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NAS KEY WEST
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FINAL RESOURCE CONSERVATION AND RECOVERY ACT FACILITY
INVESTIGATION/REMEDIATION INVESTIGATION SAMPLING AND ANALYSIS PLAN AT
TWELVE SITES NAS KEY WEST FL
3/1/1993
IT CORPORATION

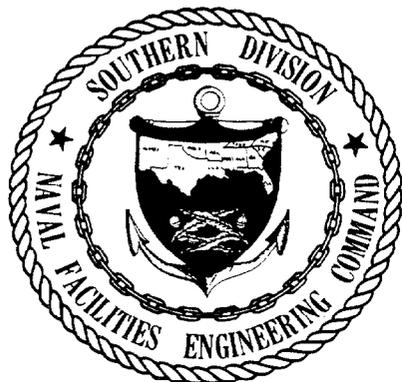
FINAL



RFI/RI
SAMPLING & ANALYSIS PLAN
12 SITES
MARCH, 1993

NAVAL AIR STATION - KEY WEST
KEY WEST, FLORIDA
CONTRACT NO. N62467-88-C-0196

Prepared by:
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Southern Division
Naval Facilities Engineering
Command, Charleston, S.C.
29411-0068

**SAMPLING AND ANALYSIS PLAN
RCRA FACILITY INVESTIGATION
REMEDIAL INVESTIGATION
NAVAL AIR STATION - KEY WEST
KEY WEST, FLORIDA**

PREPARED FOR

**SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SOUTH CAROLINA
CONTRACT NO. N62467-88-C-0196**

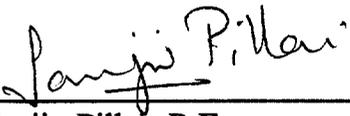
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**IT PROJECT NO. 595392
MARCH 1993**

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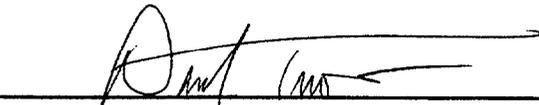
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1.0 Project Description

The purpose of this Sampling and Analysis Plan (SAP) is to outline the procedures that will be undertaken to maximize the precision, accuracy, and completeness of the data gathered during the RCRA Facility Investigation (RFI) and Remedial Investigation (RI) of Naval Air Station (NAS) in Key West, Florida by IT Corporation (IT). This SAP describes measures that will be undertaken by IT and its subcontractors to perform quality work to accomplish project objectives and be responsive to the QA requirements of the US Environmental Protection Agency (US EPA). The plan addresses:

- The Quality Assurance (QA) objectives of the project
- Specific QA and Quality Control (QC) procedures that will be implemented to achieve these objectives
- Staff organization and responsibility.

The US EPA QA requirements focus on the acquisition of environmental data of acceptable quality. Engineering analysis and report preparation are described in IT's Quality Assurance Program, which is documented in the IT Engineering Comprehensive Quality Assurance Project Plan (CompQAPP). The policies and procedures specified in the manual define acceptable practices to be employed by personnel engaged in any particular aspect of a project.

1.0.1 Project Description

The NAS-Key West facility is located approximately 150 miles southwest of Miami, on the second to last major island of the Florida Keys. The general location of NAS-Key West is shown on the area map in Figure 1-1. The facility at this time has 6 Solid Waste Management Units, 4 Installation Restoration Sites, and 2 Areas of Concern (SWMUs, IRs, AOCs) identified for further investigation during this phase. The Work Plan approach and a more detailed site background and physical setting is described in Section 2.0 and 3.0 of the Work Plans.

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DRAWN BY: L. NIST	DRAWN BY: L. NIST	APPROVED BY: <i>MJ</i>	PROJ. MGR.: M. HAMPTON	PROJ. NO.: 595392	ARCHIVED:	

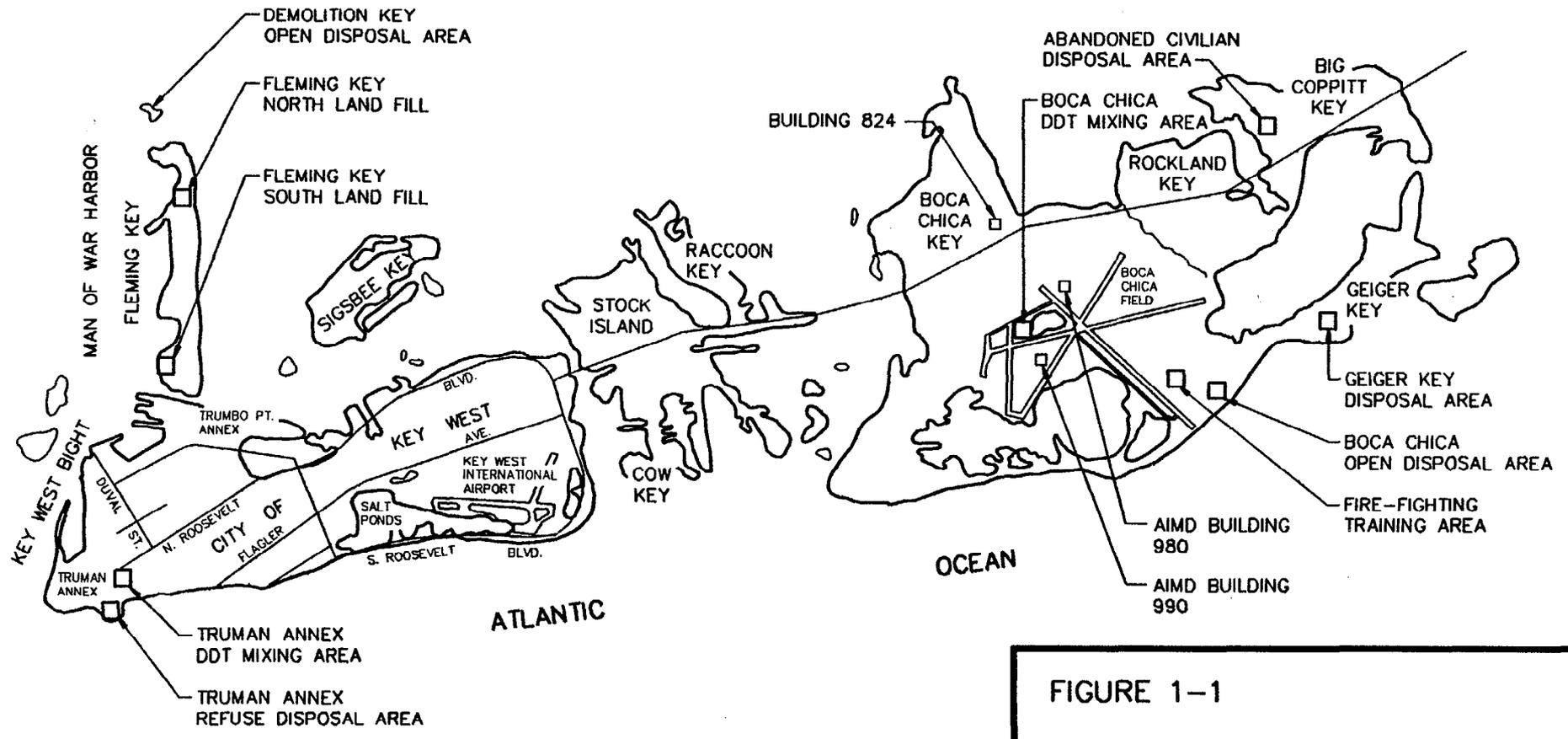


FIGURE 1-1
LOCATION OF NAVAL ACTIVITIES
AND STUDY SITES
NAS - KEY WEST
KEY WEST, FLORIDA
Prepared for:
NAS - KEY WEST
KEY WEST, FLORIDA

SOURCES: 1) FREDERICK H. HILDERBRANDT, INC.
ENGINEERS-SURVEYORS-PLANNERS
15321 S. DIXIE HWY., SUITE 202
MIAMI, FLORIDA 33157
2) GERAGHTY AND MILLER, INC.



1.0.2 Project Objectives

The objectives of the SAP for the NAS-Key West facility SWMUs, IRs, and AOCs is to collect the data needed to assess site hazards and evaluate remedial alternatives in the Corrective Measures Study (CMS) phase. Tasks that will be undertaken include:

- Review existing site data and relevant regulatory guidance
- Assess the magnitude (in addition to the vertical and horizontal extent) of suspected contamination at the SWMUs, IRs, and AOCs
- Further identify the contaminants which may be migrating from the 12 sites.
- Delineate the potential contaminant migration pathways as well as the exposure and risk characteristics of the contaminants to human health and the environment.

These objectives will be accomplished through an assessment of the existing conditions through the use of available data and the data from the upcoming field activities to be performed at NAS-Key West.

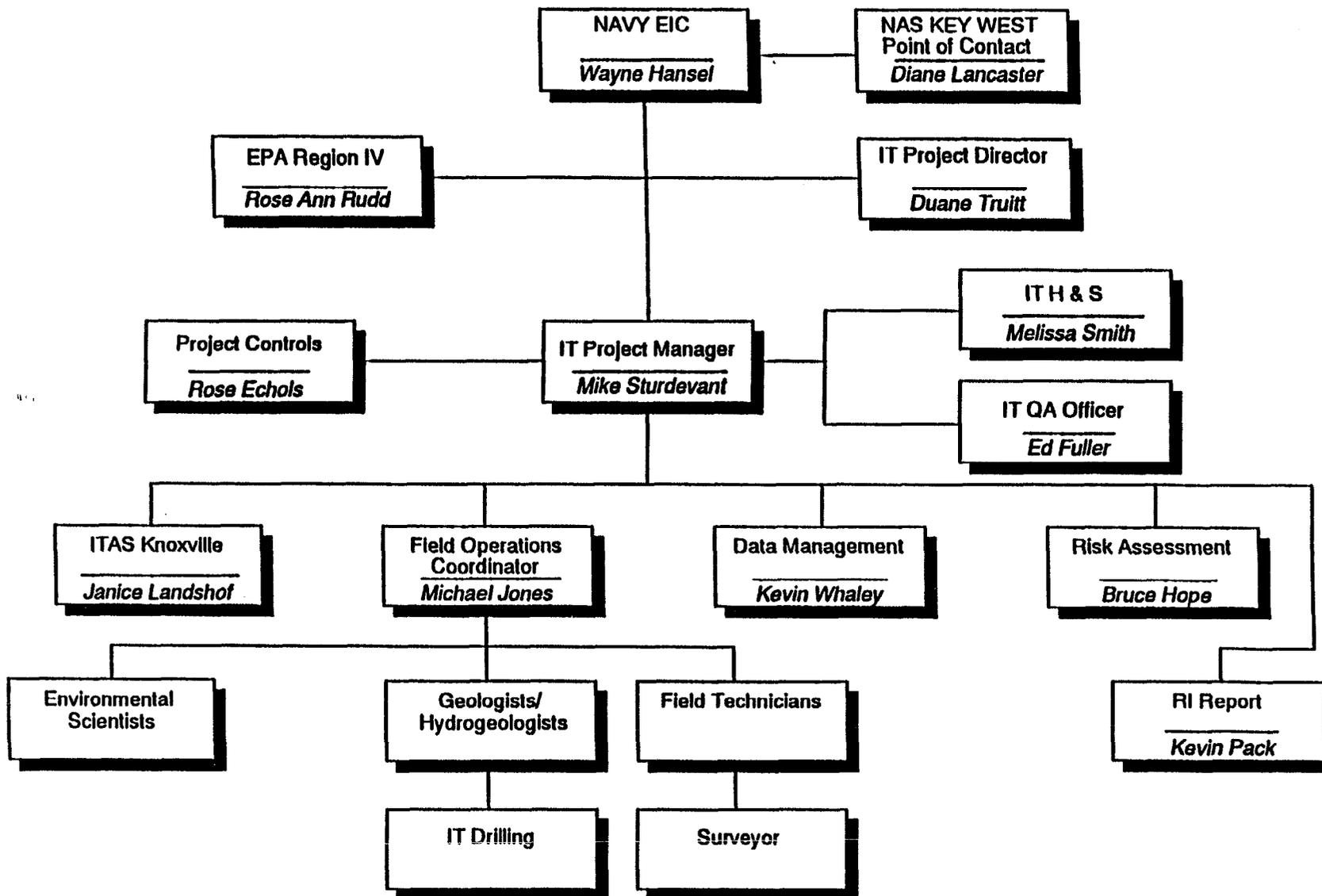
1.1 Project Organization and Responsibility

1.1.1 IT Project Personnel

Figure 1-2 identifies the project organization, reporting relationships and line authority as it relates to this project. The principal contractor personnel assigned to conduct the work are D. Truitt (Project Director), M. Sturdevant (Project Manager), D. Simmerly (Quality Assurance Officer), and M. Jones (Field Operations Coordinator). Other technical personnel will be assigned as deemed necessary.

The Project Manager will be the point of contact with NAS-Key West and Region IV EPA. He will have primary responsibility for technical, financial, and scheduling matters. The Project Manager is also responsible for reviewing all work plans, assigning staff to the project and establishing and maintaining the project budget and schedule.

FIGURE 1-2
Project Organization Chart
RFI/RI
NAS-Key West



The Project Director provides corporate oversight and support to the Project Manager. He will conduct periodic project reviews with the project, and provide an alternative point of contact with NAS-Key West.

The Quality Assurance Officer (QAO) implements and monitors field personnel compliance with IT's QA program. To accomplish this, the QAO will review field data including QC data to determine conformance with IT's QA Program. The QAO will follow-up on any non-conformances to verify that the proper corrective action is taken in a timely manner. He also maintains copies of IT's QA Manuals and is supervised by the Project Director, IT Regional QAOs and IT Corporate QAOs.

The Health and Safety Coordinator (HSC) is responsible for making sure the Health and Safety Plan (HSP) is followed. The HSC is responsible for verifying that all necessary health and safety equipment are available on site. In the absence of the HSC, the Project Manager will assume these responsibilities.

The Field Operations Coordinator will be responsible for verifying that all field operations are performed in accordance with the accepted Work Plans, Sampling and Analysis Plan, and Health and Safety Plan. The Field Operations Coordinator will inform the Project Manager of the status of field activities.

The Laboratory Coordinator for IT Analytical Services (ITAS) is responsible for verifying the laboratory follows its QA manual and the requirement placed upon it by the QAPP document which is included as Section 3.0. The Laboratory Coordinator will serve as a contact for IT's Project Manager at the laboratory.

1.1.2 Subcontractor Activities

The selection of qualified subcontractors will be in accordance with the established IT Procurement and QA procedures. Subcontractors, such as surveyors, must meet pre-determined qualifications developed by the Project Manager which are defined in the procurement bid packages. Each subcontractor bid submittal is reviewed by technical, purchasing, and QA personnel to certify that the bidders are qualified and can satisfy bid

requirements. Subcontractors involved in environmental measurements will be monitored by the Project Manager and QAO to assure use of calibrated equipment and qualified operators.

1.2 Sampling Strategy

The sampling strategy for the 12 sites in question will be to collect information needed to assess the current site conditions.

Solid Waste Management Units (SWMUs), Installation Restoration Sites (IRs), and Areas of Concern (AOCs)

The concerns at the 12 sites in question are related to the migration of suspected contaminants from the sites, and the potential for surface water (ocean) contamination which may result. The concerns will be investigated through the use of:

- Background samples of groundwater, soil, surface water, ocean water, and sediment media
- Soil borings along with soil sampling
- Monitoring well or sand point installation and subsequent groundwater sampling
- Surface water and/or sediment sampling
- Review of the existing data from the Phase I work.

Each SWMU, IR, and AOC will be treated as a specific point source of contamination for investigation. The associated surface drainage features (where present) will be investigated and samples will be collected and analyzed for similar parameters as the influencing point source of contamination (SWMU, IR, or AOC) for that specific area.

Monitoring well and/or sand point installation will also be performed at selected sites to identify and assess the extent of contamination at the SWMUs, IRs, or AOCs. Groundwater sampling will be performed at selected sites and the samples will be analyzed by laboratory analysis. Data obtained from these analyses will be utilized to define the extent and magnitude

of contamination. Soil borings will also be used to obtain and define lithologic data about the sites.

Table 1-1 contains a breakdown of the 12 sites, the sample media, number of samples, and recommended analysis for those samples as put forth in the Work Plans.

1.2.1 Sample Location and Frequency

The locations of the proposed sampling points for the selected SWMU, IR, and AOC sites are described in the Work Plan for each specific site. The locations are based on the objectives of the RCRA permit issued to NAS-Key West. Figures 1-3 to 1-14 illustrate the proposed site specific sampling locations based on a current understanding of the NAS-Key West facility. The number of samples collected, media types, and recommended analysis are listed in Table 1-1. This SAP addresses a one time sampling event that will be used to help plan future sampling events that may be required.

1.3 Description of Activities at Solid Waste Management Units, Installation Restoration Sites, and Areas of Concern

This section describes the SWMUs, IRs, and Areas of Concern (AOCs) to be investigated as part of the Work Plans for NAS-Key West. The sites under investigation are:

- SWMU No. 1 - Boca Chica Open Disposal Area
- SWMU No. 2 - Boca Chica DDT Mixing Area
- SWMU No. 3 - Boca Chica Fire Fighting Training Area
- SWMU No. 4 - AIMD Building A - 980
- SWMU No. 5 - AIMD Sand Blasting Area by Building A-990
- SWMU No. 7 - Former Hazardous Waste Storage Building A-824
- IR Site 1 - Truman Annex Refuse Disposal Area
- IR Site 3 - Truman Annex DDT Mixing Area
- IR Site 7 - Fleming Key North Landfill

Table 1-1

**Suspected Chemical Hazards
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 1 of 3)**

CONTAMINANT	PEL/STEL	HEALTH RISKS	EXPOSURE SYMPTOMS
Benzene	1 ppm/5 ppm	Carcinogen	Irritation, Depression, Convulsions, Headache
Toluene	100 ppm/150 ppm	Kidney, Liver and Nervous System damage	Fatigue, Convulsions, Dizziness, Headache
Trichloro-ethylene (TCE)	50/200 ppm	Suspect carcinogen, Kidney and Liver damage, Heart and Nervous System damage	Irritation, Vomiting, Rapid Heart Beat
Vinyl Chloride	1/5 ppm ceiling limit	Carcinogen; Liver and Nervous System damage	Narcosis, Weakness, Abdominal Pain
JP-4/JP-5 Jet Fuel	200 ppm/300 ppm	Moderate skin, Eye, Respiratory irritant	CNS depression, staggering, Slurred speech, Confusion
Methyl ethyl ketone (MEK)	200 ppm/300 ppm	Skin, Eye irritant	Nausea, Vomiting, Gastrointestinal effects
Lead	.05 mg/m ³	Suspected carcinogen	Loss appetite, Headache, Anemia, Insomnia, Skin sensitivity

Table 1-1
Suspected Chemical Hazards
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 2 of 3)

CONTAMINANT	PEL/STEL	HEALTH RISKS	EXPOSURE SYMPTOMS
Chromium	.5 mg/m ³	Skin sensitizer, Respirator system damage	Skin sensitivity
Methyl Chloride	50 ppm/100 ppm	Eye, Skin, Respiratory irritant	Dizziness, Nausea, Vomiting
Phenol	5 ppm skin	Liver, Kidneys, Skin damage	Eye, Nose, Throat irritation
DDT (DDE & DDD) components of DDT	1 mg/m ³ /- skin	Carcinogen, liver damage	Convulsions, Weakness, CNS degeneration
Naphthalene	10/15 ppm	Liver damage	Nausea, Vomiting, Headache
1,2-dichloroethylene	200/- ppm	Respiratory irritation	Narcosis
Chlorobenzene	75/- ppm	Respiratory irritant - Liver, lung, kidney damage	Irritation eyes, nose - drowsiness
Polychlorinated biphenyls (PBCs)	.5/- mg/m ³ skin	Carcinogen	Chloracne, Excessive eye discharges
Lindane (Alpha-BHC)	.5/- mg/m ³ skin	Liver damage, Skin sensitivity	Dizziness, Headache, Nausea, Vomiting
Heptachlor	.5/- mg/m ³ skin	Liver narcosis, Blood dyscrasia	

Table 1-1

**Suspected Chemical Hazards
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 3 of 3)**

CONTAMINANT	PEL/STEL	HEALTH RISKS	EXPOSURE SYMPTOMS
Cadmium	.005 mg/m ³	Renal dysfunction	Choking, Vomiting, Headache
Manganese	-/5 mg/m ³ (ceiling)	CNS	Sleepiness, Weakness
Mercury	.05/- mg/m ³ (skin)	Kidney damage	Vomiting, Nausea

NOTE:

TLV Threshold Limit Values
PEL Permissible Exposure Limit
PPM Parts Per Million

- IR Site 8 - Fleming Key South Landfill
- AOC - Site A - Demolition Key, Open Disposal Area
- AOC - Site B - Big Coppitt Key, Abandoned Civilian Disposal Area

Some of the sites are discrete units and/or individual locations while other sites are comprised of multiple locations. The description of each unit is as follows:

1.3.1 SWMU No. 1 - Boca Chica Open Disposal Area

The Boca Chica Open Disposal Area is shown in detail in Figure 1-3 and is located in the southeastern part of Boca Chica Key, between the perimeter road and Gieger Creek as shown in the vicinity map Figure 1-1. The site was originally operated as an open disposal and burning area from 1942 to the mid 1960's. The site received general refuse and waste associated with the operation and maintenance of aircraft. These wastes might have included waste oils, hydraulic fluids, paint thinners, and solvents.

Approximately 2,600 tons of waste from NAS-Key West were disposed of and burned at this site annually. Whenever possible, this burning area was cleared of any remaining debris left over from the burning process and deposited in an area of unknown dimensions to the north of the burning area. Because the burning operation was not a controlled process, all wastes may not have been completely destroyed. There may exist residual wastes within the burn area and/or debris zone.

The burn area is presently clear of any debris with the exception of four abandoned aboveground tanks located in the northwest portion of the site. Much of the area is subject to tidal inundation.

The "buried" debris area, of unknown size, has a predominant thick cover of mangrove trees, spotted with areas of open water. Debris can still be seen lying among the mangroves and in these open areas.

CAD FILE: AB201841.DWG PLOT: 1=1
 DRAWING NO.: AB201841 PROJ. NO.: 555392
 INITIATOR: S. PILLAI M. HAMPTON
 CHECKED BY: L. NIST APPROVED BY:
 LAST REV. DATE: 10/28/92 DRAWN BY: L. NIST
 STARTING DATE: 9/27/91 DRAWN BY: L. NIST

GROUNDWATER SAMPLES

COMPOUND	STANDARDS* μg/l	SAMPLE LOCATIONS
1,2 DICHLOROETHENE	4.2	KWM-07 6
NE = NOT ESTABLISHED		

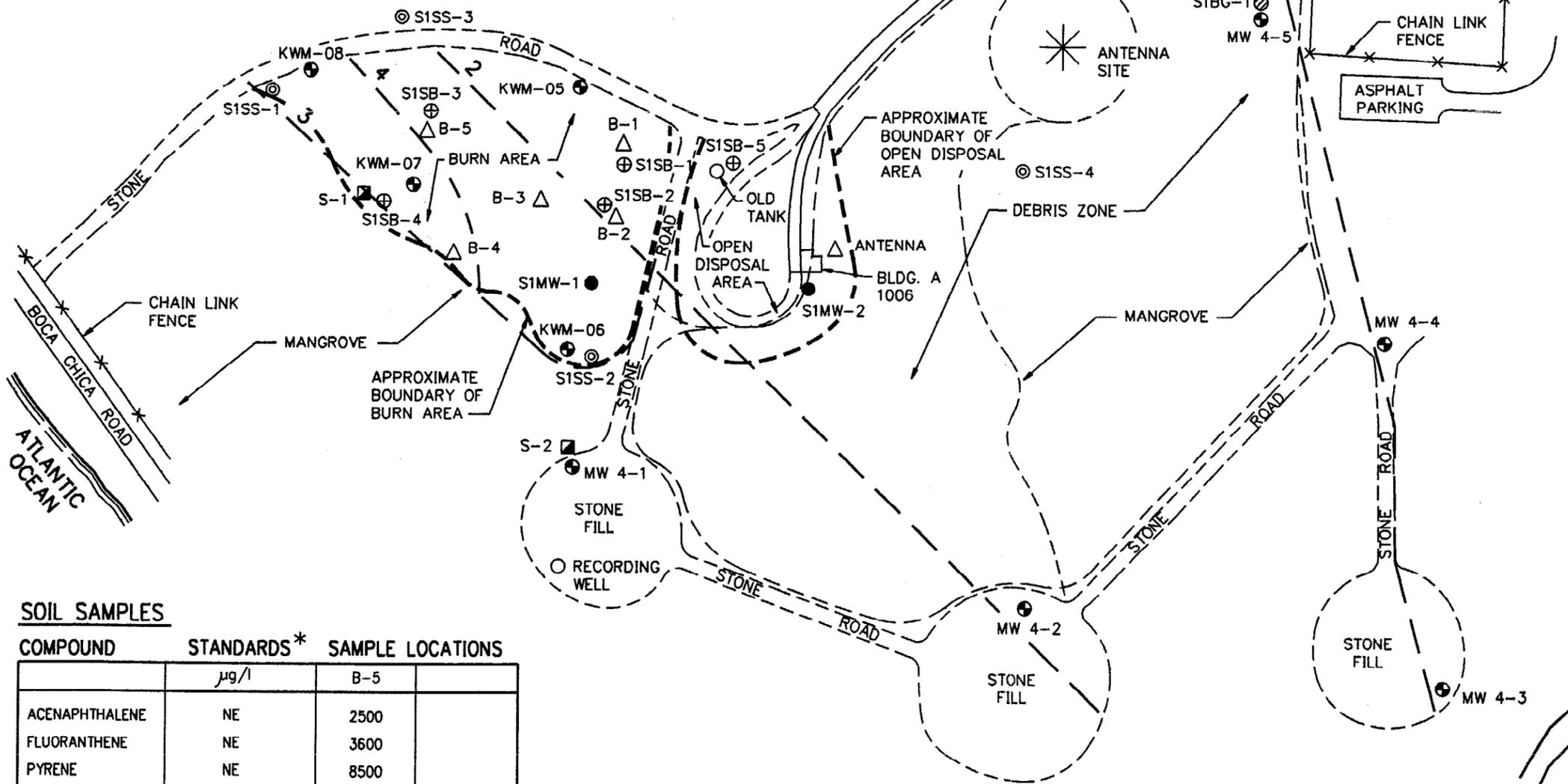
SEDIMENT SAMPLES

COMPOUND	STANDARDS* μg/l	SAMPLE LOCATIONS
ALDRIN	21	84
DELTA - BHC	NE	69
HEPTACHLOR EPOXIDE	38	71
ACENAPHTHYLENE	NE	13,000
ANTHRACENE	NE	6300
BENZO (a) ANTHRACENE	NE	7500
BENZO (b) FLUORANTHENE	NE	7600

COMPOUND	STANDARDS* μg/l	SAMPLE LOCATIONS
BENZO (K) FLUORANTHENE	NE	10,000
BENZO (A) PYRENE	NE	8300
BENZO (G,H,I) PERYLENE	NE	8600
CHRYSENE	NE	16,000
FLUORANTHENE	NE	8300
INDENO (1,2,3-CD) PYRENE	NE	7000
PYRENE	NE	18,000

* STANDARDS REFERS TO A COMBINATION OF DRINKING WATER STANDARDS, FLORIDA GUIDANCE CONCENTRATIONS AND CORRECTIVE ACTION LIMITS.

SOURCE: FREDERICK H. HILDERBRANDT, INC.
 ENGINEERS-SURVEYORS-PLANNERS
 15321 S. DIXIE HWY., SUITE 202
 MIAMI, FLORIDA 33157



SOIL SAMPLES

COMPOUND	STANDARDS* μg/l	SAMPLE LOCATIONS
ACENAPHTHALENE	NE	2500
FLUORANTHENE	NE	3600
PYRENE	NE	8500
BENZO (a) ANTHRACENE	NE	2900
CHRYSENE	NE	5900
BENZO (b) FLUORANTHENE	NE	3800
BENZO (k) FLUORANTHENE	NE	3800
BENZO (a) PYRENE	NE	3500
INDENO (1,2,3-cd) PYRENE	NE	3000
BENZO (g,h,i) PERYLENE	NE	3900
HEPTACHLOR EPOXIDE	38	120

LEGEND

- ⊕ KWM-08 GERAGHTY & MILLER MONITORING WELL
- ⊕ MW 4-2 IT CORP. MONITORING WELL
- △ B-2 BORING NO. 2
- S-1 SURFACE WATER & SEDIMENT SAMPLE NO. 1
- 2 — AIR QUALITY SURVEY TRANSECT AND NUMBER
- S1MW-1 PROPOSED MONITORING WELL
- ⊕ S1SB-1 PROPOSED SOIL BORING
- ⊙ S1SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE
- ⊙ S1BG-1 PROPOSED BACKGROUND SOIL SAMPLE

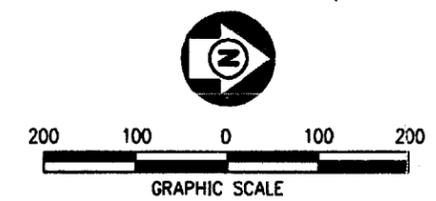


FIGURE 1-3
INVESTIGATION & SAMPLING LOCATIONS
 BOCA CHICA
 OPEN DISPOSAL AREA
Prepared for:
NAS - KEY WEST
KEY WEST, FLORIDA

INTERNATIONAL TECHNOLOGY CORPORATION

0026012

The presence of mangrove trees are indicative of a salt water environment, and, therefore some connection to the sea must exist. This fact establishes the debris zone as a wetlands which is protected by state/federal wetland regulations.

For the Phase I Remedial Investigation, the concentrations of compounds and metals detected in the groundwater and surface water were compared against a combination of Drinking Water Standards and standards identified in Florida Administrative Code (FAC) 17-550.310 through 320 and the Florida Groundwater Guidance Concentrations. For soils and sediments the Corrective Action Limits as per proposed rule for RCRA Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities Subpart S. These standards were used in the previous Phase I RI Study in order to assess impacts and decide if a release occurred. When standards were exceeded the media was considered to be impacted. The combination of Groundwater Guidance Concentration Drinking Water Standards and Corrective Action Limits will hereafter be referred to in this document as "standards."

Two soil samples were analyzed for Resource Conservation and Recovery Act (RCRA) metals by EP Toxicity. Concentrations of these metals were all below the analytical method detection limits.

The following additional information was discerned from the Phase I RI conducted by IT at the site. A total of seven metal concentrations were detected exceeding their Standards in the groundwater at the site. Of these seven metals, lead and iron are the most dominant. Table A-2 in Appendix A lists a summary of the inorganic contaminants detected at the site during the Phase I RI study. The sample locations and levels of organic contamination detected during the Phase I RI study are presented in Figure 1-3. Volatile organics were detected in only one groundwater sample and the reported concentrations were only slightly above their respective Standards. Because of very limited and random detections of volatile organics and metals in groundwater and surface water samples, widespread impacts due to these contaminants does not appear to be present. Although these contaminants appear to be isolated, IT considers the locations where these compounds were detected above their Standards to have been impacted.

Pesticide compounds were also detected above their Standards in the sediment, and soil samples at this site. The data indicates that the detection of pesticides may be local contamination only. Due to the isolated nature of detection, pesticide contamination is not likely to cause immediate impacts on human health or the environment. However, it is not recommended that this site be dropped from further consideration for remedial action because the metal contamination in soil and groundwater may require remedial measures.

1.3.2 SWMU No. 2 - Boca Chica DDT Mixing Area

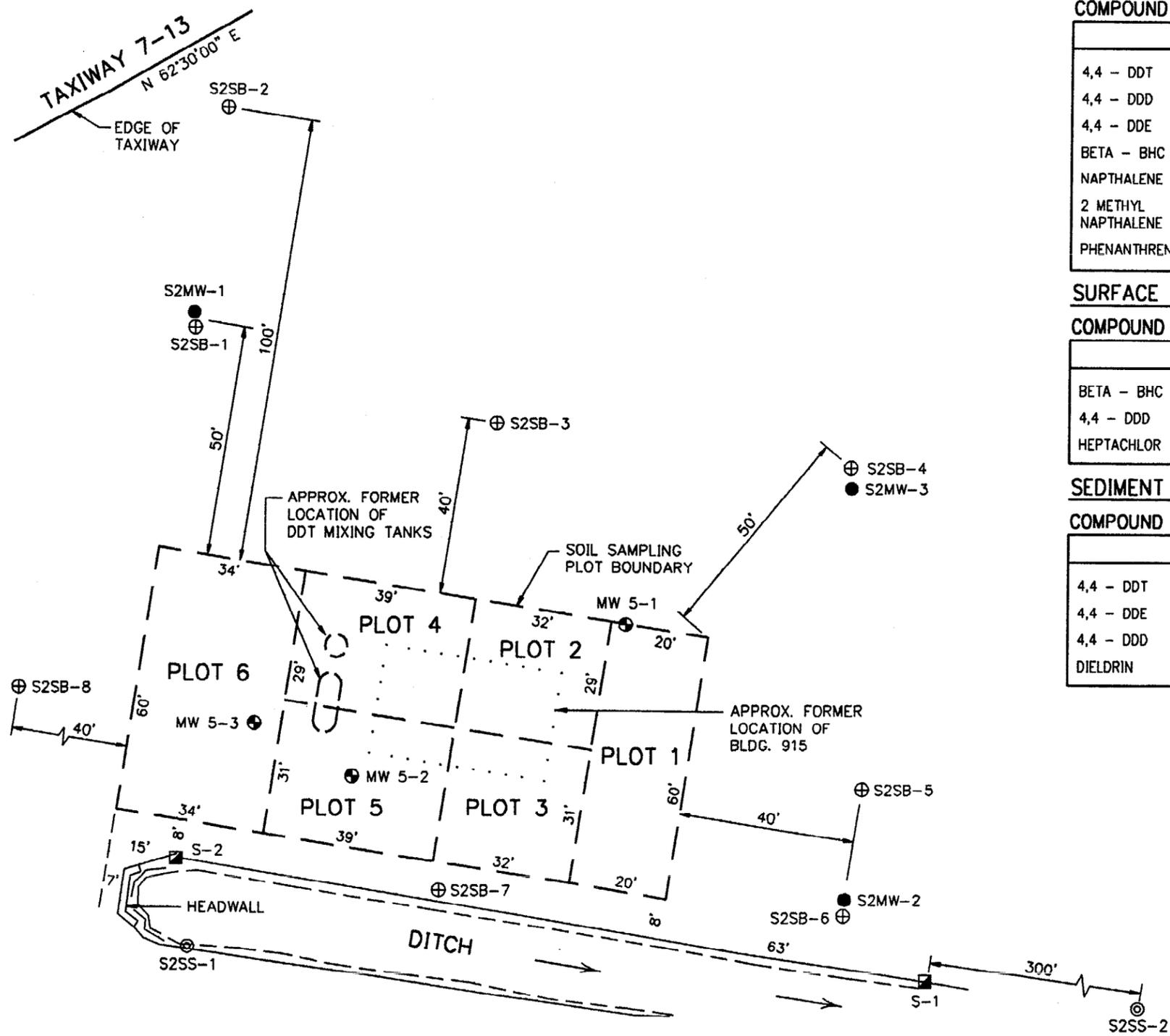
The Boca Chica DDT Mixing Area is shown in detail in Figure 1-4 and is located next to a man-made drainage ditch that is connected to a large borrow pit, along the west side of Runway 13. The location of this site is shown in Figure 1-1, on the vicinity map. DDT mixing operations were conducted at the site of Building 915 (demolished in 1982) from the 1940's to the early 1970's. To help destroy insect larvae, the pesticides were mixed with waste fuel oil to allow the pesticide to float on the surface of any standing water. Disposal at the site was not intentional but probably resulted from spillage. Two aboveground tanks on concrete foundations (a 500-gallon mixing tank and a 1,000-gallon storage tank) were located to the west of the building. During the removal of the tanks, some spillage reportedly occurred per NAS-Key West records.

A slight odor of pesticide was detectable at the site during the on site survey (July 1989). A man-made drainage ditch is located just south of the site. Drainage from the ditch is to a large borrow pit to the east. The area near the demolished building is partly covered with sparse grass. The ditch has medium size mangroves around its banks. During the on site survey, numerous fish were observed in the ditch.

The following additional information was discerned from the Phase I work conducted at the site.

The pesticides DDD, DDE, DDT, and related chlorinated hydrocarbon pesticides were detected in the soil, sediment, surface water, and groundwater samples significantly above the established standards. The soil samples at this site contained the highest pesticide concentration levels. Due to significant leaching in the area, these same pesticides are found to a lesser degree in the sediment and groundwater at this site.

CAD FILE: AB201842.DWG
 DRAWING NO.: AB201842
 PROJ. NO.: 595392
 INITIATOR: S. PILLAI
 PROJ. MGR.: M. HAMPTON
 CHECKED BY: L. NIST
 APPROVED BY:
 LAST REV DATE: 10/28/92
 DRAWN BY: L. NIST
 STARTING DATE: 9/27/91
 DRAWN BY: L. NIST



SOIL SAMPLES

COMPOUND	STANDARDS* µg/l	SAMPLE LOCATIONS							
		PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	MW5-2	MW5-1
4,4 - DDT	1000	2,800,000	42,000	160,000	210,000	470,000	25,000	8100	1000
4,4 - DDD	1500	1,800,000	620,000	840,000	49,000	580,000	23,000	37,000	-
4,4 - DDE	1000	-	-	-	-	-	-	8400	-
BETA - BHC	NE	-	-	-	-	-	1100	-	-
NAPHTHALENE	NE	6000	-	-	-	-	-	-	-
2 METHYL NAPHTHALENE	NE	25,000	12,000	16,000	-	-	-	-	-
PHENANTHRENE	NE	2600	-	-	-	-	-	-	-

SURFACE WATER SAMPLES

COMPOUND	STANDARDS* µg/l	SAMPLE LOCATIONS	
		S-1	S-2
BETA - BHC	0.05	0.07	-
4,4 - DDD	0.15	-	0.24
HEPTACHLOR	0.0078	0.062	-

GROUNDWATER SAMPLES

COMPOUND	STANDARDS* µg/l	SAMPLE LOCATIONS		
		MW5-1	MW5-2	MW5-3
BENZENE	1	90	-	-
CHLOROBENZENE	10	210	57	-
1,2 DICHLOROETHENE	4.2	1800	-	-
ETHYLBENZENE	2	38	-	-
2 METHYL NAPHTHALENE	NE	52	-	-
NAPHTHALENE	10	46	-	-
XYLENES (TOTAL)	50	76	-	-
ALPHA - BHC	0.05	16	-	-
BETA - BHC	0.05	6.1	2.4	0.05
DELTA - BHC	0.05	15	13	0.1
4,4 - DDE	0.01	22	1.5	0.16
4,4 - DDT	0.01	34	0.72	0.16
4,4 - DDD	0.15	-	-	0.76

SEDIMENT SAMPLES

COMPOUND	STANDARDS* µg/l	SAMPLE LOCATIONS	
		S-1	S-2
4,4 - DDT	1000	1900	2500
4,4 - DDE	1000	2800	1800
4,4 - DDD	1500	6000	13,000
DIELDRIN	NE	<3100	-

* STANDARDS REFERS TO A COMBINATION OF DRINKING WATER STANDARDS, FLORIDA GUIDANCE CONCENTRATIONS AND CORRECTIVE ACTION LIMITS.

NE = NOT ESTABLISHED

SOURCE: FREDERICK H. HILDERBRANDT, INC.
ENGINEERS-SURVEYORS-PLANNERS
15321 S. DIXIE HWY., SUITE 202
MIAMI, FLORIDA 33157

LEGEND

- ⊕ MW 5-1 IT CORP. MONITORING WELL
- ⊕ S2MW-1 PROPOSED MONITORING WELL
- ⊕ S2SB-1 PROPOSED SOIL BORING
- ⊙ S2SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE
- S-1 SURFACE WATER & SEDIMENT SAMPLE NO. 1
- ⊙ S2SS-2 PROPOSED SEDIMENT/SURFACE WATER SAMPLE
- PLOT # PLOT BOUNDARY & NUMBER

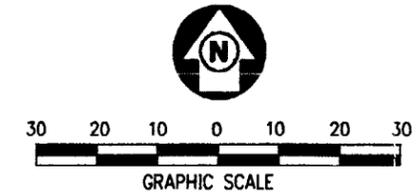


FIGURE 1-4
INVESTIGATION & SAMPLING LOCATIONS
BOCA CHICA
DDT MIXING AREA
 Prepared for:
NAS - KEY WEST
KEY WEST, FLORIDA



00260027

Most likely, the pesticide contamination is spread by water erosion, soil erosion, and groundwater migration. Certain volatile substances such as 1,2-dichloroethene, chlorobenzene, and naphthalene were also present in levels above their established standards thus further supporting the information that this site is contaminated. IT considers this site to have been impacted with respect to pesticides.

The downgradient monitoring wells at this site exhibit higher levels of pesticide/PCB concentrations than the wells located upgradient, thus supporting the pesticide migration theory. Groundwater flow (and pesticide migration) is in a southeasterly direction into a borrow pit. Although the groundwater at this site is unused by humans, the aquatic life in the surface water around this site may already be contaminated with the pesticide compounds. Those organisms higher in the food chain, such as the human race, may ultimately become contaminated if ingestion of the lower organisms occurs. Currently, access to this site is restricted, so public exposure to pesticides and related compounds should not be likely now or in the future.

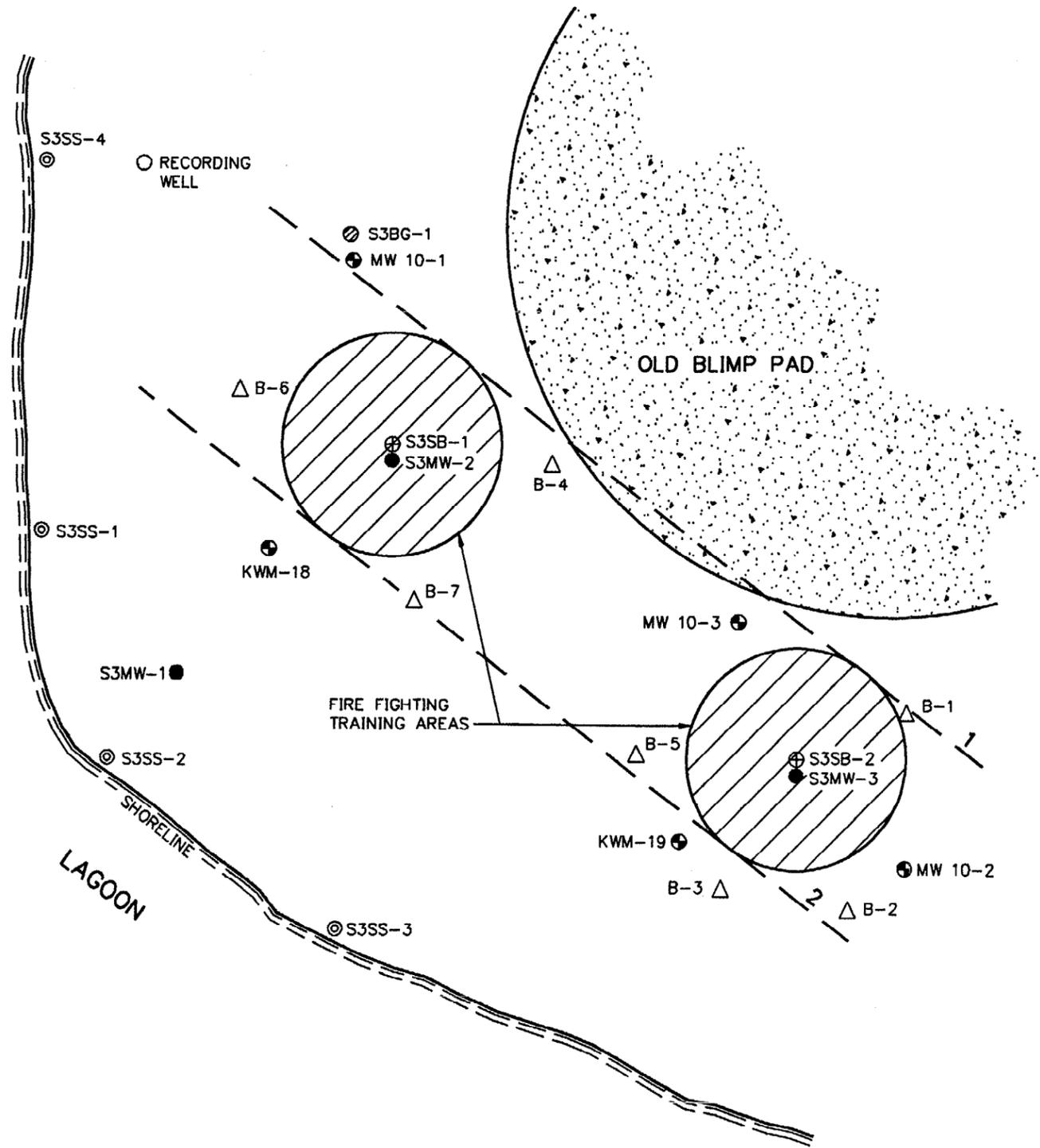
1.3.3 SWMU No. 3 - Boca Chica Fire Fighting Training Area

The Boca Chica Fire Fighting Training Area is shown in detail in Figure 1-5 and is located immediately west of the southern blimp pad. The fire training facility consists of two unlined circular pits approximately 20 feet in diameter. The pits are surrounded by a gravel apron. The fire pit area is only used occasionally during the year. Each time a training session occurs, flammable liquids such as JP-5, waste oils and/or hydraulic fluids are poured onto junk vehicles within the pit and ignited. The area surrounding the burn pits shows visible evidence of burning and oil staining.

The following additional information was discerned from the Phase I work conducted at the site. The metals cadmium, chromium, and manganese were detected above their established standards in groundwater samples taken at this site. However, due to the random occurrence of these metals, contaminant migration does not appear to be occurring based on the current understanding of the site.

In addition, some volatile organic compounds were detected above their standards in groundwater samples at this site. These compounds include benzene, ethylbenzene, and

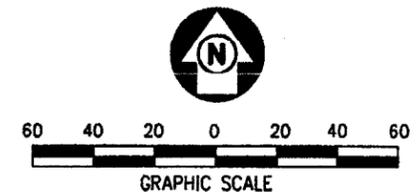
STARTING DATE: 9/27/91
 DRAWN BY: L. NIST
 LAST REV DATE: 10/28/92
 CHECKED BY: L. NIST
 INITIATOR: S. PILLAI
 PROJ. MGR.: M. HAMPTON
 DRAWING NO.: AB201843
 PROJ. NO.: 595392
 CAD FILE: AB201843.DWG
 PLOT: 1=1
 ARCHIVED:



COMPOUND	STANDARDS* µg/l	SAMPLE LOCATIONS			
		MW10-2	MW10-3	KWM-18	KWM-19
BENZENE	1	-	-	11	-
ETHYLBENZENE	2	-	-	15	-
NAPHTHALENE	10	-	-	39	-

* STANDARDS REFERS TO A COMBINATION OF DRINKING WATER STANDARDS, FLORIDA GUIDANCE CONCENTRATIONS AND CORRECTIVE ACTION LIMITS.

SOURCE: FREDERICK H. HILDERBRANDT, INC.
 ENGINEERS-SURVEYORS-PLANNERS
 15321 S. DIXIE HWY., SUITE 202
 MIAMI, FLORIDA 33157



- LEGEND**
- KWM-18 GERAGHTY & MILLER MONITORING WELL
 - S3MW-1 PROPOSED MONITORING WELL
 - ⊕ MW 10-1 IT CORP. MONITORING WELL
 - ⊕ S3SB-1 PROPOSED SOIL BORING
 - RECORDING WELL
 - ⊙ S3SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE
 - △ B-2 BORING NO. 2
 - ⊙ S3BG-1 PROPOSED BACKGROUND SOIL SAMPLE
 - 2 AIR QUALITY SURVEY TRANSECT AND NUMBER

FIGURE 1-5
INVESTIGATION & SAMPLING LOCATIONS
BOCA CHICA, FIRE FIGHTING TRAINING AREA
Prepared for:
NAS - KEY WEST
KEY WEST, FLORIDA



naphthalene. Concentrations of these volatile organics again appeared isolated in nature and were reported only slightly above the established standards. Widespread impact of volatile organics is not likely, based on a current understanding of the site.

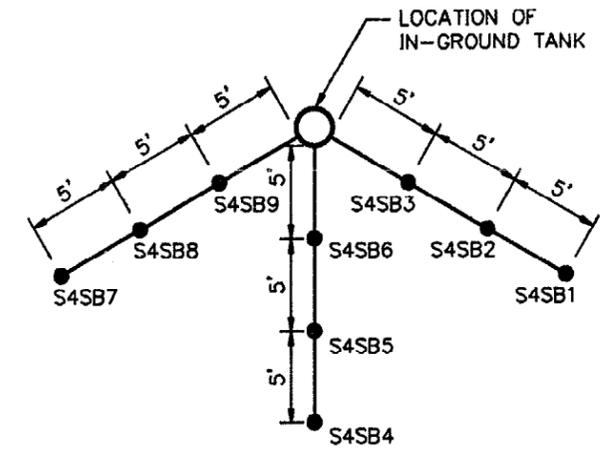
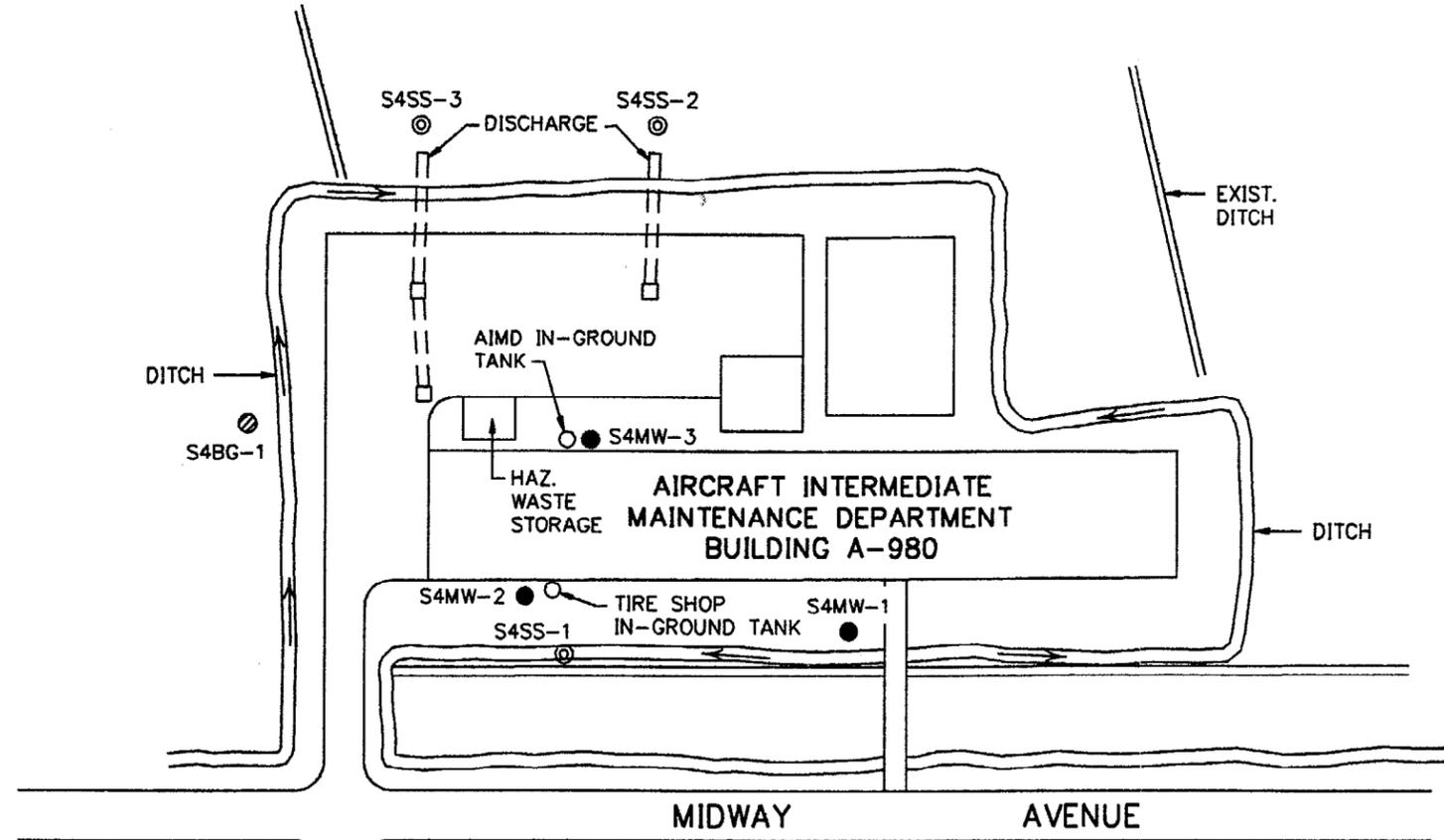
Groundwater flow at this site is to the southwest. No elevated levels of dissolved metals or volatile organic were present in downgradient wells, therefore, migration of these contaminants does not appear to be occurring. The groundwater at this site is not used as a public/domestic water supply system, therefore, exposure of humans to these contaminants at this site would not be expected to occur. There is no immediate impact on human health or the environment due to these contaminants.

1.3.4 SWMU No. 4 AIMD Building A-980

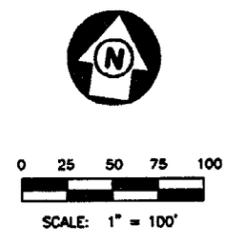
The site is located at the Aircraft Intermediate Maintenance Department (AIMD) Building A-980, at the Naval Air Station, Key West which is located on the island of Boca Chica Key, Florida as shown on the vicinity map, Figure 1-1. The area is shown in detail in Figure 1-6. In the late 1960's, the area was filled with six feet of crushed limerock, compacted, and building A-980 was constructed. In August 1981, a 55 gallon plastic tank was installed, in-ground, on the north side of Building A-980 for the collection and temporary storage of 30 percent dielectric fluid and a 70 percent freon mixture which sometimes spilled in the work area inside of Building A-980. During this same period, one additional in-ground 55 gallon plastic tank was installed on the south side of Building A-980 for the collection and temporary storage of a mixture of 96 percent water, 2 percent PD-680, 2 percent Turco (a phenolic base aircraft cleaner) and a residue of PCA-44 Type C (emulsifier cleaner). The contents of these in-ground drums were routinely removed every 60 to 90 days and properly disposed of off site.

The mechanism for filling the tanks is through piping, which drained the mixtures from the interior of the building through the wall and into the tanks. The north tank was connected to a floor trench drain with grate inside Building A-980. This drain was designed for the collection of incidental spillage from the work area operations. The south tank was connected to a dip tank. The dip tank was used by the tire shop for the rinsing of aircraft wheel rims during routine maintenance. Upon receipt of the NOV May 11, 1987, NAS-Key West cut and

CAD FILE: AR201837.DWG PLOT 1=1
 DRAWING NO.: AR201837 PROJ. NO.: 595392
 INITIATOR: S. PILLAI PROJ. MGR.: M. HAMPTON
 CHECKED BY: L. NIST DRAWN BY: L. NIST
 LAST REV DATE: 10/28/92
 STARTING DATE: 9/27/91



RADIAL SOIL SAMPLE LOCATIONS AT AIMD & TIRE SHOP IN-GROUND TANKS
 N.T.S.



- LEGEND**
- S4MW-1 PROPOSED SOIL BORING/MONITORING WELL
 - ⊙ S4SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE
 - ⊗ S4BG-1 PROPOSED BACKGROUND SURFACE WATER SAMPLE

FIGURE 1-6
INVESTIGATION & SAMPLING LOCATIONS
AIMD BUILDING A-980

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NAS - KEY WEST
KEY WEST, FLORIDA



002604Z

plugged the connective piping and ceased operating the in-ground tanks. The NOV was issued because some soil around one in-ground collection tank appeared to be contaminated with solvents and TF freon.

1.3.5 SWMU No. 5 AIMD Sand Blasting Area by Building A-990

The sand blasting area is located between Buildings A-990 and A-991, and is shown in detail in Figure 1-7 and is shown on the vicinity map Figure 1-1. The area has been used to sand blast "yellow gear," (yellow gear is the ground handling/ground support equipment for aircraft, i.e., moving vehicles and refueling tankers) aircraft components, and various metal objects as needed by the facility since the early 1970's. This area is approximately 65 by 90 feet and has a drainage ditch running behind the four AIMD buildings that collects surface runoff waters. The ditch also has trapped the sand blasting compound called "Black Beauty." This drainage ditch directs rain water to a culvert which in turn empties into a tidal area containing mangrove trees.

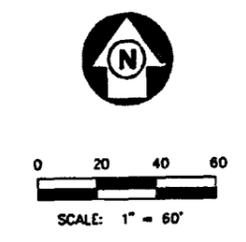
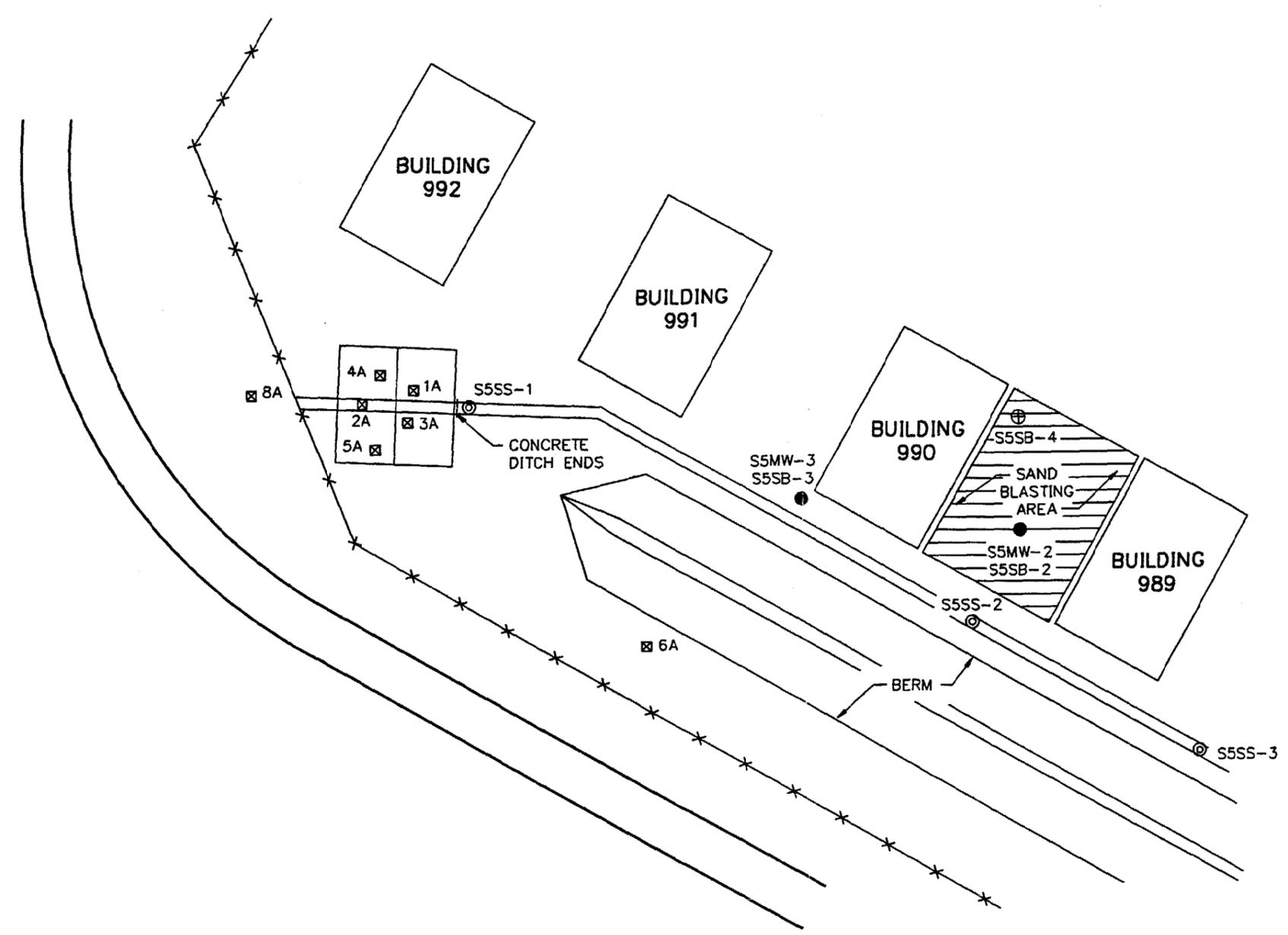
In April 1988, the Navy requested Geraghty and Miller, Inc., (G&M) to coordinate the analysis of two samples of the "Black Beauty." According to Reed Minerals Division of Tampa, Florida, the manufacturer's of "Black Beauty," this material is a compound of coal slag obtained from a electrical power company.

Samples of this blasting material were collected by the Florida Department of Environmental Regulation (FDER) during a RCRA Facility Assessment, April 1988. One sample was unused "Black Beauty" and the other was "Black Beauty" after it had been used as a blasting material for equipment. The two samples were sent for analysis for EP Toxicity metals (arsenic, silver, barium, cadmium, chromium, mercury, lead, and selenium). The results showed the samples did not have metals present above the maximum concentration of contaminants characteristic of EP Toxicity (40 CFR 261).

1.3.6 SWMU No. 7 - Former Hazardous Waste Storage Building A-824

Building A-824 is located to the west of US 1 on Boca Chica Key. Navy records indicate that the structure had been used to store lumber, telephone poles, plumbing supplies, small electrical transformers, and temporary staging of 55 gallon drums (under 90 days). The

STARTING DATE: 9/27/91
 DRAWN BY: L. NIST
 LAST REV DATE: 1/18/93
 DRAWN BY: L. NIST
 CHECKED BY:
 APPROVED BY:
 INITIATOR: S. PILLAI
 PROJ. MGR.: M. HAMPTON
 DRAWING NO.: AB201039
 PROJ. NO.: 993392
 CAD FILE: AB201039.DWG
 ARCHIVED:
 PLOT: 1-1



LEGEND

- ☒ 1A EXISTING SOIL SAMPLE (NAVY, 1984)
- S5MW-1 PROPOSED MONITORING WELL
- ⊙ S5SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE
- ⊕ S1SB-1 PROPOSED SOIL BORING

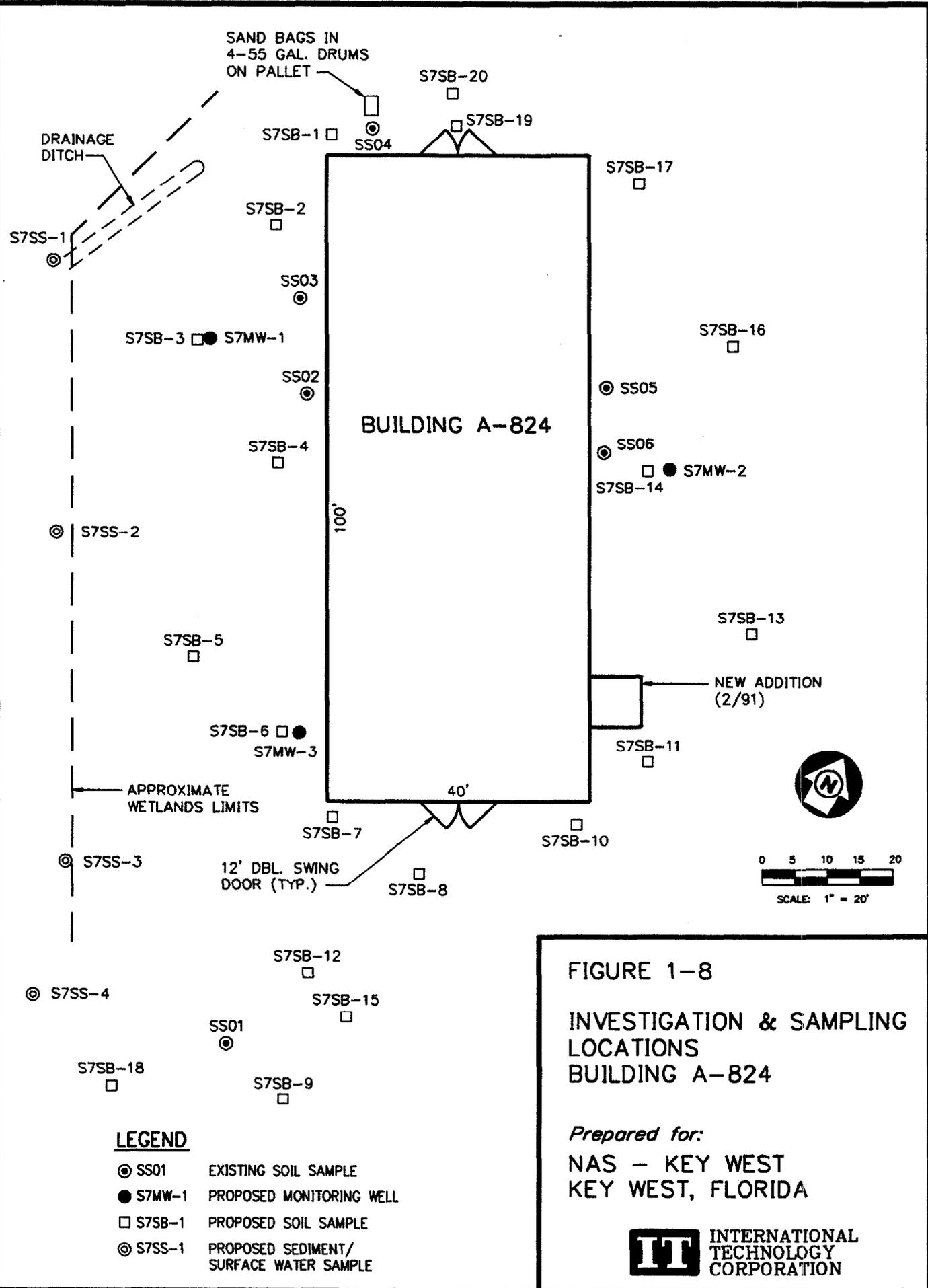
FIGURE 1-7
INVESTIGATION & SAMPLING
LOCATIONS
BUILDING A-990

Prepared for:
NAS - KEY WEST
KEY WEST, FLORIDA



0026C052

CAD FILE: AB201840.DWG PLOT 1=1
 DRAWING NO.: AB201840 PROJ. NO.: 595392
 ARCHIVED:
 INITIATOR: S. PILLAI PROJ. MGR.: M. HAMPTON
 CHECKED BY: APPROVED BY:
 LAST REV DATE: 10/26/92 DRAWN BY: L. NIST
 STARTING DATE: 7/27/91 DRAWN BY: L. NIST



- LEGEND**
- ⊙ SS01 EXISTING SOIL SAMPLE
 - S7MW-1 PROPOSED MONITORING WELL
 - S7SB-1 PROPOSED SOIL SAMPLE
 - ⊙ S7SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE

FIGURE 1-8
INVESTIGATION & SAMPLING
LOCATIONS
BUILDING A-824

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 NAS - KEY WEST
 KEY WEST, FLORIDA



building is shown in detail in Figure 1-8, and is shown on the vicinity map, Figure 1-1. No reported releases of contaminants have been recorded at this location.

The firm Blasland, Bouck, and Lee (BB&L) performed clean-up activities culminating on March 29, 1991 at the structure and surrounding area. Based on the information contained in the BB&L report, decontamination of the building has been completed in accordance with the FDER approved closure permit. Navy sources have indicated the building is to be retrofitted or "re-skinned" and updated for future use.

1.3.7 IR Site 1 - Truman Annex Refuse Disposal Area

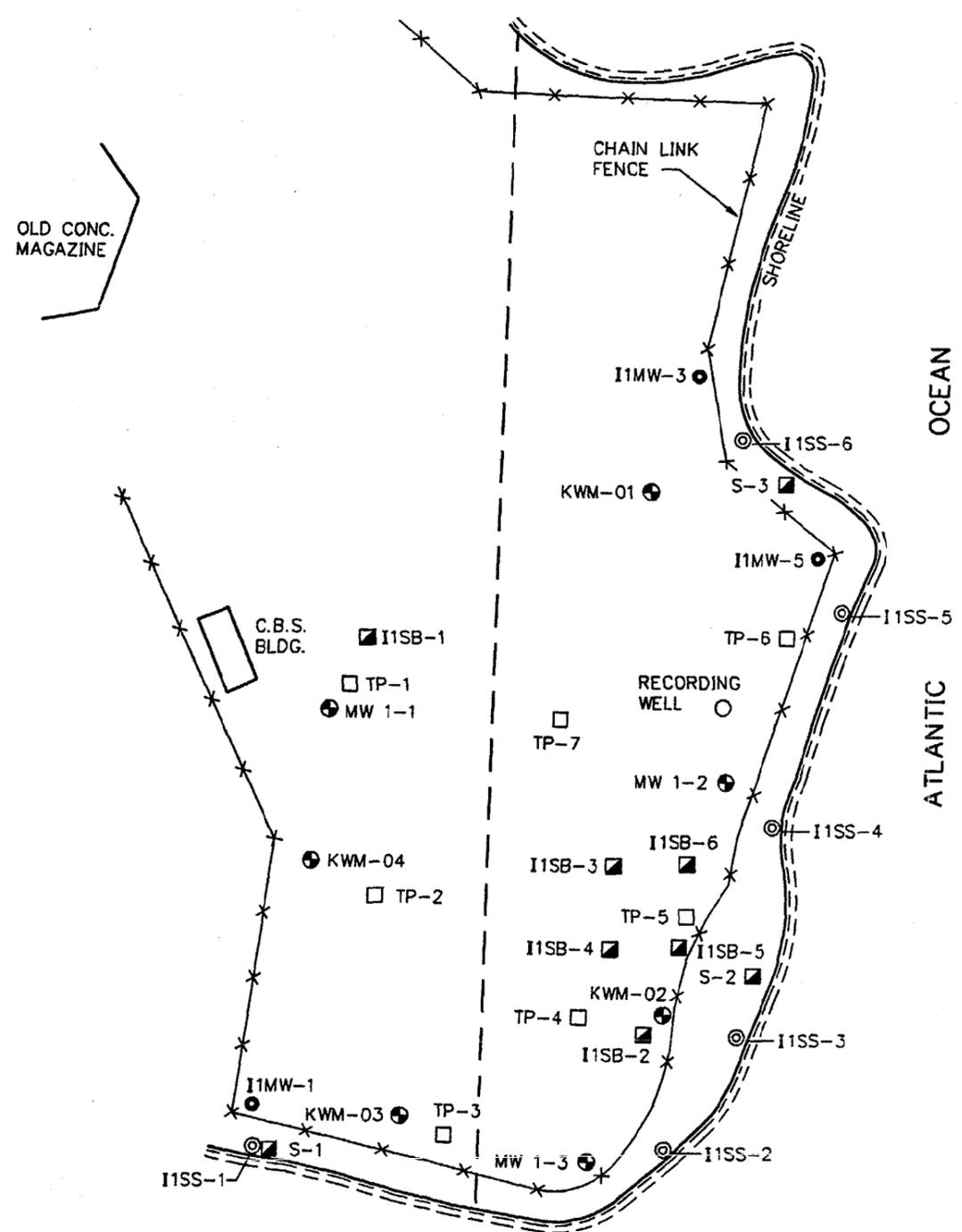
The Truman Annex Refuse Disposal Area is shown in detail on Figure 1-9, located along the southern shore of Truman Annex which is shown on the vicinity map, Figure 1-1. The site is reported to cover an area of approximately seven acres, including the antenna field and the area to the immediate north.

The subsurface at this site consists of landfill material in a shallow fill area with the landfill extending beyond the natural shoreline. Previous investigations reported that groundwater in the area is approximately two to three feet below land surface and flow is in a southerly direction towards the Atlantic Ocean.

The following additional information was discerned from the Phase I work conducted at the site. A total of 11 metal concentrations exceeding the standards have been detected in the groundwater samples taken at Site 1. These metals fractions include antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, and zinc. Of these metals, only copper, iron, lead, manganese, and mercury are present in significant amounts. The suspected origin of the lead contamination is believed to be north of monitoring wells MW1-2 and KWM-02 at Site 1. IT considers the groundwater to have been impacted with respect to metals at this site.

One sediment sample and one groundwater sample were found to have both pesticide and PCB concentrations above their standards. However, since these detections were isolated to one well at the site, this contamination is not believed to be a widespread problem. During low tidal cycles, the groundwater at this site discharges into the Atlantic Ocean. Tidal influence

STAR DATE: 9/27/91
 DRAWN BY: L. NIST
 LAST REV DATE: 2/11/93
 DRAWN BY: L. NIST
 CHECKED BY:
 APPROVED BY:
 INITIATOR: S. PILLAI
 PROJ. MGR.: M. HAMPTON
 DRAWING NO.: AB201845
 PROJ. NO.: 595392
 CAD FILE: AB201845.DWG
 PLOT: 1-1
 ARCHIVED:



NOTE:
 BACKGROUND SOIL AND
 GROUNDWATER SAMPLE WILL
 BE COLLECTED FROM THE
 TRUMAN ANNEX, DDT
 MIXING AREA (IR SITE 3).

- LEGEND**
- ⊕ KWM-01 GERAGHTY & MILLER MONITORING WELL
 - ⊕ MW 10-1 IT CORP. MONITORING WELL
 - RECORDING WELL
 - TP-4 TEST PIT NO. 4
 - 2 — AIR QUALITY SURVEY TRANSECT AND NUMBER
 - S-2 SEDIMENT SAMPLE NO. 2
 - I1MW-1 PROPOSED MONITORING WELL
 - ⊕ I1SB-1 PROPOSED SOIL BORING
 - ⊙ S1SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE

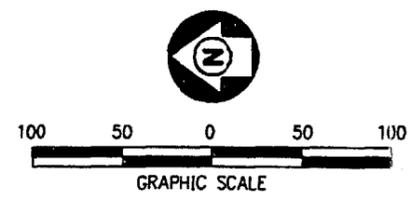
GROUNDWATER SAMPLES

COMPOUND	STANDARDS*	SAMPLE LOCATIONS						
		μg/l	MW1-1	MW1-2	MW1-3	KWM-01	KWM-02	KWM-03
ALPHA CHLORDANE	0.03	-	0.98	-	-	-	-	-
ALPHA CHLORDANE	0.03	-	1.10	-	-	-	-	-

SEDIMENT SAMPLES

COMPOUND	STANDARDS*	SAMPLE LOCATIONS		
		μg/l	S-1	S-2
AROCLOR 1260	450	-	2300	-

* STANDARDS REFERS TO A
 COMBINATION OF DRINKING WATER
 STANDARDS, FLORIDA GUIDANCE
 CONCENTRATIONS AND CORRECTIVE
 ACTION LIMITS.



SOURCE: FREDERICK H. HILDERBRANDT, INC.
 ENGINEERS-SURVEYORS-PLANNERS
 15321 S. DIXIE HWY., SUITE 202
 MIAMI, FLORIDA 33157

FIGURE 1-9
INVESTIGATION & SAMPLING
LOCATIONS
TRUMAN ANNEX
REFUSE DISPOSAL AREA
 Prepared for:
NAS - KEY WEST
KEY WEST, FLORIDA



00210007

has been observed to affect groundwater flow as far as 125 feet inland. Like the lead concentrations described above, the metal concentrations present in the groundwater are highest in the monitoring wells in downgradient positions along the coastline. Note, this distribution of metal concentrations indicates the migration of dissolved metals to the south toward the Atlantic coastline. Although groundwater at this site is not used as a public/domestic water supply system, humans could be indirectly affected by this contamination if the groundwater is seeping into the ocean in significant amounts, allowing for bioaccumulation in the tissues in receptor organisms.

1.3.8 IR Site 3 - Truman Annex DDT Mixing Area

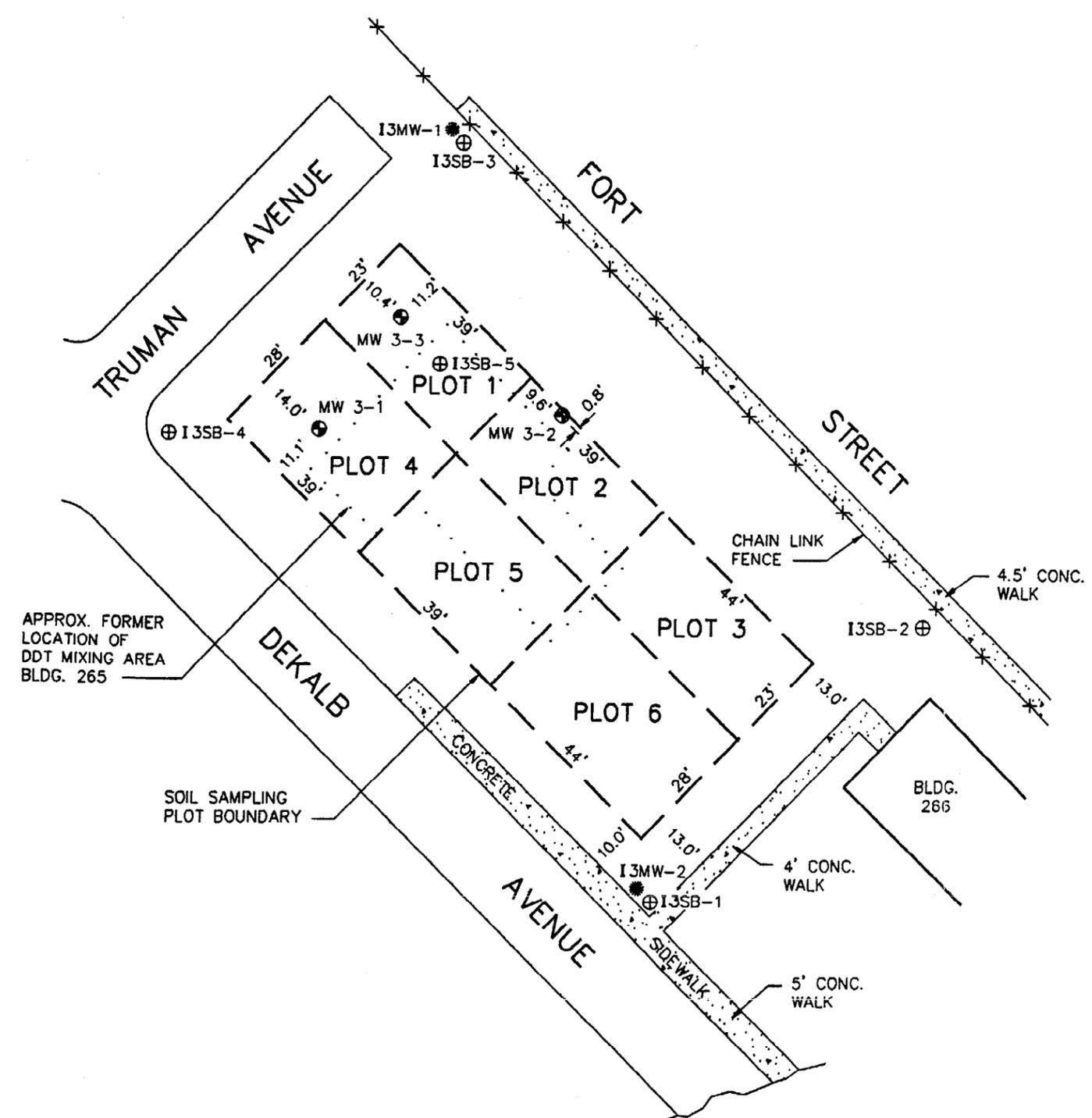
The Truman Annex DDT Mixing Area is shown in detail in Figure 1-10 and is located at the site of Building 265, which has been demolished. The location of this site is shown on the vicinity map, Figure 1-1. The site covers an area of about 0.25 acres and is located approximately 1,100 feet inland from the coastline in an area this is subject to limited vehicular and pedestrian traffic. The site is underlaid by highly permeable soils with no surface water features present. It is reported that groundwater is approximately two to three feet below land surface.

From the 1940's to the early 1970's, the location was used as a DDT mixing area. Powdered DDT concentrate was mixed with water and temporarily stored in 55 gallon drums both inside and outside the former building. The mixed solution was then transferred to trucks for dispersal. Discharges at the site were by spillage factors.

The following additional information was discerned from the Phase I work conduct at the site. A groundwater study of Site 3 indicates that three inorganic materials are present in concentrations above their established standards. These materials include cadmium, iron, and sodium. Iron and sodium are considered to occur naturally at this site, but cadmium is more indicative of groundwater contamination.

Seven different pesticide compounds have also been detected in the groundwater above their established standards. These compounds include alpha-BHC, beta-BHC, dieldrin, 4,4-DDD, 4,4-DDE, 4,4-DDT, and heptachlor epoxide. The pesticides 4,4 DDT, 4,4-DDD, and 4,4-DDE were found to be present in significant amounts in the soil samples taken at this site.

CAD FILE: AB201849.DWG PLOT 1-1
 DRAWING NO.: AB201846 PROJ. NO.: 595392 ARCHIVED:
 INITIATOR: S. PILLAI PROJ. MGR.: M. HAMPTON
 CHECKED BY: L. NIST APPROVED BY:
 LAST REV DATE: 2/19/92 DRAWN BY: L. NIST
 STARTING DATE: 9/27/91 DRAWN BY: L. NIST



SOIL SAMPLES

COMPOUND	STANDARDS* µg/l	SAMPLE LOCATIONS							
		PLOT 1	PLOT 2	PLOT 3	PLOT 4	PLOT 5	PLOT 6	MW3-2	MW3-1
4,4 - DDT	1000	220,000	86,000	100,000	79,000	17,000	9100	1800	6000
4,4 - DDD	1500	34,000	6700	80,000	68,000	2000	1200	-	83,000
4,4 - DDE	1000	30,000	20,000	33,000	26,000	9100	8700	-	8600
BETA - BHC	NE	-	-	2900	4700	800	-	89	2300
DIELDRIN	NE	28,000	-	6800	4400	-	-	-	-

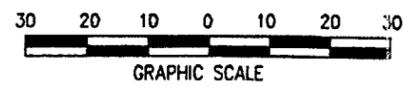
GROUNDWATER SAMPLES

COMPOUND	STANDARDS* µg/l	SAMPLE LOCATIONS		
		MW3-1	MW3-2	MW3-3
ALPHA - BHC	0.05	-	-	0.11
BETA - BHC	0.05	1.0	7.0	0.91
DIELDRIN	0.05	0.47	-	1.8
4,4 - DDD	0.15	2.1	0.77	-
4,4 - DDE	0.1	-	-	0.19
4,4 - DDT	0.1	-	-	0.21
HEPTACHLOR EPOXIDE	0.0039	-	0.14	-

NE = NOT ESTABLISHED

* STANDARDS REFERS TO A COMBINATION OF DRINKING WATER STANDARDS, FLORIDA GUIDANCE CONCENTRATIONS AND CORRECTIVE ACTION LIMITS.

SOURCE: FREDERICK H. HILDERBRANDT, INC.
ENGINEERS-SURVEYORS-PLANNERS
15321 S. DIXIE HWY., SUITE 202
MIAMI, FLORIDA 33157



LEGEND

- MW 3-1 IT CORP. MONITORING WELL.
- PLOT BOUNDARY & NUMBER
- ⊕ I3SB-1 PROPOSED SOIL BORING
- I3MW-1 PROPOSED MONITORING WELL

FIGURE 1-10
INVESTIGATION & SAMPLING LOCATIONS
 TRUMAN ANNEX
 DDT MIXING AREA
Prepared for:
 NAS - KEY WEST
 KEY WEST, FLORIDA



Pesticide concentrations in the groundwater indicate leaching is occurring in this area. IT considers this site to be impacted with respect to pesticides.

Groundwater at this site flows the south-southeast toward the Atlantic Ocean. Although analytical data on groundwater flow does indicate pesticide migration to be occurring in a southeasterly direction at this site, it can not be determined if the pesticide concentrations are contaminating the Atlantic Ocean. If the pesticides are migrating into the waters of the ocean, humans may ingest these materials indirectly through the consumption of seafood.

1.3.9 IR Site 7 - Fleming Key North Landfill

The Fleming Key North Landfill covers approximately 30 acres and is shown in detail in Figure 1-11 on the northern end of Fleming Key as shown in the vicinity map, Figure 1-1. Reportedly, 4,000 to 5,000 tons of unknown wastes were disposed into excavated trenches annually between 1952 and 1962. The trenches were typically cut 25 feet wide, 10 feet deep and 500 to 1,000 feet in length.

In 1977, the US Department of Agriculture Animal Import Center constructed a new building over a portion of the landfill. During the construction, various wastes were excavated and transferred to an area immediately to the west of the construction site where they were re-buried under a soil/rock cover.

Groundwater in the area is approximately three to four feet below the surface over much of the site, and during trenching activities it is reported that saline groundwater stood in the trenches.

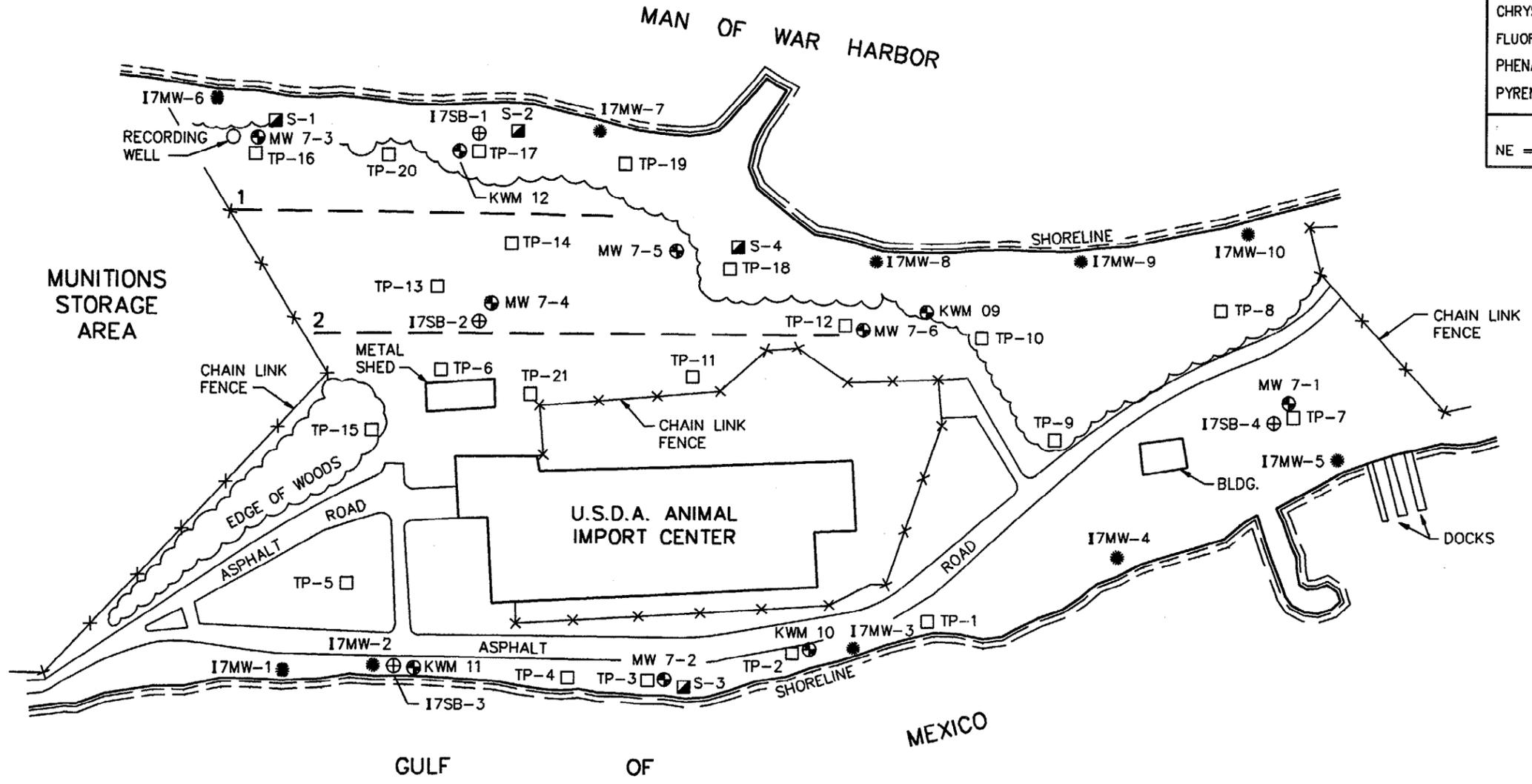
The following additional information was discerned from the Phase I work conducted at the site. Elevated concentrations of lead, manganese, antimony, cadmium, chromium, iron, and mercury were detected in the only surface water sample collected at this site. Significant metal concentrations were not detected in any of the sediment samples. IT considers only the groundwater to have been impacted with respect to metals at this site.

PLOT 1-1
 CAD FILE: FIG-8.DWG
 ARCHIVED: 595392
 DRAWING NO.: A820825
 PROJ. NO.:
 INITIATOR: S. PILLAI
 PROJ. MGR.: M. HAMPTON
 CHECKED BY: [Signature]
 APPROVED BY: [Signature]
 LAST REV DATE: 11/8/91
 DRAWN BY: L. NIST
 STARTING DATE: 9/27/91
 DRAWN BY: L. NIST

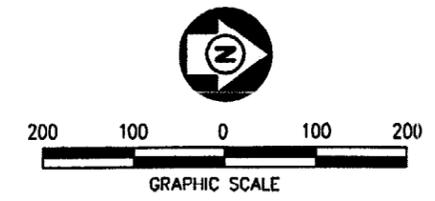
SEDIMENT SAMPLES

COMPOUND	µg/l	SAMPLE LOCATIONS			
		S-1	S-2	S-3	S-3
CHRYSENE	NE	-	950	-	-
FLUORANTHENE	NE	-	1900	-	-
PHENANTHENE	NE	-	2100	-	-
PYRENE	NE	-	1700	-	-

NE = NOT ESTABLISHED



SOURCE: FREDERICK H. HILDERBRANDT, INC.
 ENGINEERS-SURVEYORS-PLANNERS
 15321 S. DIXIE HWY., SUITE 202
 MIAMI, FLORIDA 33157



LEGEND

- ⊕ KWM-09 GERAGHTY & MILLER MONITORING WELL
- ⊕ MW 7-2 IT CORP. MONITORING WELL
- RECORDING WELL
- TP-14 TEST PIT NO. 14
- S-1 SURFACE WATER & SEDIMENT SAMPLE NO. 1
- I7MW-1 PROPOSED MONITORING WELL
- ⊕ I7SB-1 PROPOSED SOIL BORING
- AIR QUALITY SURVEY TRANSECT AND NUMBER

FIGURE 1-11
INVESTIGATION & SAMPLING
LOCATIONS
FLEMING KEY
NORTH LANDFILL SITE NO. 7
Prepared for:
NAS - KEY WEST
KEY WEST, FLORIDA



Groundwater flow at this site is to the eastern and western coastline of the Key. Tidal influence has been observed to affect groundwater flow throughout the entire site. In addition, there appears to be a relationship between groundwater flow and the location of detected metal concentrations. Specifically, wells located downgradient toward the shoreline but within the landfill area had the highest metal concentrations. Hence, evidence for the migration of metals in groundwater is apparent and the contamination may be seeping into the ocean at this time. However, since all potable water supplied to the Key West area is from Miami, humans would not be directly exposed to the metals present in the groundwater at this site.

1.3.10 IR Site 8 - Fleming Key South Landfill

Fleming Key South Landfill covers approximately 45 acres and is shown in detail in Figure 1-12 on the southern end of Fleming Key as shown in the vicinity map, Figure 1-1. Reportedly, as much as 8,000 tons of unknown wastes were disposed of at the landfill annually between 1962 and 1982. Beginning in 1966, the public works disposal activities of the City of Key West were combined with those of the Navy.

The open trench disposal method was practiced at this site, with the trenches being constructed in a manner similar to that at the Fleming Key North Landfill. The trenches were partially full of sea water when the wastes were disposed. Wet garbage was placed directly into one end of the trench and combustible wastes were taken to the western portion of the site and burned. The ashes and unburned wastes were then pushed and piled into an area in the western portion of the site.

The following additional information was discerned from the Phase I work conducted at the site. The seven metals detected in the groundwater above their established standards include antimony, cadmium, chromium, copper, lead, manganese, and mercury. The volatile organic, chlorobenzene was also detected above its established standard at this site. Several metals were also detected in a surface water samples, but this is due to the fact that the surface water feature was merely a surface expression of the groundwater table. The metals present in this surface water represent actual groundwater conditions. A pesticide contamination aspect was only detected in one of the groundwater samples.

IT therefore only considers this site to have been impacted with respect to metals in the groundwater.

Groundwater flow at this site trends to the northeast further inland and is greatly influenced by tidal variation. Higher metal concentrations were detected in the downgradient wells further inland, thereby showing evidence of the migration of metals in the groundwater. Potable water in Key West is piped in from the mainland, therefore, direct human ingestion of metal contaminated groundwater would not be expected. The effect of metals contaminated groundwater discharging into the ocean is inconclusive now and does require further investigation. This site does not appear to have any immediate impact on human health based on the preceding information.

1.3.11 AOC Site A - Demolition Key Open Disposal Area

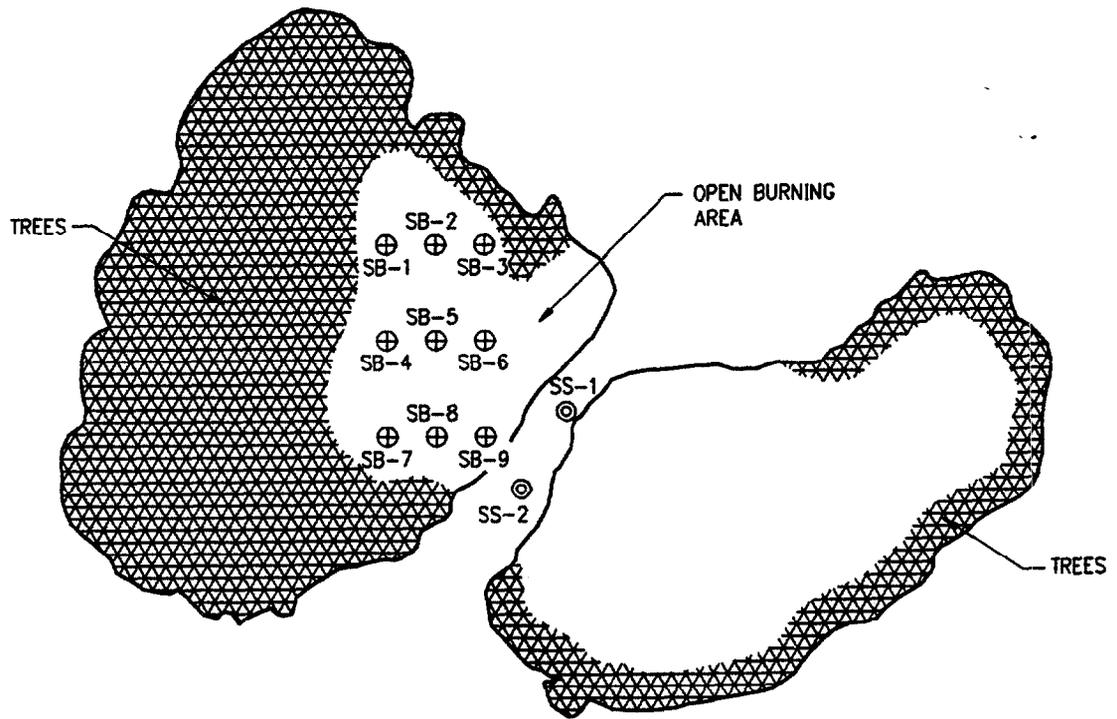
Demolition Key is a man-made dredge spoil island which is approximately six feet above mean sea level at its highest point. Figure 1-13 shows in detail, aspects of Demolition Key, while the vicinity map is shown on Figure 1-1. The fact that the Key is constructed from dredge materials, the soil and subsurface is assumed to be quite porous allowing for interaction with the nearby sea water. The groundwater flow direction has not been determined at this time as no monitoring wells are in place on the Key.

Demolition Key is approximately 24 acres in size and is surrounded by both the Atlantic Ocean and the Gulf of Mexico. No permanent surface water features are present on the Key. All rain events drain directly into the surrounding sea waters. The shoreline is currently supporting a mangrove community that does not appear to be affected by the disposal aspects. Note that the key is only accessible by water transportation and is an off limits restricted area.

Demolition Key has been used by the Navy as a secure area for the disposal of out of date ordinance.

The open burning unit is an earthen pit approximately two to three feet deep and eight to ten feet in diameter with a rip rap apron surrounding it.

STARTING DATE: 2/24/91 DRAWN BY: L. NIST	CHECKED BY: APPROVED BY:	INITIATOR: S. PILLAI PROJ. MGR.: M. HAMPTON	DRAWING NO.: AA102202 PROJ. NO.: 599392	CAD FILE: AA102202.DWG ARCHIVED:	PLOT: 1-1
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NOT TO SCALE

LEGEND

- ⊕ SB-1 PROPOSED SOIL BORING
- ⊙ SS-1 PROPOSED SEDIMENT/
SURFACE WATER SAMPLE

FIGURE 1-13

AOC SITE A
DEMOLITION KEY
OPEN DISPOSAL AREA

Prepared for:

NAS - KEY WEST
KEY WEST, FLORIDA



INTERNATIONAL
TECHNOLOGY
CORPORATION

Detonation and burning is initiated using standard explosive equipment. No outside power sources are required to operate the units. Any resultant ash is collected into 55 gallon drums and transported to a satellite collection area where it is properly sampled and analyzed to determine if it is hazardous prior to proper disposal.

1.3.12 AOC Site B - Big Coppitt Key Abandoned Civilian Disposal Area

The Key site in question is part of Big Coppitt Key. Figure 1-14 shows in detail the pertinent aspects of Big Coppitt Key, while the vicinity map is shown on Figure 1-1. The site encompasses approximately 10 acres, of which approximately 0.7 acre is improved and approximately 1.6 acres is occupied by a dead end canal. The ground elevations vary from sea level up to approximately four feet above mean sea level. The groundwater flow direction has not been determined at this time, as no monitoring wells are in place at this site.

The area of concern is an old abandoned civilian disposal area for discarded car/truck parts. The fill area is horseshoe shaped, approximately 1 to 2 feet in thickness and 20 feet by 200 feet in size. Surface water is present in a canal which lies adjacent to the site. The shoreline and the disposal area supports a mangrove community, with mangroves partially covering some of the disposal debris. To date no assessment work has been conducted at this site. Surface water exists in the mangrove wetlands and runoff from precipitation is into the wetlands and the canal.

STARTING DATE: 2/19/81	LAST REV DATE: 10/28/92	CHECKED BY: L. NIST	INITIATOR: S. PILLAI	DRAWING NO.: AA102203	CAD FILE: AA102203.DWG
DRAWN BY: L. NIST	DRAWN BY: L. NIST	APPROVED BY:	PROJ. MGR.: M. HAMPTON	PROJ. NO.: 595392	ARCHIVED:
LOT 1-1					

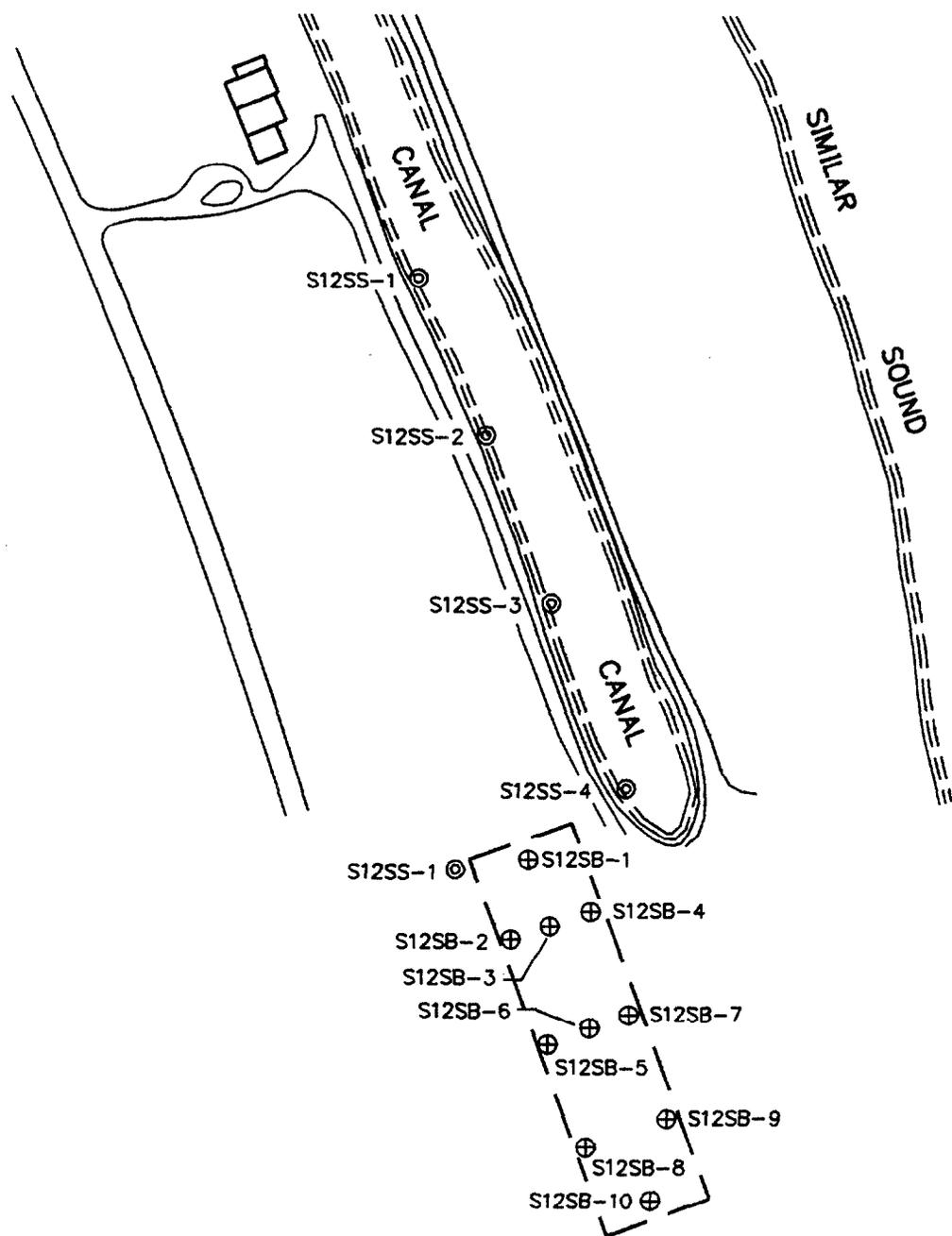


FIGURE 1-14

AOC SITE B
 BIG COPPITT KEY
 ABANDONED CIVILIAN
 DISPOSAL AREA

Prepared for:
 NAS - KEY WEST
 KEY WEST, FLORIDA

LEGEND

- APPROXIMATE BOUNDARY OF ABANDONED CIVILIAN DISPOSAL AREA
- ⊕ S12SB-1 PROPOSED SOIL BORING
- ⊙ S7SS-1 PROPOSED SEDIMENT/SURFACE WATER SAMPLE



2.0 Sampling Procedures

Any sample obtained during a field sampling event should be representative of the sample location and free of contaminants from sources other than the sampling point. The equipment and the techniques that will be employed to obtain representative samples will be in accordance with approved sampling procedures in the ECB SOPQAM.

The NAS-Key West Work Plans describe sampling locations; the numbers and types of samples to be collected. Section 2.0 of the SAP describes sampling collection and handling procedures for each type of sample. Analytical tests that will be performed at each site are described in detail in the Work Plans. Table 2-1 presents a summary of analytical methods, container types, preservation and holding times. The selected samples for VOA analysis will not be composited. The following paragraphs discuss general sampling procedures that will be used in all locations.

2.0.1 Prevention of Cross Contamination

Before entering the site, all sampling equipment will have been cleaned to remove any foreign material that might contaminate the site. Drilling equipment that will be in contact with the soil will be decontaminated before use and between each borehole. Monitoring well screen and blank casing in contact with groundwater will be decontaminated before use. Sampling equipment will be decontaminated before use and between each sample location. Detailed procedures for decontamination of drilling and sampling equipment and disposal of decontamination by products are provided in Section 2.4.10 of the SAP.

2.0.2 Sampling Identification

The sample identification label is necessary to ensure that sampling location and time can be tracked. The sample identification will include sample location, type, and site sampled. The sampling date and time will be recorded on the sample label and sample date will be indicated on the resulting analytical report. The exact sample identification method is included in Section 2.1 of the SAP.

TABLE 2-1
SAMPLING AND PRESERVATION REQUIREMENTS FOR WATER SAMPLES
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 1 of 6)

ANALYSIS	CONTAINER	VOLUME REFERENCED FOR ANALYSIS (ml)	PRESERVATIVE	HOLDING TIMES
Volatiles (8010/8020)	3-glass vials w/teflon septa	40	Cool 4°C, HCL, pH <2	14 days
Polynuclear Aromatic (8310) Hydrocarbons	2 Amber glass w/teflon lined cap	1,000	Cool 4°C	7 days until extraction, 40 days after extraction
Pesticides/PCBs (8080)	2 Amber glass w/teflon lined cap	1,000	Cool 4°C	7 days until extraction, 40 days after extraction
Metals (except Mercury)	1 polyethylene	1,000	Cool 4°C, HNO ₃ to pH <2	6 months
Mercury	1 polyethylene	1,000	Cool 4°C, HNO ₃ to pH <2	28 days
Appendix IX Volatiles	3 glass vials w/teflon septa	40	Cool 4°C, HNO ₃ to pH <2	10 days from VTSR ¹
Appendix IX Semi-Volatiles	2 Amber glass w/teflon lined cap	1,000	Cool 4°C	5 days from VTSR ¹ to extraction, 40 days after extraction
Appendix IX Organochlorine Pesticides/PCBs	1 Amber glass w/teflon lined cap	1,000	Cool 4°C	5 days from VTSR ¹ to extraction, 40 days after extraction
Appendix IX Organophosphorus Pesticides	2 Amber glass w/teflon lined cap	1,000	Cool 4°C	7 days until extraction, 40 days after extraction

TABLE 2-1
SAMPLING AND PRESERVATION REQUIREMENTS FOR WATER SAMPLES
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 2 of 6)

ANALYSIS	CONTAINER	VOLUME REFERENCED FOR ANALYSIS (ml)	PRESERVATIVE	HOLDING TIMES
Appendix IX Herbicides	1 Amber glass	1,000	Cool 4°C	7 days until extraction, 40 days after extraction
Appendix IX Metals (except Mercury)	1 polyethylene	1,000	Cool 4°C, HNO ₃ to pH <2	180 days from VTSR ¹
Mercury	1 polyethylene	1,000	Cool 4°C, HNO ₃ to pH <2	26 days from VTSR ¹
Cyanide	1 polyethylene	1,000	Cool 4°C, NaOH to pH >12	12 days from VTSR ¹
Sulfide	1 polyethylene	1,000	Cool 4°C, Zml ZN Zinc Acetate NaOH to pH >9	7 days
pH	Plastic	100	Cool 4°C	Immediately after sample collection
Specific Conductance	Plastic	100	Cool 4°C	28 days

TABLE 2-1
SAMPLING AND PRESERVATION REQUIREMENTS
FOR SEDIMENTS AND SOIL SAMPLES
NAS-Key West
Key West, Florida
(Page 3 of 6)

PARAMETER	CONTAINER	SAMPLE WEIGHT REQUIRED (gm)	PRESERVATIVE	MAXIMUM HOLDING TIMES ^a
Volatiles (8010/8020)	2 vials (glass) w/teflon lined cap	60	Cool 4°C	14 days
Polynuclear Aromatic (8810) Hydrocarbons	1 Amber glass w/teflon lined cap	250	Cool 4°C,	14 days until extraction, 40 days after extraction
Pesticides/PCBs (8080)	1 Amber glass, w/teflon lined cap	250	Cool 4°C	14 days until extraction, 40 days after extraction
Metals (except mercury)	1 polyethylene or clear glass	60	None	6 months
Mercury	1 polyethylene or clear glass	60	None	28 days
Total Organic Carbon (TOC)	2 vials w/Teflon lined cap	60	Cool 4°C	28 days
TCLP Volatiles	2 vials (glass) w/Teflon lined cap	60	Cool 4°C	14 days to TCLP extraction, 14 days after TCLP extraction
TCLP Semi-volatiles, pesticides and herbicides	1 Amber glass w/Teflon lined cap	250	Cool 4°C	14 days to TCLP extraction, 7 days to solvent extraction, 40 days after extraction
TCLP Metals (except mercury)	1 clear glass	125	Cool 4°C	6 months to TCLP extraction, 6 months after extraction
TCLP mercury	1 clear glass	125	Cool 4°C	28 days to TCLP extraction, 28 days after trip extraction

**TABLE 2-1
SAMPLING AND PRESERVATION REQUIREMENTS
FOR SEDIMENTS AND SOIL SAMPLES
NAS-Key West
Key West, Florida
(Page 4 of 6)**

PARAMETER	CONTAINER	SAMPLE WEIGHT REQUIRED (gm)	PRESERVATIVE	MAXIMUM HOLDING TIMES ^a
Appendix IX Volatiles	2 vials (glass) w/teflon lined cap	60	Cool 4°C	10 days from VTSR ¹
Appendix IX Semi-volatiles	1 Amber glass w/teflon lined cap	250	Cool 4°C	10 days from VTSR ¹ to extraction, 40 days after extraction
Appendix IX Organochlorine	1 Amber glass w/teflon lined cap	250	Cool 4°C	10 days from VTSR ¹ to extraction, 40 days after extraction
Appendix IX Organophosphorus Pesticides	1 Amber glass w/teflon lined cap	250	Cool 4°C	14 days to extraction, 40 days after extraction
Appendix IX Herbicides	1 Amber glass w/teflon lined cap	250	Cool 4°C	14 days to extraction, 40 days after extraction
Appendix IX metals (except mercury)	1 polyethylene or clear glass	60	None	180 days from VTSR ¹
Appendix IX mercury	1 polyethylene or clear glass	60	None	26 days from VTSR ¹
Cyanide	1 polyethylene or clear glass	60	Cool 4°C	12 days from VTSR ¹
Sulfide	1 polyethylene or clear glass	60	Cool 4°C	7 days

TABLE 2-1
SAMPLING AND PRESERVATION REQUIREMENTS FOR WATER SAMPLES
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 5 of 6)

ANALYSIS	CONTAINER	VOLUME REFERENCED FOR ANALYSIS (ml)	PRESERVATIVE	HOLDING TIMES
TAL/TCL Volatiles	3 glass vials w/teflon septa	40	Cool 4°C, HNO ₃ to pH <2	10 days from VTSR ¹
TAL/TCL Semi-Volatiles	2 Amber glass w/teflon lined cap	1,000	Cool 4°C	5 days from VTSR ¹ to extraction, 40 days after extraction
TAL/TCL Organochlorine Pesticides/PCBs	1 Amber glass w/teflon lined cap	1,000	Cool 4°C	5 days from VTSR ¹ to extraction, 40 days after extraction
TAL/TCL Organophosphorus Pesticides	2 Amber glass w/teflon lined cap	1,000	Cool 4°C	7 days until extraction, 40 days after extraction
TAL/TCL Metals (except Mercury)	1 polyethylene	1,000	Cool 4°C, HNO ₃ to pH <2	180 days from VTSR ¹
TAL/TCL Mercury	1 polyethylene	1,000	Cool 4°C, HNO ₃ to pH <2	26 days from VTSR ¹
TAL/TCL Cyanide	1 polyethylene	1,000	Cool 4°C, NaOH to pH >12	12 days from VTSR ¹
TAL/TCL Sulfide	1 polyethylene	1,000	Cool 4°C, Zml ZN Zinc Acetate NaOH to pH >9	7 days

TABLE 2-1
SAMPLING AND PRESERVATION REQUIREMENTS
FOR SEDIMENTS AND SOIL SAMPLES
NAS-Key West
Key West, Florida
(Page 6 of 6)

PARAMETER	CONTAINER	SAMPLE WEIGHT REQUIRED (gm)	PRESERVATIVE	MAXIMUM HOLDING TIMES ¹
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¹ Validated time of sample receipt

References

- (1) US Environmental Protection Agency (EPA), September 1982, "Handbook for Sampling and Sample Preservation of Water and Wastewater," EPA 600/4-82-029.
- (2) US Environmental Protection Agency (EPA), 1986, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd Edition.
- (3) US Environmental Protection Agency (EPA), 1984, "Proposed Sampling and Analytical Methodologies for Addition to Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," PB85-103026.
- (4) US Environmental Protection Agency (EPA), 1978, "Field and Laboratory Methods Applicable to Overburdens and Mine Soil," EPA-600/2-80-054.
- (5) US Environmental Protection Agency (EPA), September 1985, "Chemical Analytical Services for Multi-Media Multi-Concentration Metals and Inorganics," WA-85-J839, US EPA, Washington, DC

2.0.3 Sample Turnaround Time

Sample analyses will be scheduled based on site investigation needs and will be consistent with the sample holding times. ITAS will provide a standard turnaround time of approximately 6 weeks, this time frame will meet the project schedule and objectives.

2.0.4 Field Documentation

An integral part of the SAP for the field activities will be maintaining a Field Activity Daily Log. Information identified on the Field Activity Daily Log will have been obtained from site exploration and/or sampling activities and will be documented by the FOC. Photographs will be taken of the site (where allowed by the Navy) and activities to further document sampling and exploration.

All information pertinent to field activities will be recorded in the Daily Field Log. Entries in the log will be made in water resistant ink and will include as a minimum:

- The names and affiliations of all IT field personnel and subcontractor personnel
- A general description of the day's field activities and events
- Documentation of weather conditions during the day and any major changes that occurred
- Documentation of weather conditions for the previous 48 hours, if field work was not performed during that time
- Field measurements such as temperature, pH, specific conductance from groundwater sampling events and readings from personnel safety instruments in use
- Changes to the sampling and/or work plans (location, type) and the reasons for said changes.

Appropriate field generated data forms will be prepared. Data to be recorded will include identification of the monitored location (e.g., boring number, well number, depth, sampling station, elevation, and field coordinates), the type of sample and other data obtained during work.

2.0.5 Field Data Management

Field data will be generated and used to assess the sites. Field data allows for the identification, evaluation, and support of recommended appropriate actions.

Field data, including instrument readings, recordings, measurements, and tests will be documented and reviewed by IT personnel. Field records will be kept in a legible condition and sufficiently complete to permit reconstruction of daily activities by a qualified individual other than the FOC when data is reviewed. Field generated data sheets will be collected and reviewed every week for accuracy and completeness by the FOC. The data sheets will be assembled into packages that represent each borehole, monitoring well, etc. These data sheet record packages will be sent to the IT regional office in Tampa, Florida for review, examination, analysis of data and for the technical staff to use in preparing the required studies and reports. Field data approved by the Project Manager and QAO will be included in the RFI report.

2.0.6 Sample Bottle Preparation and Sample Preservation

All sample bottles used by IT Tampa will be shipped to the field by ITAS Knoxville and will be US EPA certified cleaned. Table 2-1 presents the types and volumes of sample bottles that may be used during this project as well as the sample preservation required for each analytical method.

2.1 Sample Custody

An important consideration in the collection of environmental data is the ability to demonstrate that samples have been obtained from the stated locations and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal must be documented to accomplish this. Documentation is accomplished through a chain-of-custody record that tracks each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's actual possession
- In view after being in physical possession

- Sealed so that no one can tamper with it after having been in physical custody
- In a secured area, restricted to authorized personnel.

2.1.1 Field Sampling

The following will be used in the chain-of-custody process for sample tracking and field activities by IT personnel:

- Sample identification and labeling
- Sample chain-of-custody form
- Sample collection log
- Laboratory request for analysis form
- Container and custody seals
- Carrier/waybill for the shipping of samples or signed chain-of-custody form by an ITAS Knoxville representative if the samples are picked up at the NAS-Key West site.

2.1.1.1 Sample Identification and Labeling

All samples will be adequately marked for identification from the time of collection and packaging through shipping and storage. Marking will generally be on the sample container (jar, bottle, etc.) but may be applied directly to the sample, or on a tag or label attached to the sample or container, depending on the type of sample and its intended use. Sample identification will include, as appropriate:

- Project name and number
- Sample number
- Sample location (e.g., boring number, monitoring wells number, depth, or sampling interval)
- Sampling date and time

- The initials of the individual(s) performing the sampling
- Sample preservative if used
- Sample analysis to be performed.

A sample numbering system will be established for the purpose of identifying the samples according to location and type as described in the sampling plan. In addition, this numbering system will provide for identification of the sample matrix, the site name or designation, and sampling round if appropriate.

2.1.2 Laboratory Analysis Request and Chain-of-Custody Record

The final step in providing information to the laboratory is the analysis request form. It shall be completed by appointed field personnel and documentation of the sample is provided by the use of chain-of-custody forms that record the sampling location, the type and amount of samples collected, the date and time of sample collection, the name(s) of the person(s) responsible for sample collection, the date and time of all custody transfers, the signature of the person relinquishing and accepting sample custody, and other pertinent information. An additional continuation form will be included, if deemed necessary. The continuation form contains a reference document number and page number to coincide with the original Analysis Request and Chain-of-Custody form. An example of this form is contained in Appendix A.

It is imperative that the analysis request and chain-of-custody form be provided so that analytical requirements are defined and sample holding times are not exceeded, also a copy (attachment) of the parameters to be analyzed for may be included if it is needed. A copy of the analysis request and chain-of-custody form will be maintained in the field file.

The laboratory analysis request section of this form is prepared to indicate the testing program required for the collected samples. The following information is recorded on the laboratory analysis request form:

- Project name and number
- Date that samples are shipped

- Required report date and turnaround times for analysis
- Contact with telephone number for receipt of the analytical report and billing invoices
- Sample identification numbers
- Sample volume collected and appropriate preservatives
- Quality level required
- Possible hazard identification
- Request for sample disposition following analysis

The chain-of-custody seals will be placed on all containers and coolers as per ECBSOPQAM, February 1991.

The chain-of-custody form to be used by field personnel in collecting and shipping samples.

This form shall be signed by each individual who has the samples in his/her possession. Preparation of the chain-of-custody section of this form shall be as follows:

- This section of the chain-of-custody record shall be initiated in the field by the person collecting the sample, for every sample. Every sample shall be assigned a unique identification number that is entered on the chain-of-custody form. Samples can be grouped for shipment using a single form. The form allows for ten samples. If more than ten samples are shipped in the same container, more than one chain-of-custody form is required.
- The record shall be completed in the field to indicate project, sampling team, etc.
- If the person collecting the samples does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By ____, Received By ____, shall be completed in the field.
- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record from as Relinquished By ____.

- If the samples are shipped to the laboratory by commercial carrier, the original chain-of-custody form shall be sealed in a watertight container, placed in the shipping container, and the shipping container sealed prior to being given to the carrier. The carbonless copy of the chain-of-custody form is retained in the field file.
- If the samples are directly transported to the laboratory, the chain-of-custody shall be kept in possession of the person delivering the samples.
- For samples shipped by commercial carrier, the waybill shall serve as an extension of the chain-of-custody record between the final field custodian and receipt in the laboratory. The waybill number will be recorded on the chain-of-custody to assist in tracking the cooler.
- Upon receipt at ITAS Knoxville their coding and receiving supervisor, or his designated representative, shall open the shipping containers, compare the contents with the chain-of-custody record, and sign and date the record. Any discrepancies shall be noted on the chain-of-custody form.
- If discrepancies occur, the samples in question shall be segregated from normal sample storage and the field personnel immediately notified.
- Upon receipt at ITAS Knoxville, IT Tampa shall be considered to have completed all EPA requirements pertaining to appropriate field requirements/performance aspects.
- Chain-of-custody records shall be maintained with the records of the project.

2.1.3 Sample Collection Log

A sample collection log is prepared for each sample to record information pertaining to the location, condition, and collection of a sample. The following information is on the sample collection log, as deemed appropriate:

- Project name and number
- Date and time sample collected
- Field geologist(s)/scientist(s) or technician(s) responsible for sample collection

- Sample identification number and type (e.g., soil, water, sediment)
- Field testing results such as pH, temperature, and specific conductance
- Location sketch of sample collection area if needed for verification
- Weather conditions
- Water level depth of collected sample
- General field observations.

An example of a sample collection log is included in Appendix A.

2.1.4 Field Collection and Shipment

As soon as samples are collected and preserved they will be stored in an ice chest packed with plenty of wet ice or a dedicated sample refrigerator that can be locked. The samples will be placed in a sturdy coolers. The drain plug in the cooler will be taped with duct-tape and the cooler will be lined with a large heavy duty plastic bag. Sufficient overage will be allowed for in all sample bottles placed in the cooler (except VOAs) to compensate for any pressure and temperature changes. Two to four inches of vermiculite will be placed in the bottom of the cooler and sample bottles will be placed on the vermiculite. Wet ice in polyethene bags will be placed on top for the samples and the remaining space between the bottles will be filled with vermiculite. The Analysis Request and Chain-of-Custody Record will be placed in a plastic bag and kept above the ice. The cooler will then be closed and the top of the cooler securely fastened with duct tape. Chain-of-Custody seals will be affixed on the top and sides of the cooler. The shipping container will be marked "THIS END UP" and arrow labels indicating proper upward position of the cooler will be affixed to the container. Samples will be shipped within 24 hours to ITAS Knoxville via overnight delivery to minimize sample holding times or will be picked up at the NAS-Key West facility by ITAS representatives who will sign all paper work signifying receipt of samples.

The transportation of samples must be accomplished not only in a manner designed to protect the integrity of the sample, but also to prevent any detrimental affects from the potentially hazardous nature of the sample. Regulations for packaging, marking, labeling, and shipping

of hazardous material, hazardous substances, and hazardous wastes are promulgated by the US Department of Transportation (DOT) and described in the Code of Federal Regulations (49 CFR 171 through 172.402h), Regulation (49 CFR 171 through 177, in particular 172.402h, Packages Containing Samples). In general, these regulations were not intended to cover the shipment of samples collected at hazardous waste sites. However, the US EPA has deemed it prudent to package, mark, label, and ship samples observing these DOT procedures. The information contained in this section is for general guidance and, although factual, should not be misconstrued as identical to DOT regulations for transportation for hazardous materials.

2.1.5 Sample Custody Responsibilities

Procedures for sample custody will be followed according to the procedures described above. For purposes of clarification IT will perform the following:

- Collect the sample(s) and package them in proper containers
- Complete all necessary forms to track the samples
- Properly package the sample containers in a sturdy cooler, attach all paper work, and either ship via overnight express or ITAS will pick up the samples at the site. If the samples are picked up at the site, the ITAS representative will sign the chain-of-custody form indicating he received the samples.

2.1.6 Laboratory Sample Receipt

NAS-Key West has selected ITAS to conduct the analytical work associated with the Work Plans. Accordingly, ITAS will handle all responsibility associated with:

- Delivery of appropriate sample containers, with appropriate preservatives
- Laboratory sample receipt and sign in
- Laboratory storage of samples
- Initiation of the testing program
- Completion of the testing program

- Appropriate sample disposal
- Issuance of signed certificates of analysis
- Sample disposal coordination

2.2. Field Equipment Calibration Procedures and Frequencies

This section describes calibration procedures and policies of field equipment to be used for this project.

2.2.1 Field Equipment Calibration and Control

All measuring and/or test equipment used in the field shall be controlled and subject to a formal calibration program. For field equipment, documentation of calibration of the equipment shall be on a daily basis. Equipment will also be stored in secure areas. Other IT policies provide details and guidance for equipment control. The calibration program shall provide equipment of the proper type, range, accuracy, and precision to supply data compatible with project requirements and desired results.

The Project Manager and/or Field Operations Coordinator are responsible for ensuring proper calibration of project specific IT field equipment.

2.2.1.1 Field Calibration Procedures

Documented approved procedures shall be used for calibrating measuring and/or test equipment. Whenever possible, widely accepted procedures (such as those published by ASTM or EPA) or procedures provided by manufactures shall be adopted. Where pre-established information is not available, procedures shall be developed considering the type of equipment, stability characteristic of the equipment, required accuracy, precision, and the effect of error on the quantities measured. As an minimum procedures shall include but not be limited to:

- Type of equipment to be calibrated
- Reference equipment and/or standard to be used
- Calibration method and sequential actions
- Acceptable tolerances

- Frequency of calibration
- Data recording format.

Calibration procedures for test equipment routinely calibrated by IT are presented in IT Manuals of Technical Practice or Standard Operating Procedures (SOPs).

2.2.2 Field Equipment Identification

Calibrated equipment shall be uniquely identified by using either the manufacturer's serial number, an IT calibration system identification number, or other means. This identification, along with a label indicating when the next calibration is due (only for equipment requiring periodic calibration), shall be attached to the equipment. If this is not possible, records traceable to the equipment shall be readily available for reference.

It is the responsibility of all personnel to verify the calibration status from the due date labels or records prior to using the equipment.

2.2.3 Field Equipment Calibration Frequency

Measuring and test equipment shall be calibrated at prescribed intervals and/or as part of operational use. Calibration frequency shall be based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, effect of error on the measurement process, and experience. Specific calibration procedures and frequencies are given in IT's Manuals of Practice of SOPs. Calibration procedures and frequencies are summarized in Table 2-2.

In some cases, particularly for field equipment, scheduled periodic calibration will not be performed because the equipment is not continuously in use. Such equipment shall be calibrated on an "as needed" basis prior to use and then at the required frequencies for as long as its use continues.

For instruments and equipment that are calibrated on an operational basis, calibration generally consists of the measurement of instrumental response to standards of known composition and concentration and the preparation of a standard response curve for the compound at different

concentrations. Records of these calibrations will be maintained on a calibration form, an example is contained in Appendix A.

Scheduled calibration of measuring and/or test equipment does not relieve personnel of the responsibility of using properly functioning equipment. If an equipment malfunction is suspected, the device shall be tagged, removed from service, re-calibrated or replaced.

2.2.4 Field Equipment Calibration Records

Records shall be prepared and maintained for each piece of calibrated measuring and test equipment to indicate that established calibration procedures have been followed. Records for equipment used only for a specific project may be kept in the project files.

Records for calibrated equipment shall include, as appropriate:

- Type and identification number of equipment
- Calibration frequency and acceptance tolerances
- Standards and numbers
- Calibration dates
- Identities of individuals performing the calibrations
- Standards used for each calibration
- Calibration data
- Statements concerning calibration acceptance or failure and repair of failed equipment.

2.2.5 Calibration Standards

Equipment shall be calibrated, whenever possible, using standards that have known relationships to nationally recognized standards (e.g., National Bureau of Standards) or accepted values of natural constants.

2.2.6 Calibration Failure

Equipment that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use, or shall be tagged to indicate that it is out of calibration. Such equipment shall be repaired and satisfactorily re-calibrated to the satisfaction of the Project Manager or Field Operations Coordinator, as appropriate. Equipment that cannot be repaired shall be replaced.

**TABLE 2-2
CALIBRATION PROCEDURES AND FREQUENCY
NAS-Key West
Key West, Florida
IT Project No. 595392**

INSTRUMENT	CALIBRATION STANDARDS USED	ACCEPTANCE LIMITS	CORRECTIVE ACTION	DOCUMENTATION
pH Meter	Daily: Buffer solutions pH-4, pH-7, and pH-10	± 0.005 pH unit	Recalibrate to standards, clean or replace electrode, service unit	Log book
Specific Conductivity Meter	Daily: Buffer solutions 720 and 1410	2%, in umhos/cm	Recalibrate to standards, clean or replace electrode, service unit	Log book
Temperature Meter	Unit must meet National Bureau of Standards (NBS)	± 0.5°C	Replace if broken, cracked or otherwise damaged	Log book
Organic Vapor Analyzer: Foxboro 108/128 (F10) Photovac MicroTip Air Analyzer (PID)	Daily: Known gas standards, Isobutylene at 100 ppm	± 10%	Recalibrate to standards or replace if faulty	Log book

2.3 Sample Designation

A unique sample number helps tie a particular sample to a specific physical location. IT Tampa will place a unique sample number on each sample sent to the laboratory. This sample number will be referenced on field sample collection logs, chain-of-custody, and request for analysis forms. The sample labels are preprinted on an adhesive tape roll with three (3) of each number in sequence. The three (3) numbers will be used in the following manner:

- One number will be put on the sample jar itself
- One number will be put on the lid of the sample jar
- One number will be put on the sample collection log

In addition, a sample label will be placed on each container and will provide the following information:

- Project number
- Project name
- Sample number
- Date/time collected
- Preservative used
- Analytical information
- Sampler initials

2.4 Sampling Equipment and Procedures

This section of the SAP presents the methodology of soil/sediment sampling, monitoring well installation, groundwater sampling, surface water sampling, and air monitoring at the sites. The sampling activities include collection, preservation, packaging, handling, shipping, and storage of samples performed in accordance with the US EPA "Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, February 1, 1991", National Institute of Occupational Safety and Health (NIOSH), and American Society of Testing and Materials (ASTM).

2.4.1 Soil Sampling

Three (3) types of soil sampling will be performed. These are sampling of sediments, surface and subsurface soil. Soil borings will be conducted at a number of separate boring locations, or in conjunction with monitoring well installation to obtain the subsurface soil sample. All field work will be described in the Field Activity Daily Logs. The methods for sampling are discussed in the following sections.

2.4.1.1 Soil Borings

Field activity logs will be filled out on a daily basis to indicate drilling activities such as footage drilled and materials used. Well installation will follow all of the commonly accepted professional drilling procedures. The boreholes will be logged by a qualified geologist/hydrogeologist as the drilling proceeds. Boring and test logs will be generated to document subsurface conditions on the Visual Classification of Soils form, contained in Appendix A using IT's Visual Field Classification of subsurface materials classification log legend manual of practice which is based on the ASTM's D2488 Standard Practice for description identification of soils and the Unified Soil Classification System. Wells will be completed as discussed in Section 2.4.3.1 of this SAP. Borings will be installed using either hollow stem auger or the rotary mud method. The lithologic borehole descriptions will be submitted to the EPA as part of the RFI include the following:

- Detailed lithologic description of each unit
- Soil sample locations, method of sampling and percent recovery
- Soil classification used
- Depth to first water encounter
- Termination depth of borehole.

The methods and procedures applicable for subsurface investigations are ASTM D1586 Method for Penetration Test and Split Barrel Sampling of Soils.

The drilling contractor will be responsible for securing boring or well drilling permits as required by the state and/or local authorities and for complying with state or local regulations with regard to the submission of driller's well logs, etc. IT Tampa will also be responsible for complying with regulations with regard to boring/well drilling safety as described in the HSP document.

2.4.2 Sediment and Surface Samples

Sediment and surface samples will be collected using a stainless steel hand corer or stainless steel trowel. The corer is a hollow barrel with a handle to facilitate driving the corer into the ground. The corer is also designed to prevent the sediment sample from washing out of the barrel if the sample is retrieved through water.

The cleaned decontaminated corer is driven into the sediments to be sampled. Twisting the corer during removal makes recovery of the samples easier. The sample can then be removed from the corer and placed in a glass pyrex pan for transfer into the appropriate sample containers for shipment to the laboratory.

The sediment sample will typically first be composited prior to placement in the sample collection bottle. The only exception to this procedure involves the collection of sediment samples for analyses of purgeable organic compounds (VOA analysis) or discrete (depth) samples. If this type of analysis is to be performed the sediment will be collected on a grab basis only. These discrete samples will not be mixed in any way and will be transferred from the sample collection device to the sample container with as little disturbance as possible to prevent volatilization.

Sediment samples will be composited by:

- Removal from the sampling device and placed in a glass pyrex pan
- Mixed thoroughly using a stainless steel spoon/trowel
- The sediment in the pan will be scraped from the sides, corners, and bottom of the pan, rolled to the middle of the pan
- The sample will then be quartered and moved to the four corners of the container
- Each quarter of the sample will be mixed individually and then rolled to the center of the glass pan and the entire sample is mixed again.

The use of a trowel for sediment sampling is similar to the use of a trowel for soil sampling. The primary difference is that care must be taken when samples are removed from under a water depth of more than six (6) inches. The sediment samples removed with a trowel will not be from water having a depth greater than 18 inches. The sample will be moved slowly through the water to minimize sample loss due to washing from the trowel.

2.4.3 Groundwater Sample Techniques

Standard activities involved with groundwater sampling include monitoring well drilling, construction and development, monitoring well elevation survey, water level measurements, removal of standing water in wells (i.e., well evacuation or purging) and retrieval of groundwater samples.

2.4.3.1 Monitoring Well Installation

Monitoring well installation will be recorded on the Monitor Well Installation Sheet as contained in Appendix A. All lines on the form will be filled in. The letter designation "NA" for not applicable procedures or "NK" for not known will be used in all blank spaces. If some steps or procedures were not performed as described, the reason will be stated as completely as is practicable on the appropriate form or submitted as an attachment thereto. Actual materials utilized in the well construction will be documented on the well specific forms.

Each monitoring well will be constructed in the following manner:

- A borehole will be constructed using hollow stem augers and/or rotary wash techniques. If rotary wash techniques are employed, potable water will be used.
- Commercial grade 10 foot long, 0.010 inch schedule 40 PVC slot screen with flush threaded joints.
- Monitoring wells will be cased using blank 2 inch diameter schedule 40 PVC riser pipe to the surface. Joints will be flush threaded. Length of PVC piping will be 10 feet.
- Screen sand pack material will be a 20/30 silica sand.
- Wells will be backfilled with the sand pack to a height of at least 2 feet above the well screen.
- Approximately 2 feet of 1/4 to 3/8 inch bentonite pellets consisting of 90 percent montmorillonite clay will be placed above the sand pack and hydrated. The bentonite pellets will be allowed to hydrate for 1/2 to 1 hour before the well is to be grouted. At each well, a hydration observation test will be conducted concurrent with the pellet seal hydration to verify that hydration occurs in the specified timeframe.

- Wells will be grouted to the surface with a cement/bentonite mixture. Type I Portland cement will be used.
- Grout materials will be placed using a pump and tremie line.
- A 3 foot above grade steel guard pipe will be used as a security measure. Each guard pipe will be fitted with a hinged cap, hasp, and lock. The outer casing will have a minimum of two weep holes for drainage purposes.
- The well apron will be approximately 3 feet by 3 feet by 0.5 foot thick concrete. The concrete for the apron will extend into the borehole to top of the grout.
- A notch representing the top of casing measuring point will be filed/or marked permanently on the inner casing of each well and will be identified on the notes and well sketches.

A well completion report will be prepared for the installed well. This report will be included with the final report submitted to the EPA. The well completion report will contain the following:

- Survey of well location map with scale and orientation
- Type of casing material
- Length and diameter of casing material
- Elevation of the notched top of the casing, height of notched casing above ground level and name of licensed surveyor
- Borehole depth and diameter
- Detailed lithologic borehole descriptions
- Size of screen slot and statement that the slot size was manufactured rather than field slotted
- Screened interval
- Materials and methods used to fill annulus

- Size and type of filter pack
- Method of installation and date
- Well development procedures and disposal method of development water, drilling fluids, and soils
- Security devices
- Decontamination procedures used on equipment between borings
- Any problems encountered during boring or well installation
- Method of coupling casing sections and screens
- Driller's and/or geologist's complete name(s)

2.4.4 Monitoring Well Development

The following procedure is presented for the proper development of monitoring wells for groundwater sampling purposes.

Monitoring well development will be performed after the surface pad and protective casing are installed.

Equipment and materials used in development will be properly cleaned and decontaminated prior to use as described in the following section. Development shall be accomplished either with a small surface centrifugal pump or a bottom discharge bailer, until the well water is clear and sediment within the well is removed to the fullest extent practical. As a minimum the following steps will be performed:

- Well development will be performed to obtain maximum achievable water clarity. Three to five times the standing water in the well will be removed. The temperature, pH and specific conductivity will be measured after each volume is purged. Sampling will commence after stabilization of the three parameters. However, even if the parameters have not stabilized after purging of five well volumes, sampling will commence and as recommended by EPA, a note will be made in the field logs.

- All water generated during well development will be collected in 55 gallon drums. It is assumed that this material is non-hazardous in nature and will be disposed of on site at a later date. If contaminant levels are above set limits, proper disposal of the water will be documented.

The following data will be recorded on the well completion log contained in Appendix A, or an attachment thereof, as part of development:

- Well designation (ID)
- Date(s) of well installation
- Date(s) and time of well development
- Static water level before and after development
- Physical character of the removed water to include changes during development of clarity, color, and particulates
- Type and size/capacity of pump and/or bailer used.

2.4.5 Water Level Measurements

All water level measurements in each monitoring well will be made from a surveyed measuring point located at the top of well casing. The measuring point will usually be positioned on the north side of the well casing and will be conspicuously marked for ease of measurement. Water level measurements will be made using an electronic probe.

- **Electronic probe**
Using an electronic water level indicator, the technician will lower the probe down the center of the well casing. When the probe enters the water, an alarm will sound. Note the depth to water from the measuring point and record the depth to water in a field log. Repeat the measurement two more times to ensure the reading is accurate. Subtract the average depth to water from the measuring point elevation to find the elevation of the water level in the well to the nearest 0.01 foot.

Water level measurements must be obtained at each sampling point every time water samples are collected. After each water level measurement, the probe will be decontaminated according to the following procedure:

- 1) Wash with laboratory detergent and tap water
- 2) Rinse with tap water
- 3) Rinse with deionized water

Total depth of each well will be determined by physical measurement (i.e., tape) when the well is completed and recorded on the appropriate forms.

2.4.6 Well Purging (Evacuation) Procedures

All wells will be purged using a centrifugal pump with an aluminum intake tube section (for ease of deconning) or teflon well bailers. All purged groundwater will be collected and containerized pending results of the laboratory analyses and determination of disposal options. To help minimize cross contamination, plastic sheeting will be placed around each well during purge events to prevent release of well water to the ground surface.

2.4.6.1 Volume Determination

Prior to purging a well, it will be necessary to determine the volume of water being held in the well casing. The calculation of the well volume will be conducted as follows:

- Measure inside diameter of well casing;
- Measure the static water level (as described above);
- Determine the total depth of the well from the measuring point;
- Calculate the number of linear feet of static water (total depth of well minus the static water level);
- Calculate the volume of water in a 2 inch ID well casing using the equation:

$$V = 0.1632h$$

Where,

V = Volume of water (gallons)

0.1632 = Conversion factor constant for well diameter of 2 inches

h = height of water in well (feet)

2.4.6.2 Placement of Intake Hose

Monitoring wells will be purged from the top of the water column, even if a monitoring well is likely to go dry. This will force water to move up the well casing to the pump. Otherwise, water standing in the well above the screen may not be evacuated.

2.4.6.3 Pumping Rate

The pumping rate used for monitoring well purging will be kept to a minimum. A monitoring well capable of yielding up to 1 gpm will be purged at the rate they are capable of producing. Wells that yield 1 to 5 gpm will be purged at approximately 1 to 2 gpm and wells capable of yielding more than 5 gpm will be purged at approximately 2 to 5 gpm. The flow rate of the pump may be measured using a graduated plastic bucket, graduated cylinder, or a totalizing flow meter.

2.4.6.4 Volume Purged

A minimum of three casing volumes will be removed prior to sample collection from the monitoring well. The removal of three casing volumes should result in the collection of a representative groundwater sample not influenced by the water originally in the monitoring well casing while not overpumping the monitoring well. The latter can result in pulling diluted or more concentrated groundwater from another area within the aquifer into the monitoring well. If the monitoring well goes dry during purging, it will be allowed to recover and then it will be sampled once it recovers.

2.4.6.5 Well Stabilization

In addition to keeping track of the volume of water pumped from a monitoring well, the pH, specific conductivity, and temperature of discharge water will be monitored. A monitoring well will be considered to be sufficiently purged when these three (3) parameters meet the stabilization criterion stated below, provided that a minimum of three casing volumes have been purged (Refer to Section 2.4.4). Temperature will be considered to be stabilized when three consecutive temperature readings are within 1.0°C of one another. When three consecutive pH readings are within 1.0 pH units of one another, pH will be considered stabilized. Conductivity will be considered stabilized when each of three conductivity values are within 1,000 micro-mhos per centimeter (umho/cm) of each other. Temperature, pH, and conductivity values obtained during well purging will be recorded in field notebooks. It should

be noted that after five well volumes have been purged, the well will be considered stabilized regardless of the fluctuations in the above parameters.

2.4.7 Groundwater Sample Collection

Immediately after a monitoring well has been properly purged, it will be sampled, unless the well has a very slow recharge rate, in which case, the monitoring well will be sampled within three hours with a decontaminated teflon/stainless steel bailer. Teflon/stainless steel bailers will be decontaminated between wells and a new nylon line will be attached to avoid cross contamination. A teflon leader will be attached to the bailer and the nylon rope will be attached to the leader. All information will be recorded on a sample collection log form. An example of a sample collection log used by IT for recording well purging and sample collection data during groundwater sample collection is contained in Appendix A.

Water sample collection for volatile organic compounds (VOCs), Appendix IX, Toxicity Characteristic Leaching Procedures (TCLP) and general chemistry parameters will be performed in accordance with the following procedures:

Volatile Organic Compounds

- VOA sample vials will be preserved with concentrated HCl prior to collecting samples to minimize the chance of air bubbles being introduced into the samples.
- Three screw cap vials with teflon lined silicone rubber septa (US EPA approved vials) will be filled to overflowing and sealed without any entrapped air bubbles. These vials will be 40 milliliters or larger.
- A custody seal will be placed on the bottles to ensure sample security prior to arriving at the laboratory.
- Each vial is placed in a secure cooler.
- The samples will not be composited.
- A sample collection log, chain-of-custody form, a laboratory request for analysis form, and a sample label will be filled out in the field. These

forms, except for the sample collection log, will accompany the samples to the laboratory.

- The sample bottles will be placed in a cooler with sufficient packing to prevent breakage during shipment.
- Collected samples will be stored prior to shipping in an ice chest filled with wet ice and maintained at approximately 4°C or stored in an on site dedicated refrigerator at approximately 4°C.
- The cooler will be packed with wet ice to maintain the samples at approximately 4°C during shipment, sealed, and transported to the laboratory. To protect sample container integrity during shipment, the cooler will be packed with vermiculite, and absorbent material.

Acid and Base Neutral Extractable Compounds

- One liter amber glass sample bottles complete with teflon lined caps will be filled to 90 percent capacity and sealed to allow 10 percent headspace to compensate for any pressure and/or temperature changes.
- A custody seal will be placed on the bottles to ensure sample security prior to arriving at the laboratory.
- The sample bottles will be placed in a cooler with sufficient packing to prevent breakage during shipment.
- A sample collection log, a chain-of-custody form, a request for analysis form, and a sample label will be filled out in the field. These forms, except for the sample collection log, will accompany the samples to the laboratory.
- Collected samples will be stored prior to shipping in an ice chest filled with wet ice and maintained at approximately 4°C or stored in an on site dedicated refrigerator at approximately 4°C.
- The cooler will be packed with wet ice to maintain the samples at approximately 4°C during shipment, sealed, and transported to the laboratory. To protect sample container integrity during shipment, the cooler will be packed with vermiculite, and absorbent material.

Metals

- Samples will be placed in a one liter polyethylene or glass bottle.
- Bottles will be filled to within about 10 mls of capacity.
- Samples will be preserved to pH <2 using HNO₃.
- Sample containers will be sealed.
- A custody seal will be placed on the bottles to ensure sample security prior to arriving at the laboratory.
- Samples will be placed in a cooler with sufficient packing to prevent breakage.
- Samples will be stored on wet ice until packing for shipment to the laboratory or stored in an on site dedicated refrigerator at approximately 4°C. To protect sample container integrity during shipment, the cooler will be packed with vermiculite, and absorbent material.

General Chemistry Parameters

- Sample bottles will be either polyethylene or glass and will contain the appropriate chemical preservatives. Sample bottle closures will be plastic with polyethylene liners.
- Preservatives will be added to the sample containers after the sample has been collected to ensure that enough preservative has been added to adjust for the proper pH (only VOA vials will be preserved prior to collecting the sample). Electronic pH meters with automatic temperature compensation (ATC) will be used. In the field, the meter will be calibrated daily before use with two buffers bracketing the expected sample pH.
- Sample bottles will be filled to capacity and sealed.
- Custody seal will be placed on the bottles to ensure sample security prior to arriving at the laboratory.
- The sample bottles will be placed in a cooler with sufficient packing to prevent breakage during shipment.

- Collected samples will be stored prior to shipping in an ice chest filled with wet ice and maintained at approximately 4°C or stored in an on site dedicated refrigerator at approximately 4°C.
- A sample collection log, a chain-of-custody form, a request for analysis form, and a sample label will be filled out in the field. These forms, except for the sample collection log, will accompany the sample to the laboratory.

Sample integrity can be further enhanced through a few general sampling precautions. The precautions are:

- Samples will be collected in order from least contaminated to most contaminated, when known. Anticipated or known direction of groundwater flow will be used to determine sampling order when no chemical data are available. Areas upgradient from a contaminant source areas will be sampled first and sampling will then proceed from areas furthest downgradient, working toward the source areas.
- When sampling monitoring wells, wells will be purged to ensure representative sampling of groundwater in the saturated zone.
- Surgical style or Nitrile gloves will always be worn during and changed between each sample collection and sample handling will be kept to a minimum.
- Samples, preservatives and sample containers will be handled carefully to minimize exposure time and potential for evaporative loss and/or airborne contamination.
- Upon completion of a round of sampling for a site, all sampling equipment will be scrubbed with tap water and laboratory grade soap and rinsed thoroughly with tap water, rinsed with deionized water and rinsed twice with a pesticide grade isopropanol and then with organic free water. The equipment will then be allowed to air dry for a period of time.
- Samples will be delivered to the analyzing laboratory as soon as possible following sample collection typically overnight express and/or laboratory pickup at the NAS-Key West facility.

2.4.8 Surface Water Sampling

Surface water will be collected from the surface ditches on site and/or where the ditches go off site. Surface water samples can only be collected if water is present during the sampling event at those chosen locations. Surface water samples will be collected at the same time as sediment samples, if both media are to be sampled at a specified location. Water samples will be collected by placing the bottles directly into the water. If there is a flow of water, the sampler will collect the downstream samples first and work upstream to prevent downstream samples from becoming contaminated before being collected. The sampling procedures listed below will be followed.

Volatile Organic Compounds

- VOA sample vials will be preserved with concentrated HCL prior to collecting samples to minimize the chance of air bubbles being introduced into the samples.
- Three screw cap vials with teflon lined silicone rubber septa (US EPA approved vials) will be filled to overflowing and sealed without any entrapped air bubbles. These vials will be 40 milliliters or larger.
- A custody seal will be placed on the bottles to ensure sample security prior to arriving at the laboratory.
- Each vial is placed in a cooler.
- The samples will not be composited.
- A sample collection log, chain-of-custody form, a laboratory request for analysis form, and a sample label will be filled out in the field. These forms, except for the sample collection log, will accompany the samples to the laboratory.
- The sample bottles will be placed in a cooler with sufficient packing to prevent breakage during shipment.
- The cooler will be packed with wet ice to maintain the samples at 4°C during shipment, sealed, and transported to the laboratory.

Metals

- Samples will be placed in a one liter polyethylene or glass bottle.
- Bottles will be filled to within about 10 mls of capacity.
- Samples will be preserved to pH <2 using HNO₃.
- Sample containers will be sealed.
- A custody seal will be placed on the bottles to ensure sample security prior to arriving at the laboratory.
- Samples will be placed in a cooler with sufficient packing to prevent breakage.
- Samples will be stored on wet ice or in a refrigerator until packing for shipment to the laboratory.

General Chemistry Parameters

- Sample bottles will be either polyethylene or glass. Sample bottle closures will be plastic with polyethylene liners.
- Preservatives will be added to the sample containers after the sample has been collected to ensure that enough preservative has been added to adjust for the proper pH. (Only VOA vials will be preserved prior to collecting the sample).
- Sample bottles will be filled to capacity and sealed.
- A custody seal will be placed on the bottles to ensure sample security prior to arriving at the laboratory.
- The sample bottles will be placed in a cooler with sufficient packing to prevent breakage during shipment.
- Collected samples will be stored prior to shipping in an ice chest filled with wet ice and maintained at approximately 4°C or stored in an on site dedicated refrigerator at approximately 4°C.

- A sample collection log, a chain-of-custody form, a request for analysis form, and a sample label will be filled out in the field. These forms, except for the sample collection log, will accompany the sample to the laboratory.

2.4.9 Ambient Air Monitoring

Air monitoring will be performed using an OVA at the drilling locations. Results of air monitoring will be used as described in the HSP. Calibration procedures are outlined in Section 2.2 of this document.

Ambient air samples will be taken both at ground level and approximately five (5) feet above ground level at the site using the OVA. The samples taken five (5) feet above ground level corresponds to a "breathing zone" sample. Results of these analyses will be used to determine the required level of protection for field personnel.

2.4.10 Procedure for Decontamination of Drilling and Sampling Equipment

Normally, any portion of the drill rig that is over the borehole (Kelly bar, mast, backhoe buckets, drilling platform, hoist, or chain pulldowns and/or cathead, etc.) must be steam cleaned and scrubbed with laboratory grade detergent before being brought on site to remove all rust, soil, and other material which may have come from other sites and contaminate the well. All equipment will be decontaminated prior to site entry according to the procedure specified in this section. Any equipment that is extremely rusted will not be accepted at the site and will be returned to the contractor for rust removal using sand blasting or replacement. The drill rig will then be inspected to ensure that all oil, grease, hydraulic fluid, etc. has been removed from the exterior of the rig and all seals and gaskets are intact with no major areas/seals leaking fluids. Steam cleaning of the drilling equipment will be performed prior to drilling each borehole. In addition, all downhole drilling, sampling, and associated equipment that will come into contact with the downhole equipment and sample medium shall be decontaminated by the following steps:

- Step 1 Clean with tap water and laboratory grade detergent, using a brush, if necessary, to remove particulate matter and surface films. Steam cleaning may be necessary to remove matter that is difficult to remove with the brush.
- Step 2 Rinse thoroughly with tap water.

- Step 3 Rinse with organic free water.
- Step 4 Rinse twice with solvent (pesticide grade isopropanol). Any equipment containing plastic (i.e., water level indicators) will not require a solvent rinse.
- Step 5 Rinse thoroughly with organic free water and allow to air dry. Decontamination liquids will be applied by EPA approved methods.
- Step 6 Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported. Clean plastic can be used to wrap augers, drill stems, casing, etc. following air drying, if they are going to be stored for a period of time.

Decontamination of all drilling equipment will occur at specified locations at NAS-Key West. The specified area will be lined with heavy duty visqueen. All drill rod, auger flights, well screen/casing, etc., will be placed on sawhorses for proper cleaning procedures in this area also. Runoff will gravity flow into a catchment sump. This will allow the rinse waters to be contained for proper treatment. Residual soils will be washed into the sump for collection, and collected in separate containers, followed by proper disposal at a later time.

2.5 Sample Analysis

The analytical method for each sample bottle will be identified on the sample label and the request for analysis forms. The analytical methods for each site are identified in the NAS-Key West RFI Work Plans.

2.6 Data Reduction, Validation, and Reporting

The following procedures summarize the practices routinely used by an environmental/engineering group for data reduction, validation, and reporting. Numerical analyses, including manual calculations, mapping, and computer modeling will be documented and subjected to quality control review. Records of numerical analyses will be legible and complete enough to permit reconstruction of the work by a qualified individual other than the originator, as described in the following subsections.

2.6.1 Analytical Laboratory Data

As referenced earlier, ITAS Knoxville will be responsible for all analytical laboratory data. In addition, ITAS Knoxville will control analytical data according to:

- Review of data processing
- Review of data reporting
- Data validation
- Data reporting
- Laboratory quality control checks

2.6.2 Field Data Reduction

According to IT's CompQAPP, Section 12.1, Data Reduction; field data are often presented in table form or as part of figures or drawings. These are prepared by project personnel (originator) appointed by the project manager. Field measurements which do not require data reduction include pH, temperature, conductivity, and salinity. there is not correction factor to the above direct readings for temperature (pH, temperature, conductivity, and salinity. There is no correction factor to the above direct readings for temperature (pH, conductivity, salinity, etc.) or other reasons (i.e., conductivity cell constant = 1). The data presented in the tables, figures, or drawings is transcribed directly from the filed data forms and validated. The individuals that enter raw data onto computer/file forms are identified during transfer.

Data reduction for screening organic analysis by gas chromatograph (SRI 8610) is only necessary if the analysis does not include a dilution factor value or sample volume/weight in the calculation program. Otherwise a calculation will be required to account for these values to obtain final concentration values.

$$\text{ppb (ng/g) or (ng/ml)} = \frac{\text{found ng of compound}}{\text{sample weight (g) or volume (ml)}} \times \frac{\text{sample aliquot (ml)}}{\text{total dilution volume (ml)}}$$

The found ng of compound is derived automatically from individual compound calibration curves based on ng injected versus area response store in GC software once generated.

2.6.3 Field Data Validation

Field data generated in accordance with the NAS-Key West RFI project specific work plan will primarily consist of field temperature, pH, and specific conductance data, and data associated with soil boring advancement, monitoring well installation and development, and soil classification. These data will be validated by review of the project documentation to check that all forms specified in the field sampling plan have been completely and correctly filled out and that documentation exists for the required instrument calibration. This documentation will be considered sufficient to ensure that proper procedures have been followed during the field investigation.

2.7 Field Quality Control Samples

This section discusses samples taken by IT field personnel that are routinely added to the normal laboratory sample stream to demonstrate that IT field personnel are operating within prescribed requirements for accuracy and precision.

Table 2-3 summarizes the quality control samples that relate to field activities. Included in this table are:

- Type of sample
- Purpose of the sample
- Frequency with which the sample is to be analyzed within the normal sample stream
- Applicability of the sample to organic or inorganic analyses.

2.8 Performance and Systems Audits and Frequency

A planned and documented performance and systems audit will be conducted to verify compliance with IT and specific project QA/QC program requirements. These audits will consist, as appropriate, of an evaluation of QA/QC procedures, the effectiveness of the QA/QC implementation, and evaluation of work areas and activities, and a review of the project documentation.

**FIGURE 2-1
FIELD PERFORMANCE AUDIT CHECKLIST**

Field Investigation Audit		
Project No.:		Date:
Project Location:		Signature:
Team Members:		
Yes	No	1. Has a project manager been appointed? Comments:
Yes	No	2. Was a project plan prepared? Comments:
Yes	No	3. Was a briefing held for project participants? Comments:
Yes	No	4. Were additional instructions given to project participants during the course of the project? Comments:
Yes	No	5. Is there a written list of sampling locations and descriptions? Comments:
Yes	No	6. Is there a list of accountable field documents checked out to the project manager? Comments:
Yes	No	7. Are samples collected as stated in the Field Sampling Plan (FSP) or as directed by the field operations coordinator (FOC)? Comments:

Yes	No	8. Are samples collected in the type of containers specified in the FSP or as directed by the FOC? Comments:
Yes	No	9. Are samples preserved as specified in the FSP or as directed by the FOC? Comments:
Yes	No	10. Are the number, frequency, and type of samples collected as specified in the FSP or as directed by the FOC? Comments:
Yes	No	11. Are the number, frequency, and type of measurements and observations taken as specified in the FSP or as directed by the FOC? Comments:
Yes	No	12. Are samples identified with sample labels? Comments:
Yes	No	13. Are blank and duplicate samples properly identified? Comments:
Yes	No	14. Are sample and serial numbers for samples split with other organizations recorded in a log book or on a chain-of-custody record? Comments:
Yes	No	15. Are samples listed on a chain-of-custody record? Comments:
Yes	No	16. Is a chain-of-custody documented and maintained? Comments:

Yes	No	17. Are quality assurance checks performed as directed? Comments:
Yes	No	18. Have any accountable documents been lost? Comments:
Yes	No	19. Have any accountable documents been voided? Comments:
Yes	No	20. Have any accountable documents been disposed of? Comments:
Yes	No	21. Are work zones set up in an efficient manner? Comments:
Yes	No	22. Is the schedule being adhered to? Comments:
Yes	No	23. Have unexpected/unplanned events occurred? Comments:
Yes	No	24. Are the RFI Work Plans being modified by site conditions? Comments:
Yes	No	25. Are change orders being properly tracked? Comments:

**TABLE 2-3
FIELD QUALITY CONTROL SAMPLES
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 1 of 2)**

TYPE	PURPOSE OF SAMPLE	FREQUENCY	APPLICABILITY		ACCURACY AND PRECISION APPLICATION	INTRODUCED BY FIELD SAMPLER ANALYST/QC COORDINATOR
			INORGANIC	ORGANIC		
Trip Blank	40-ml VOA vial filled with organic free water and taken with field sample collection kit. Used to verify that contamination of soil/water VOA samples has not occurred due to shipment and sample containers being in field.	Each VOA cooler returned to the lab should contain one trip blanks (minimum 5% of total water/soil samples)		X	Accuracy	Supplier of Containers
Field Blank	A volume of "clean" water is placed into a container for analysis to verify absence of field contamination.	Once per week.	X	X	Accuracy	Field Sampler

TABLE 2-3
FIELD QUALITY CONTROL SAMPLES
NAS-Key West
Key West, Florida
IT Project No. 595392
(Page 2 of 2)

TYPE	PURPOSE OF SAMPLE	FREQUENCY	APPLICABILITY		ACCURACY AND PRECISION APPLICATION	INTRODUCED BY FIELD SAMPLER ANALYST/QC COORDINATOR
			INORGANIC	ORGANIC		
Equipment Rinsate	Rinse of field sample collection equipment to verify cleanliness, eliminate carryover of contamination to later samples	Once a week per each sampling media.	X	X	Accuracy	Field Sampler
Duplicate	Collected sample that has been split into two or more parts in the field, sent the same laboratory for analysis.	5 percent of total number of samples	X	X	Precision	Field Sampler

The audits will cover both field investigations and report preparation. The audits will be conducted by the Project Director or his designee.

2.8.1 Performance Audits

An audit will be performed to review and evaluate the adequacy of all field performance, and to ascertain whether the SAP is being completely and uniformly implemented. Two performance audits will be conducted during the project. The initial audit will be performed to verify that the proper procedures are being used and documented. A follow-up audit will be performed near the end of the project to verify the continued use of the same procedures and to establish consistency. These audits will also assess the effectiveness of the QA Program, identify non-conformances, and verify that identified deficiencies are corrected. The audits will evaluate:

- Project responsibilities
- Sample custody procedures
- Document control
- Sample identification system
- QC corrective action procedures.

Figure 2-1 lists example audit questions for field performance audits. These will be used as guides for the construction of an complete audit checklist.

Audits will involve on site visits by the Project Director. Items to be examined will, as appropriate, include the availability and implementation of approved work procedures; sampling procedures; sampling documentation; field instrument calibration; labeling, packaging, storage, shipment, receipt of samples; performance documentation and checking; non-conformance and documentation; use of QC samples; and QA reporting.

The Project Director (PD) responsible for such audits will direct their performance according to a schedule planned to coincide with appropriate activities on the project schedule and sampling plans. The PD will be notified prior to beginning work so that a field operations audit can be scheduled in the early stages of on-site activity. During an audit and upon its completion, the auditor(s) will discuss the findings with the individuals audited and discuss and agree on corrective actions to be initiated.

Scheduled audits may be supplemented by additional audits for one or more of the following reasons:

- When significant changes are made in the SAP
- When it is necessary to verify that corrective action has been taken on a non-conformance reported in a previous audit
- When requested by the Project Manager.

In addition to audits, surveillance (detailed examination of specific parts of a QA Program) of selected activities may be performed as part of routine IT policies.

2.8.2 System Audit

A system audit shall be conducted by the PD or his designee. This audit reviews the operation of reporting programs and resulting documentation, including all items that establish and verify the quality of work. The audit will examine, as appropriate:

- The documentation and verification of field data and results
- Performance, documentation, and verification of data
- Preparation and verification of drawings, logs, and tables
- Content, consistency, and conclusions of the final report
- Compliance with IT and project requirements
- Maintenance and filing of project records.

The maintenance and control of project records will be reviewed as part of the systems audit. The primary concern is that project materials, such as correspondence, memorandums, telexes, field and laboratory data, computer output, calculations, drawings, checkprints, and reports are properly maintained in the record filing systems. Records will be examined to verify that they are identified and maintained in a controlled manner to provide retrievability during and after the project. Completeness and traceability of documentation will be inspected by following selected samples throughout the sampling process. The system or evidence audit will be conducted during the project.

2.8.3 Audit Reports

The PD is responsible for scheduling and performing audits. He or his designated lead auditor will be responsible for assembling an audit team (which may include technical specialists) and training them. Based on the audit plan prepared by QA personnel, detailed checklists of questions will be developed. These checklists will be applied during the audits and will be supplemented by auditor observations. At the close of auditing activities, the auditor(s) will meet with management (field) to discuss the audit findings. Non-conformances, deficiencies, and problems will be described and corrective actions discussed. If actions can be taken immediately, these will be documented in the audit report.

Within 20 working days of completion of an audit, the PD and/or his representative will prepare and submit an audit report to the PD, and copies will be sent to the organization or group audited. Within 30 working days after receipt of the audit report, the Project Manager will prepare and submit to the PD a reply to the audit. This reply will include, as a minimum, a plan for implementing the corrective actions to be taken on non-conformances indicated in the audit report, the dates by which such corrective actions will be completed, and the actions taken to prevent recurrence. If the corrective action has been completed, supporting documentation will be attached to the reply. The PD will ascertain (by re-audit or other means) whether appropriate and timely corrective action has been taken. After verification of corrective actions, the PD will issue a closure statement stating that all corrective actions have been completed and the audit closed.

Records of audits will be maintained in the project files. Audit files will include, as a minimum, the audit report, the reply to the audit, and any supporting documents.

2.9 Preventive Maintenance

Periodic preventive maintenance is required for equipment whose performance can affect results. Instrument manuals are kept on file for reference if equipment needs repair. Troubleshooting sections of manuals are often useful in assisting personnel in performing maintenance tasks.

Any equipment that requires routine maintenance will be included in the field routine preventive maintenance program. Appropriate and sufficient replacement parts or backup

equipment will be available so that sampling and monitoring tasks are not substantially impeded or delayed by failure or breakage.

2.9.1 Sampling and Analytical Equipment

Depending on the media involved and the intended purpose, a wide variety of equipment is available for sampling activities. Because of the reliance placed on such equipment to assist in evaluating the appropriate level of protection and because of the use of environmental measurements to support enforcement cases, all sampling equipment (whether electronic, mechanical, chemical or otherwise) will be maintained at its proper functional status.

Sampling equipment for air, groundwater, surface water, soils, and sediments will be maintained to manufacturer's specifications and in operational condition. Routine preventive maintenance as well as maintenance required by inspections and checkout will be conducted to verify proper operation of the various pieces of equipment. The objective of the preventive maintenance program for sampling equipment is to avoid generating spurious environmental measurements that could endanger site personnel or lead to inappropriate remedial responses.

2.9.2 Support Equipment

Support equipment includes items such as safety devices, storage and/or transportation containers, wind indicators, cameras, and vehicles that may be required for completing an environmental monitoring or measurement task. Support equipment will be periodically inspected to maintain the performance standards necessary for proper and efficient execution of all tasks and responsibilities.

2.10 QA Reports to Management

2.10.1 Project Specific QA Reports to Management

After field work has been completed and checked, a final quality assurance report will be prepared for project management. The report will summarize quality assurance and audit information, indicating any corrective actions taken, and an assessment of the overall effectiveness of the SAP.

The final report will include:

- QA management
- Measures of data quality from the project
- Significant quality problems, quality accomplishments, and status of corrective actions taken
- Results of QA performance audits
- Results of QA system audits
- Assessment of data quality in terms of precision, accuracy, completeness, representativeness, and comparability
- QA related training during the course of the project.

3.0 Sample Analysis

3.1 Sample Custody

3.1.1 Chain-of-Custody

An overriding consideration for environmental measurement data is the ability to demonstrate that samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal must be documented to accomplish this. Documentation is accomplished through a chain-of-custody form that records each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's actual possession
- In view after being in physical possession
- Sealed so that no one can tamper with it after having been in physical custody
- In a secured area, restricted to authorized personnel.

Figure 3.1-1 is the Analysis Request and Chain-of-Custody Record to be used by field personnel in collecting and shipping samples. An ITAS laboratory shall not accept samples for analysis without a correctly prepared Analysis Request and Chain-of-Custody Record.

The Analysis Request and Chain-of-Custody Record shall be signed by each individual who has the samples in his/her possession. Preparation of the Analysis Request and Chain-of-Custody Record shall be as follows:

- The Analysis Request and Chain-of-Custody Record shall be initiated in the field by the person collecting the sample, for every sample. Every sample shall be assigned a unique identification number that is entered on the chain-of-custody form, and the testing program shall be defined for the collected samples. Samples can be grouped for shipment using a single form.

FIGURE 3.1-1



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 326701
Page 1 of ____

Project Name/No. ¹
Sample Team Members ²
Profit Center No. ³
Project Manager ⁴
Purchase Order No. ⁶
Required Report Date ¹¹

Samples Shipment Date ⁷
Lab Destination ⁸
Lab Contact ⁹
Project Contact/Phone ¹²
Carrier/Waybill No. ¹³

Bill to: ⁵
Report to: ¹⁰

ONE CONTAINER PER LINE

Sample Number ¹⁴	Sample Description/Type ¹⁵	Date/Time Collected ¹⁶	Container Type ¹⁷	Sample Volume ¹⁸	Pre-servative ¹⁹	Requested Testing Program ²⁰	Condition on Receipt ²¹	Disposal Record No. ²²

Special Instructions: ²³

Possible Hazard Identification: ²⁴ Non-hazard Flammable Skin Irritant Poison B Unknown Sample Disposal: ²⁵ Return to Client Disposal by Lab Archive (mos.)

Turnaround Time Required: ²⁶ Normal Rush QC Level: ²⁷ I. II. III. Project Specific (specify):

1. Relinquished by ²⁸ (Signature/Affiliation)	Date: Time:	1. Received by ²⁸ (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: ²⁹

Write: To accompany samples
Yellow: Field copy
* See back of form for special instructions.

Figure 3.1-1
ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

- The form in Figure 3.1-1 allows for eight samples. If more than eight samples are shipped in the same cooler, more than one Analysis Request and Chain-of-Custody Record is required.
- The record shall be completed in the field to indicate project, sampling team, etc.
- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By _____, Received By _____ shall be completed in the field.
- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record form as Relinquished By _____.
- If the samples are shipped to the laboratory by commercial carrier, the original Analysis Request and Chain-of-Custody Record shall be sealed in a watertight container, placed in the shipping container, and the shipping container sealed prior to being given to the carrier. The carbonless copy of the Analysis Request and Chain-of-Custody Record is sent to the field file.
- For samples shipped by commercial carrier, the waybill shall serve as an extension of the Analysis Request and Chain-of-Custody Record between the final field custodian and receipt in the laboratory.
- If the samples are directly transported to the laboratory, the Analysis Request and Chain-of-Custody Record shall be kept in possession of the person delivering the samples.
- Upon receipt in the laboratory, the sample custodian shall open the shipping containers, compare the contents with the Analysis Request and Chain-of-Custody Record, and sign and date the record. Any discrepancies shall be noted on the Analysis Request and Chain-of-custody Record.
- If discrepancies occur, the samples in question shall be segregated from normal sample storage and the field personnel immediately notified.
- Analysis Request and Chain-of-custody Records shall be maintained with the records for a specific project.

3.1.2 Documentation of Sample Custody

In addition to the Analysis Request and Chain-of-custody Record, several types of records and supporting documentation are used to trace samples and containers from point of origin to final disposition.

- Certificates of Analysis for vendor cleaned sample containers are the vendor's certification of the cleaning procedures used and analyses performed on a specific lot of sample containers. See Figure 3.1-2.
- Request for Sample Containers forms are initiated by sales personnel or project managers upon client request for sample containers. The bottle order is filled by sample receipt personnel, and the request for sample containers form is used to initiate the chain-of-custody. See Figure 3.1-3.
- Sample labels or identification tags are used by field personnel to uniquely identify each sample. An example of a standard label is illustrated in Figure 3.1-4.
- Laboratory sample receipt log is used to document the receipt of a shipment of samples, the condition of samples upon receipt, the required testing program, the requested turnaround time, and the laboratory storage location. See Figure 3.1-5.
- QC sample tracking forms are initiated either in the sample receipt department or in the sample preparation groups to trace samples to their associated QC samples. See Figure 3.1-6.
- Internal chain-of-custody records are initiated upon client request by sample receipt personnel and are used to document legal chain-of-custody of samples within the laboratory. See Figure 3.1-7.
- Sample extraction/digestion worksheets are used to record any procedures performed in the preparation of samples for instrumental analyses. Figure 3.1-8 is an example of a worksheet used for digestion of samples prior to metals analyses.
- Instrument run logs are used to document analyses performed. At a minimum, the instrument identification, lab sample numbers, analyst initials, and date/time analyzed are recorded. See Figure 3.1-9 for an example run log for semivolatiles analysis.

MTAS-K-CPO01R3

Lab Job # _____
and
Lab PC # _____
or
Client PO # _____

IT ANALYTICAL SERVICES

REQUEST FOR SAMPLE CONTAINERS, CHEMICALS
OR FIELD SUPPLIES

CLIENT: _____

DATE ISSUED: _____

CONTACT: _____

ISSUED BY: _____

PROJECT CODE: _____

ATTACH TO
QUOTATION NO.: _____

SHIP TO: _____

PAYMENT:
_____ Included in Analysis Price
_____ Bill with Analytical work
 @ \$ _____
_____ Bill Separately
 @ \$ _____
_____ No Charge
_____ Charge Prep Time
 _____ Hours @ \$ _____
_____ Bill Shipping

SHIP ORDER BY (Date): _____

SHIP VIA:
_____ US MAIL _____ UPS _____ FEDERAL EXPRESS
_____ OTHER (Specify) _____ AIRBORNE

LABEL REQUIREMENTS:
_____ Label with Sample Tape
_____ Label with Type of Analysis
_____ Blank Labels
_____ No Labels
_____ Special Labels (Specify)

AIR BILL NUMBER: _____

CLIENT PICK UP:

ON _____ (Date) AT _____ (Time)

ITEMS TO BE SHIPPED (Include Quantity): _____

CHARGEABLE TIME (Include with Persons doing Prep): _____

DATE SHIPPED: _____

UPS/US MAIL FEE: _____

Order Completed By: _____
(Date, Time, Signature, Company)

Order Received By: _____
(Date, Time, Signature, Company)

**FIGURE 3.1-2
REQUEST FOR SAMPLE CONTAINERS,
CHEMICALS, OR FIELD SUPPLIES**

Certificate of Analysis

Bottle Type & QA Level: G Level 1

Description : 120 mL. Clear U.M.

Lot No.: G0030020

Date: 2-6-90

METALS QUALITY CONTROL ANALYSIS

This is to certify that this lot was tested and found to comply with Eagle-Picher Environmental Services specifications for this product.

<u>Compound Analyzed</u>	<u>Quantity Found (ug/L)</u>
Silver	< 10
Aluminum	<100
Arsenic	< 0.5
Barium	< 20
Beryllium	< 0.5
Calcium	<100
Cadmium	< 1
Cobalt	< 10
Chromium	< 10
Copper	< 10
Iron	<100
Mercury	< 0.2
Potassium	<100
Magnesium	<100
Manganese	< 10
Sodium (Glass)	<100
Nickel	< 20
Lead	< 2
Antimony	< 5
Selenium	< 2
Thallium	< 10
Vanadium	< 10
Zinc	< 20
Fluoride	<200
Nitrate + Nitrite	<100

Approved: *Jul Brights*

Date: 2-6-90



EAGLE EP PICHER
ENVIRONMENTAL SERVICES

36 B. J. TUNNELL BLVD. EAST • MIAMI, OKLAHOMA 74354-3300 • (800) 331-7425

FIGURE 3.1-3
CERTIFICATE OF ANALYSIS FOR
VENDOR-CLEANED SAMPLE BOTTLES

EAGLE  Picher ENVIRONMENTAL SERVICES 28 S.J. TUNNELL BLVD. EAST-MAINE, OH 42824-3200 1-800-331-7425		Specially Cleaned Sample Container <hr/> LOT NO.: _____
DATE	TIME	COLLECTED BY
SAMPLING SITE		
<input type="checkbox"/> Grab <input type="checkbox"/> Composite <input type="checkbox"/> Other _____		
TESTS REQUIRED		PRESERVATIVE

Figure 3.1-4
 EXAMPLE SAMPLE LABEL



ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document N 376758
Page 1 of ____

Project Name/No. ¹ _____ Samples Shipment Date ⁷ _____
 Sample Team Members ² _____ Lab Destination ⁸ _____
 Profit Center No. ³ _____ Lab Contact ⁹ _____
 Project Manager ⁴ _____ Project Contact/Phone ¹² _____
 Purchase Order No. ⁶ _____ Carrier/Waybill No. ¹³ _____
 Required Report Date ¹¹ _____

Bill to: ⁵ _____
 Report to: ¹⁰ _____

ONE CONTAINER PER LINE

Sample ¹⁴ Number	Sample ¹⁵ Description/Type	Date/Time ¹⁶ Collected	Container ¹⁷ Type	Sample ¹⁸ Volume	Pre- servative ¹⁹	Requested Testing ²⁰ Program	Condition on ²¹ Receipt	Disposal ²² Record No.

Special Instructions: ²³

Possible Hazard Identification: ²⁴
 Non-hazard Flammable Skin Irritant Poison B Unknown Sample Disposal: ²⁵
 Return to Client Disposal by Lab Archive (mos.)

Turnaround Time Required: ²⁶
 Normal Rush QC Level: ²⁷
 I. II. III. Project Specific (specify): _____

1. Relinquished by ²⁸ (Signature/Affiliation)	Date: _____ Time: _____	1. Received by ²⁸ (Signature/Affiliation)	Date: _____ Time: _____
2. Relinquished by (Signature/Affiliation)	Date: _____ Time: _____	2. Received by (Signature/Affiliation)	Date: _____ Time: _____
3. Relinquished by (Signature/Affiliation)	Date: _____ Time: _____	3. Received by (Signature/Affiliation)	Date: _____ Time: _____

Comments: ²⁹

White: To accompany samples

Yellow: Field copy

* See back of form for special instructions.

IT ANALYTICAL SERVICES
QC SAMPLE INITIATION FORM
CODING

Contract No: _____ Original Sample: _____
Matrix: _____ Matrix Spike: _____
Parameters: _____ Matrix Spike Dup: _____
Project Code: _____ Date Initiated: _____
SDG #: _____ Date Completed: _____
(Metals Only)

Project Code	Sample ID	QC Samples
1) _____	_____	_____
2) _____	_____	_____
3) _____	_____	_____
4) _____	_____	_____
5) _____	_____	_____
6) _____	_____	_____
7) _____	_____	_____
8) _____	_____	_____
9) _____	_____	_____
10) _____	_____	_____
11) _____	_____	_____
12) _____	_____	_____
13) _____	_____	_____
14) _____	_____	_____
15) _____	_____	_____
16) _____	_____	_____
17) _____	_____	_____
18) _____	_____	_____
19) _____	_____	_____
20) _____	_____	_____

FIGURE 3.1-7
QC SAMPLE INITIATION FORM

- Raw data, calibration data, and associated QC data provide documentation for the analysis of samples.
- Final reports document the results of sample analyses. Refer to section 3.2.5 for examples of final reports.
- Final sample disposition is documented on the laboratory sample receipt log upon disposal or on a chain-of-custody form when samples are returned to a client.

3.1.3 Responsibility for Sample Custody

The following is a brief discussion of key laboratory positions and their responsibilities as they relate to sample custody.

Sample Custodian

- Provides vendor cleaned sample containers to clients and initiates chain-of-custody.
- Receives samples, documents condition upon receipt, reviews associated paperwork, and logs-in samples to initiate testing program.
- Provides for proper storage of samples.
- May assign QC samples to a batch of samples.
- Initiates internal chain-of-custody records.
- Transfers samples to other laboratories for analysis, when required.
- Returns samples to clients for final disposition, or initiates sample disposal process.

Project Manager

- Assists sample custodian in defining the testing program.
- Reviews project file to assure that the testing program was properly defined and that sample log-in procedures were adhered to.

PROJECT (P) = pass (F) = fail

Continued From Page

Project	Date	Time	Pilemark	EPS	Delta	Remarks
STP	11/30/90	1054	BL2030(P)	555000	-	
STP	11/30/90	1110	(S) BL2030(F)	555000	-	
SKO	11/30/90	1217	BL21130	5550160	-	
SKO	11/30/90	1311	BL21130	5550030	-	
SKO	11/30/90	1401	BL21130	5550090	-	
SKO	11/30/90	1451	BL21130	5550130	-	
SKO	11/30/90	1613	(T) BL21130(P)	5550050	-	
STP	11/30/90	1708	(T) BL21130	5550000	-	
INT 47051	11/30/90	1815	BL2031	5550000	(1)	
	11/30/90	1855	PP1398E	1092070E		
	11/30/90	1942	PP1398E	1092070E		
	11/30/90	2025	PP1400E	1092070E		
INT 47232	11/30/90	2109	PP316B	109207		
(REV 30395)	11/30/90	2152	PP316A	1092070E		
	11/30/90	2235	PP3170	1092070E		
INT 47144	11/30/90	2318	PP2346	115407		
(REV 30409)	11/30/90	0002	PP2347	115412		
	11/30/90	0045	PP2348	115507		
	11/30/90	0129	PP2349	115507		
	11/30/90	0212	PP2350	115511		
INT 47143	11/30/90	0256	BL2031	555000		
(REV 30406)	11/30/90	0339	PP2350	555000		

11/30/90

[Signature]

ITAS-KNOXVILLE
GC/MS
SEMIOVA RUN LOG-1500

Continued on Page

Read and Understood By

[Signature] _____ Date 11/30/90 _____ Signed _____ Date _____

FIGURE 3.1-9
 EXAMPLE INSTRUMENT RUN LOG

Group Supervisors

- Review request for analysis forms and clients instructions to assure that the sample custodian interpreted the testing program correctly.
- Assign analyses based on holding times and requested turnaround times.
- Train employees in the proper use of internal chain-of-custody procedures.
- Assure that internal chain-of-custody is not broken.
- Assure that samples are tracked with QC samples at the proper frequency.

Analysts

- Perform analyses to assure that holding times are met.
- Maintain custody of samples with proper documentation.
- Return samples/extracts/digestates to proper storage areas after use.

3.1.4 Laboratory Custody Procedures

3.1.4.1 Laboratory Sample Receipt and Log-in

The first step in the laboratory receipt of samples is to verify the integrity of the sample shipment and to complete the sample receipt log presented in Figure 3.1-6. The sample custodian shall note that the shipment has been accepted and notify the project manager that samples have been received.

Upon sample receipt, the sample custodian shall:

- Examine samples and determine if proper temperature has been maintained during shipment. The receiving temperature will be recorded on the sample receipt log.
- Examine samples for damage that may have occurred during shipment, such as broken bottles, leaking or distended containers, inverted septa, or broken custody seals. If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they were affected. It will be noted on the Analysis Request and Chain-of-custody Record that specific samples were damaged and that the samples

were removed from the sampling program. Field personnel will be notified as soon as possible so that samples can be recollected, or the testing program changed. Sample receipt condition is noted on the Analysis Request and Chain-of-custody Record.

- Compare samples received against those listed on the Analysis Request and Chain-of-custody Record.
- Verify that sample holding times have not been exceeded.
- If any problems exist with sample receipt condition or accompanying paperwork, fill out a nonconformance memorandum (see Figure 3.8-1).
- Sign and date the Analysis Request and Chain-of-custody Record and attach the waybill to it.
- Assign a unique laboratory number to each sample using labelled tape.
- Assign a unique project code to the shipment of samples. The project code is alphanumeric and consists of a three or four letter prefix which identifies the client, followed by a unique, sequential, five digit number.
- Enter the samples on the laboratory sample receipt log and in the laboratory information management system with the following information:
 - Project code
 - Sample numbers, including laboratory numbers and field identifications
 - Sample collection date
 - Type of samples
 - Requested analyses and any special instructions
 - Date received in laboratory
 - Requested turnaround time
 - Sample storage location

- Date of disposal (entered after project is complete).
- Initiate internal chain-of-custody records.
- Initiate QC sample tracking if client requested project-specific QC results.
- Prepare a project folder which contains all records submitted by the client and the forms prepared upon sample receipt. Refer to Figure 3.1-10 for a project file index. The sample custodian shall initial and date the project file prior to submission to the project manager for review.
- Notify the project manager and group supervisors of sample arrival. Submit copies of the information contained in the project file to the group supervisors for initiation of the testing program.

3.1.4.2 Initiation of Testing Program

If the analytical program is not defined on the Analysis Request and Chain-of-custody Record submitted with the sample shipment, the sample custodian shall immediately notify the project manager for definition of the analysis program; if necessary, the project manager shall contact the client to determine the testing program.

Once defined, the analytical testing program shall be recorded on the sample receipt log and laboratory information management system, as described in Section 3.1.4.1. The sample custodian shall submit the project file to the laboratory project manager for review. This review is done to assure that the testing program is properly defined and that the log-in procedures were followed correctly.

The group supervisors are responsible for reviewing the contents of the project file and prioritizing samples on the basis of holding time and required turnaround time.

Assignments are made to analysts based on these priorities. In addition to prioritizing samples according to holding time, the following measures are taken to ensure that holding times are met:

PROJECT INDEX CHECKLIST

Project Code: _____

<u>FILE DESIGNATION</u>	<u>RECORD DESCRIPTION</u>	<u>INCLUDED IN FILE</u>	<u>IF "NO" SPECIFY LOCATION OF FILE</u>
A	Correspondence	YES ___ NO ___ N/A ___	_____
B	Tracking Records/ Coding Information	YES ___ NO ___ N/A ___	_____
C	Organic Analytical/ QC Information		
	- GC	YES ___ NO ___ N/A ___	_____*
	- HPLC	YES ___ NO ___ N/A ___	_____*
	- GC/MS	YES ___ NO ___ N/A ___	_____*
	- Misc. Organics	YES ___ NO ___ N/A ___	_____
	- Organic Prep	YES ___ NO ___ N/A ___	_____
	- Subcontractor	YES ___ NO ___ N/A ___	_____
D	Inorganic Analytical/ QC Information		
	- Metals	YES ___ NO ___ N/A ___	_____*
	- Water/Wastewater	YES ___ NO ___ N/A ___	_____
	- Subcontractor	YES ___ NO ___ N/A ___	_____
E	Data Reports	YES ___ NO ___ N/A ___	_____
F	Nonconformances	YES ___ NO ___ N/A ___	_____
G	QAPP Summary/ Proj. Spec. Req.	YES ___ NO ___ N/A ___	_____

*GC, HPLC, GC/MS, and metals raw data and data packages are filed in the respective labs.

Completed & Reviewed By: _____ Date: _____

**FIGURE 3.1-10
PROJECT INDEX CHECKLIST**

- Sample receipts are limited to laboratory capacity whenever possible.
- Spare parts and backup instrumentation is available in case of excessive instrument down-time.
- Analysts are cross-trained to allow sharing of personnel resources between groups.
- Two to three shifts, including weekends, are routinely scheduled for analyses with short holding times, e.g., volatiles, extractions.
- Upon client approval, samples are shipped to other IT laboratories for analyses.

Samples and projects are tracked throughout the laboratory using the unique project code associated with each shipment of samples. All employees have access to the active project files which contain all the information submitted by the client, and a complete definition of the testing program. Copies of the project file contents are provided to the analysts by the group supervisor when assignments are made.

When samples are transferred to another IT facility, for analysis, the entire contents of the project file are copied and submitted with the samples. In addition, the sample custodian shall prepare Analysis Request and Chain-of-custody Records, as well as an intercompany purchase order; these documents are shipped with the samples. If sample extracts or digestates are sent to another IT laboratory, the sample preparation worksheets are also provided.

3.1.4.3 Laboratory Storage of Samples

The primary considerations for sample storage are:

- Maintenance of prescribed temperature, if required, which is typically $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
- Separation of volatiles samples from all others to avoid contamination of the volatiles samples.
- Separation of samples from standards and reagents to avoid contamination of samples.

- Separation of extracts and digestates from original samples.

The sample custodian is responsible for placing the original sample in the proper storage environment. Sufficient refrigerator space is provided to allow storage of samples under proper conditions for at least six weeks after analyses are reported (usually ten weeks from sample receipt). Volatiles samples are stored in refrigerators dedicated to volatiles samples only; extracts and digestates are stored separately from original samples; and samples are stored separately from reagents and standards.

The entire laboratory is a secured access facility, thereby maintaining security of all samples. Only ITAS laboratory personnel have access to samples and their extracts/digestates.

3.1.4.4 Sample Disposition

There are several possibilities for sample disposition:

- Samples may be returned to the client or location of sampling for disposal. Transfer of samples will be documented on an Analysis Request and Chain-of-custody Record, the carbon copy of which shall be maintained in the project file.
- The samples may be stored after analysis. Proper environmental control and holding time must be observed if reanalysis is anticipated. If reanalysis is not anticipated, environmental conditions for storage may not be observed. Storage will be documented in the project file.
- The samples and associated extracts/digestates may be disposed of by the laboratory. Disposal into laboratory waste drums shall be documented in the project file.

In general, ITAS laboratories will not maintain samples and extracts longer than 6 weeks beyond completion of analysis, unless otherwise specified.

3.2 Laboratory Analytical Procedures

Sample analysis shall be conducted in accordance with SW-846, "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods," Third Edition, for all sites with the exception of the Appendix IX parameters.

The Appendix IX analyses will require analytical results which satisfy Data Quality Objective (DQO) level IV specifications for all sites. In order to meet these specifications, the EPA CLP 2/88 Statement of Work for organics and the EPA CLP Statement of Work Document Number ILM01, 1990, for inorganics will be employed for all analyses where applicable. Section 3.2.1 will discuss in greater detail the applicability of CLP procedures to the proposed analytical programs for these sites. In general, samples will be analyzed for halogenated and aromatic volatile organics, polynuclear aromatic hydrocarbons, the complete list of Appendix IX parameters, metals, pesticides/PCBs, and TCLP parameters. Tables 3.2-1 through 3.2-19 list the specific methods that will be used for analyses performed in support of the groundwater contamination investigation at the Naval Air Station, Key West, Florida.

3.2.1 Method Modifications

Analyses will be performed in accordance with the methods cited herein unless specific project requirements or needs dictate adoption of an alternate method or modification of the cited methods. Any major method changes will be submitted for approval prior to implementation.

Based on laboratory experience with a procedure and matrix type, ITAS has developed modified methods for some analytes; these procedures are based on regulatory methods but may include modifications to improve efficiency, reproductibility and/or accuracy. This section provides a summary of modifications made to the methods referenced in Tables 3.2-1 through 3.2-19.

3.2.1.1 Aromatic and Halogenated Volatile Organics

Analysis for aromatic and halogenated volatiles is performed by EPA methods 8010/8020 modified by using a capillary column with the PID and HALL detectors connected in series. This modification allows for one injection per sample and provides additional confirmation of the presence of analytes (dual detector confirmation). The technology was adopted from EPA method 8021.

3.2.1.2 Polynuclear Aromatic Hydrocarbon (PAHs)

HPLC analysis for PAHs is based on EPA method 8310. This method uses fluorescence detection for some parameters to achieve lower detection limits than those normally achieved by UV detection. However, ITAS has the capability to obtain the specified detection limits

Table 3.2-1. Quality Assurance Objectives - Purgeable Halocarbons

Analytical Method No. ^(a)	Matrix Spike ^(b)				Surrogate Spike Accuracy ^(d)		Practical Quantitation Limit (POL) ^(e)	
	Precision RPD% ^(c)		Accuracy ^(b) % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA 8010 ^(a)								
Bis(2-chloroisopropyl)ether	-	-	-	-	-	-	20	20
Bromodichloromethane	-	-	42-172	-	-	-	1	1
Bromoform	-	-	13-159	-	-	-	2	2
Bromomethane	-	-	D ^(f) -144	-	-	-	1	1
Bromobenzene	-	-	-	-	-	-	2	2
Carbon tetrachloride	-	-	43-143	-	-	-	1	1
Chlorobenzene	-	-	38-150	-	-	-	2	2
Chloroethane	-	-	46-137	-	-	-	5	5
2-Chloroethylvinyl ether	-	-	14-186	-	-	-	1	1
Chloroform	-	-	49-133	-	-	-	0.5	0.5
Chloromethane	-	-	D ^(f) -193	-	-	-	1	1
Chlorotoluene	-	-	-	-	-	-	1	1
Dibromochloromethane	-	-	24-191	-	-	-	1	1
Dibromomethane	-	-	-	-	-	-	2	2
1,2-Dichlorobenzene	-	-	D ^(f) -208	-	-	-	2	2
1,3-Dichlorobenzene	-	-	7-187	-	-	-	3	3
1,4-Dichlorobenzene	-	-	42-143	-	-	-	2	2
Dichlorodifluoromethane	-	-	-	-	-	-	2	2
1,1-Dichloroethane	-	-	47-132	-	-	-	0.7	0.7
1,2-Dichloroethane	-	-	51-147	-	-	-	0.3	0.3
1,1-Dichloroethene	-	-	28-167	-	-	-	1	1
cis-1,2-Dichloroethene	-	-	38-155	-	-	-	1	1
trans-1,2-Dichloroethene	-	-	38-155	-	-	-	1	1
1,2-Dichloropropane	-	-	44-156	-	-	-	0.4	0.4
cis-1,3-Dichloropropene	-	-	22-178	-	-	-	3	3
trans-1,3-Dichloropropene	-	-	22-178	-	-	-	3	3
n-Hexyl chloride	-	-	-	-	-	-	1	1
Methylene Chloride	-	-	25-162	-	-	-	5	5
1,1,1,2-Tetrachloroethane	-	-	-	-	-	-	0.3	0.3

Table 3.2-1, Continued

Analytical Method No. ^(a)	Matrix Spike ^(b)				Surrogate Spike Accuracy ^(d)		Practical Quantitation Limit (POL) ^(e)	
	Precision RPD% ^(c)		Accuracy ^(b) % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA 8010 ^(a)								
1,1,2,2-Tetrachloroethane	-	-	8-184	-	-	-	0.3	0.3
Tetrachloroethene	-	-	26-162	-	-	-	0.3	0.3
1,1,1-Trichloroethane	-	-	41-138	-	-	-	0.3	0.3
1,1,2-Trichloroethane	-	-	39-136	-	-	-	0.2	0.2
Trichloroethene	-	-	35-146	-	-	-	1	1
Trichlorofluoromethane	-	-	21-158	-	-	-	2	2
1,2,3-Trichloropropane	-	-	-	-	-	-	1	1
Vinyl Chloride	-	-	28-163	-	-	-	2	2
<u>Surrogate Compounds:</u>								
Bromochloromethane	-	-	-	-	63-119	36-133	-	-
o-Chlorofluorobenzene	-	-	-	-	64-126	49-116	-	-
Fluorobenzene	-	-	-	-	76-120	66-110	-	-

^(a) ● The method used is SW-846 Method 8010/8020 using a capillary column with the PID and HALL detectors connected in series.

● For SW-846 Method 8010, the preparation method used is SW-846 Method 5030.

^(b) Matrix spike accuracy goals, where stated, are found in EPA method references. Since limits are not provided for soil samples, the water limits are used. The following indicator compounds are used for spiking: vinyl chloride; 1,1-dichloroethene, chloroform; 1,1,1-trichloroethane; carbon tetrachloride; benzene; 1,2-dichloroethane; trichloroethene; bromodichloromethane; dibromochloromethane; bromoform; and 1,4-dichlorobenzene.

^(c) RPD = relative percent difference. The method does not provide limits, therefore, inhouse limits of 0-25% are used for soil and water.

^(d) The surrogate percent recoveries listed are the current laboratory limits. After each set of 30 samples of the same matrix are analyzed, the average percent recovery and standard deviation are calculated and new limits are set as detailed in SW-846 Method 8000.

^(e) Sample POLs are highly matrix dependent and may not always be achievable. The POLs listed for water are the current POLs achieved by the laboratory using capillary column with PID/HALL in series. The POLs listed for soils are estimated expected limits. The POLs for soils will be updated when enough data are available.

^(f) D = detected.

REFERENCE: U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste" SW-846, Third Edition.

Table 3.2-2. Quality Assurance Objectives - Purgeable Aromatics

Analytical Method No. ^(a)	Matrix Spike ^(b)				Surrogate Spike Accuracy ^(d)		Practical Quantitation Limit (PQL) ^(e)	
	Precision RPD% ^(c)		Accuracy ^(b) % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA 8020 ^(a)								
Benzene	-	-	39-150	-	-	-	2	2
Chlorobenzene	-	-	55-135	-	-	-	2	2
1,2-Dichlorobenzene	-	-	37-154	-	-	-	2	2
1,3-Dichlorobenzene	-	-	50-141	-	-	-	3	3
1,4-Dichlorobenzene	-	-	42-143	-	-	-	2	2
Ethyl benzene	-	-	32-160	-	-	-	2	2
Toluene	-	-	46-148	-	-	-	2	2
Xylenes	-	-	-	-	-	-	1	1
<u>Surrogate Compounds:</u>								
Bromochloromethane	-	-	-	-	63-119	36-133	-	-
o-Chlorofluorobenzene	-	-	-	-	64-126	49-116	-	-
Fluorobenzene	-	-	-	-	76-120	66-110	-	-

^(a) • The method used is SW-846 Method 8010/8020 using a capillary column with the PID and HALL detectors connected in series.

• For SW-846 Method 8020, the preparation method used is SW-846 Method 5030.

^(b) Matrix spike accuracy goals, where stated, are found in EPA method references. Since limits are not provided for soils, the water limits are used. The following indicator compounds are used for spiking: vinyl chloride; 1,1-dichloroethene, chloroform; 1,1,1-trichloroethane; carbon tetrachloride; benzene; 1,2-dichloroethane; trichloroethene; bromodichloromethane; dibromochloromethane; bromoform; and 1,4-dichlorobenzene.

^(c) RPD = relative percent difference. The method does not provide limits, therefore, inhouse limits of 0-25% are used for soil and water.

^(d) The surrogate percent recoveries listed are the current laboratory limits based on control charts. After each set of 30 samples of the same matrix are analyzed, the average percent recovery and standard deviation are calculated and limits are updated as detailed in SW-846 Method 8000.

^(e) Sample PQLs are highly matrix dependent and may not always be achievable. The PQLs listed for water are the current PQLs achieved by the laboratory using capillary column with PID/HALL in series. The PQLs listed for soils are estimated expected limits. The PQLs for soils will be updated as data become available.

REFERENCE: U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste" SW-846, Third Edition.

Table 3.2-3. Quality Assurance Objectives - Polynuclear Aromatic Hydrocarbons

Parameter	Analytical Method No.	Matrix Spike ^(b)				Practical Quantitation Limit (PQL) ^(d)	
		Precision RPD ^(c)		Accuracy ^(b) % Recovery		Water µg/l	Low Soil µg/kg
		Water	Solids	Water	Solids		
	EPA 8310 ^(a)						
Acenaphthene		-	-	D ^(e) -124	-	0.016	1.6
Acenaphthylene		-	-	D-139	-	0.016	1.6
Anthracene		-	-	D-126	-	0.008	0.8
Benzo(a)anthracene		-	-	12-135	-	0.008	0.8
Benzo(a)pyrene		-	-	D-128	-	0.008	0.8
Benzo(b)fluoranthene		-	-	6-150	-	0.008	0.8
Benzo(g,h,i)perylene		-	-	D-116	-	0.008	0.8
Benzo(k)fluoranthene		-	-	D-159	-	0.008	0.8
Chrysene		-	-	D-199	-	0.008	0.8
Dibenzo(a,h)anthracene		-	-	D-110	-	0.008	0.8
Fluoranthene		-	-	14-123	-	0.008	0.8
Fluorene		-	-	D-142	-	0.008	0.8
Indeno(1,2,3-cd)pyrene		-	-	D-116	-	0.008	0.8
Naphthalene		-	-	D-122	-	0.016	1.6
Phenanthrene		-	-	D-155	-	0.008	0.8
Pyrene		-	-	D-140	-	0.008	0.8

^(a) Analysis is by HPLC option. Samples preparation for Method SW-846 8310 follows SW-846 Method 3510 for water and SW-846 Method 3540 for soil.

^(b) Matrix spike accuracy goals, where stated, are found in EPA method references. Since limits are not provided for soil samples, the water limits are used.

^(c) RPD = relative percent difference. The method does not provide limits, therefore, inhouse limits of 0-25% are used for soil and water.

^(d) PQLs are highly matrix dependent and may not always be achievable. The limits listed are current laboratory limits.

^(e) D = detected.

REFERENCE:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste" SW-846, Third Edition.

Table 3.2-4, Continued

Analytical Method No.	Matrix Spike ^(b)				Surrogate Spike Accuracy ^(d)		Practical Quantitation Limit (POL) ^(e)	
	Precision RPD% ^(c)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA 8080 ^(a)								
Aroclor 1016	-	-	-	-	-	-	0.6	20
Aroclor 1221	-	-	-	-	-	-	0.6	20
Aroclor 1232	-	-	-	-	-	-	0.6	20
Aroclor 1242	-	-	-	-	-	-	0.6	20
Aroclor 1248	-	-	-	-	-	-	0.6	20
Aroclor 1254	-	-	-	-	-	-	1	40
Aroclor 1260	-	-	-	-	-	-	1	40
<u>Surrogate Compound:</u>								
Dibutyl chlorendate	-	-	-	-	24-154	20-150	-	-

^(a) Sample preparation for Method 8080 follows SW-846 Method 3510 for water and 3550 for solids.

^(b) Matrix spike precision and accuracy goals, where stated, are found in EPA method references.

^(c) RPD = relative percent difference.

^(d) Accuracy goals stated are from EPA CLP 2/88 SOW. Surrogate spike accuracy objectives for EPA 8080 are in-house limits based on control charts. These limits are updated with each set of 25 data points. If, however, the in-house limits are broader than the EPA limits stated, the more stringent criteria are used to determine data acceptability.

^(e) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

REFERENCE:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition.

Table 3.2-5. Quality Assurance Objectives - Metals

Matrix: Water

Parameter	Preparation Method No.	Analytical Method No.	Duplicate Precision RPD ^(a)	Matrix Spike Accuracy % Recovery ^(a)	Expected Method Detection Limit ^(b) (µg/l)
Antimony	EPA 3010	EPA 6010	0-20	±25	4
Arsenic	EPA 3020	EPA 7060	0-20	±25	2
Barium	EPA 3010	EPA 6010	0-20	±25	2
Beryllium	EPA 3010	EPA 6010	0-20	±25	1
Cadmium	EPA 3010	EPA 6010	0-20	±25	5
Chromium	EPA 3010	EPA 6010	0-20	±25	10
Cobalt	EPA 3010	EPA 6010	0-20	±25	20
Copper	EPA 3010	EPA 6010	0-20	±25	10
Lead	EPA 3020	EPA 7421	0-20	±25	2
Mercury	EPA 7470	EPA 7470	0-20	±25	1
Nickel	EPA 3010	EPA 6010	0-20	±25	20
Selenium	EPA 3020	EPA 7740	0-20	±25	2
Silver	EPA 3010	EPA 6010	0-20	±25	5
Thallium	EPA 3020	EPA 7841	0-20	±25	2
Tin	EPA 3010	EPA 6010	0-20	±25	20
Vanadium	EPA 3010	EPA 6010	0-20	±25	10
Zinc	EPA 3010	EPA 6010	0-20	±25	5

Table 3.2-5, Continued

- (a) Precision and accuracy objectives for laboratory duplicates and matrix spikes are based on EPA SW-846 acceptance limits.
- (b) Detection limits are highly matrix dependent and may not always be achievable. Limits shown are calculated on a wet weight basis.

REFERENCE:

U.S. Environmental Protection Agency (EPA), September 1986, "Test Methods for Evaluating Solid Waste," SW-846, Third Edition.

Table 3.2-6. Quality Assurance Objectives - Metals

Matrix: Soil

Parameter	Preparation Method No.	Analytical Method No.	Duplicate Precision RPD ^(a)	Matrix Spike Accuracy % Recovery ^(a)	Expected Method Detection Limit ^(b) (mg/kg)
Antimony	EPA 3050	EPA 6010	0-20	±25	6
Arsenic	EPA 3050	EPA 7060	0-20	±25	0.4
Barium	EPA 3050	EPA 6010	0-20	±25	0.4
Beryllium	EPA 3050	EPA 6010	0-20	±25	0.2
Cadmium	EPA 3050	EPA 6010	0-20	±25	1
Chromium	EPA 3050	EPA 6010	0-20	±25	2
Cobalt	EPA 3050	EPA 6010	0-20	±25	4
Copper	EPA 3050	EPA 6010	0-20	±25	2
Lead	EPA 3050	EPA 7421	0-20	±25	0.4
Mercury	EPA 7471	EPA 7471	0-20	±25	0.04
Nickel	EPA 3050	EPA 6010	0-20	±25	4
Selenium	EPA 3050	EPA 7740	0-20	±25	0.4
Silver	EPA 3050	EPA 6010	0-20	±25	1
Thallium	EPA 3050	EPA 7841	0-20	±25	0.4
Tin	EPA 3050	EPA 6010	0-20	±25	4
Vanadium	EPA 3050	EPA 6010	0-20	±25	2
Zinc	EPA 3050	EPA 6010	0-20	±25	1

Table 3.2-6, Continued

- ^(a) Precision and accuracy objectives for laboratory duplicates and matrix spikes are based on EPA SW-846 acceptance limits.
- ^(b) Detection limits are highly matrix dependent and may not always be achievable. Limits shown are calculated on a wet weight basis.

REFERENCES:

U.S. Environmental Protection Agency (EPA), September 1986, "Test Methods for Evaluating Solid Waste," SW-846, Third Edition.

Table 3.2-7. Quality Assurance Objectives^(a) - TCLP Volatile Organic Compounds

Parameter	Analytical Method No.	TCLP Matrix Spike Accuracy ^(c) % Recovery	Surrogate Spike Accuracy ^(d) % Recovery	Practical Quantitation Limit (PQL) ^(e) mg/l in extract
	EPA 1311 EPA 8240 ^(b)			
Benzene		37-151	-	0.025
Carbon Tetrachloride		71-140	-	0.025
Chlorobenzene		37-160	-	0.025
Chloroform		51-136	-	0.025
1,2-Dichloroethane		49-155	-	0.025
1,1-Dichloroethene		59-155	-	0.025
Methyl Ethyl Ketone		NL ^(f)	-	0.050
Tetrachloroethene		46-157	-	0.025
Trichloroethene		71-157	-	0.025
Vinyl Chloride		D ^(g) -251	-	0.050
Surrogate Compounds:				
Toluene-d ₈		-	88-110	-
Bromofluorobenzene		-	86-115	-
1,2-Dichloroethane-d ₄		-	76-114	-

^(a) This table summarizes the QA objectives for TCLP matrix spikes, as required by method 1311. Additional QA objectives for method 8240 are listed in Table 5-2a; those objectives also apply to the analysis of TCLP volatiles.

^(b) A capillary column will be used for analysis.

^(c) TCLP matrix spike accuracy goals, where stated, are found in EPA method references.

^(d) Surrogate spike accuracy goals stated are from EPA SW-846 methods.

^(e) Sample PQLs are highly matrix dependent. The PQLs listed here are provided for guidance and may not always be achievable.

^(f) Not listed by EPA. Reference limits shall be 25-250% until in-house limits are generated.

^(g) D = detected.

REFERENCES:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition. Federal Register, Vol. 55, No. 126, "Toxicity Characteristic Leaching Procedure," Friday, June 29, 1990.

Table 3.2-8. Quality Assurance Objectives^(a) - TCLP Semivolatile Organic Compounds

Parameter	Analytical Method No.	TCLP Matrix Spike Accuracy ^(b) % Recovery	Surrogate Spike Accuracy ^(c) % Recovery	Practical Quantitation Limit (PQL) ^(d) mg/l in extract
	EPA 1311 EPA 8270			
o-Cresol		NL ^(e)	-	0.040
m-Cresol		NL	-	0.040
p-Cresol		NL	-	0.040
1,4-Dichlorobenzene		18-190	-	0.040
2,4-Dinitrotoluene		39-139	-	0.040
Hexachlorobenzene		D ^(f) -152	-	0.040
Hexachloro-1,3-butadiene		24-116	-	0.040
Hexachloroethane		40-113	-	0.040
Nitrobenzene		35-180	-	0.040
Pentachlorophenol		14-176	-	0.20
Pyridine		NL	-	0.40
2,4,5-Trichlorophenol		37-144	-	0.20
2,4,6-Trichlorophenol		37-144	-	0.040
<u>Surrogate Compounds</u>				
Nitrobenzene-d ₆		-	35-114	-
2-Fluorobiphenyl		-	43-116	-
p-Terphenyl-d ₁₄		-	33-141	-
Phenol-d ₆		-	10-94	-
2-Fluorophenol		-	21-100	-
2,4,6-Tribromophenol		-	10-123	-

Table 3.2-8, Continued

- (a) This table summarizes the QA objectives for TCLP matrix spikes, as required by method 1311. Additional QA objectives for method 8270 are listed in Table 5-2b; those objectives also apply to the analysis of TCLP semivolatiles.
- (b) TCLP matrix spike accuracy goals, where stated, are found in EPA method references.
- (c) Surrogate spike accuracy goals stated are from EPA SW-846 methods.
- (d) Sample PQLs are highly matrix dependent. The PQLs listed here are provided for guidance and may not always be achievable.
- (e) Not listed by EPA. Reference limits shall be 25-250% until in-house limits are generated.
- (f) D = detected.

REFERENCES:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition. Federal Register, Vol. 55, No. 126, "Toxicity Characteristic Leaching Procedure," Friday, June 29, 1990.

Table 3.2-9. Quality Assurance Objectives^(a) - TCLP Pesticides

Parameter	Analytical Method No.	TCLP Matrix Spike Accuracy ^(b) % Recovery	Surrogate Spike Accuracy ^(c) % Recovery	Practical Quantitation Limit (POL) ^(d) mg/l in extract
	EPA 1311 EPA 8080			
Lindane		32-127	-	0.001
Endrin		D ^(e) -209	-	0.001
Heptachlor		D-192	-	0.001
Heptachlor epoxide		D-192	-	0.001
Methoxychlor		NL ^(f)	-	0.001
Chlordane		45-119	-	0.004
Toxaphene		41-126	-	0.004
<u>Surrogate Compound:</u>				
Dibutyl chlorendate		-	24-154	-

^(a) This table summarizes the QA objectives for TCLP matrix spikes, as required by method 1311. Additional QA objectives for method 8080 are listed in Table 5-2c; those objectives also apply to the analysis of TCLP pesticides.

^(b) TCLP matrix spike accuracy goals, where stated, are found in EPA method references.

^(c) Surrogate spike accuracy goals stated are from EPA SW-846 methods.

^(d) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

^(e) D = detected.

^(f) Not listed by EPA. Reference limits shall be 25-250% until in-house limits are generated.

REFERENCES:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition. Federal Register, Vol. 55, No. 126, "Toxicity Characteristic Leaching Procedure," Friday, June 29, 1990.

Table 3.2-10. Quality Assurance Objectives - TCLP Herbicides

Parameter	Analytical Method No.	Matrix Spike ^(a)		TCLP Matrix Spike ^(c)	Surrogate Spike ^(c)	Practical Quantitation Limit (PQL) ^(d) mg/l in extract
		Precision RPD ^(b)	Accuracy % Recovery	Accuracy % Recovery	Accuracy % Recovery	
	EPA 1311 EPA 8150					
2,4-D		-	65-100	65-100	-	0.05
2,4,5-TP (Silvex)		-	72-100	72-100	-	0.01
<u>Surrogate Compound:</u>						
2,4-DB		-	-	-	77-100	-

^(a) Matrix spike precision and accuracy goals, where stated, are found in EPA method references.

^(b) RPD = relative percent difference.

^(c) Accuracy goals stated are from EPA methods.

^(d) Sample PQLs are highly matrix dependent. The PQLs listed here are provided for guidance and may not always be achievable.

REFERENCES:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition. Federal Register, Volume 55, No. 126, June 29, 1990, "Toxicity Characteristic Leaching Procedure," pp. 26986-26998.

Table 3.2-11. Quality Assurance Objectives - TCLP Metals

Parameter	Preparation Method No.	Analytical Method No.	Typical Precision RPD ^(b)	Typical Accuracy % Recovery	Expected Method Detection Limit
Arsenic	1311 ^(a) , 3010	6010	0-20	± 25	0.03 mg/l in leachate
Barium	1311 ^(a) , 3010	6010	0-20	± 25	0.002 mg/l in leachate
Cadmium	1311 ^(a) , 3010	6010	0-20	± 25	0.005 mg/l in leachate
Chromium	1311 ^(a) , 3010	6010	0-20	± 25	0.01 mg/l in leachate
Lead	1311 ^(a) , 3010	6010	0-20	± 25	0.03 mg/l in leachate
Mercury	1311 ^(a)	7470	0-20	± 25	0.001 mg/l in leachate
Selenium	1311 ^(a) , 3010	6010	0-20	± 25	0.06 mg/l in leachate
Silver	1311 ^(a) , 3010	6010	0-20	± 25	0.005 mg/l in leachate

^(a) Method 1311 as modified by the Federal Register, Volume 55, No. 126, June 29, 1990, "Toxicity Characteristic Leaching Procedures," pp. 26986-26998.

^(b) RPD = relative percent difference.

REFERENCES:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, Third Edition. Federal Register, Volume 55, No. 126, June 29, 1990, "Toxicity Characteristic Leaching Procedure," pp. 26986-26998.

Table 3.2-12, Continued

Analytical Method No.	Matrix Spike				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CRQL/PQL) ^(d)	
	Precision RPD% ^(b)		Accuracy ^(a) % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
Toluene	0-13	0-21	76-125	59-139	-	-	5	5
1,1,1-Trichloroethane (Methylchloroform)	-	-	-	-	-	-	5	5
1,1,2-Trichloroethane	-	-	-	-	-	-	5	5
Trichloroethylene	0-14	0-24	71-120	62-137	-	-	5	5
Trichlorofluoromethane	-	-	-	-	-	-	5	5
1,2,3-Trichloropropane	-	-	-	-	-	-	5	5
Vinyl Acetate	-	-	-	-	-	-	10	10
Vinyl Chloride	-	-	-	-	-	-	10	10
Xylenes (total)	-	-	-	-	-	-	5	5
<u>Surrogate Compounds:</u>								
Toluene-d8	-	-	-	-	88-110	81-117	-	-
4-Bromofluorobenzene	-	-	-	-	86-115	74-121	-	-
1,2-Dichloroethane-d4	-	-	-	-	76-114	70-121	-	-

^(a) Matrix spike precision and accuracy goals, where stated, are from the EPA CLP 2/88 SOW.

^(b) RPD = relative percent difference.

^(c) Accuracy goals stated are from EPA CLP 2/88 SOW.

^(d) Sample CRQLs for TCL volatiles and PQLs for additional volatiles are highly matrix dependent and are calculated on a wet weight basis. The CRQLs/PQLs listed here are provided for guidance and may not always be achievable.

REFERENCE:

U.S. EPA Contract Laboratory Program; Statement of Work for Organics 2/88 revision.

Table 3.2-13. Quality Assurance Objectives - Appendix IX Semivolatile Organic Compounds

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CROL/POL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
Acenaphthene	-	-	-	-	-	-	10	330
Acenaphthylene	0-31	0-19	46-118	31-137	-	-	10	330
Acetophenone	-	-	-	-	-	-	10	330
2-Acetylaminofluorene	-	-	-	-	-	-	10	330
4-Aminobiphenyl	-	-	-	-	-	-	50	1,600
Aniline	-	-	-	-	-	-	50	1,600
Anthracene	-	-	-	-	-	-	10	330
Aramite	-	-	-	-	-	-	10	330
Benzo(a)anthracene	-	-	-	-	-	-	10	330
Benzo(b)fluoranthene	-	-	-	-	-	-	10	330
Benzo(k)fluoranthene	-	-	-	-	-	-	10	330
Benzo(g,h,i)perylene	-	-	-	-	-	-	10	330
Benzo(a)pyrene	-	-	-	-	-	-	10	330
Benzyl alcohol	-	-	-	-	-	-	10	330
bis(2-Chloroethoxy)methane	-	-	-	-	-	-	10	330
bis(2-Chloroethyl)ether	-	-	-	-	-	-	10	330
bis(2-Chloro-1-methylethyl)ether	-	-	-	-	-	-	10	330
bis(2-Ethylhexyl)phthalate	-	-	-	-	-	-	10	330
4-Bromophenyl phenyl ether	-	-	-	-	-	-	10	330
Butyl benzyl phthalate (Benzyl butyl phthalate)	-	-	-	-	-	-	10	330
p-Chloroaniline	-	-	-	-	-	-	10	330
p-Chloro-m-cresol	0-42	0-33	23-97	26-103	-	-	10	330
2-Chloronaphthalene	-	-	-	-	-	-	10	330
2-Chlorophenol	0-40	0-50	27-123	25-102	-	-	10	330
4-Chlorophenyl phenyl ether	-	-	-	-	-	-	10	330

Table 3.2-13, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CROL/POL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
m-Cresol	-	-	-	-	-	-	10	330
o-Cresol	-	-	-	-	-	-	10	330
p-Cresol (4-Methyl phenol)	-	-	-	-	-	-	10	330
Chrysene	-	-	-	-	-	-	10	330
Dibenz(a,h)anthracene	-	-	-	-	-	-	10	330
Dibenzofuran	-	-	-	-	-	-	10	330
Di-n-butyl phthalate	-	-	-	-	-	-	10	330
o-Dichlorobenzene (1,2-Dichlorobenzene)	-	-	-	-	-	-	10	330
m-Dichlorobenzene (1,3-Dichlorobenzene)	-	-	-	-	-	-	10	330
p-Dichlorobenzene (1,4-Dichlorobenzene)	0-28	0-27	36-97	28-104	-	-	10	330
3-3'-Dichlorobenzidine	-	-	-	-	-	-	20	670
2,4-Dichlorophenol	-	-	-	-	-	-	10	330
2,6-Dichlorophenol	-	-	-	-	-	-	10	330
Diethyl phthalate	-	-	-	-	-	-	10	330
p-(Dimethylamino)azobenzene	-	-	-	-	-	-	30	1,000
7,12-Dimethylbenz(a)anthracene	-	-	-	-	-	-	20	670
3-3'-Dimethylbenzidine	-	-	-	-	-	-	80	2,700
alpha, alpha-Dimethyl- phenethylamine	-	-	-	-	-	-	10	330
2,4-Dimethylphenol	-	-	-	-	-	-	10	330
Dimethyl phthalate	-	-	-	-	-	-	10	330
m-Dinitrobenzene	-	-	-	-	-	-	10	330

Table 3.2-13, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CRQL/PQL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
4,6-Dinitro-o-cresol (2-Methyl-4,6-dinitrophenol)	-	-	-	-	-	-	50	1,600
2,4-Dinitrophenol	-	-	-	-	-	-	10	330
2,4-Dinitrotoluene	0-38	0-47	24-96	28-89	-	-	10	330
2,6-Dinitrotoluene	-	-	-	-	-	-	10	330
Di-n-octyl phthalate	-	-	-	-	-	-	10	330
Diphenylamine	-	-	-	-	-	-	10	330
Ethyl methanesulfonate	-	-	-	-	-	-	10	330
Fluoranthene	-	-	-	-	-	-	10	330
Fluorene	-	-	-	-	-	-	10	330
Hexachlorobenzene	-	-	-	-	-	-	10	330
Hexachlorobutadiene	-	-	-	-	-	-	10	330
Hexachlorocyclopentadiene	-	-	-	-	-	-	10	330
Hexachloroethane	-	-	-	-	-	-	50	1,600
Hexachlorophene	-	-	-	-	-	-	20	670
Hexachloropropene	-	-	-	-	-	-	10	330
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	10	330
Isophorone	-	-	-	-	-	-	10	330
Isosafrole	-	-	-	-	-	-	10	330
Methapyrilene	-	-	-	-	-	-	40	1,300
3-Methylcholanthrene	-	-	-	-	-	-	30	1,000
Methyl methanesulfonate	-	-	-	-	-	-	10	330
2-Methylnaphthalene	-	-	-	-	-	-	10	330
Naphthalene	-	-	-	-	-	-	10	330
1,4-Naphthoquinone	-	-	-	-	-	-	10	330
1-Naphthylamine	-	-	-	-	-	-	20	670
2-Naphthylamine	-	-	-	-	-	-	70	2,300

Table 3.2-13, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c) % Recovery		Contract Required and Practical Quantitation Limit (CROL/POL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		Water	Solids	Water µg/l	Low Soil µg/kg
	Water	Solids	Water	Solids				
EPA CLP 2/88 SOW								
o-Nitroaniline	-	-	-	-	-	-	50	1,600
m-Nitroaniline	-	-	-	-	-	-	50	1,600
p-Nitroaniline	-	-	-	-	-	-	50	1,600
Nitrobenzene	-	-	-	-	-	-	10	330
o-Nitrophenol	-	-	-	-	-	-	10	330
p-Nitrophenol	0-50	0-50	10-80	11-114	-	-	50	1,600
4-Nitroquinoline 1-oxide	-	-	-	-	-	-	10	330
N-Nitrosodi-n-butylamine	-	-	-	-	-	-	20	670
N-Nitrosodiethylamine	-	-	-	-	-	-	10	330
N-Nitrosodimethylamine	-	-	-	-	-	-	10	330
N-Nitrosodiphenylamine ¹	-	-	-	-	-	-	10	330
N-Nitrosodipropylamine	0-38	0-38	41-116	41-126	-	-	10	330
N-Nitrosomethylethylamine	-	-	-	-	-	-	10	330
N-Nitrosomorpholine	-	-	-	-	-	-	10	330
N-Nitrosopiperidine	-	-	-	-	-	-	10	330
N-Nitrosopyrrolidine	-	-	-	-	-	-	10	330
5-Nitro-o-toluidine	-	-	-	-	-	-	20	670
Pentachlorobenzene	-	-	-	-	-	-	20	670
Pentachloroethane	-	-	-	-	-	-	20	670
Pentachloronitrobenzene	-	-	-	-	-	-	20	670
Pentachlorophenol	0-50	0-47	9-103	17-109	-	-	50	1,600
Phenacetin	-	-	-	-	-	-	10	330
Phenanthrene	-	-	-	-	-	-	10	330
Phenol	0-42	0-35	12-89	26-90	-	-	10	330
2-Sec-butyl-4,6-dinitrophenol (Dinoseb)	-	-	-	-	-	-	20	670
p-Phenylenediamine	-	-	-	-	-	-	50	1,600
2-Picoline	-	-	-	-	-	-	70	2,300

Table 3.2-13, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CROL/POL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
Pronamide	-	-	-	-	-	-	30	1,000
Pyridine	-	-	-	-	-	-	20	670
Pyrene	0-31	0-36	26-127	35-142	-	-	10	330
Safrole	-	-	-	-	-	-	10	330
1,2,4,5-Tetrachlorobenzene	-	-	-	-	-	-	10	330
2,3,4,6-Tetrachlorophenol	-	-	-	-	-	-	10	330
Tetraethyl dithiopyrophosphate (Sulfotepp)	-	-	-	-	-	-	10	330
o-Toluidine	-	-	-	-	-	-	10	330
1,2,4-Trichlorobenzene	0-28	0-23	39-98	38-107	-	-	10	330
2,4,5-Trichlorophenol	-	-	-	-	-	-	50	1,600
2,4,6-Trichlorophenol	-	-	-	-	-	-	10	330
0,0,0-Triethyl phosphorothioate	-	-	-	-	-	-	10	330
sym-Trinitrobenzene	-	-	-	-	-	-	10	330
<u>Surrogate Compounds:</u>								
Nitrobenzene-d ₅	-	-	-	-	35-114	23-120	-	-
2-Fluorobiphenyl	-	-	-	-	43-116	30-115	-	-
p-Terphenyl-d ₁₄	-	-	-	-	33-141	18-137	-	-
Phenol-d ₅	-	-	-	-	10-94	24-113	-	-
2-Fluorophenol	-	-	-	-	21-100	25-121	-	-
2,4,6-Tribromophenol	-	-	-	-	10-123	19-122	-	-

Table 3.2-13, Continued

- (a) Matrix spike precision and accuracy goals, where stated, are from the EPA CLP 2/88 SOW.
- (b) RPD = relative percent difference.
- (c) Accuracy goals stated are from EPA CLP 2/88 SOW.
- (d) Sample CRQLs for TCL volatiles and PQLs for additional volatiles are highly matrix dependent and are calculated on a wet weight basis. The CRQLs/PQLs listed here are provided for guidance and may not always be achievable.

REFERENCE:

U.S. EPA Contract Laboratory Program; Statement of Work for Organics 2/88 revision.

Table 3.2-14, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CROL/PQL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
CLP 2/88 SOW								
Aroclor-1016	-	-	-	-	-	-	0.5	80
Aroclor-1221	-	-	-	-	-	-	0.5	80
Aroclor-1232	-	-	-	-	-	-	0.5	80
Aroclor-1242	-	-	-	-	-	-	0.5	80
Aroclor-1248	-	-	-	-	-	-	0.5	80
Aroclor-1254	-	-	-	-	-	-	1	160
Aroclor-1260	-	-	-	-	-	-	1	160
<u>Surrogate Compound:</u>								
Dibutylchlorodate	-	-	-	-	24-154	20-150	-	-

^(a) Matrix spike precision and accuracy goals, where stated, are found in EPA CLP 2/88 SOW.

^(b) RPD = relative percent difference.

^(c) Accuracy goals stated are from EPA CLP 2/88 SOW.

^(d) Specific quantitation limits are highly matrix dependent and are calculated on a wet weight basis. The quantitation limits listed herein are provided for guidance and may not always be achievable.

^(e) According to the EPA CLP 2/88 SOW, soil extracts must be passed through alumina as part of the extraction procedure. This cleanup procedure causes the endrin aldehyde compound to convert to endrin ketone; therefore, soil samples will report the Appendix IX parameter endrin aldehyde as endrin ketone.

REFERENCE:

U.S. EPA Contract Laboratory Program; Statement of Work for Organics 2/88 revision.

Table 3.2-15. Quality Assurance Objectives - Appendix IX Organophosphorus Pesticides^(a)

Parameter	Analytical Method No. ^(b)	Matrix Spike ^(c)				Practical Quantitation Limit (POL) ^(d)	
		Precision ^(e)		Accuracy ^(e)		Water	Low Soil
		Standard Deviation %		% Recovery		µg/l	µg/kg
		Water	Solids	Water	Solids		
	EPA 8140						
Dimethoate		-	-	-	-	0.5	200
Disulfoton		9.0	NA	55-109	NA	2.0	200
Famphur		-	-	-	-	1	1,000
Parathion		-	-	-	-	0.5	200
Parathion Methyl		5.3	NA	80-112	NA	0.5	200
Phorate		8.9	NA	36-89	NA	2	200
Thionazin (O,O-Diethyl O-2-pyrazinyl Phosphorothioate)		-	-	-	-	0.5	1,000

^(a)Analyses will be performed at the ITAS-San Jose, California laboratory.

^(b)Sample preparation for Method 8140 follows SW-846 Method 3510 for water and 3550 for solids.

^(c)Matrix spike precision and accuracy goals, where stated, are found in EPA method references.

^(d)Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

REFERENCE:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition.

Table 3.2-16. Quality Assurance Objectives - Appendix IX Chlorinated Herbicides^(a)

Parameter	Analytical Method No. ^(b)	Matrix Spike ^(c)				Practical Quantitation Limit (POL) ^(d)	
		Precision ^(e)		Accuracy ^(e)		Water	Low Soil
		Standard Deviation	%	% Recovery	%	µg/l	µg/kg
	EPA 8150						
2,4-D (2,4-Dichlorophenoxyacetic acid)		4	N/A	50-80	N/A	10	670
2,4,5-TP (Silvex)		5	N/A	57-87	N/A	2	270
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)		5	N/A	63-92	N/A	2	270

^(a) Analyses will be performed at the ITAS-San Jose, California laboratory.

^(b) Matrix spike precision and accuracy goals, where stated, are found in EPA method references and will be used as starting points. After the analysis of five spiked samples (of the same matrix), the accuracy assessment for spiked compounds will be updated. Thereafter, the accuracy assessment will be updated after every ten spiked samples.

^(c) Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

REFERENCE:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste," SW-846, Third Edition.

Table 3.2-17. Quality Assurance Objectives - Appendix IX Metals
Matrix: Water

Parameter	Preparation Method No.	Analytical Method No.	Duplicate Precision ^(a) RPD ^(b)	Matrix Spike Accuracy ^(a) % Recovery	Expected Method Detection Limit ^(c) (µg/l)
Antimony	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	30
Arsenic	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	2
Barium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	2
Beryllium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	1
Cadmium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	5
Chromium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	10
Cobalt	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	20
Copper	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	10
Lead	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	2
Mercury	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	0.2
Nickel	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	20
Selenium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	2
Silver	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	5
Thallium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	2
Tin	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	20
Vanadium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	10
Zinc	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	+25	5

^(a) Precision and accuracy objectives for laboratory duplicates and matrix spikes are from EPA CLP ILM01 SOW.

^(b) RPD = relative percent difference.

^(c) Detection limits are highly matrix dependent and may not always be achievable. Limits shown are calculated on a wet weight basis.

REFERENCE:

U.S. EPA, Contract Laboratory Program, 1990 Statement of Work for Inorganics, Document Number ILM01.

Table 3.2-18. Quality Assurance Objectives - Appendix IX Metals
Matrix: Soil

Parameter	Preparation Method No.	Analytical Method No.	Duplicate Precision ^(a) RPD ^(b)	Matrix Spike Accuracy ^(a) % Recovery	Expected Method Detection Limit ^(c) (µg/l)
Antimony	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	6
Arsenic	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	0.4
Barium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	0.4
Beryllium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	0.2
Cadmium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	1
Chromium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	2
Cobalt	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	4
Copper	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	2
Lead	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	0.4
Mercury	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	0.1
Nickel	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	4
Selenium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	0.4
Silver	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	1
Thallium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	0.4
Tin	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	4
Vanadium	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	2
Zinc	EPA CLP ILM01	EPA CLP ILM01	0-20 ± CRDL	±25	1

^(a) Precision and accuracy objectives for laboratory duplicates and matrix spikes are from EPA CLP ILM01 SOW.

^(b) RPD = relative percent difference.

^(c) Detection limits are highly matrix dependent and may not always be achievable. Limits shown are calculated on a wet weight basis.

REFERENCE:

U.S. EPA, Contract Laboratory Program, 1990 Statement of Work for Inorganics, Document Number ILM01.

Table 3.2-19. Quality Assurance Objectives - Appendix IX Classical Parameters

Parameter	Analytical Method No.	Matrix Spike		Expected Method Detection Limit ^(b)
		Precision RPD% ^(a)	Accuracy % Recovery	
Cyanide (total)	EPA CLP ILM01	0-20	± 25	10 µg/l (water) 1 mg/kg (solids)
Sulfide	EPA 9030	0-20	± 25	200 µg/l (water) 20 mg/kg (solids)

^(a) RPD = relative percent difference.

^(b) Detection limits are highly matrix dependent and may not always be achievable. Limits shown are calculated on a wet weight basis.

REFERENCES:

U.S. Environmental Protection Agency (EPA), "Test Methods for Evaluating Solid Waste", SW-846, Third Edition.
U.S. EPA, Contract Laboratory Program, 1990 Statement of Work for Inorganics, Document Number ILM01.

Table 3.2-20, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c) % Recovery		Contract Required and Practical Quantitation Limit (CRQL/PQL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		Water	Solids	Water µg/l	Low Soil µg/kg
	Water	Solids	Water	Solids				
EPA CLP 2/88 SOW								
Styrene	-	-	-	-	-	-	5	5
Xylene (total)	-	-	-	-	-	-	5	5

^(a) Matrix spike precision and accuracy goals, where stated, are from the EPA CLP 2/88 SOW.

^(b) RPD = relative percent difference.

^(c) Accuracy goals stated are from EPA CLP 2/88 SOW.

^(d) Sample CRQLs for TCL volatiles and PQLs for additional volatiles are highly matrix dependent and are calculated on a wet weight basis. The CRQLs/PQLs listed here are provided for guidance and may not always be achievable.

Table 3.2-21. Quality Assurance Objectives - TAL/TCL Semivolatile Organic Compounds

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CROL/POL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
Phenol	0-42	0-35	12-89	26-90	-	-	10	330
bis(2-Chloroethyl)Ether	-	-	-	-	-	-	10	330
2-Chlorophenol	-	-	-	-	-	-	10	330
1,3-Dichlorobenzene	-	-	-	-	-	-	10	330
1,4-Dichlorobenzene	0-28	0-27	36-97	28-104	-	-	10	330
Benzyl Alcohol	-	-	-	-	-	-	10	330
1,2-Dichlorobenzene	-	-	-	-	-	-	10	330
2-Methylphenol	-	-	-	-	-	-	10	330
N-Nitroso-Di-n-Propylamine	-	-	-	-	-	-	10	330
Hexachloroethane	-	-	-	-	-	-	10	330
Nitrobenzene	-	-	-	-	-	-	10	330
Isophorone	-	-	-	-	-	-	10	330
2-Nitrophenole	-	-	-	-	-	-	10	330
2,4-Dimethylphenol	-	-	-	-	-	-	10	330
Benzoic Acid	-	-	-	-	-	-	50	1600
bis(2	-	-	-	-	-	-	10	330
2,4-Dichlorophenol	-	-	-	-	-	-	10	330
1,2,4-Trichlorobenzene	-	-	-	-	-	-	10	330
Naphthalene	-	-	-	-	-	-	10	330
4-Chloroniline	-	-	-	-	-	-	10	330
Hexachlorobutadiene	-	-	-	-	-	-	10	330
4-Chloroniline	-	-	-	-	-	-	10	330
Hexachlorobutadiene	-	-	-	-	-	-	10	330
4-Chloro-3-Methylphenol	-	-	-	-	-	-	10	330
2-Methylnaphthalene	-	-	-	-	-	-	10	330
Hexachlorocyclopentadien	-	-	-	-	-	-	10	330
2,4,6-Trichlorophenol	-	-	-	-	-	-	10	1600
2,4,5-Trichlorophenol	-	-	-	-	-	-	50	330
2-Chloronaphthalene	-	-	-	-	-	-	10	1600
2-Nitroaniline	-	-	-	-	-	-	50	330

Table 3.2-21, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c) % Recovery		Contract Required and Practical Quantitation Limit (CRQL/POL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		Water	Solids	Water µg/l	Low Soil µg/kg
	Water	Solids	Water	Solids				
EPA CLP 2/88 SOW								
Dimethyl Phtalate	-	-	-	-	-	-	10	330
Acenaphthene	0-31	0-19	46-118	31-137	-	-	10	330
2,6-Dinitrotoluene	-	-	-	-	-	-	10	330
3-Nitroaline	-	-	-	-	-	-	10	1600
Acenaphthene	-	-	-	-	-	-	10	330
2,4-Dinitrophenol	-	-	-	-	-	-	10	1600
4-Nitrophenol	0-50	0-50	10-80	11-114	-	-	10	1600
Dibenzofuran	-	-	-	-	-	-	10	330
2,4-Dinitrotoluene	0-38	0-47	24-96	25-89	-	-	10	330
Diethylphthalate	-	-	-	-	-	-	10	330
4-Chlorophenyl	-	-	-	-	-	-	10	330
Fluorine	-	-	-	-	-	-	10	330
4-Nitroaniline	-	-	-	-	-	-	50	1600
4,6-Dintro-2-Methylphenol	-	-	-	-	-	-	50	1600
N-Nitrosodiphenylamine ⁽¹⁾	-	-	-	-	-	-	10	330
4-Bromophenyl	-	-	-	-	-	-	10	330
Hexachlorobenzene	-	-	-	-	-	-	10	330
Pentachlorophenol	0-50	0-47	9-103	17-109	-	-	50	1,600
Phenathrene	-	-	-	-	-	-	10	330
Aanthracene	-	-	-	-	-	-	10	330
Di-n-Butylphthalate	-	-	-	-	-	-	10	330
Fluoranthene	-	-	-	-	-	-	10	330
Pyrene	0-31	0-36	26-127	35-142	-	-	10	330
Butylbenzylphthalate	-	-	-	-	-	-	10	330
3,3'-Dichlorobenzidine	-	-	-	-	-	-	20	330
Chysene	-	-	-	-	-	-	10	330
bis(2-Ethylexyl)phthalate	-	-	-	-	-	-	10	330
Di-n-Octyl Phthalate	-	-	-	-	-	-	10	330
Benzo(b)Fluoranthene	-	-	-	-	-	-	10	330
Benzo(k)Fluoranthene	-	-	-	-	-	-	10	330

Table 3.2-21, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CRQL/PQL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
Benzo(a)Pyrene	-	-	-	-	-	-	10	330
Indeno(1,2,3-cd)Pyrene	-	-	-	-	-	-	10	330
Dibenz(a,h)Anthracene	-	-	-	-	-	-	10	330
Benzo(g,hi,i)Perylene	-	-	-	-	-	-	10	330

^(a) Matrix spike precision and accuracy goals, where stated, are from the EPA CLP 2/88 SOW.

^(b) RPD = relative percent difference.

^(c) Accuracy goals stated are from EPA CLP 2/88 SOW.

^(d) Sample CRQLs for TCL volatiles and PQLs for additional volatiles are highly matrix dependent and are calculated on a wet weight basis. The CRQLs/PQLs listed here are provided for guidance and may not always be achievable.

Table 3.2-22. Quality Assurance Objectives - TAL/TCL Organochlorine Pesticides and PCBs

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c)		Contract Required and Practical Quantitation Limit (CRQL/PQL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		% Recovery		Water	Low Soil
	Water	Solids	Water	Solids	Water	Solids	µg/l	µg/kg
EPA CLP 2/88 SOW								
Alpha-BHC	-	-	-	-	-	-	0.05	8
beta-BHC	-	-	-	-	-	-	0.05	8
delta-BHC	0-15	0-50	56-123	46-127	-	-	0.05	8
Lindane	-	-	-	-	-	-	0.05	8
Heptachlor	0-20	0-31	40-131	35-130	-	-	0.05	8
Aldrin	-	-	-	-	-	-	0.05	8
Heptachlor epoxide	-	-	-	-	-	-	0.05	8
Endosulfan	-	-	-	-	-	-	0.05	8
Dieldrin	0-18	0-38	56-126	31-134	-	-	.10	8
4,4'-DDE	-	-	-	-	-	-	.10	16
Endrin	0-21	0-45	56-121	42-139	-	-	.10	16
Endosulfan II	-	-	-	-	-	-	.10	16
4,4'-DDD	-	-	-	-	-	-	.10	16
Endosulfan sulfate	-	-	-	-	-	-	0.5	80
4,4'-DDT	0-27	0-50	38-127	23-134	-	-	.10	16
Methoxychlor	-	-	-	-	-	-	0.5	80
Endrin keytone	-	-	-	-	-	-	.10	16
alpha-Chlordane	-	-	-	-	-	-	0.5	80
gamma-Chlordane	-	-	-	-	-	-	0.5	80
Toxaphene	-	-	-	-	-	-	1	160
Aroclor-1016	0-22	0-43	40-120	-	-	-	0.5	80
Aroclor-1221	-	-	-	-	-	-	0.5	80
Aroclor-1232	-	-	-	-	-	-	0.5	80
Aroclor-1242	-	-	-	-	-	-	0.5	80
Aroclor-1248	0-15	0-50	56-123	-	-	-	0.5	80
Aroclor-1254	-	-	-	-	-	-	1	160
Aroclor-1260	-	-	-	-	-	-	1	160

^(a) Matrix spike precision and accuracy goals, where stated, are from the EPA CLP 2/88 SOW.

^(b) RPD = relative percent difference.

^(c) Accuracy goals stated are from EPA CLP 2/88 SOW.

^(d) Sample CRQLs for TCL volatiles and PQLs for additional volatiles are highly matrix dependent and are calculated on a wet weight basis. The CRQLs/PQLs listed here are provided for guidance and may not always be achievable.

Table 3.2-23. Quality Assurance Objectives - Appendix IX Semivolatile Organic Compounds

	Preparation Method No.	Duplicate Precision ^(a) RPD ^(b)	Matrix Spike Accuracy ^(a) % Recovery	Contract Required and Practical Quantitation Limit (CROL/PQL) ^(d)	
				Water µg/l	Low Soil µg/kg
EPA CLP 2/88 SOW					
Aluminum	EPA CLP IL MOI	0-20 ± CRDL	± 25	40	4
Arsenic	EPA CLP IL MOI	0-20 ± CRDL	± 25	2	0.2
Barium	EPA CLP IL MOI	0-20 ± CRDL	± 25	2	0.2
Beryllium	EPA CLP IL MOI	0-20 ± CRDL	± 25	1	0.1
Cadmium	EPA CLP IL MOI	0-20 ± CRDL	± 25	5	0.5
Calcium	EPA CLP IL MOI	0-20 ± CRDL	± 25	30	3
Chromium	EPA CLP IL MOI	0-20 ± CRDL	± 25	10	1
Cobalt	EPA CLP IL MOI	0-20 ± CRDL	± 25	20	2
Copper	EPA CLP IL MOI	0-20 ± CRDL	± 25	10	1
Iron	EPA CLP IL MOI	0-20 ± CRDL	± 25	10	1
Lead	EPA CLP IL MOI	0-20 ± CRDL	± 25	2	0.2
Magnesium	EPA CLP IL MOI	0-20 ± CRDL	± 25	30	3
Manganese	EPA CLP IL MOI	0-20 ± CRDL	± 25	2	0.2
Mercury	EPA CLP IL MOI	0-20 ± CRDL	± 25	0.2	0.2
Nickel	EPA CLP IL MOI	0-20 ± CRDL	± 25	20	2
Potassium	EPA CLP IL MOI	0-20 ± CRDL	± 25	1000	100
Selenium	EPA CLP IL MOI	0-20 ± CRDL	± 25	2	0.2
Silver	EPA CLP IL MOI	0-20 ± CRDL	± 25	5	0.5
Sodium	EPA CLP IL MOI	0-20 ± CRDL	± 25	200	0.2
Thallium	EPA CLP IL MOI	0-20 ± CRDL	± 25	2	0.2
Vanadium	EPA CLP IL MOI	0-20 ± CRDL	± 25	10	1
Zinc	EPA CLP IL MOI	0-20 ± CRDL	± 25	5	0.5
Cyanide	EPA CLP IL MOI	0-20 ± CRDL	± 25	10	1

Table 3.2-23, Continued

Analytical Method No.	Matrix Spike ^(a)				Surrogate Spike Accuracy ^(c) % Recovery		Contract Required and Practical Quantitation Limit (CRQL/PQL) ^(d)	
	Precision RPD% ^(b)		Accuracy % Recovery		Water	Solids	Water µg/l	Low Soil µg/kg
	Water	Solids	Water	Solids				
EPA CLP 2/88 SOW								

^(a) Matrix spike precision and accuracy goals, where stated, are from the EPA CLP 2/88 SOW.

^(b) RPD = relative percent difference.

^(c) Accuracy goals stated are from EPA CLP 2/88 SOW.

^(d) Sample CRQLs for TCL volatiles and PQLs for additional volatiles are highly matrix dependent and are calculated on a wet weight basis. The CRQLs/PQLs listed here are provided for guidance and may not always be achievable.

REFERENCE:

U.S. EPA Contract Laboratory Program; Statement of Work for Organics 2/88 revision.

for all parameters with UV diode array detection, and therefore, does not use fluorescence detection.

3.2.1.3 Appendix IX

GC/MS analysis for Appendix IX volatiles will be based on EPA CLP 2/88 SOW. The purge vessel will be heated to $40^{\circ} \pm 1^{\circ}\text{C}$ for both water and soil samples. To provide better recovery for dichlorodifluoromethane, acetonitrile and some additional gases, the purge time will be eight minutes (instead of 11 minutes). It has been the experience of ITAS that this purge time minimizes loss on the system trap while still meeting SPCC and CCC requirements and maintaining good sensitivity for all parameters. Isobutyl alcohol and 1,4-dioxane have been found to exhibit low responses in the volatiles analysis and tend to be retained in the system at the levels required for detection. To eliminate the carryover problem with these compounds, calibration for these compounds will consist of a single level standard analyzed well before any set of sample runs. This standard will be used to confirm detectability, retention times and spectral characteristics.

Appendix IX analyses for all sites will be performed in accordance with the EPA CLP Statements of Work for those Appendix IX parameters that are amenable to the CLP procedures. The CLP procedures will be modified to include the parameters listed under Appendix IX that are not a part of the TCL/TAL parameter list. CLP QC acceptance criteria will be used for all TCL/TAL parameters.

The analysis for organophosphorus pesticides, chlorinated herbicides, and sulfide will be performed using the SW-846 methods as previously stated. The EPA CLP SOW does not include procedures for the analysis of these parameters. The analyses will be performed using CLP-like QC criteria as availability and applicability allow.

3.2.1.4 TCL/TAL

GC/MS analysis for the TCL/TAL parameter list will be based on the EPA CLP 2/88 SOW.

3.2.2 QA Targets for Precision and Accuracy of Data

The QA objectives for the measurement of data (accuracy, precision and method detection limits) are listed in Tables 3.2-1 through 3.2-7. In most cases, these objectives are based on

published EPA method acceptance criteria from "Test Methods for Evaluating Solid Waste," SW-846 3rd ed. Exceptions to this are listed below:

- In-house control limits have been generated for laboratory control sample recoveries (metals and cyanide) and method blank surrogate recoveries (8010/8020, VOA, BNA) using control charts. This information has been generated to monitor whether the laboratory process for sample preparation and analysis is in control.
- In-house control limits have been generated for sample surrogate standard recoveries for methods 8010/8020 as per EPA method 8000 (i.e., using control charts).
- Standard in-house limits for accuracy and precision for general chemistry parameters were determined based on ITAS quality assurance program requirements and EPA acceptance criteria for other inorganic parameters.

3.3 Calibration Procedures and Frequencies

Measuring and test equipment used in the ITAS laboratory shall be controlled and subject to a formal calibration program. The calibration program shall provide equipment of the proper type, range, accuracy, and precision to supply data compatible with project requirements and desired results. Calibration of measuring and test equipment may be performed internally using ITAS reference equipment and standards, or externally by agencies or manufacturers.

Documented approved procedures shall be used for calibrating measuring and test equipment. Whenever possible, widely accepted procedures (such as those published by ASTM or EPA) or procedures provided by manufacturers shall be adopted. As a minimum procedures shall include:

- Type of equipment to be calibrated
- Reference equipment and standards to be used
- Calibration method and sequential actions
- Acceptance tolerances
- Frequency of calibration
- Data recording format

Detailed calibration procedures for test equipment routinely calibrated by the laboratory are presented in the ITAS Quality Assurance Manual, ITAS-Knoxville QAM Laboratory Specific Attachment, and SOPs. Tables 3.3-1 and 3.3-2 summarize the calibration procedures by instrument.

3.3.1 Calibration Records

Records shall be prepared and maintained for each piece of calibrated measuring and test equipment to indicate that established calibration procedures have been followed. Records for equipment controlled by the ITAS calibration system shall generally be maintained by the groups responsible for maintaining that equipment. Records for calibrated equipment shall include, as appropriate:

- Type and identification number of equipment
- Calibration frequency and acceptance tolerances
- Standards preparation log with dates, dilutions, source, and numbers
- Calibration dates
- Identities of individuals and organizations performing the calibrations
- Reference equipment and standards used for each calibration
- Calibration data
- Certificates or statements of calibration provided by manufacturers and external agencies, and traceable to national standards
- Statements concerning calibration acceptance or failure and repair of failed equipment

Records of these calibrations shall be maintained with the analytical sample data or in a calibration log book prepared for each instrument.

Table 3.3-1. Summary of Operational Calibration Requirements

Instrument	Calibration Standards Used Initially and Daily	Acceptance Limits	Corrective Actions	Documentation
Atomic absorption spectrophotometer	Initial: 5 levels and blank	Correlation coefficient ≥ 0.995	Make new standards and/or establish new calibration curve	Instrument data file
	Daily: 1 check standard (mid-range) per 10 samples	Daily check standard 90-110% recovery		
Inductively coupled plasma emission spectrophotometer	Initial: high standard and blank	N/A	Establish new curve. Repeat twice (daily check); if outside control limit, then recalibrate making new standards if necessary	Instrument data file
	Daily: Check standard (mid-range) and calibration blank every 10 samples	Check standard $\pm 10\%$		
GC/MS	Mass scale calibration every 12 hours: BFB/DFTPP	EPA CLP criteria	Retune: system maintenance	Instrument calibration file and/or GC/MS project file
	Initial: 5 levels + blank	RF %RSD $< 30\%$	Make new standards; recalibrate	
	Daily: 1 level (low-range)	$\pm 25\%$ of initial curve (CCC). Retention time ± 30 sec for internal standards	Make new standards; recalibrate	
Gas chromatograph	Initial: 3-5 levels + blank	Response factor %RSD $< 20\%$ or use curve	Make new standards or establish new calibration curve	Calibration chart file or GC project file
	Daily: 1 level of check standards (mid-range)	Check standard $\pm 15\%$ of predicted response	Make new standards or establish new calibration curve	
	Standard check every 10 samples (mid-range)	RF $< \pm 15\%$ of daily calibration ($< \pm 20\%$ for confirmation column). Retention times within retention time windows (for methods using retention time windows)	Reanalyze samples that were analyzed after standard that failed criteria and before the next standard that passes criteria	GC project file
UV-visible spectrophotometer	Initial: 3-5 levels and blank	Graph curve	Recalibrate, making new standards if necessary	Calibration file/logbook
	Daily: 1 check standard (mid-range)	Daily check standard 90-110% recovery	Recalibrate	
	Quarterly: Wavelength accuracy and photometric linearity	Manufacturer specifications	Service	

Table 3.3-1, Continued

Instrument	Calibration Standards Used Initially and Daily	Acceptance Limits	Corrective Actions	Documentation
pH meter	Daily: 2 levels (4.0-7.0)	± 0.05 pH unit	1) Clean or replace electrode 2) Recalibrate 3) Service	Log book
	Daily: Check calibration (10.0)	± 10% of true value		
HPLC	Initial: 5 levels + blank	Graph curve or RF % RSD < 20%	Make new standards and/or establish a new calibration curve	Project file
	Daily: Check standard every 10 samples (mid-range)	15% of original curve	Reanalyze affected samples	
GC/MS - Dioxins and furans	Mass scale calibration: PFTBA	Method 8280 criteria	System maintenance	GC/MS project file
	Initial: 5 levels and blank	RSD < 15%	Recalibration	
	Daily: 1 level (low level)	± 30% of predicted response	Repeat daily check and recalibrate if necessary	

Table 3.3-2. Summary of Periodic Calibration Requirements

Instrument	Calibration Standards/Frequency	Acceptance Limits	Corrective Actions
Analytical Balance	Daily: Sensitivity (with a Class "S" weight) Quarterly: Reproducibility Quarterly: Consistency Quarterly: Class "S" weights check	Acceptance criteria based on $\pm 1\%$ of Certified Weight Value	Adjust sensitivity All balances are checked and serviced quarterly by an outside service contractor
Thermometers	Annually: Calibrate in constant temperature baths at two temperatures against precision thermometers certified by NBS	$\pm 0.5^\circ\text{C}$	Discard thermometer
Pipettors	Quarterly: Gravimetric check	High volume ($> 100 \mu\text{l}$): $\leq 1.0\%$ relative error and RSD Low volume ($< 100 \mu\text{l}$): $\leq 2.0\%$ relative error and RSD	Service or replace
Refrigerators	Daily: Temperature checked and recorded	$4 \pm 2^\circ\text{C}$	Notify QCC; service

3.3.2 Calibration Standards and Reference Equipment

Equipment shall be calibrated, whenever possible, using reference equipment and standards that have known relationships to nationally recognized standards (e.g., NIST) or accepted values of natural physical constants. If national standards do not exist, the basis for the reference standard or calibration shall be documented.

3.4 Data Reduction, Validation, and Reporting

Data review procedures, ideally defined as a set of computerized and manual checks applied at various appropriate levels of the measurement process, will be in written form and clearly defined for all measurement systems. Data review begins with the reduction (processing) of data and continues through validation of the data and the reporting of analytical results. Calculations are checked from the raw data to final value prior to reporting results for a group of samples. Data reduction can be performed by the analyst who obtained the data or another analyst. Data validation starts with an analyst independent of the data acquisition and reduction, or the group supervisor, reviewing (validating) that data reduction has been correctly performed, and continues through verifying that the reported analytical results correspond to the data acquired and processed. Final review of the data to be reported is by the Laboratory Project Manager. The procedure is outlined in Figure 3.4-1.

3.4.1 Data Reduction

3.4.1.1 Analyst Responsibilities

The analyst's responsibilities for data reduction include the following:

- Proper identification of analysis output (charts, chromatograms, mass spectra, etc.)
- Calculation of instrument linearity
- Calculation or verification of QC sample/standard results
- Calculation or verification of sample results
- In some cases, preparation of draft report forms
- Documentation of problems encountered

- Reporting of any nonconformances
- Continuation of chain-of-custody

In general, data will be processed by an analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets
- Input of raw data for computer processing
- Direct acquisition and processing of raw data by a computer

If data are manually processed by an analyst, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors (RFs), dilution factors, and calibration constants. If calculations are not performed directly on the data sheet, calculations shall be done on standard IT calculation paper and attached to the data sheets. The analyst shall sign/initial and date in ink each page of calculations.

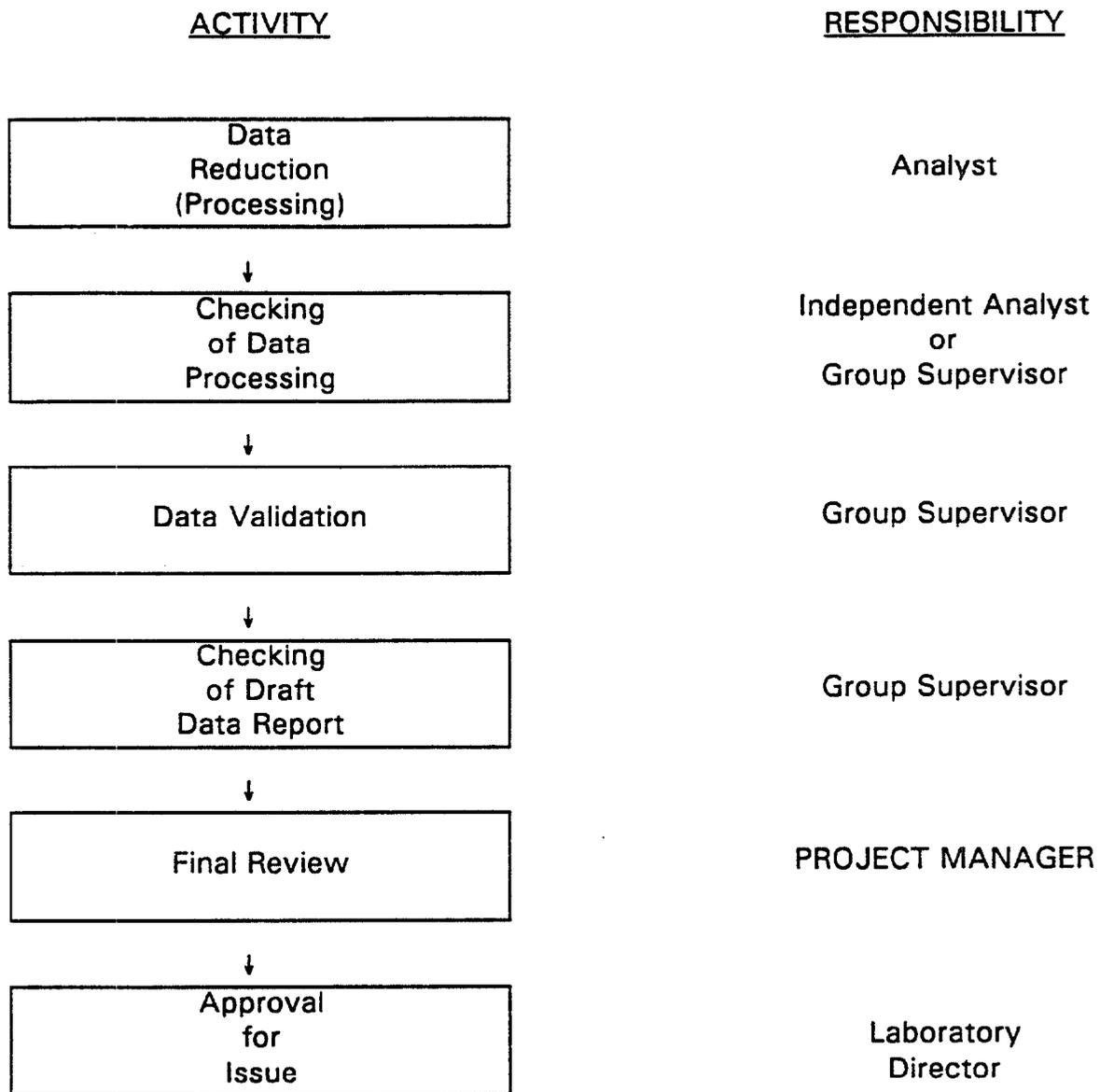
For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the project number and other information as needed. The samples analyzed shall be evident and the input signed and dated by the analyst.

If data are directly acquired from instrumentation and processed, the analyst shall verify that the following are correct: project and sample numbers, calibration constants and RFs, output parameters such as units, and numerical values used for detection limits (if a value is reported as less than). The analyst shall sign and date the resulting output.

3.4.1.2 Documentation

The records used to document the data reduction process include the following:

- Laboratory notebooks or worksheets are used to record standards preparation, instrument run sequence (log), sample preparation (including initial weight/volume, final weight/volume, concentration/dilution factors), and QC sample tracking (worksheets used to trace field samples to associated QC samples).



**FIGURE 3.4-1
DATA REVIEW PROCESS**

- Chromatograms, mass spectra and charts are properly identified with the project code, unique laboratory sample number, standard identification, QC sample number, date analyzed, and analyst initials.
- Computer records are identified with a unique file number which is associated with a project code, laboratory sample number, standard identification, QC sample number, date and time analyzed, and analyst initials.
- Calculation raw data worksheets are used for manual calculation of general chemistry results and cold vapor atomic absorption results.
- Manual calculations, when performed, are recorded directly on chromatograms/raw data or on IT standard calculation paper for GC, GC/MS, and HPLC analyses.

3.4.2 Data Validation

The validation process begins with review of the data reduction results to verify data integrity. At least 20 percent of all data shall be checked as described below. If, during the review process, errors are found, checking shall be completely (100 percent) performed for the data set.

- The analyst responsible for data reduction shall give an independent analyst the data package. The package shall include all documents used or generated by the original analyst, i.e., raw data, data sheets, strip charts, computer input/output, calculations, sources for input parameters such as RFs, sample preparation worksheets, as appropriate.
- The independent analyst or group supervisor shall review the data for:
 - Proper calibration and calculation of RFs
 - Appropriateness of equations used
 - Correctness of numerical input
 - Correctness of data entry
 - Numerical correctness of all calculations by recalculating results
 - Correct interpretation of chromatograms, strip charts, etc.
 - Correct use of sample preparation and dilution factors by comparison to sample preparation worksheets
 - Transcription errors which may have occurred during preparation of the draft report form(s)

The group supervisor is responsible for verifying that the project results meet the acceptance criteria specified by the method(s), client, and/or QAPP. In general, the group supervisor shall perform the following tasks:

- Confirm traceability of the sample from receipt to data reporting through the use of chain-of-custody and/or unique sample numbers
- Compare initial and continuing calibration results to method calibration criteria
 - The initial calibration and daily calibration checks must meet the criteria specified in section 3.3. If these criteria are not met, the affected samples will be reanalyzed or the data flagged.
- Review matrix spike/matrix spike duplicate results for organics or matrix spike and duplicate results for inorganics
 - These results will be compared to the appropriate method criteria listed in section 3.2. Data not meeting the listed QC criteria will be flagged or reanalyzed. Deviation from stated method criteria may not require that samples be reanalyzed. An evaluation for laboratory caused problems will be made; if laboratory errors are suspected or the Laboratory Project Manager deems it necessary, samples will be reanalyzed.
- Evaluate blank results
 - Method, reagent, and calibration blank results will be compared to the stated method criteria in section 3.8. If the blank results deviate from the required criteria stated in the appropriate method, all affected samples will be reextracted/redigested and reanalyzed.
- Evaluate surrogate recoveries
 - Surrogate recoveries will be evaluated against the criteria of the appropriate method as listed in section 3.2. If the surrogate recoveries do not meet these criteria, the sample will be reextracted and reanalyzed. If reextraction and reanalysis confirms a matrix effect, the data will be flagged and results from both sample aliquots reported. If a matrix effect is not confirmed, results from only the second analyses will be reported. Note:

Pesticide limits are advisory only; if pesticide surrogates are out, reextraction is not necessarily required.

- Evaluate all QC sample results (LCS, SRM, ICP interference check sample, etc.) as described in section 3.8
- Perform QC review of data reduction procedures and final reports
- Prepare final draft of a case narrative

The Laboratory Project Manager performs a final review of report summaries and compiles the reports and case narratives provided by each group supervisor into a final project report. The project manager review is not intended to verify the integrity of the reported data, but is intended to determine that the report meets project requirements. The data report is approved for issue by the laboratory director or designated representative. Note: All steps in the data review process are documented by the signature and date of the person performing the review.

3.4.3 Data Reporting and Turnaround Time

The final project report is submitted to the word processing group for preparation of Certificates of Analysis (refer to Figure 3.4-2 for an example Certificate of Analysis).

Data entry is checked by the clerical staff (word processing or data processing); one clerk reads the original document, while a second clerk proofs the final report. This proofing process is also documented by the signature and date of the persons performing the review. The project manager reviews the final document prior to signature by the laboratory director and issuance to the client.

The final analysis report shall consist of 1) a case narrative which describes the number and type of samples received, methods used, a discussion of QC results and problems encountered, and 2) Certificates of Analysis which include the following information:

- Method blank results
- Sample results

- Matrix spike, matrix spike duplicate, duplicate, and TCLP matrix spike results
- Surrogate standard recovery summary
- Dates of sample receipt, sample preparation and analysis
- Client sample number
- Laboratory sample number
- Matrix

The turnaround time from sample receipt to issuance of the final report is four to six weeks.

3.5 Quality Control Checks, Routines to Assess Precision and Accuracy

Quality control checks are needed to demonstrate that the laboratory is operating within prescribed requirements for accuracy and precision. This section describes 1) the type and frequency of quality control checks performed by ITAS, and 2) the procedures ITAS will use to determine the precision and accuracy targets listed in section 3.2.

3.5.1 Laboratory Quality Control Checks

The ITAS QA program was designed to meet or exceed the requirements of the analytical methods employed. The type and frequency of quality control checks is discussed below. Specific acceptance criteria for these checks are tabulated in sections 3.2 and 3.8.

3.5.1.1 Trip (Travel) Blank Analyses

Volatile organics samples are susceptible to contamination by diffusion of organic contaminants through the Teflon-faced silicone rubber septum of the sample vial; therefore, trip blanks are analyzed to monitor for possible sample contamination during shipment. Trip blanks are prepared in the laboratory by filling two VOA vials (40 ml) with organic-free water and shipping the blanks with the field kit. Trip blanks accompany each set of sample bottles through collection and shipment to the laboratory and are stored with the samples.



ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation
312 Directors Drive
Knoxville, TN 37923
ATTN: XXXXXXXXXX

June 25, 1991

Job Number: XXXXXXXXXX

P.O. Number: XXXXXXXXXX

This is the Certificate of Analysis for the following sample:

Client Project ID: XXXXXXXXXXXXX
Date Received by Lab: 06/17/91
Number of Samples: One (1)
Sample Type: Soil

I. Introduction

On 06/17/91, one (1) soil sample arrived at the ITAS-Knoxville, Tennessee, laboratory from IT-Engineering, Knoxville, Tennessee, in support of the XXXXXXXXXXXXX project. The list of analytical tests performed, as well as date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. Please note that the data are not blank corrected.

The sample was prepared in accordance with the "Toxicity Characteristic Leaching Procedure," Federal Register, Vol. 55, No. 126, pp. 26986-26998, Friday, June 29, 1990.

The TCLP leachate was analyzed for the regulated metals by inductively coupled plasma spectroscopy (ICP) and cold vapor atomic absorption spectroscopy (CVAA) based on EPA SW-846 methods 6010 and 7470, respectively.

Reviewed and Approved:

Alyce R. Moore
Laboratory Manager

American Council of Independent Laboratories
International Association of Environmental Testing Laboratories
American Association for Laboratory Accreditation

IT Analytical Services, 5815 Middlebrook Pike, Knoxville, TN 37921

681-1-89

Figure 3.4-2
EXAMPLE CERTIFICATE OF ANALYSIS

IT Corporation
June 25, 1991

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: XXXXXXXXXXXXX

Job Number: XXXXXXXXXXXXX

III. Quality Control

The TCLP method requires preparation and analysis of TCLP matrix spikes for each matrix and with each analytical batch. The purpose of the TCLP matrix spike is to monitor the performance of the analytical methods used, and to determine whether matrix interferences exist. The samples used to perform TCLP matrix spike analyses for this project were selected by the client.

Please note that the data are reported uncorrected for the TCLP matrix spike recovery. The bias determined from the TCLP matrix spike can be used to correct the measured values of the associated sample as follows:

$$X_c = 100(U/\%Recovery)$$

where:

X_c = Corrected value for an analyte.

U = Uncorrected concentration, i.e., the measured value for the unspiked sample.

$\%Recovery$ = % Recovery of the TCLP matrix spike.

The TCLP leaching procedure was performed from 06/17 to 06/18/91.

The TCLP leachate was digested on 06/18/91 for ICP. The TCLP leachate sample for mercury analysis was prepared just prior to analysis. The CVAA analysis for mercury was performed on 06/19/91; the remaining metals were analyzed by ICP on 06/18/91. All run OC was acceptable. No problems were encountered.

IT Corporation
June 25, 1991

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: XXXXXXXXXXXXX

Job Number: XXXXXXXXXXXX

TCLP METALS ANALYSIS

Results in mg/liter (ppm) in the leachate

Sample Matrix: Water

Client Sample ID: TCLP-Method Blank
Lab Sample ID: XXXXXXXX

	<u>Uncorrected Concentration</u>
arsenic	0.04 U
barium	0.002 U
cadmium	0.005 U
chromium	0.01 U
lead	0.03 U
mercury	0.001 U
selenium	0.06 U
silver	0.005 U

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

TCLP Extraction Date: 06/17 to 06/18/91
Digestion Date: 06/18/91
Analysis Date: 06/18/91 (ICP), 06/19/91 (CVAA)

IT Corporation
June 25, 1991

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: XXXXXXXXXXXX

Job Number: XXXXXXXXXXXX

TCLP METALS ANALYSIS

Results in mg/liter (ppm) in the leachate

Sample Matrix: Soil

Client Sample ID: XXXXXXXXXXXX
Lab Sample ID: XXXXXX

	<u>Uncorrected Concentration</u>	<u>Spike %Recovery</u>
arsenic	0.04 U	96.0
barium	5.4	90.0
cadmium	0.005 U	100.0
chromium	0.02	87.6
lead	0.15	91.0
mercury	0.001 U	100.0
selenium	0.06 U	98.0
silver	0.005	67.9

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

TCLP Extraction Date: 06/17 to 06/18/91
Digestion Date: 06/18/91
Analysis Date: 06/18/91 (ICP), 06/19/91 (CVAA)

IT Corporation
June 25, 1991

IT ANALYTICAL SERVICES
5815 MIDDLEBROOK PIKE
KNOXVILLE, TN

Client Project ID: XXXXXXXXXXXXX

Job Number: XXXXXXXXXXXX

TCLP MATRIX SPIKE ANALYSIS

Results in mg/liter (ppm) in the leachate

Sample Matrix: Soil

Client Sample ID: XXXXXXXXXXXX
Lab Sample ID: XXXXXX

<u>Compound</u>	<u>Conc. Spike Added</u>	<u>Sample Result</u>	<u>Conc. MS</u>	<u>% Rec.</u>
arsenic	5.0	0.04 U	4.8	96.0
barium	5.0	5.4	9.9	90.0
cadmium	1.0	0.005 U	1.0	100.0
chromium	5.0	0.02	4.4	87.6
lead	5.0	0.15	4.7	91.0
selenium	1.0	0.06 U	0.98	98.0
silver	5.0	0.005	3.4	67.9
mercury	0.010	0.001 U	0.010	100.0

TCLP Extraction Date: 06/17 to 06/18/91
Analysis Date: 06/18 and 06/19/91

U - Compound was analyzed for but not detected. The number is the detection limit for the sample.

3.5.1.2 Method Blank Analyses

A method blank is a volume of deionized, reagent laboratory water for water samples, or a purified solid matrix for soil/sediment samples carried through the entire analytical procedure. The volume or weight of the blank is approximately equal to the sample volume or sample weight processed. A method blank is performed with each batch of samples. Analysis of the blank verifies that method interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware are known and minimized.

3.5.1.3 Reagent Blank Analyses

A reagent blank is composed of the materials which will be added to samples during preparation (e.g., solvents, acids, adsorptive materials). It is run prior to the use of the materials on "real" samples, to verify that no contaminants are present at levels which would affect sample results.

3.5.1.4 Duplicate Sample Analyses

Duplicate analyses are performed to evaluate the precision of an analysis. Results of the duplicate analyses are used to determine the relative percent difference between replicate samples. Duplicate samples are analyzed at a frequency of 10% for inorganic and general chemistry tests. Refer to Table 3.5-1 for the anticipated number of duplicate sample analyses for this project.

3.5.1.5 Check Standard Analyses

Because standards and calibration curves are subject to change and can vary from day to day, a midpoint standard or check standard is analyzed at the beginning of each run, after every 10 or 20 samples, depending on the method, and at the end of each run. Analysis of this standard is necessary to verify the calibration curve.

3.5.1.6 Surrogate Standard Analyses

Surrogate standard determinations are performed on all samples and blanks for GC/MS analyses and for most GC and HPLC analyses. All samples and blanks are fortified with surrogate spiking compounds before purging or extraction to monitor preparation and analysis of samples.

3.5.1.7 Matrix Spike Analyses

To evaluate the effect of the sample matrix upon analytical methodology, a separate aliquot of sample is spiked with the analyte of interest and analyzed with the sample. The percent recovery for the respective compound is then calculated, and results evaluated. Matrix spikes are prepared and analyzed at a frequency of one per 20 samples. Refer to Table 3.5-1 for the anticipated number of matrix spike analyses for this project.

3.5.1.8 Matrix Spike Duplicate Analyses

Similar in concept to the matrix spike sample above, it is a separate aliquot of sample that is spiked with the analyte(s) of interest and analyzed with the associated sample and matrix spike. A comparison of the recoveries of the spiked compounds in the matrix spike and the matrix spike duplicate (MS/MSD) samples is made to determine the relative percent difference between the MS/MSD samples. Matrix spike duplicates are prepared and analyzed with each group of 20 samples for all organic tests. Refer to Table 3.5-1 for the anticipated number of matrix spike duplicate analyses for this project.

3.5.1.9 Verification/Reference Standard Analyses

On a quarterly basis, the Quality Control Coordinator introduces a group of prepared verification samples, or standard reference materials, into the analytical testing regime. The concentrations are unknown to laboratory personnel. Results of these data are summarized, evaluated, and presented to laboratory management for review and corrective actions, if appropriate.

3.5.1.10 Blank Spike Analyses

A blank spike is a volume of deionized, reagent laboratory water for aqueous samples, or a purified solid matrix for soil/sediment samples which is spiked with parameters of interest and carried through the entire analytical procedure. Analysis of this sample with acceptable recoveries of spike materials demonstrates that the laboratory techniques for this method are in control. This sample is generally analyzed with matrix spike/matrix spike duplicates on those sample matrices which are anticipated to cause analytical difficulties due to matrix interferences. If the MS/MSD pair shows poor recoveries due to interferences, yet the blank spike sample is acceptable, this is strong evidence that the method has been performed

**TABLE 3.5-1
SAMPLE ANALYSIS, MATRIX AND
EXPECTED NUMBER OF FIELD AND QC SAMPLES
NAS - Key West
Key West, Florida
IT Project 595392**

Analysis	Matrix	Number Samples	Laboratory QC Samples ¹	Field QC Samples
8010/8020	Surface water/groundwater	91	5 MS/5 MSD	40 TB, 2 FB
	Soil/sediment	97	5 MS/5 MSD	40 TB
8310	Surface water/groundwater	91	5 MS/5 MSD	2 FB, 7 ER, 4 DUPS
	Soil/sediment	94	5 MS/5 MSD	6 ER, 4 DUPS
Appendix IX	Surface water/groundwater	39	2 MS/2 MSD	3 ER, 2 DUPS
	Soil/sediment	61	4 MS/4 MSD	4 ER, 3 DUPS
Metals	Surface water/groundwater	103	6 MS/6 DUP	2 FB, 8 ER, 5 DUPS
	Soil/sediment	100	6 MS/6 DUP	6 ER, 5 DUPS
8080	Surface water/groundwater	64	4 MS/4 MSD	2 FB, 5 ER, 3 DUPS
	Soil/sediment	79	4 MS/4 MSD	5 ER, 4 DUPS
TCLP	Soil	24	7 TCLP MS	2 ER, 1 DUP

¹ The number of QC samples may increase if samples are not shipped in optimal batch sizes. Samples are generally batched using the EPA Contract Laboratory program guidelines to determine the frequency of MS/MSD or MS/DUP analyses. One MS/MSD or MS/DUP pair is analyzed with each 20 field samples, or each 14 calendar day period during which field samples are received, whichever is more frequent.

TB = Trip Blank
 FB = Field Blank
 ER = Equipment Rinsate
 DUPS = Duplicate

correctly by the laboratory for these samples, but matrix interferences have affected the results.

3.5.1.11 Laboratory Control Samples

A laboratory control sample is a blank spike analyzed for inorganic or general chemistry parameters. The LCS spiking solution is generally a certified material from EPA, ERA or NIST, and represents a source of material independent from that used for calibration. The LCS is carried through the entire sample preparation/analysis procedure with each batch of 20 samples and is used to determine whether the laboratory techniques are in control for the method employed.

3.5.1.12 Standard Addition Spike Analyses

This is a sample created by spiking target analytes into a prepared portion of a sample just prior to analysis. It only provides information on matrix effects encountered during analysis, i.e., suppression or enhancement of instrument signal levels. It is most often encountered with elemental analyses, and is analyzed with each sample digestate during graphite furnace and cold vapor atomic absorption analyses.

3.5.1.13 Internal Standard Spike Analyses

This is an analyte which has the same characteristics as the surrogate, but is added to a sample just prior to analysis. It provides a short-term indication of instrument performance, but it may also be an integral part of the analytical method in a non-quality control sense, e.g., to normalize data for quantitation purposes. Internal standards are spiked into all GC/MS standards, blanks and samples.

3.5.1.14 TCLP Matrix Spike

The TCLP method requires preparation and analysis of TCLP matrix spikes for each matrix and with each analytical batch. The TCLP matrix spike is a separate aliquot of leachate spiked with the regulated compounds after filtration of the TCLP leachate and prior to preservation. The purpose of the TCLP matrix spike is to monitor the performance of the analytical methods used, and to determine whether matrix interferences exist. The samples used to perform TCLP matrix spike analyses for this project will be selected based on the following definition of a matrix:

A matrix is a medium of distinctive physical makeup that can be clearly distinguished from other samples as a unique material. If a set of samples are physically similar, come from the same sampled population, and are expected to show the same pattern in method recoveries when analyzed by a chemist experienced in multimedia environmental analysis, they constitute a single matrix. As an example, soil samples that are physically similar, and taken from the same waste population, constitute a single matrix. These soils would have similar recoveries even though variabilities might be observed from sample to sample. If a client sends several types of samples from the same site, e.g., one sample each of filamentous refuse, sludge, soil, wastewater, and waste oil, each would be a different matrix, requiring separate TCLP matrix spikes.

Please note that the data will be reported uncorrected for the TCLP matrix spike recovery. The bias determined from the TCLP matrix spike can be used by the client to correct the measured values of the associated batch of samples as follows:

$$X_c = 100(U/\% \text{Recovery})$$

where:

X_c = Corrected value for an analyte.

U = Uncorrected concentration, i.e., the measured value for the unspiked sample.

%Recovery = % Recovery of the TCLP matrix spike.

3.5.2 Routine Methods to Assess Precision and Accuracy

When the analysis of a sample set is completed, the QC data generated will be reviewed, and calculated accuracy and precision will be evaluated against the goals identified in Section 3.2 to validate the sample set.

3.5.2.1 Accuracy

Accuracy is the nearness of a result or the mean of a set of results to the true value, and is calculated as follows:

Percent Recovery (p)

where:

A = concentration determined in unspiked aliquot

B = concentration determined in spiked aliquot

T = known value of the spike

p = percent recovery

3.5.2.2 Precision

Precision is the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true results. A measure of the agreement in the reported values for the two portions is obtained by calculating the relative percent difference (RPD) in the concentration level of each constituent, where A_i and B_i are the concentrations of constituents A and B.

3.6 Performance and System Audits

Audits of the ITAS laboratory are described as:

- ITAS performance audits conducted on an ongoing basis within the laboratory by the quality control coordinator (QCC). These audits are reported to the laboratory director and the ITAS Director of Quality and Compliance (QA/C). They include insertion of quality control samples into the sample stream, monthly surveillance, and semiannual internal audits.
- ITAS system audits performed on a scheduled, periodic (semiannual) basis by the ITAS QA/C Director. These audits are external to the laboratory and are reported to the Vice President, Analytical Services and the Corporate Director, Quality Assurance.
- Data audits performed on representative projects from a laboratory. These audits are conducted on a project-specific basis by the ITAS QA/C Director or designee.
- External performance audits conducted by EPA, State agencies, and other government agencies. They include submission of performance evaluation samples on a regularly scheduled basis (e.g. quarterly, yearly) or submission of blind audit samples with field samples.

- External systems audits conducted by EPA, State agencies, government agencies, and commercial clients on a scheduled or as-needed basis.

Audits of the laboratories are performed for the following reasons:

- To determine that contractual and regulatory obligations are fulfilled.
- To determine that IT procedures and standards are being followed. These audits may cover the ITAS QA Manual, Laboratory-Specific Attachments, project-specific QA project plans, chain-of-custody forms, sample collection logs, etc.
- To establish that quality assurance objectives are met, including holding times, reporting turnaround times, use of approved analytical methods, and stated objectives for precision, accuracy, representativeness, completeness, and comparability.
- To serve as a management tool to evaluate appropriateness of quality assurance policies.
- To identify potential or actual deficiencies for the purposes of evaluating compliance with requirements and providing the means for correction.
- To determine that records are prepared/maintained as required.

3.6.1 Performance Audits

The QCC is responsible for the preparation of quality control samples, insertion into the sample stream and evaluation of the results. Internal quality control samples are submitted to the laboratory at least on a quarterly basis, and with each set of external performance evaluation samples received by the laboratory.

The QCC is also responsible for performing monthly surveillance and semiannual internal audits to verify that the laboratory quality assurance program is implemented and functioning on a daily basis. Surveillance are detailed inspections of specific areas of a laboratory and its QA program. Surveillance do not require as extensive planning and preparation as do audits, and prior communication with the surveyed group or personnel is not necessary. The QCC observes the activity of interest while it is in process and/or reviews objective evidence.

The semiannual internal audit covers the same criteria that the semiannual ITAS quality assurance systems audit does, namely the laboratory's QA Program. The audit is intended to be a spot check and should include:

- Sample maintenance
 - Are stated temperatures for sample storage provided?
 - Are samples processed and tested within prescribed holding times?
 - Are samples properly logged in?
- Calibration
 - Are calibrations performed as required?
 - Are they properly documented in instrument log books, or as part of project data if required?
 - Do calibration results indicate a trend in instrument performance?
- Preventive maintenance
 - Are adequate spare parts available?
 - Do specific instruments have repeated maintenance problems?
 - Is preventive maintenance performed and properly documented?
- Receipt and storage of standards, chemicals and gases
 - Are all reagents, chemicals, and gases purchased for use in the laboratory of adequate grade for the intended use?
 - Are certifications of material compositions provided when required?
 - Are materials adequately stored to prevent degradation?
 - Are materials kept beyond stated shelf life?
 - Are standards properly prepared and stored?
 - Are standards kept beyond stated shelf life?
- Analytical Methods
 - Are the methods used appropriate for project requirements?
 - Are alternate methods approved for use?

- Data verification
 - Are data processed and validated as prescribed?
- Records management
 - Are the records of analyses complete and properly identified?
 - Are documents submitted to the record system in a timely manner and are they properly maintained?

Nonconformances observed by the QCC are reported to the group supervisors and operations manager for corrective action. The technical director, laboratory director, or the ITAS QA/C Director are notified if necessary to implement corrective action.

3.6.2 System Audits

System audits are conducted by the ITAS QA/C Director or designee. These audits are performed on a semiannual basis and provide a thorough overview of the implementation of the ITAS Quality Assurance Program within the laboratory. (If additional project-specific system audits are performed because of project requirements, the audit focuses only on the performance of the laboratory for that project).

System audits review operation of the laboratory and resulting documentation, including all items reviewed by the QCC. Particular emphasis is placed upon implementation of the quality control sample program and nonconformance log. Review of these aspects of the laboratory quality assurance program will indicate trends adverse to data quality.

Audits by the ITAS QA/C Director are performed in the following manner:

- An audit plan is prepared which considers the activities of the specific laboratory. The Quality Assurance Manual and Manuals of Practice are the sources of generic requirements for the audit. Laboratory-Specific Attachments are the source documents for specific laboratory activities. The audit plan is reviewed and updated for every semiannual audit, with information gained during previous audits considered. The audit plan is the basis for the audit and defines: participating auditors, applicable documents, schedule, scope of laboratory activities. A lead auditor is

responsible for the audit planning and performance. As necessary, technical specialists assist the audit team in preparing and conducting the audit. All persons participating in the audit team are independent of the laboratory audited.

- Based on the audit plan, detailed checklists of questions to be asked during the audit are prepared. The checklists provide adequate means for indicating whether the question is satisfactorily answered, or if it is not applicable, and for comments.
- The audit team meets at the beginning of the audit with the laboratory director to discuss the laboratory operations to be audited. The QCC should be available to the audit team throughout the audit.
- At the close of the audit, the audit team meets again with the laboratory director to discuss the audit findings. As necessary, the operations manager, group supervisors, technical director, and QCC attend the audit closure to discuss the findings. The lead auditor can close a finding during this discussion if the laboratory staff can satisfactorily demonstrate that the finding is inappropriate.

Also, during the audit-closure meeting, the means for corrective action and verifying correction are discussed. If corrective action can be initiated immediately after the audit closure, the action is taken.

- An audit report is prepared by the lead auditor to include the following information:
 - Date and location of audit
 - Audit team members and person contacted in the laboratory
 - Laboratory operations audited
 - Description of items requiring corrective action and, if possible the means for correction
 - Due date for completion of corrective actions
 - Means for verifying completion of corrective action
 - Review of the quality assurance program

The audit report shall be issued as soon as possible after completion of the audit (required within 30 days).

- The laboratory director is responsible for responding to the audit report. Response shall be in writing to the lead auditor and shall state the corrective action taken or the action underway. If correction can be verified through correspondence, the laboratory director shall attach documentation of corrective action to the audit response.
- Upon receipt of the audit response, the lead auditor must verify completion of the corrective action.
- After verification of corrective action, the lead auditor will issue a closure statement stating that all corrective action has been completed and the audit is closed. All audits must be closed.

3.6.3 Data Quality Audits

Data quality audits are designed to address the precision, bias (accuracy), representativeness, and completeness of data. Representative projects performed by the laboratory are evaluated periodically by the ITAS QA/C Director or designee. USEPA guidelines and project-specific checklists are used as criteria during the audits. Results are reported to the QCC, laboratory director, and the project managers.

3.6.4 External Performance Audits

The Knoxville laboratories routinely analyze performance evaluation samples submitted by EPA and various State and government agencies. Table 3.6-1 provides a list of external performance audits and their frequency.

3.6.5 External System Audits

The Knoxville laboratories are routinely audited by several EPA, State, government and independent accreditation agencies. Refer to Table 3.6-2.

3.7 Preventive Maintenance

Periodic preventive maintenance is required for equipment whose performance can affect results. Instrument manuals are kept on file for reference if equipment needs repair. Troubleshooting sections of manuals are often useful in assisting personnel in performing maintenance tasks.

Any equipment that requires routine maintenance will be included in the laboratory preventive maintenance program. Information pertaining to life histories of equipment maintenance will be kept in individual equipment logs with each instrument. Appropriate and sufficient replacement parts or backup equipment will be available so that sampling and monitoring tasks are not substantially impeded or delayed.

3.7.1 Routine Maintenance Activities

Depending on the parameters to be analyzed and the intended purpose of the data, a wide variety of instrumentation and equipment is available for analytical activities. Because of the reliance placed on such equipment to assist in evaluating the appropriate level of protection for field personnel and because of the use of environmental measurements to support enforcement cases, all analytical equipment will be maintained at its proper functional status.

Analytical instrumentation and equipment used to prepare and analyze groundwater, surface water, soil, and sediment samples will be maintained to manufacturers' specifications and in operational condition. Routine preventive maintenance will be conducted to verify proper operation of the various pieces of equipment. The objective of the preventive maintenance program for analytical equipment is to avoid generating spurious environmental measurements that could endanger site personnel or lead to inappropriate remedial responses. Table 3.7-1 summarizes ITAS's preventive maintenance program for laboratory instrumentation and equipment.

3.7.2 Preventive Maintenance Documentation

Laboratory instrument logs are used to record maintenance and service procedures and to document instrument problems and steps taken to resolve problems. It is the responsibility of the person performing the maintenance activity or repair to provide documentation in the instrument log. These records are kept at the instrument or filed in the respective instrument laboratory according to laboratory standard operating procedures. Instrument logs are subject to QC audit.

3.7.3 Contingency Plans

ITAS maintains an inventory of spare parts and equipment to be used in the case of equipment failure. In addition, backup instrumentation is available to minimize the effects of instrument

Table 3.6-1. External Performance Audits

Agency	Frequency
US EPA Water Supply Study	Semiannual
US EPA Water Pollution Study	Semiannual
US EPA Contract Laboratory Program - Inorganics	Quarterly
NIOSH PAT Round Metals on Filters and Organic Solvents	Quarterly
US Army Corps of Engineers	Biennial
New York State Potable and Non-Potable Water Studies	Semiannual
State of North Carolina Department of Human Resources	Annual
US EPA Contract Laboratory Program - Organics	Quarterly

down-time. Manufacturer service contracts have been purchased for some equipment to assure prompt response for needed repairs. And finally, the ITAS network of eleven laboratories provides a means for completing analyses within holding times and with a standard QA program when the other contingency plans for equipment failure do not succeed. (Of course, the other ITAS laboratories will only be used with a client's permission.)

3.8 Corrective Action

Corrective actions are required to correct deficiencies resulting from nonconformances. It is the responsibility of all IT employees to report nonconformances to the project manager, and QC coordinator (QCC). The project manager, QCC and other appropriate personnel will make up a review committee to determine what corrective actions are required. In appropriate situations, regulatory agencies and other interested parties may be involved in the decision.

3.8.1 Nonconformances

A nonconformance is an unauthorized deviation from documented procedures, practices, or standards, or a defect in an item that could lead to degradation of quality. Nonconformances require review to determine what, if any, corrective actions may be required to correct the problem.

Nonconformances may include (but are not limited to) the following:

- Failure of an instrument to work properly
- Sample chain-of-custody broken
- Sample receiving documentation not correct
- Sample condition on receipt not acceptable
- Sample holding time exceeded
- Sample storage conditions outside criteria
- Incorrect sample preparation/analysis procedures used

Table 3.7-1 Preventive Maintenance Requirements

Instrument	Items Checked/Service	Frequency
Inductively Coupled Argon Plasma (ICAP)	Replace Pump Tubing	As needed
	Inspect and Clean Sample Introduction System	As needed
	Drain Air Filters	Semi-Weekly
	Check Drain Receptacle Level	Weekly
	Clean Torch	Monthly
AA 151B for Mercury Analysis (AVA)	Replace Check Valves	As needed
	Check Pump Delivery	As needed
	Check Tubing Integrity	As needed
	Clean Burner/Adsorption Cell Mount	Monthly
	Clean Adsorption Cell	Monthly
Replace System Tubing	Semi-Annually	
Atomic Absorption Spectrophotometer - Flame Units	Inspect Backflash Diaphragm	As needed
	Check Drain Receptacle Level	As needed
	Replace Nebulizer Chamber O-rings	As needed
	Replace Beam Splitter	As needed
	Clean Nebulizer	Weekly
	Clean Burner Head	Weekly
	Clean Spray Chamber	Weekly
Remove and Clean Burner Mount	Monthly	
Graphite Furnace 951/655	Replace Graphite Cuvette	As needed
	Replace Dry-Rite and Glass Wool	As needed
	Check Drain Receptacle	As needed
	Replace Temperature Sensor	As needed
	Clean Electrodes	As needed
	Replace Graphite Inserts	As needed
	Replace Electrodes and Sensor Posts	As needed
	Check Graphite Insert	Weekly
	Check Recirculator Water Level	Weekly
	Replace Set Screw	Weekly
Check Electrode Appearance	Weekly	

Table 3.7-1, Continued

Instrument	Items Checked/Serviced	Frequency
Graphite Furnace 12/E188	Clean Nebulizer and Spray Chamber	Monthly
	Clean Furnace Chamber and Windows	Monthly
	Flush Furnace Head with Acetic Acid	Semi-Annually
	Replace Recirculator Water	Semi-Annually
	Check Drain Receptacle	As needed
	Clean Sapphire Window	As needed
	Replace Graphite Cuvette	As needed
	Clean Cell Body and Windows	Weekly
	Replace Marble Chips	Weekly
	Check Recirculator Water Level	Weekly
	Clean Temperature Sensor Filter	Semi-Monthly
	Clean FASTAC Pump	Monthly
	Clean Nebulizer and Spray Chamber	Monthly
	Clean Air Filter	Monthly
Flush Furnace Head with Acetic Acid	Semi-Annually	
Replace Recirculator Water	Semi-Annually	
High Performance Liquid Chromatography (HPLC)	Degas Solvents	Daily when used
	Check for Leaks	Daily when instrument used
	Flush Column	Daily when instrument used
	Check Injector for Blockage/ Pressure Drop	Daily when instrument used
	Check Column Pressure	Daily when instrument used
	Replace Lamp	As needed
	Replace Guard Column	As needed
	Organic Prep: Sonicator	Inspect Probe Tips for Etching/Pitting
Replace Probe Tip		As needed
Disassemble and Clean Sonicator Probe Tips		Semi-Annually
Tune Sonicator		Semi-Annually

Table 3.7-1, Continued

Instrument	Items Checked/Serviceed	Frequency
GC Purge and Trap GC Purge and Trap Autosampler	Check Zone Temperatures	Daily when in use
	Helium Tank Pressure (> 500 PSI)	Daily when in use
	Purge and Trap Regulator Pressure (20 PSI)	Daily when in use
	Bake Trap	Daily when in use
	Replace Trap	As needed
	Acid Wash Purge Vessel	As needed
	Leak Test	As needed
GC/MS	Diffusion Pump Oil	Bi-Weekly
	Mechanical Pump Oil	Quarterly
	Power Cop. Air Filter	Bi-Weekly
	OEM Filter	Bi-Weekly
	Water Bay Filter	Bi-Weekly
	Interface Box	Bi-Weekly
	Vacuum Chaff Filter	Monthly
	Turbo Pump Oil	Quarterly
	Water Filter (if applicable)	Observe and change as needed
	Computer Air Filter	Monthly
	Card Cage Air Filter	Monthly
	Source-Clean Ceramics, Polish Lenses	As needed
	Clean Poles and Ceramics on the Poles	As needed
	Clean Contact on the Component Boards	As needed
	Vacuum the Component Boards	As needed
	Clean all fan screens	Weekly
	Vacuum outside of instrument	Weekly
	Clean Grob and Replace Quartz Insert	As needed
	Replace Septum	Daily (each shift)
	Injection Port Liner Checked	Daily
	Column maintenance	As needed
	Disk Drive (CMD only)	Semi-Annual (Service Engineer) or as needed
Printer	Quarterly	

Table 3.7-1, Continued

Instrument	Items Checked/Service	Frequency
Refrigerators Walk-in Coolers	Temperature Checked and Logged Temperature Checked and Logged	Daily Daily
Ovens	Temperature Checked and Logged	Daily
Vacuum Pumps and Air Compressor	Check Performance Lubrication, Belts, etc.	Weekly As needed

- QC sample data (blank, spike, duplicate, surrogates, etc.) outside limits
- Calibration requirements not met
- Data recording errors, transcription errors, or failure to provide adequate documentation
- Data validation errors
- Positive blanks
- Any situation or result that might affect the quality of data.

A nonconformance memorandum (Figures 3.8-1 and 3.8-2) is formal documentation of a nonconformance that includes a description of the problem, the corrective action taken, the individual recognizing the problem and the date discovered, the sample analyses affected (if any), and the initials of appropriate reviewers and the QCC.

A corrective action is an appropriate measure applied to correct a deficiency, minimize the possibility of recurrence, and if necessary, correct problems caused by the nonconformance. The following are examples of corrective action:

- Recalibration of instruments, using freshly prepared calibration standards
- Reanalysis of samples
- Replacement of lots of solvent or other reagents that give unacceptable blank values
- Additional training of laboratory personnel in correct implementation of sample preparation and analytical methods
- Reassignment of personnel, if necessary, to improve the overlap between operator skills and method requirements
- Communication with the clients to determine the appropriate action (e.g., insufficient sample remaining for reanalysis)

Table 3.8-1 summarizes recommended corrective actions for various nonconformances to QC acceptance criteria.

3.8.2 Responsibilities

All employees of the laboratory staff are responsible for reporting nonconformances that they observe or identify. Employees who identify problems that might affect quality are required to report the problems to the appropriate supervisor and sign nonconformance memorandums.

Each laboratory group supervisor is responsible for documenting and correcting problems that might affect quality in accordance with the requirements of this procedure. The supervisor is responsible for preparing and signing nonconformance memos, stopping work in the event of out of control situations, and notifying the project manager and QCC of nonconforming items. The supervisor is responsible for determining whether reported problems are nonconformances, concurring with proposed corrective action, and notifying the QCC that corrective action has been completed.

The QCC is responsible for reviewing nonconformance memos, recommending or approving proposed corrective actions, maintaining an up-to-date nonconformance log, verifying that corrective action has been completed, distributing and filing nonconformance memorandums, and assisting in resolving disagreements. With the laboratory management and group supervisors, the QCC is also responsible for determining whether reported problems are nonconformances, whether operations need to be stopped, and establishing schedules for completion of corrective action. The QCC is responsible for assisting in resolving disagreements and quality problems and for performing audits of all affected organizations for compliance with the requirements of this procedure.

The QCC is responsible for reporting all nonconformances to the ITAS Director of Quality and Compliance on a monthly basis.

3.8.3 General Procedure

The corrective action process is considered internal when the deficiency is identified by a laboratory employee, whether that employee works in the responsible group or is independent of it (e.g., the QCC). External corrective action results when a deficiency is identified by an



**ITAS-Knoxville
LABORATORY NONCONFORMANCE MEMO (NCM)**

PROJECT ID (Name/Number): _____
NCM INITIATED BY (Name/Date): _____
PARAMETER(S): _____
SAMPLE NUMBER(S) AFFECTED: _____

AREA: SHIP/REC GC GEN CHEM BIOASSAY IH
 ORG EXT HPLC METALS RADIOCHEM DATA VERIF
 INORG PREP GCMS GEO COUNTING REPORTING
 OTHER: _____ _____ _____ _____

NONCONFORMANCE [check appropriate item(s)]:

1. Not enough sample received for proper analysis.
2. Holding time exceeded by _____ days due to:

2.1. **CATEGORY I: Out of Laboratory Control**
 Holding time expired at receipt.

2.2. **CATEGORY II: Laboratory Dependent**
 work backlog instrument failure
 communication other (see #10)

2.3. **CATEGORY III: Laboratory Reruns**

2.3.1. **QA/QC:**
 surrogates internal standards
 spike recoveries blank contamination

2.3.2. **CONFIRMATION:**
 second column contamination check
 other (see #10)

2.3.3. **DILUTION:**
 over calibration under calibration
 other (see #10)

2.3.4. **OTHER: (see #10)**

3. Sample lost during extraction/analysis; no re-prep or re-analysis possible.

4. QC data reported to client outside of:
 method limits internal limits
 QAPP limits contract limits
 regulatory limits blank criteria

5. Incorrect procedure(s) used. (See #10)

6. Invalid instrument calibration. (See #10)

7. Incorrect/incomplete data reported to client. (See #10)

8. Reported detection limit(s) higher than:
 method limits QAPP limits
 contract limits other (see #10)

Due to:
 sample matrix insufficient sample
 instrumentation other (see #10)

9. **Other (specify):**

10. **Comments/Explanation:**

NOTIFICATION [check appropriate item(s)]:

1. Client notified by (name and date): _____
 in writing by FAX
 by phone Other (explain)

2. Client's name _____ and response
 process "as is" resample
 on hold til _____ Other (explain)

PROJECT MANAGER (signature & date): _____

FURTHER ACTION REQUIRED, SEE PAGE 2 OF 2

Figure 3.8-1
LABORATORY NONCONFORMANCE MEMO

CORRECTIVE ACTION

ROOT CAUSE: _____ INITIALS/DATE _____

CORRECTIVE ACTION: _____ INITIALS/DATE _____

RESPONSIBILITY FOR PERFORMING CORRECTIVE ACTION ASSIGNED TO: _____

ACTIONS TO PREVENT RECURRENCE: _____ INITIALS/DATE _____

FIRST LEVEL SUPERVISOR: _____ DATE: _____

RESPONSIBLE MANAGER: _____ DATE: _____

QC REVIEW

NONCONFORMANCE DEFICIENCY

FURTHER ACTION REQUIRED: _____

ASSIGNED TO _____

QC COORDINATOR: _____ DATE: _____

CORRECTIVE ACTION VERIFICATION

VERIFIED CANNOT VERIFY (specify reason)

REASON: _____

NCM CLOSURE

QC COORDINATOR: _____ DATE: _____

SIGNED ORIGINAL MUST BE RETAINED IN FILE: QUALITY/OPERATIONS FILE PROJECT FILE

Figure 3.8-1
LABORATORY NONCONFORMANCE MEMO

ITAS - KNOXVILLE
SAMPLE RECEIPT ACKNOWLEDGEMENT/NONCONFORMANCE

Date : _____

Client : _____ Project Code : _____
Address: _____ Job Number : _____
City : _____
State : _____ Zip Code: _____
Attention: _____
Subject : _____

On _____, _____ arrived at the
ITAS-Knoxville, Tennessee Laboratory from _____

The following nonconformance(s) were noted at the time of receipt.

SAMPLE RECEIVED:

- Broken/Leaking
- Without proper preservative
- In improper container
- With incomplete/unclear paperwork
- Holding time exceeded at time of receipt
- With custody seal missing or broken
- Other

COMMENTS: _____

Figure 3.8-2
**SAMPLE RECEIPT ACKNOWLEDGEMENT/
NONCONFORMANCE MEMO**

CORRECTIVE ACTION:

_____ was verbally notified by
(Client) _____ on _____

Resolution: _____

_____ was informed in writing by
(Client) _____ on _____

Resolution: _____

Sample(s) processed as received per: _____
(Client)

Comments: _____

Sample(s) on hold until _____

If released, notify: _____

COMMENTS: _____

Corrective action initiated/performed by: _____

Project Coordinator: _____ Date: _____

external organization, particularly through quality assurance functions such as audits, split samples, or data validation review.

3.8.3.1 Internal Nonconformance Corrective Action Procedure

Any laboratory employee who notices a deficiency that is suspected to be a nonconformance shall report the deficiency to the responsible supervisor and project manager, and to the QCC on a nonconformance memorandum. The sequence of events in the use of the nonconformance memorandum is as follows:

- Potential or actual nonconformance identified; initiator fills out project number, filed by, date, samples affected, lab area, and nonconformance.
- If initiator can perform corrective action, it is so noted under corrective action section, and the memo is then forwarded to the initiator's supervisor. If not, initiator passes the memorandum directly along to his/her supervisor.
- Agreement to corrective action is indicated by both an operations concurrence (group supervisor level and/or project manager) and a QC concurrence. At this point, if the reported nonconformance does not render final data quality unacceptable, it may be designated by the QCC as a deficiency. If so designated, the memorandum goes directly to the project files and no corrective action close-out by the QCC is necessary. The decision to downgrade a nonconformance to a deficiency is the responsibility of the QCC.
- The nonconformance is assigned a unique, sequential log number by the QCC and is logged into the laboratory nonconformance log.
- It is the responsibility of the QCC to verify the completion of all nonconformance corrective actions. In the rare case where a corrective action cannot be verified (because information is not provided by a client), such is indicated on the memo.
- The completed original nonconformance memorandum is filed with the project records.

3.8.3.2 External Nonconformance Corrective Action Procedure

Reports of quality assurance functions by external organizations and reports of compulsory proficiency tests are considered to be externally generated. External reports are distributed

Table 3.8-1. Summary of Corrective Action Procedures

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Organochlorine Pesticides/PCBs (EPA 8080 and EPA CLP)	Five-level multipoint calibration	Initially for each column and as required by daily check	Relative standard deviation (RSD) $\leq 20\%$ or use curve check	N/A
	DDT/Endrin linearity/breakdown standard	At beginning of analytical sequence	DDT, Endrin breakdown $\leq 20\%$	1) Rerun standard 2) Perform corrective maintenance
	Single point calibration	Daily	$\pm 15\%$ D of ($\pm 20\%$ for confirmation) initial calibration. Establish daily retention time window.	1) Rerun standard 2) Prepare new standards and/or repeat initial calibration
	QC check standard	After every 10 samples	$\leq 15\%$ D for quantitation; $\leq 20\%$ for confirmation; retention time of peaks within retention time window	1) Reanalyze samples run after a standard that fails the criteria and before the next standard meeting the criteria 2) Evaluate system 3) Perform corrective maintenance
	Matrix spike/matrix spike duplicate	One set per batch ^(a)	Refer to method for percent recovery and RPD criteria	1) Check calculations 2) Evaluate process 3) Re-extract and reanalyze or flag data 4) Limits are advisory
	Method blank	One per extraction batch ^(a)	Analytes < PQL	1) Rerun blank 2) Re-extract associated samples
	Surrogate standards	Every sample	Percent recovery water: 24-154% soil: 20-150% (will be updated by laboratory control charts)	1) Check calculations 2) Flag data 3) Limits are advisory

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Chlorinated Herbicides (EPA 8150)	Five-level Multipoint calibration	Initially for each column and as required by daily check	Relative standard deviation (RSD) \leq 20% or use curve	N/A
	Single point calibration	Daily	\pm 15% D of (\pm 20% for confirmation) initial calibration. Establish daily retention time window.	1) Rerun standard 2) Prepare new standards and/or repeat initial calibration
	QC check standard	After every 10 samples	\leq 15% D for quantitation; \leq 20% for confirmation; retention time of peaks within retention time window	1) Reanalyze samples run after a standard that fails the criteria and before the next standard meeting the criteria 2) Evaluate system 3) Perform corrective maintenance
	Matrix spike/matrix spike duplicate	One set per batch ^(e)	Refer to method for percent recovery and RPD criteria	1) Check calculations 2) Evaluate process 3) Re-extract and reanalyze or flag data 4) Limits are advisory
	Method blank	One per extraction batch ^(e)	Analytes < PQL	1) Rerun blank 2) Re-extract associated samples
	Surrogate standards	Every sample	Established by laboratory control charts	1) Check calculations 2) Flag data

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Organophosphorous Pesticides (EPA 8140)	Five-level multipoint calibration	Initially for each column and as required by daily check	Relative standard deviation (RSD) $\leq 20\%$ or use curve check	N/A
	Single point calibration	Daily	$\pm 15\%$ D of ($\pm 20\%$ for confirmation) initial calibration. Establish daily retention time window.	1) Rerun standard 2) Prepare new standards and/or repeat initial calibration
	QC check standard	After every 10 samples	$\leq 15\%$ D for quantitation; $\leq 20\%$ for confirmation; retention time of peaks within retention time window	1) Reanalyze samples run after a standard that fails the criteria and before the next standard meeting the criteria 2) Evaluate system 3) Perform corrective maintenance
	Matrix spike/matrix spike duplicate	One set per batch ^(a)	Refer to method for percent recovery and RPD criteria	1) Check calculations 2) Evaluate process 3) Re-extract and reanalyze or flag data 4) Limits are advisory
	Method blank	One per extraction batch ^(a)	Analytes < PQL	1) Rerun blank 2) Re-extract associated samples
	Surrogate standards	Every sample	Established by laboratory control charts	1) Check calculations 2) Flag data

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Volatile halo-carbons/volatile aromatics (EPA 8010/8020)	Five-level multipoint calibration	Initially for each column and as required by daily check	RSD \leq 20% or use curve	N/A
	Single point calibration	Daily	\leq 15% D	1) Rerun standard 2) Prepare new standards and/or repeat initial calibration
	QC check standard	After every 10 samples	\leq 15% D for quantitation	1) Reanalyze samples run after a standard that fails the criteria and before the next standard meeting the criteria 2) Evaluate system 3) Perform corrective maintenance
	Matrix spike/matrix spike duplicate	One set per batch ^(a)	Refer to method for percent recovery and RPD criteria	1) Check calculations 2) Evaluate process 3) Reanalyze or flag data 4) Limits are advisory
	Method blank	One per extraction batch ^(a)	Analytes < PQL	1) Rerun blank 2) Reanalyze associated samples
	Surrogate standards	Every sample	Percent recovery; see method for criteria	1) Check calculations 2) Reanalyze

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Polynuclear aromatic hydrocarbons (EPA 8310)	Five-level multipoint calibration	Initially for each column and as required by daily check	RSD \leq 20% or use curve	N/A
	Single point calibration	Daily	\pm 15% D from initial calibration	1) Rerun standard 2) Prepare new standards and/or repeat initial calibration
	QC check standard	After every 10 samples	\leq 15% D for quantitation	1) Reanalyze samples run after a standard that fails the criteria and before the next standard meeting the criteria 2) Evaluate system 3) Perform corrective maintenance
	Matrix spike/matrix spike duplicate	One set per batch ^(a)	Refer to method for percent recovery and RPD criteria	1) Check calculations 2) Evaluate process 3) Re-extract and reanalyze or flag data 4) Limits are advisory 5) May re-extract and reanalyze
	Method blank	One per extraction batch ^(a)	Analytes < PQL	1) Rerun blank 2) Re-extract associated samples
	Surrogate standard	Every sample	Refer to method	1) Check calculations 2) Flag data 3) Limits are advisory

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Volatiles (EPA CLP 2/88 SOW)	Mass scale calibration using PFTBA ^(b)	Daily prior to sample analyses	Refer to method	Repeat calibration
	Check of mass spectral ion intensities using BFB ^(c)	Every 12 hours	Refer to method	1)Retune instrument 2)Repeat BFB analysis
	Initial multipoint calibration	Initially, and as required by daily check	RSD <30% response factor (RF) ≥ 0.300 (0.250 for bromoform)	Repeat calibration
	System performance check compounds	Every 12 hours	RF ≥ 0.300 (0.250 for bromoform)	1)Evaluate system 2)Repeat calibration
	Calibration check compounds	Every 12 hours	Percent difference <25%	1)Evaluate system 2)Repeat calibration
	Surrogate spikes	Every sample	Refer to method	1)Evaluate system 2)Recalculate data and/or reanalyze sample 3)Reanalyze sample or flag data
	Internal standard	Every sample	Refer to method	Check system/reanalyze, if still outside criteria, flag data
	Method blank	Every 12 hours	Refer to method	1)Clean system 2)Repeat blank analysis
Matrix spike/matrix spike duplicate	One pair every batch ^(e)	Refer to method for percent recovery and relative percent difference criteria	1)Run check standard 2)Correct problem 3)Reanalyze or flag data	

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Semivolatiles (EPA CLP 2/88 SOW)	Mass scale calibration using PFTBA ^(b)	Daily prior to sample analyses	Refer to method	Repeat calibration
	Check of mass spectral ion intensities using DFTPP ^(d)	Every 12 hours	Refer to method	1)Retune instrument 2)Repeat DFTPP analysis
	Initial multipoint calibration	Initially and as required	RSD <30%	Repeat calibration
	System performance check compounds	Every 12 hours	RF \geq 0.050	1)Evaluate system 2)Repeat calibration
	Calibration check compounds	Every 12 hours	Percent difference <30%	1)Evaluate system 2)Repeat calibration
	Surrogate spikes	Every sample	Refer to method	1)Evaluate system 2)Recalculate data and/or reanalyze extract 3)Reextract and reanalyze sample or flag data
	Internal standard	Every sample	Refer to method	Check system/reanalyze, if still outside criteria, flag data
	Method blank	One per extraction batch ^(e)	<5 × method detection limit	1)Run solvent blank 2)Evaluate system 3)Re-extract and reanalyze samples
Matrix spike/matrix spike duplicate	One per batch ^(e)	Refer to method	1)Run check standard 2)Correct problem 3)Reextract and reanalyze or flag data	

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Metals - Inductively coupled plasma (ICP) (EPA 6010 and EPA CLP)	Mixed standard calibration	Daily	Measured value for high standard within 10% of expected value	Repeat calibration
	Limit of detection (LOD) check	Quarterly	LOD < CLP contract required detection limits (CRQL)	Use to determine current LOD
	Calibration check	Every 10 samples	Measured value within 10% of true value for element of interest	Repeat calibration
	Calibration blank	Every 10 samples	≤ CLP CRQL	1) Repeat test 2) Evaluate system 3) Recalibrate 4) Reanalyze samples since last compliant blank
	Preparation blank (Digestion blank)	One per batch ^(a)	≤ CLP CRQL	Redigest and reanalyze samples, if blank > CRQL and lowest sample conc. < 10 x blank value
	Matrix spike	One per batch ^(a)	± 25% recovery	1) Evaluate problem and possibly reanalyze 2) Flag data
	TCLP matrix spike	One per matrix, per site	± 25% recovery	1) Evaluate problem 2) Flag data
	TCLP blank spike	One per batch ^(a)	± 25% recovery	1) Evaluate problem and reanalyze with associated samples
	Duplicate	One per batch ^(a)	RPD < 20%	1) Evaluate problem and possibly reanalyze 2) Flag data

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
	ICP interference check	Run at beginning and end of daily run or twice every 8 hours	80-120% of true value for EPA check sample elements	1)Repeat calibration 2)Reanalyze samples
	ICP linear range check	Quarterly	Measured value within $\pm 5\%$ expected value	Tests upper limit of ICP linear range
Metals - Graphite furnace (GFAA) and cold vapor atomic absorption (CVAA) (See Section 3.2 for methods)	LOD check	Quarterly	LOD < CLP CRQL	Used to determine current LOD
	Multipoint calibration	Daily prior to analyses	$r \geq 0.995$	Repeat calibration
	Calibration check	Every 10 samples	$\pm 10\%$ of predicted response	Recalibrate
	Calibration blank	Every 10 samples	\leq CLP CRQL	1)Repeat test 2)Evaluate system 3)Recalibrate 4)Reanalyze samples since last compliant blank
	Preparation blank (Digestion blank)	One per batch ^(e)	\leq CLP CRQL	1)Redigest and reanalyze samples if blank > CRQL and lowest sample conc. < 10 x blank value
	Matrix spike	One per batch ^(e)	$\pm 25\%$ recovery	1)Evaluate problem and possibly reanalyze 2)Flag data
	Duplicate	One per batch ^(e)	RPD < 20%	1)Evaluate problem and possibly reanalyze 2)Flag data

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Cyanide (EPA 9010 and EPA CLP)	Multipoint calibration	As needed by calibration check	Plot curve (or adjust instrument)	N/A
	Check standard (distilled)	Daily	± 10% of initial calibration	1)Check standard preparation 2)Reanalyze 3)Recalibrate
	Method blank	Daily or one per 20 sample batch ^(e)	< detection limit	1)Check DI water source/reagents 2)Clean equipment 3)Rerun tests
	Matrix Spike	One per batch ^(e)	± 25% recovery	Assess reason and reanalyze or flag data
	Duplicate or Matrix Spike Duplicate	One per batch ^(e)	± 25% recovery and/or 0-20 RPD	Assess reason and reanalyze or flag data
	Laboratory Control Sample (if available)	Daily	Vendor (ERA) acceptance criteria	1)Check standard preparation 2)Reanalyze 3)Recalibrate

Table 3.8-1, Continued

Parameter Method	Quality Control Check	Frequency	Acceptance Criteria	Typical Corrective Action
Sulfide (EPA 376.1)	Check standard	Daily	± 10% of expected value	1)Check standard preparation 2)Check reagents 3)Reanalyze
	Matrix spike	One per batch ^(e)	± 25% recovery	Assess reason and reanalyze or flag data
	Duplicate or matrix spike duplicate	One per batch ^(e)	± 25% recovery and/or 0-20 RPD	Assess reason and reanalyze or flag data
	Laboratory control sample (if available)	Daily	Vendor (ERA) acceptance criteria	1)Check standard preparation 2)Check reagents 3)Reanalyze

^(a) An extraction batch is defined as a set of samples which number no more than 20 and are extracted together with the same method sequence within the same time period or in continuous sequential time periods.

^(b) PFTBA = Perfluorotributylamine (FC-43)

^(c) BFB = p-Bromofluorobenzene

^(d) DFTPP = Decafluorotriphenylphosphine

^(e) A batch is a group of samples of the same matrix from the same project received over a 14 day period or less and not exceeding 20 samples.

Table 3.6-2. External System Audits

Agency	Frequency
State of Tennessee Department of Health and Environment	Biennial
State of New York Department of Health	Annual
State of Utah Department of Health and Environment	Biennial
US Army Corps of Engineers	Biennial
US EPA Contract Laboratory Program - Organics	Biennial
American Association of Laboratory Accreditation	Annual
American Industrial Hygiene Association	Annual
US Department of Energy - HAZWRAP Program	Every 15-18 months
State of Florida Department of Health and Rehabilitation Services	Biennial
State of California Department of Health	Biennial
State of North Carolina Department of Human Resources	Biennial
US DOD - USATHAMA Program	As required

to the affected group supervisors, the QCC, and the IT Project Manager. Corrective actions deemed necessary through external audits, split samples and data review will be implemented.

If the report identifies deficiencies that require corrective action, the QCC shall generate a memorandum to the responsible supervisors that describes the particular deficiency and make a copy to be bound in the nonconformance log. The QCC shall verify that action is taken and that a response, or notification of unavoidable delay, is generated in time to meet the due date to the client.

The QCC shall verify that the problem has been corrected. With the responsible supervisor, the QCC shall prepare a formal written response to the external organization, if required. The laboratory director shall transmit the response to the external organization, with copies to other managers, as deemed necessary.

Upon notification by the external organization of acceptance of the corrective action, the QCC shall notify the responsible supervisor, the laboratory director, and other managers. If corrective action is not acceptable, the QCC shall start the process over until the problem is satisfactorily resolved, at which time the nonconformance closeout is documented and dated in the nonconformance log.

Nonconformances and required corrective action can also result from audits performed by the ITAS Director of Quality and Compliance.

Table 3.8-1, Continued

REFERENCES:

U.S. Environmental Protection Agency, March 1983, "Methods for Chemical Analysis of Water and Wastes," Publication EPA-600/4-79-020.

U.S. Environmental Protection Agency "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, "SW-846, 3rd Edition.

USEPA Contract Laboratory Program; Statement of Work for Organics, 2/88 revision, and for Inorganics, ILM01.

U.S. Environmental Protection Agency "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," 40 CFR Part 136, Federal Register Volume 49, No. 209, October 26, 1984.

U.S. Environmental Protection Agency, December 1988, "Methods for the Determination of Organic Compounds in Drinking Water," Publication EPA-600/4-88/03.

**Material Safety Data Sheets will be kept on file at the
IT Field Office for reference**