIT SERIES DATALOGGER X 55 GRAMS (11 GRAMS/CELL)

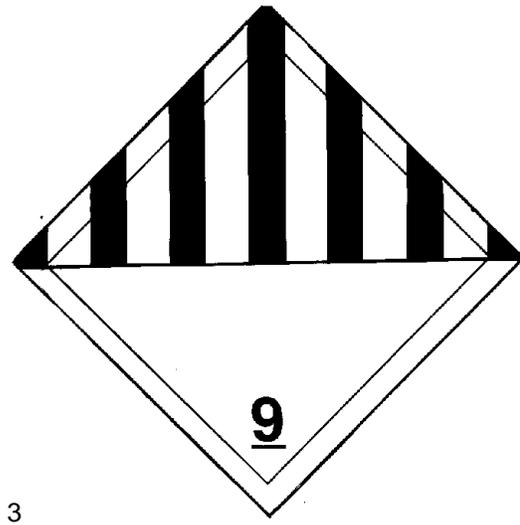
I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in the proper condition for transport by air according to the applicable International and National Government Regulations.	Name/Title of Signatory
Emergency Telephone Number (Required for US Origin or Destination Shipments) 800-535-5053	Place and Date
IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.	Signature (see warning above)

ATTACHMENT G
LITHIUM BATTERY SHIPPING PAPERS

Subject NON-RADIOLOGICAL SAMPLE HANDLING		Number SA-6:1	Page 23 of 24
Revision 1	Effective Date 03/00		

Subject NON-RADIOLOGICAL SAMPLE HANDLING	Number SA-6.1	Page 24 of 24
	Revision 1	Effective Date 03/00

**ATTACHMENT G (CONTINUED)
LITHIUM BATTERY SHIPPING PAPERS**



3

**LITHIUM BATTERIES CONTAINED
IN EQUIPMENT.
UN-3091.
SHIPPED UNDER CA-9206009**



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number SA-6.3	Page 1 of 37
Effective Date 01/00	Revision 1
Applicability Tetra Tech NUS, Inc.	
Prepared Earth Sciences Department	
Approved D. Senovich <i>DS</i>	

Subject
FIELD DOCUMENTATION

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs and reports generally initiated and maintained for documenting Tetra Tech NUS field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Tetra Tech NUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

3.0 GLOSSARY

None

4.0 RESPONSIBILITIES

Project Manager (PM) - The Project Manager is responsible for obtaining hardbound, controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

Field Operations Leader (FOL) - The Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

5.0 PROCEDURES

5.1 Site Logbook

5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major onsite activities are documented. At a minimum, the following activities/events shall be recorded or referenced (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start and/or completion of borehole, trench, monitoring well installation, etc.
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that onsite activities take place which involve Tetra Tech NUS or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

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The following information must be recorded on the cover of each site logbook:

- Project name
- Tetra Tech NUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2), but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the field notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook/notebook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided, since they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook/notebook descriptions. The site photographs and associated negatives must be docketed into the project's central file.

5.2 Field Notebooks

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

5.3 Sample Forms

A summary of the forms illustrated in this procedure is shown as the listing of Attachments in the Table of Contents for this SOP. Forms may be altered or revised for project-specific needs contingent upon client

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approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOP.

5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results

5.3.1.1 Sample Log Sheet

Sample Log Sheets are used to record specified types of data while sampling. Attachments B-1 to B-4 are examples of Sample Log Sheets. The data recorded on these sheets are useful in describing the waste source and sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. A log sheet must be completed for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B-5. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source electronically generated in-house, or are supplied from the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) Record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One carbonless copy of the completed COC form is retained by the field crew, one copy is sent to the Project Manager, while the original is sent to the laboratory. The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the first cooler. The COC form should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment B-6. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Tetra Tech NUS Project Manager). The COC form is signed and copied. The laboratory will retain the copy while the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is an adhesive-backed label. It is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. The COC seals are signed and dated by the samplers and affixed across the opening edges of each cooler containing environmental samples. COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

5.3.1.5 Field Analytical Log Sheets for Geochemical Parameters

Field Analytical Log Sheets (Attachment B-8) are used to record geochemical and/or natural attenuation field test results. Attachments B-8 (3-page form) should be used when applicable.

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5.3.2 Hydrogeological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

A groundwater level measurement sheet, shown in Attachment C-1 must be filled out for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. The pumping test data sheet (Attachment C-2) facilitates this task by standardizing the data collection format, and allowing the time interval for collection to be laid out in advance.

5.3.2.3 Packer Test Report Form

A packer test report form shown in Attachment C-3 must be completed for each well upon which a packer test is conducted.

5.3.2.4 Summary Log of Boring

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring, or Boring Log, (Attachment C-4) is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a PID or FID), these results must be entered on the boring log at the appropriate depth. The "Remarks" column can be used to subsequently enter the laboratory sample number, the concentration of key analytical results, or other pertinent information. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

A Monitoring Well Construction Details Form must be completed for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation, or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock), different forms are used (see Attachments C-5 through C-9). Similar forms are used for flush-mount well completions.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log (Attachment C-10) must be filled out by the responsible field geologist or sampling technician.

5.3.2.7 Miscellaneous Monitoring Well Forms

Monitoring Well Materials Certificate of Conformance (Attachment C-11) should be used as the project directs to document all materials utilized during each monitoring well installation.

The Monitoring Well Development Record (Attachment C-12) should be used as the project directs to document all well development activities.

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5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log (Attachment D) which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used.

5.4 Field Reports

The primary means of recording onsite activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation, but are not easily useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

5.4.1 Daily Activities Report

To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

5.4.1.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors (Attachment E is an example of a Daily Activities Report).

5.4.1.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.1.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

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It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required. Attachment F is an example of a Field Trip Summary Report form.

6.0 ATTACHMENTS

Attachment A	TYPICAL SITE LOGBOOK ENTRY
Attachment B-1	EXAMPLE GROUNDWATER SAMPLE LOG SHEET
Attachment B-2	EXAMPLE SURFACE WATER SAMPLE LOG SHEET
Attachment B-3	EXAMPLE SOIL/SEDIMENT SAMPLE LOG SHEET
Attachment B-4	CONTAINER SAMPLE LOG SHEET FORM
Attachment B-5	SAMPLE LABEL
Attachment B-6	CHAIN-OF-CUSTODY RECORD FORM
Attachment B-7	CHAIN-OF-CUSTODY SEAL
Attachment B-8	FIELD ANALYTICAL LOG SHEET
Attachment C-1	EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET
Attachment C-2	EXAMPLE PUMPING TEST DATA SHEET
Attachment C-3	PACKER TEST REPORT FORM
Attachment C-4	EXAMPLE BORING LOG
Attachment C-5	EXAMPLE OVERBURDEN MONITORING WELL SHEET
Attachment C-5A	EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)
Attachment C-6	EXAMPLE CONFINING LAYER MONITORING WELL SHEET
Attachment C-7	EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL
Attachment C-8	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK
Attachment C-9	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-10	EXAMPLE TEST PIT LOG
Attachment C-11	MONITORING WELL MATERIALS CERTIFICATE OF CONFORMANCE
Attachment C-12	MONITORING WELL DEVELOPMENT RECORD
Attachment D	EXAMPLE EQUIPMENT CALIBRATION LOG
Attachment E	EXAMPLE DAILY ACTIVITIES RECORD
Attachment F	FIELD TRIP SUMMARY REPORT

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**ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY**

START TIME: _____ DATE: _____

SITE LEADER: _____

PERSONNEL:

TtNUS	DRILLER	SITE VISITORS
_____	_____	_____
_____	_____	_____
_____	_____	_____

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenny and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was _____. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well _____.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _____.
4. Well _____ drilled. Rig geologist was _____. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _____.
8. Test pit _____ dug with cuttings placed in dump truck. Rig geologist was _____. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ____ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

Field Operations Leader

ATTACHMENT B-4



Tetra Tech NUS, Inc.

CONTAINER SAMPLE & INSPECTION SHEET

Page ____ of ____

Project Site Name: _____	Sample ID No. _____
Project Number: _____	Sampled By: _____
Site Identification: _____	C.O.C. No. _____
Container Number(s): _____	Concentration: <input type="checkbox"/> High
Sample Type: <input type="checkbox"/> Grab	<input type="checkbox"/> Medium
<input type="checkbox"/> Composite	<input type="checkbox"/> Low

CONTAINER SOURCE	CONTAINER DESCRIPTION
DRUM: <input type="checkbox"/> Bung Top <input type="checkbox"/> Lever Lock <input type="checkbox"/> Bolted Ring <input type="checkbox"/> Other _____	COLOR: _____ CONDITION: _____
TANK: <input type="checkbox"/> Plastic <input type="checkbox"/> Metal <input type="checkbox"/> Other _____	MARKINGS: _____ VOL. OF CONTENTS: _____
OTHER: _____	OTHER: _____

CONTAINER DISPOSITION	CONTENTS DESCRIPTION																				
SAMPLED: _____ OPENED BUT NOT SAMPLED: Reason _____ _____ NOT OPENED: Reason _____ _____	SINGLE PHASED: _____ MULTIPHASE : <table style="width:100%; border-collapse: collapse;"> <tr> <td></td> <td align="center">Layer 1</td> <td align="center">Layer 2</td> <td align="center">Layer 3</td> </tr> <tr> <td>Phase (Sol. or Liq.)</td> <td align="center">_____</td> <td align="center">_____</td> <td align="center">_____</td> </tr> <tr> <td>Color</td> <td align="center">_____</td> <td align="center">_____</td> <td align="center">_____</td> </tr> <tr> <td>Viscosity</td> <td align="center">L, M or H</td> <td align="center">L, M or H</td> <td align="center">L, M or H</td> </tr> <tr> <td>% of Total Volume</td> <td align="center">_____</td> <td align="center">_____</td> <td align="center">_____</td> </tr> </table>		Layer 1	Layer 2	Layer 3	Phase (Sol. or Liq.)	_____	_____	_____	Color	_____	_____	_____	Viscosity	L, M or H	L, M or H	L, M or H	% of Total Volume	_____	_____	_____
	Layer 1	Layer 2	Layer 3																		
Phase (Sol. or Liq.)	_____	_____	_____																		
Color	_____	_____	_____																		
Viscosity	L, M or H	L, M or H	L, M or H																		
% of Total Volume	_____	_____	_____																		

MONITOR READING:	SAMPLE and /or INSPECTION DATE & TIME:
	_____ HRS.
	METHOD: _____
SAMPLER(S) and / or INSPECTOR(S) SIGNATURE:	ANALYSIS:

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ATTACHMENT B-5

	Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090		Project:
			Site:
		Location:	
Sample No:		Matrix:	
Date:	Time:	Preserve:	
Analysis:			
Sampled by:		Laboratory:	

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ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL

<u>Signature</u> <hr/>		CUSTODY SEAL <hr/>
<u>Date</u> <hr/>		Date <hr/>
CUSTODY SEAL <hr/>		<u>Signature</u> <hr/>

ATTACHMENT B-8



FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page of

Tetra Tech NUS, Inc.

Project Site Name: _____	Sample ID No.: _____
Project No.: _____	Sample Location: _____
Sampled By: _____	Duplicate: <input type="checkbox"/>
Field Analyst: _____	Blank: <input type="checkbox"/>
Field Form Checked as per QA/QC Checklist (initials): _____	

SAMPLING DATA:

Date:	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Method: _____								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv): _____ Electrode Make & Model: _____
Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment: HACH Digital Titrator OX-DT CHEMetrics (Range: _____ mg/L) Analysis Time: _____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
<input type="checkbox"/>	1-5 mg/L	200 ml	0.200 N	0.01	_____	x 0.01	= _____ mg/L
<input type="checkbox"/>	2-10 mg/L	100 ml	0.200 N	0.02	_____	x 0.02	= _____ mg/L

CHEMetrics: _____ mg/L

Notes: _____

Alkalinity:

Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____ mg/L) Analysis Time: _____
Filtered:

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
<input type="checkbox"/>	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0.1	= _____ mg/L
<input type="checkbox"/>	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	= _____ mg/L
<input type="checkbox"/>	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	= _____ mg/L
<input type="checkbox"/>	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	= _____ mg/L
<input type="checkbox"/>	500-2000 mg/L	20 ml	1.600 N	5.0	_____ & _____	x 5.0	= _____ mg/L
<input type="checkbox"/>	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	= _____ mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

CHEMetrics: _____ mg/L

Notes: _____

Standard Additions: Titrant Molarity: _____ Digits Required: 1st.: _____ 2nd.: _____ 3rd.: _____

Carbon Dioxide:

Equipment: HACH Digital Titrator CA-DT CHEMetrics (Range: _____ mg/L) Analysis Time: _____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier	Concentration
<input type="checkbox"/>	10-50 mg/L	200 ml	0.3636 N	0.1	_____	x 0.1	= _____ mg/L
<input type="checkbox"/>	20-100 mg/L	100 ml	0.3636 N	0.2	_____	x 0.2	= _____ mg/L
<input type="checkbox"/>	100-400 mg/L	200 ml	3.636 N	1.0	_____	x 1.0	= _____ mg/L
<input type="checkbox"/>	200-1000 mg/L	100 ml	3.636 N	2.0	_____	x 2.0	= _____ mg/L

CHEMetrics: _____ mg/L

Notes: _____

Standard Additions: Titrant Molarity: _____ Digits Required: 1st.: _____ 2nd.: _____ 3rd.: _____

ATTACHMENT B-8 (Continued)



Tetra Tech NUS, Inc.

**FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS**

Page of

Project Site Name: _____

Project No.: _____

Sampled By: _____

Field Analyst: _____

Field Form Checked as per QA/QC Checklist (initials):

Sample ID No.: _____

Sample Location: _____

Duplicate:

Blank:

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S²⁻):

Equipment: DR-700 DR-8 __ HS-WR Color Wheel Other: _____ Analysis Time: _____

Program/Module: 610nm 93

Concentration: _____ mg/L Filtered:

Notes: _____

Sulfate (SO₄²⁻):

Equipment: DR-700 DR-8 __ Other: _____ Analysis Time: _____

Program/Module: 91

Concentration: _____ mg/L Filtered:

Standard Solution: Results: _____

Standard Additions: Digits Required: 0.1ml: _____ 0.2ml: _____ 0.3ml: _____

Notes: _____

Nitrite (NO₂⁻-N):

Equipment: DR-700 DR-8 __ Other: _____ Analysis Time: _____

Program/Module: 60

Concentration: _____ mg/L Filtered:

Reagent Blank Correction:

Standard Solution: Results:

Notes: _____

Nitrate (NO₃⁻-N):

Equipment: DR-700 DR-8 __ Other: _____ Analysis Time: _____

Program/Module: 55

Concentration: _____ mg/L Filtered:

Nitrite Interference Treatment:

Standard Solution: Results: _____ Reagent Blank Correction:

Standard Additions: Digits Required: 0.1ml: _____ 0.2ml: _____ 0.3ml: _____

Notes: _____

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ATTACHMENT B-8 (Continued)



**FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS**

Tetra Tech NUS, Inc.

Page of

Project Site Name: _____	Sample ID No.: _____
Project No.: _____	Sample Location: _____
Sampled By: _____	Duplicate: <input type="checkbox"/>
Field Analyst: _____	Blank: <input type="checkbox"/>
Field Form Checked as per QA/QC Checklist (initials): 	

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn²⁺):

Equipment: DR-700 DR-8 __ HACH MN-5 Other: _____ Analysis Time: _____

Program/Module: 525nm 41

Concentration: _____ mg/L Filtered:

Standard Solution: Results: _____ Digestion:

Standard Additions: Reagent Blank Correction:

Digits Required: 0.1ml: _____ 0.2ml: _____ 0.3ml: _____

Notes: _____

Ferrous Iron (Fe²⁺):

Equipment: DR-700 DR-8 __ IR-18C Color Wheel Other: _____ Analysis Time: _____

Program/Module: 500nm 33

Concentration: _____ mg/L Filtered:

Notes: _____

Hydrogen Sulfide (H₂S):

Equipment: HS-C Other: _____ Analysis Time: _____

Concentration: _____ mg/L Exceeded 5.0 mg/L range on color chart:

Notes: _____

QA/QC Checklist:

All data fields have been completed as necessary:

Correct measurement units are cited in the SAMPLING DATA block:

Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet:

Multiplication is correct for each *Multiplier* table:

Final calculated concentration is within the appropriate *Range Used* block:

Alkalinity *Relationship* is determined appropriately as per manufacturer (HACH) instructions:

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents:

Nitrite interference treatment was used for Nitrate test if Nitrite was detected:

Title block on each page of form is initialized by person who performed this QA/QC Checklist:

ATTACHMENT C4 (Continued)

LEGEND
SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)										
COARSE-GRAINED SOILS More Than Half of Material is LARGER Than No. 200 Sieve Size					FINE-GRAINED SOILS More Than Half of Material is SMALLER Than No. 200 Sieve Size					
FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES	FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES	
					Identification Procedures on Fraction Smaller than No. 40 Sieve Size					
					DAY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)			
GRAVELS (50%+)>1/4"	CLEAN GRAVELS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	SILTS AND CLAYS Liquid Limit <50	None to Slight	Quick to Slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.		Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	GRAVELS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.		Slight to Medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.		SILTS AND CLAYS Liquid Limit >50	Slight to Medium	Slow to None	Slight to Medium	MH
SANDS 50%+<1/4"	CLEAN SANDS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	SW	Well graded sand, gravelly sands, little or no fines.	High to Very High		None	High	CH	Inorganic clays of high plasticity, fat clays.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.	Medium to High		None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity.
SANDS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see MCL)	SM	Silty sands, poorly graded sand-silt mixtures.	HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other organic soils	
	Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures.							

Boundary classifications: Soils possessing characteristics of two groups are designated by combining group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.
All sieve sizes on this chart are U.S. Standard.

DENSITY OF GRANULAR SOILS	
DESIGNATION	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT
Very Loose	0-4
Loose	5-10
Medium Loose	11-30
Dense	31-50
Very Dense	Over 50

CONSISTENCY OF COHESIVE SOILS			
CONSISTENCY	UNC COMPRESSIVE STRENGTH (TONS/SQ. FT.)	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT	FIELD IDENTIFICATION METHODS
Very Soft	Less than 0.25	0 to 2	Easily penetrated several inches by fist
Soft	0.25 to 0.50	2 to 4	Easily penetrated several inches by thumb.
Medium Stiff	0.50 to 1.0	4 to 8	Can be penetrated several inches by thumb.
Stiff	1.0 to 2.0	8 to 15	Readily indented by thumb.
Very Stiff	2.0 to 4.0	15 to 30	Readily indented by thumbnail.
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnail.

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)			ROCK BROKENESS		
Descriptive Terms	Screwdriver or Knife Effects	Hammer Effects	Descriptive Terms	Abbreviation	Spacing
Soft	Easily Gouged	Crushes when pressed with hammer	Very Broken	(V. Br.)	0-2"
Medium Soft	Can be Gouged	Breaks (one blow); crumbly edges	Broken	(Br.)	2'-1'
Medium Hard	Can be scratched	Breaks (one blow); sharp edges	Blocky	(Bl.)	1'-3"
Hard	Cannot be scratched	Breaks conchoidally (several blows); sharp edges	Massive	(M.)	3'-10'

LEGEND:

SOIL SAMPLES - TYPES
5-2" Split-Barrel Sample
ST-3" O.D. Undisturbed Sample
O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES
X-NX (Conventional) Core (-2-1/8" O.D.)
Q-NQ (Wireline) Core (-1-7/8" O.D.)
Z - Other Core Sizes, Specify in Remarks

WATER LEVELS
12/18
▽ 12.6 Initial Level w/Date & Depth
12/18

Subject

FIELD DOCUMENTATION

Number

SA-6.3

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Revision

1

Effective Date

01/00

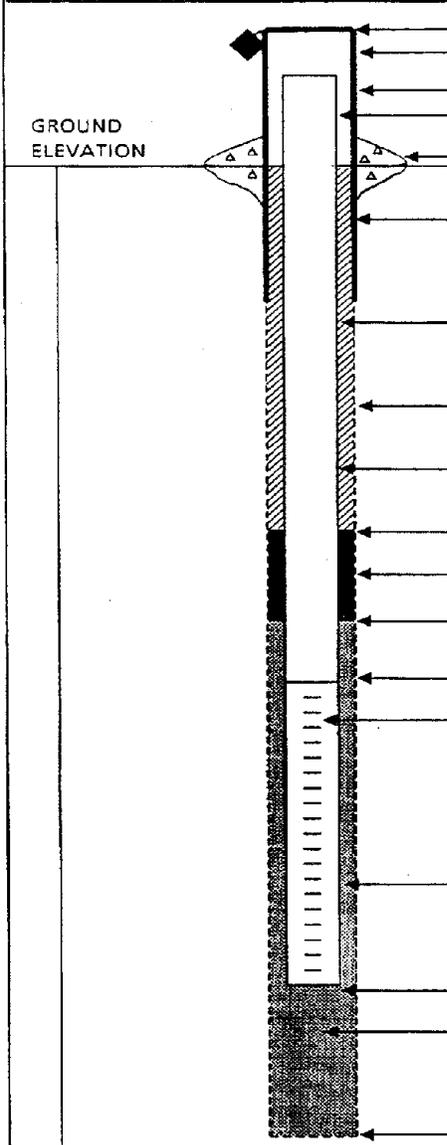
ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

BORING NO.: _____



OVERBURDEN MONITORING WELL SHEET

PROJECT _____	LOCATION _____	DRILLER _____
PROJECT NO. _____	BORING _____	DRILLING METHOD _____
ELEVATION _____	DATE _____	DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____		



ELEVATION OF TOP OF SURFACE CASING : _____

ELEVATION OF TOP OF RISER PIPE : _____

STICK - UP TOP OF SURFACE CASING : _____

STICK - UP RISER PIPE : _____

TYPE OF SURFACE SEAL : _____

I.D. OF SURFACE CASING : _____

TYPE OF SURFACE CASING : _____

RISER PIPE I.D. : _____

TYPE OF RISER PIPE : _____

BOREHOLE DIAMETER : _____

TYPE OF BACKFILL : _____

ELEVATION / DEPTH TOP OF SEAL : _____ / _____

TYPE OF SEAL : _____

DEPTH TOP OF SAND PACK : _____

ELEVATION / DEPTH TOP OF SCREEN : _____ / _____

TYPE OF SCREEN : _____

SLOT SIZE x LENGTH : _____

I.D. OF SCREEN : _____

TYPE OF SAND PACK : _____

ELEVATION / DEPTH BOTTOM OF SCREEN : _____ / _____

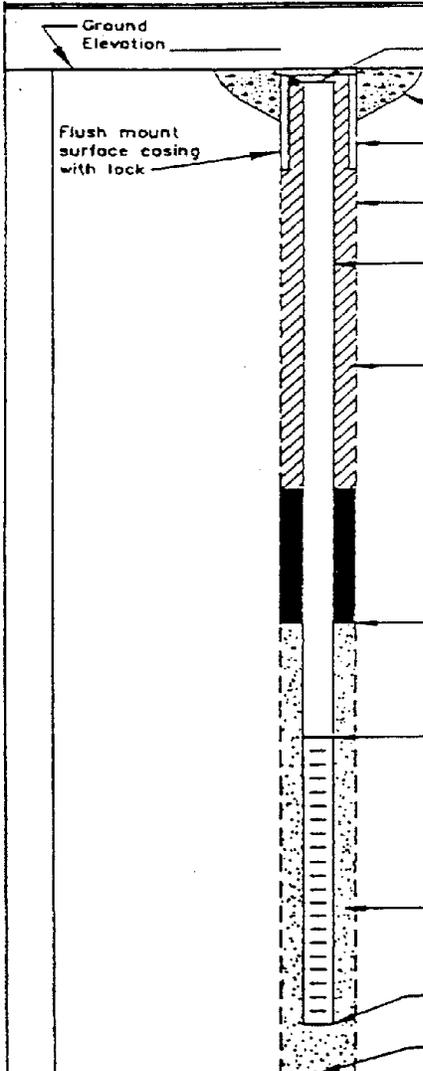
ELEVATION / DEPTH BOTTOM OF SAND PACK : _____ / _____

TYPE OF BACKFILL BELOW OBSERVATION WELL : _____

ELEVATION / DEPTH OF HOLE : _____ / _____

**ATTACHMENT C-5A
EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)**

BORING NO.: _____		
 <h2 align="center">MONITORING WELL SHEET</h2>		
PROJECT _____	LOCATION _____	DRILLER _____
PROJECT NO. _____	BORING _____	DRILLING METHOD _____
ELEVATION _____	DATE _____	DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____		

	<p>ELEVATION TOP OF RISER: _____</p> <p>TYPE OF SURFACE SEAL: _____</p> <p>TYPE OF PROTECTIVE CASING: _____</p> <p>I.D. OF PROTECTIVE CASING: _____</p> <p>DIAMETER OF HOLE: _____</p> <p>TYPE OF RISER PIPE: _____</p> <p>RISER PIPE I.D.: _____</p> <p>TYPE OF BACKFILL/SEAL: _____</p> <p>_____</p> <p>DEPTH/ELEVATION TOP OF SAND: _____ / _____</p> <p>DEPTH/ELEVATION TOP OF SCREEN: _____ / _____</p> <p>TYPE OF SCREEN: _____</p> <p>SLOT SIZE x LENGTH: _____</p> <p>TYPE OF SAND PACK: _____</p> <p>DIAMETER OF HOLE IN BEDROCK: _____</p> <p>DEPTH/ELEVATION BOTTOM OF SCREEN: _____ / _____</p> <p>DEPTH/ELEVATION BOTTOM OF SAND: _____ / _____</p> <p>DEPTH/ELEVATION BOTTOM OF HOLE: _____ / _____</p> <p>BACKFILL MATERIAL BELOW SAND: _____</p>
--	--

ADP/C: 12/76/VEED, VORSHUP, INC

ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

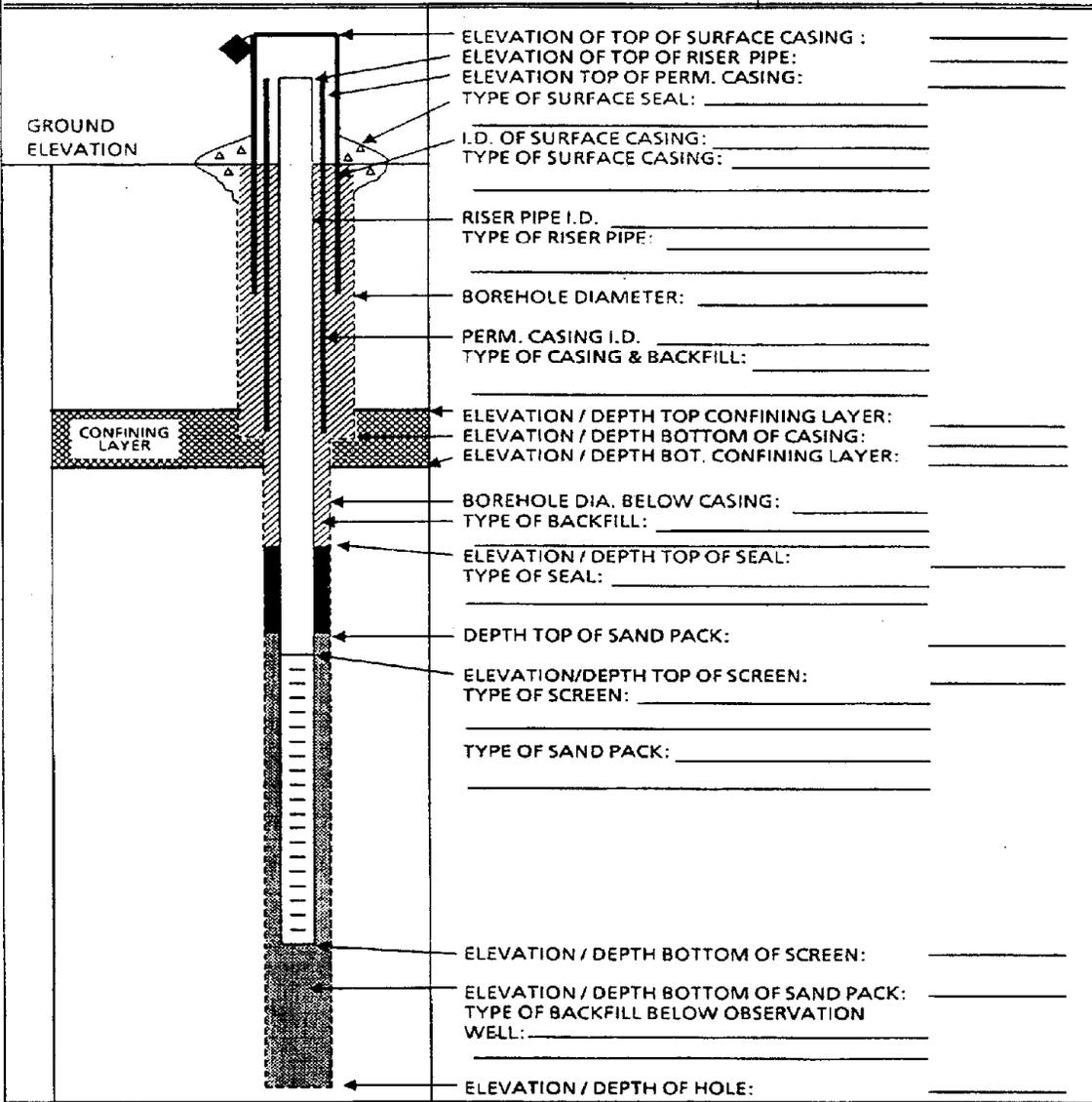


BORING NO.: _____

CONFINING LAYER
MONITORING WELL SHEET

PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING _____
METHOD _____
DEVELOPMENT _____
METHOD _____



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ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL



BORING NO.: _____
**BEDROCK
MONITORING WELL SHEET
OPEN HOLE WELL**

PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____

GROUND ELEVATION

ELEVATION OF TOP OF CASING: _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

TYPE OF SURFACE SEAL: _____

I.D. OF CASING: _____
TYPE OF CASING: _____
TEMP. / PERM.: _____

DIAMETER OF HOLE: _____

TYPE OF CASING SEAL: _____

T.O.R.

DEPTH TO TOP OF ROCK: _____

DEPTH TO BOTTOM CASING: _____

DIAMETER OF HOLE IN BEDROCK: _____

DESCRIBE IF CORE / REAMED WITH BIT:

DESCRIBE JOINTS IN BEDROCK AND DEPTH:

ELEVATION / DEPTH OF HOLE: _____

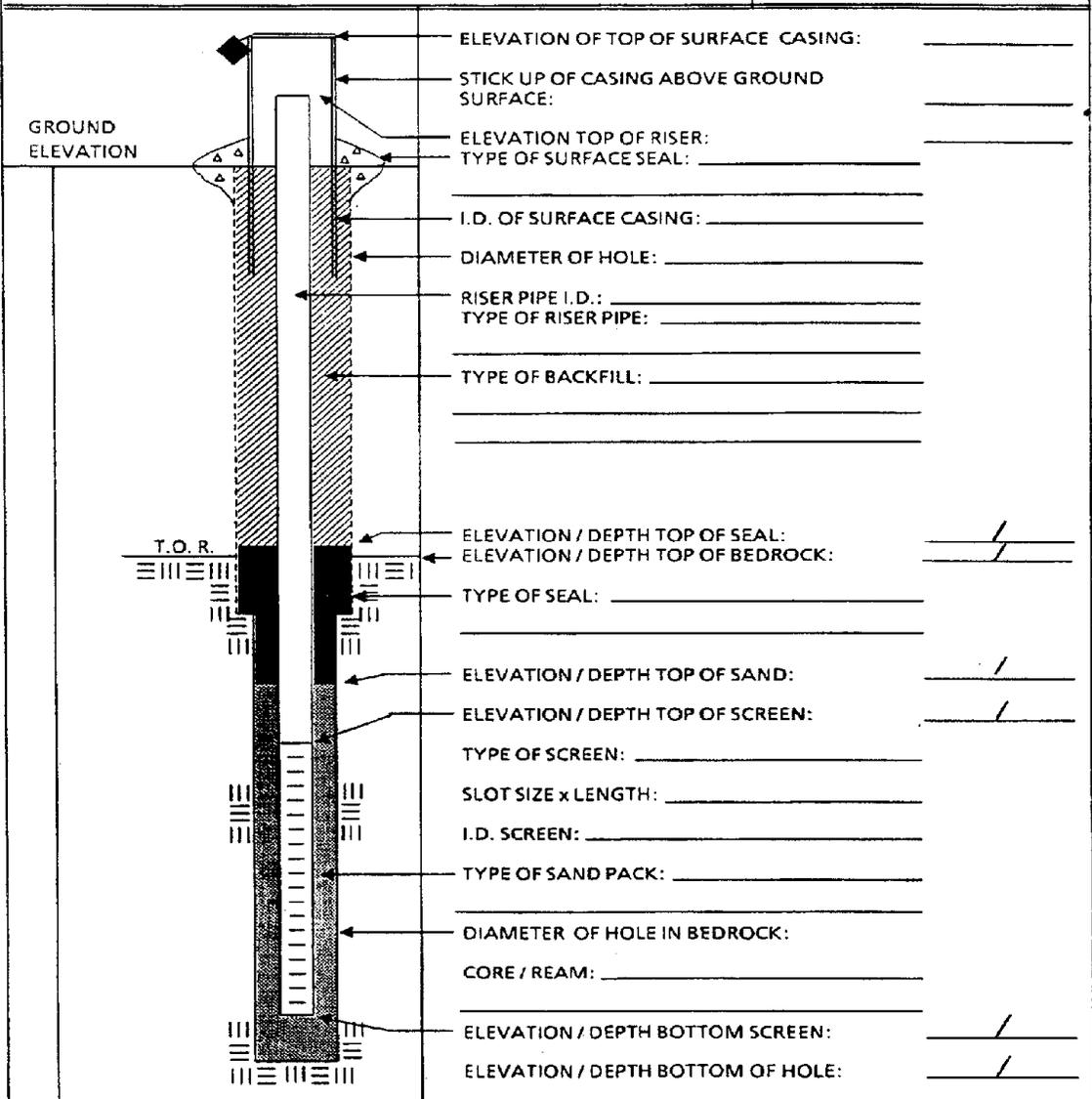
ATTACHMENT C-8
EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK



BORING NO.: _____
**BEDROCK
MONITORING WELL SHEET**
WELL INSTALLED IN BEDROCK

PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING _____
METHOD _____
DEVELOPMENT _____
METHOD _____



ATTACHMENT C-9
EXAMPLE BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK (FLUSHMOUNT)

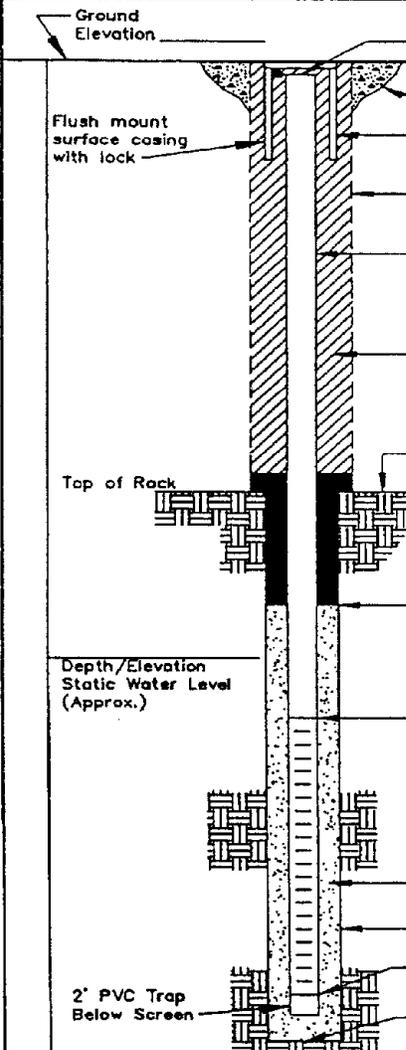
BORING NO.: _____



BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT: _____	LOCATION: _____	DRILLER: _____
PROJECT NO.: _____	BORING: _____	DRILLING METHOD: _____
ELEVATION: _____	DATE: _____	DEVELOPMENT METHOD: _____
FIELD GEOLOGIST: _____		



ELEVATION TOP OF RISER: _____

TYPE OF SURFACE SEAL: _____

TYPE OF PROTECTIVE CASING: _____

I.D. OF PROTECTIVE CASING: _____

DIAMETER OF HOLE: _____

TYPE OF RISER PIPE: _____

RISER PIPE I.D.: _____

TYPE OF BACKFILL/SEAL: _____

DEPTH/ELEVATION TOP OF BEDROCK: _____ / _____

DEPTH/ELEVATION TOP OF SAND: _____ / _____

DEPTH/ELEVATION TOP OF SCREEN: _____ / _____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

TYPE OF SAND PACK: _____

DIAMETER OF HOLE IN BEDROCK: _____

DEPTH/ELEVATION BOTTOM OF SCREEN: _____ / _____

DEPTH/ELEVATION BOTTOM OF SAND: _____ / _____

DEPTH/ELEVATION BOTTOM OF HOLE: _____ / _____

BACKFILL MATERIAL BELOW SAND: _____

ACFILE: 1670\DECL\BEDROCK.DWG

Subject

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Effective Date

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ATTACHMENT C-11
EXAMPLE CERTIFICATE OF CONFORMANCE



MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: _____

Site Geologist: _____

Site Name: _____

Drilling Company: _____

Date Installed: _____

Driller: _____

Project Name: _____

Project Number: _____

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing			
Well Screen			
End Cap			
Drilling Fluid			
Drilling Fluid Additives			
Backfill Material			
Annular Filter Pack			
Bentonite Seal			
Annular Grout			
Surface Cement			
Protective Casing			
Paint			
Rod Lubricant			
Compressor Oil			

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: _____

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 36 of 37
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**ATTACHMENT F
FIELD TRIP SUMMARY REPORT
PAGE 1 OF 2**

SUNDAY

Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

MONDAY

Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

TUESDAY

Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

WEDNESDAY

Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

Subject FIELD DOCUMENTATION	Number SA-6.3	Page 37 of 37
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**ATTACHMENT F
PAGE 2 OF 2
FIELD TRIP SUMMARY REPORT**

THURSDAY

Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

FRIDAY

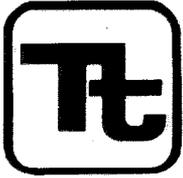
Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____

SATURDAY

Date: _____ Personnel: _____
Weather: _____ Onsite: _____

Site Activities: _____



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number	SA-7.1	Page	1 of 9
Effective Date	03/16/98	Revision	2
Applicability	Tetra Tech NUS, Inc.		
Prepared	Earth Sciences Department		
Approved	D. Senovich <i>ds</i>		

Subject DECONTAMINATION OF FIELD EQUIPMENT AND WASTE HANDLING

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2.0 SCOPE	2
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4.0 RESPONSIBILITIES.....	2
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5.2.1 Bailers and Bailing Line	3
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1.0 PURPOSE

The purpose of this procedure is to provide guidelines regarding the appropriate procedures to be followed when decontaminating drilling equipment, monitoring well materials, chemical sampling equipment and field analytical equipment.

2.0 SCOPE

This procedure addresses drilling equipment and monitoring well materials decontamination, as well as chemical sampling and field analytical equipment decontamination. This procedure also provides general reference information on the control of contaminated materials.

3.0 GLOSSARY

Acid - For decontamination of equipment when sampling for trace levels of inorganics, a 10% solution of nitric acid in deionized water should be used. Due to the leaching ability of nitric acid, it should not be used on stainless steel.

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Deionized Water - Deionized (analyte free) water is tap water that has been treated by passing through a standard deionizing resin column. Deionized water should contain no detectable heavy metals or other inorganic compounds at or above the analytical detection limits for the project.

Potable Water - Tap water used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Solvent - The solvent of choice is pesticide-grade Isopropanol. Use of other solvents (methanol, acetone, pesticide-grade hexane, or petroleum ether) may be required for particular projects or for a particular purpose (e.g. for the removal of concentrated waste) and must be justified in the project planning documents. As an example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

4.0 RESPONSIBILITIES

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved Standards Operating Procedures or as otherwise dictated by the approved project plan(s).

5.0 PROCEDURES

To ensure that analytical chemical results reflect actual contaminant concentrations present at sampling locations, the various drilling equipment and chemical sampling and analytical equipment used to acquire the environment sample must be properly decontaminated. Decontamination minimizes the potential for cross-contamination between sampling locations, and the transfer of contamination off site.

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5.1 Drilling Equipment

Prior to the initiation of a drilling program, all drilling equipment involved in field sampling activities shall be decontaminated by steam cleaning at a predetermined area. The steam cleaning procedure shall be performed using a high-pressure spray of heated potable water producing a pressurized stream of steam. This steam shall be sprayed directly onto all surfaces of the various equipment which might contact environmental samples. The decontamination procedure shall be performed until all equipment is free of all visible potential contamination (dirt, grease, oil, noticeable odors, etc.) In addition, this decontamination procedure shall be performed at the completion of each sampling and/or drilling location, including soil borings, installation of monitoring wells, test pits, etc. Such equipment shall include drilling rigs, backhoes, downhole tools, augers, well casings, and screens. Where the drilling rig is set to perform multiple borings at a single area of concern, the steam-cleaning of the drilling rig itself may be waived with proper approval. Downhole equipment, however, must always be steam-cleaned between borings. Where PVC well casings are to be installed, decontamination is not required if the manufacturer provides these casings in factory-sealed, protective, plastic sleeves (so long as the protective packaging is not compromised until immediately before use).

The steam cleaning area shall be designed to contain decontamination wastes and waste waters and can be a lined excavated pit or a bermed concrete or asphalt pad. For the latter, a floor drain must be provided which is connected to a holding facility. A shallow above-ground tank may be used or a pumping system with discharge to a waste tank may be installed.

In certain cases such an elaborate decontamination pad is not possible. In such cases, a plastic lined gravel bed pad with a collection system may serve as an adequate decontamination area. Alternately, a lined sloped pad with a collection pump installed at the lower end may be permissible. The location of the steam cleaning area shall be onsite in order to minimize potential impacts at certain sites.

Guidance to be used when decontaminating drilling equipment shall include:

- As a general rule, any part of the drilling rig which extends over the borehole, shall be steam cleaned.
- All drilling rods, augers, and any other equipment which will be introduced to the hole shall be steam cleaned.
- The drilling rig, all rods and augers, and any other potentially contaminated equipment shall be decontaminated between each well location to prevent cross contamination of potential hazardous substances.

Prior to leaving at the end of each work day and/or at the completion of the drilling program, drilling rigs and transport vehicles used onsite for personnel or equipment transfer shall be steam cleaned, as practicable. A drilling rig left at the drilling location does not need to be steam cleaned until it is finished drilling at that location.

Error! Bookmark not defined.**5.2 Sampling Equipment**

5.2.1 Bailers and Bailing Line

The potential for cross-contamination between sampling points through the use of a common bailer or its attached line is high unless strict procedures for decontamination are followed. For this reason, it is preferable to dedicate an individual bailer and its line to each sample point, although this does not eliminate the need for decontamination of dedicated bailers. For non-dedicated sampling equipment, the following conditions and/or decontamination procedures must be followed.

Subject DECONTAMINATION OF FIELD EQUIPMENT AND WASTE HANDLING	Number SA-7.1	Page 4 of 9
	Revision 2	Effective Date 03/16/98

Before the initial sampling and after each successive sampling point, the bailer must be decontaminated. The following steps are to be performed when sampling for organic contaminants. Note: contract-specific requirements may permit alternative procedures.

- Potable water rinse
- Alconox or Liquinox detergent wash
- Scrubbing of the line and bailer with a scrub brush (may be required if the sample point is heavily contaminated with heavy or extremely viscous compounds)
- Potable water rinse
- Rinse with 10 percent nitric acid solution*
- Deionized water rinse
- Pesticide-grade isopropanol (unless otherwise required)
- Pesticide-grade hexane rinse**
- Copious distilled/Deionized water rinse
- Air dry

If sampling for volatile organic compounds (VOCs) only, the nitric acid, isopropanol, and hexane rinses may be omitted. Only reagent grade or purer solvents are to be used for decontamination. When solvents are used, the bailer must be thoroughly dry before using to acquire the next sample.

In general, specially purchased pre-cleaned disposable sampling equipment is not decontaminated (nor is an equipment rinsate blank collected) so long as the supplier has provided certification of cleanliness. If decontamination is performed on several bailers at once (i.e., in batches), bailers not immediately used may be completely wrapped in aluminum foil (shiny-side toward equipment) and stored for future use. When batch decontamination is performed, one equipment rinsate is generally collected from one of the bailers belonging to the batch before it is used for sampling.

It is recommended that clean, dedicated braided nylon or polypropylene line be employed with each bailer use.

5.2.2 Sampling Pumps

Most sampling pumps are low volume (less than 2 gpm) pumps. These include peristaltic, diaphragm, air-lift, pitcher and bladder pumps, to name a few. If these pumps are used for sampling from more than one sampling point, they must be decontaminated prior to initial use and after each use.

The procedures to be used for decontamination of sampling pumps compare to those used for a bailer except that the 10 percent nitric acid solution is omitted. Each of the liquid fractions is to be pumped through the system. The amount of pumping is dependent upon the size of the pump and the length of the intake and discharge hoses. Certain types of pumps are unacceptable for sampling purposes. For peristaltic pumps, the tubing is replaced rather than cleaned.

An additional problem is introduced when the pump relies on absorption of water via an inlet or outlet hose. For organic sampling, this hose should be Teflon. Other types of hoses leach organics (especially phthalate esters) into the water being sampled or adsorb organics from the sampled water. For all other sampling, the hose should be Viton, polyethylene, or polyvinyl chloride (listed in order of preference).

* Due to the leaching ability of nitric acid on stainless steel, this step is to be omitted if a stainless steel sampling device is being used and metals analysis is required with detection limits less than approximately 50 ppb.

** If sampling for pesticides, PCBs, or fuels.

Subject DECONTAMINATION OF FIELD EQUIPMENT AND WASTE HANDLING	Number SA-7.1	Page 5 of 9
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Whenever possible, dedicated hoses should be used. It is preferable that these types of pumps not be used for sampling, only for purging.

5.2.3 Filtering Equipment

On occasion, the sampling plan may require acquisition of filtered groundwater samples. Field-filtering is addressed in SOP SA-6.1 and should be conducted as soon after sample acquisition as possible. To this end, three basic filtration systems are most commonly used: the in-line disposable Teflon filter, the inert gas over-pressure filtration system, and the vacuum filtration system.

For the in-line filter, decontamination is not required since the filter cartridge is disposable, however, the cartridge must be disposed of in an approved receptacle and the intake and discharge lines must still be decontaminated or replaced before each use.

For the over-pressure and the vacuum filtration systems, the portions of the apparatus which come in contact with the sample must be decontaminated as outlined in the paragraphs describing the decontamination of bailers. (Note: Varieties of both of these systems come equipped from the manufacturer with Teflon-lined surfaces for those that would come into contact with the sample. These filtration systems are preferred when decontamination procedures must be employed.)

5.2.4 Other Sampling Equipment

Field tools such as trowels and mixing bowls are to be decontaminated in the same manner as described above.

5.3 Field Analytical Equipment

5.3.1 Water Level Indicators

Water level indicators that come into contact with groundwater must be decontaminated using the following steps:

- Rinse with potable water
- Rinse with deionized water

Water level indicators that do not come in contact with the groundwater but may encounter incidental contact during installation or retrieval need only undergo the first and last steps stated above.

5.3.2 Probes

Probes (e.g., pH or specific-ion electrodes, geophysical probes, or thermometers) which would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise (e.g., dissolved oxygen probes). Probes that contact a volume of groundwater not used for laboratory analyses can be rinsed with deionized water. For probes which make no direct contact, (e.g., OVA equipment) the probe is self-cleaning when exposure to uncontaminated air is allowed and the housing can be wiped clean with paper-towels or cloth wetted with alcohol.

5.4 Waste Handling

For the purposes of these procedures, contaminated materials are defined as any byproducts of field activities that are suspected or known to be contaminated with hazardous substances. These byproducts

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include such materials as decontamination solutions, disposable equipment, drilling muds, well-development fluids, and spill-contaminated materials and Personal Protection Equipment (PPE).

The procedures for obtaining permits for investigations of sites containing hazardous substances are not clearly defined at present. In the absence of a clear directive to the contrary by the EPA and the states, it must be assumed that hazardous wastes generated during field activities will require compliance with Federal agency requirements for generation, storage, transportation, or disposal. In addition, there may be state regulations that govern the disposal action. This procedure exclusively describes the technical methods used to control contaminated materials.

The plan documents for site activities must include a description of control procedures for contaminated materials. This planning strategy must assess the type of contamination, estimate the amounts that would be produced, describe containment equipment and procedures, and delineate storage or disposal methods. As a general policy, it is wise to select investigation methods that minimize the generation of contaminated spoils. Handling and disposing of potentially hazardous materials can be dangerous and expensive. Until sample analysis is complete, it is assumed that all produced materials are suspected of contamination from hazardous chemicals and require containment.

5.5 Sources of Contaminated Materials and Containment Methods

5.5.1 Decontamination Solutions

All waste decontamination solutions and rinses must be assumed to contain the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. The waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility. Larger equipment such as backhoes and tractors must be decontaminated in an area provided with an impermeable liner and a liquid collection system. A decontamination area for large equipment could consist of a bermed concrete pad with a floor drain leading to a buried holding tank.

5.5.2 Disposable Equipment

Disposable equipment that could become contaminated during use typically includes PPE, rubber gloves, boots, broken sample containers, and cleaning-wipes. These items are small and can easily be contained in 55-gallon drums with lids. These containers should be closed at the end of each work day and upon project completion to provide secure containment until disposed.

5.5.3 Drilling Muds and Well-Development Fluids

Drilling muds and well-development fluids are materials that may be used in groundwater monitoring well installations. Their proper use could result in the surface accumulation of contaminated liquids and muds that require containment. The volumes of drilling muds and well-development fluids used depend on well diameter and depth, groundwater characteristics, and geologic formations. There are no simple mathematical formulas available for accurately predicting these volumes. It is best to rely on the experience of reputable well drillers familiar with local conditions and the well installation techniques selected. These individuals should be able to estimate the sizes (or number) of containment structures required. Since guesswork is involved, it is recommended that an slight excess of the estimated amount of containers required will be available.

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Drilling muds are mixed and stored in what is commonly referred to as a mud pit. This mud pit consists of a suction section from which drilling mud is withdrawn and pumped through hoses, down the drill pipe to the bit, and back up the hole to the settling section of the mud pit. In the settling section, the mud's velocity is reduced by a screen and several flow-restriction devices, thereby allowing the well cuttings to settle out of the mud/fluid.

The mud pit may be either portable above-ground tanks commonly made of steel (which is preferred) or stationary in-ground pits as depicted in Attachment A. The above-ground tanks have a major advantage over the in-ground pits because the above-ground tanks isolate the natural soils from the contaminated fluids within the drilling system. These tanks are also portable and can usually be cleaned easily.

As the well is drilled, the cuttings that accumulate in the settling section must be removed. This is best done by shoveling them into drums or other similar containers. When the drilling is complete, the contents of the above-ground tank are likewise shoveled or pumped into drums, and the tank is cleaned and made available for its next use.

If in-ground pits are used, they should not extend into the natural water table. They should also be lined with a bentonite-cement mixture followed by a layer of flexible impermeable material such as plastic sheeting. Of course, to maintain its impermeable seal, the lining material used would have to be nonreactive with the wastes. An advantage of the in-ground pits is that well cuttings do not necessarily have to be removed periodically during drilling because the pit can be made deep enough to contain them. Depending on site conditions, the in-ground pit may have to be totally excavated and refilled with uncontaminated natural soils when the drilling operation is complete.

When the above-ground tank or the in-ground pit is used, a reserve tank or pit should be located at the site as a backup system for leaks, spills, and overflows. In either case, surface drainage should be such that any excess fluid could be controlled within the immediate area of the drill site.

The containment procedure for well-development fluids is similar to that for drilling muds. The volume and weight of contaminated fluid will be determined by the method used for development. When a new well is pumped or bailed to produce clear water, substantially less volume and weight of fluid result than when backwashing or high-velocity jetting is used.

5.5.4 Spill-Contaminated Materials

A spill is always possible when containers of liquids are opened or moved. Contaminated sorbents and soils resulting from spills must be contained. Small quantities of spill-contaminated materials are usually best contained in drums, while larger quantities can be placed in lined pits or in other impermeable structures. In some cases, onsite containment may not be feasible and immediate transport to an approved disposal site will be required.

5.6 Disposal of Contaminated Materials

Actual disposal techniques for contaminated materials are the same as those for any hazardous substance, that is, incineration, landfilling, treatment, and so on. The problem centers around the assignment of responsibility for disposal. The responsibility must be determined and agreed upon by all involved parties before the field work starts. If the site owner or manager was involved in activities that precipitated the investigation, it seems reasonable to encourage his acceptance of the disposal obligation. In instances where a responsible party cannot be identified, this responsibility may fall on the public agency or private organization investigating the site.

Another consideration in selecting disposal methods for contaminated materials is whether the disposal can be incorporated into subsequent site cleanup activities. For example, if construction of a suitable

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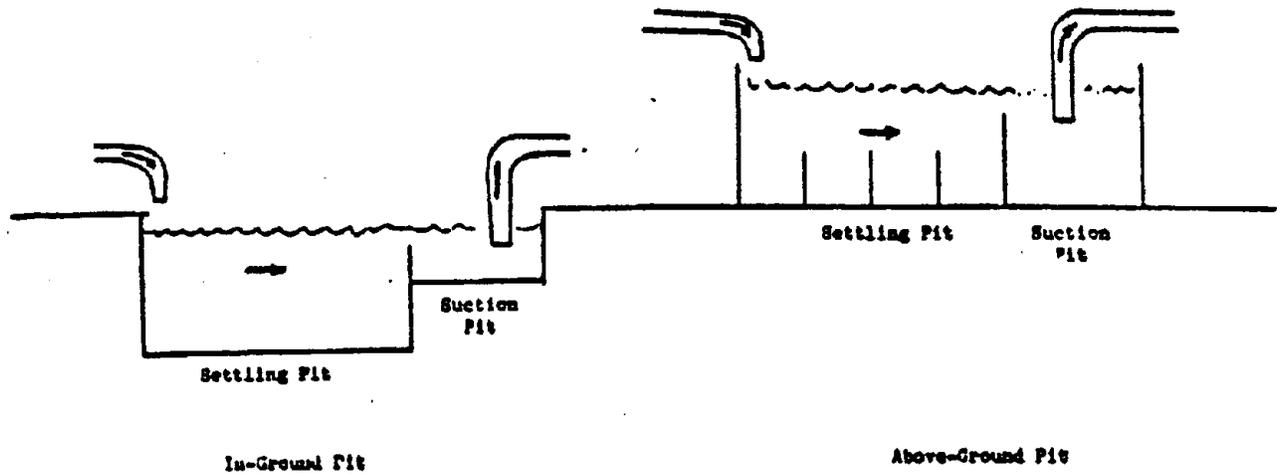
onsite disposal structure is expected, contaminated materials generated during the investigation should be stored at the site for disposal with other site materials. In this case, the initial containment structures should be evaluated for use as long-term storage structures. Also, other site conditions such as drainage control, security, and soil type must be considered so that proper storage is provided. If onsite storage is expected, then the containment structures should be specifically designed for that purpose.

6.0 REFERENCES

Brown & Root Environmental: Standard Operating Procedure No. 4.33, Control of Contaminated Material.

ATTACHMENT A

TWO TYPES OF MUD PITS USED IN WELL DRILLING



APPENDIX B

FIELD DOCUMENTATION FORMS



WELL NUMBER: _____ PROJECT NAME: _____

DATE/TIME: _____ PROJECT MANAGER: _____

INSPECTED BY: _____

VENT WELL

MONITORING INSTRUMENT READING: _____

LEL/O2 READING: _____

WELL INSPECTION/GROUNDWATER LEVEL MEASUREMENT

WELL DEPTH (FEET FROM TOP OF PVC) _____

WATER LEVEL DEPTH (FEET FROM TOP OF PVC) _____

WELL STICK-UP _____

CASING STICK-UP (FEET) _____

WELL DIAMETER (INCHES) _____

WELL CONSTRUCTION (PVC, STEEL, ETC.) _____

LOCKED UPON ARRIVAL? YES NO

LOCKED REPLACED? YES NO

OBSTRUCTIONS? YES NO

WELL RELABELED? YES NO

SLUG TEST CONDUCTED? YES NO (If YES, refer to "Hydraulic Conductivity Testing Data Sheet")

GENERAL CONDITION/COMMENTS: _____



TETRA TECH NUS, INC.

SAMPLE LOG SHEET - LIQUID PHASE

Site Name: _____
Sample ID: _____

Tetra Tech NUS Charge No. _____
QC Information: _____ (if applicable)

Sample Method/Device: _____
Depth Sampled: _____ feet Total Depth _____ feet (SW Only)
Sample Date & Time: ____/____/____ _____ hours
Sampler(s): _____

Recorded By: _____
Signature

TYPE OF SAMPLE: (Check all that apply)
 Groundwater Trip Blank*
 Surface Water Rinsate Blank*
 Residential Supply Field Duplicate Collected
 Grab Other (Specify): _____
 Composite
*include sample source & lot No.

WELL PURGE DATA: _____ Micro Tip/OVA Monitor Reading: _____ ppm

Well Depth	feet	Purge Start	hrs
Inside Diameter	Inches	Purge Stop Time	hrs
Water Level	feet	Total Gallons Purged	
Well Volume	gal.	Purge Method	
Color: _____ Turbidity: CLR/SL CLDY/CLDY/OPAQ			

Sampling/Purge Data:				
Vol. #	Temp ? C	pH	Spec. Cond.	DO
0	_____	_____	_____	_____
1	_____	_____	_____	_____
3	_____	_____	_____	_____
4	_____	_____	_____	_____

ANALYSIS	BOTTLE LOT NO.	TRAFFIC REPORT NO.		COMMENTS
		ORGANIC	INORGANIC	

APPENDIX C

FIELD MODIFICATION FORM



TETRA TECH NUS, INC.

FIELD MODIFICATION RECORD

Site Name: _____ Location: _____

Project Number: _____ Task Assignment: _____

To: _____ Location: _____ Date: _____

Description: _____

Reason for Change: _____

Recommended Action: _____

Field Operations Leader (Signature): _____ Date: _____

Disposition/Action: _____

Project Manager (Signature): _____ Date: _____

Distribution: Program Manager: _____ Others as Required: _____

Project Manager: _____

Quality Assurance Officer: _____

Field Operations Leader: _____

Project File: _____