Section : 03.03
Site 20903-5640 (White Oak)
Doc. #: 0001 Vol 2 of 3

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NSWC WHITE OAK
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# FINAL
# IRP PROGRAM
# QUALITY ASSURANCE
# PROJECT PLAN

## REMEDIAL INVESTIGATION STUDY
## NAVAL SURFACE WARFARE CENTER
## WHITE OAK, MARYLAND
## CONTRACT NO. N62477-85-C-0060

**For the**

**Naval Facilities Engineering Command**
**Washington, D.C. 20374**

**By**

**Malcolm Pirnie, Inc.**
**ENVIRONMENTAL ENGINEERS, SCIENTISTS AND PLANNERS**

**August 1989**

QUALITY ASSURANCE PROJECT PLAN

NAVAL SURFACE WARFARE CENTER (NSWC)
WHITE OAK, MARYLAND

REMEDIAL INVESTIGATION

APPROVED FOR:

MALCOLM PIRNIE, INC.

Project Manager Date

Project Officer Date

Quality Assurance Officer Date

APPROVED FOR:

NAVAL FACILITIES ENGINEERING COMMAND - CHESAPEAKE DIVISION

Lydia Wechsler 8-22-89

Engineer-In-Charge Date

0931-02-1104

QUALITY ASSURANCE PROJECT PLAN

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NAVAL SURFACE WARFARE CENTER (NSWC)
WHITE OAK, MARYLAND

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REMEDIAL INVESTIGATION

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APPROVED FOR:

MALCOLM PIRNIE, INC.

Thomas P. Fraker — 8-25-89
Project Manager — Date

Project Officer — 25/8/89
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NAVAL FACILITIES ENGINEERING COMMAND - CHESAPEAKE DIVISION

Engineer-In-Charge — Date

0931-02-1104

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# 1.0 PROJECT DESCRIPTION

## 1.1 PURPOSE AND OBJECTIVE

The Remedial Investigation (RI) Work Plan for the Naval Surface Warfare Center (NSWC) at White Oak, Maryland is designed to comprehensively assess the nature and extent of contaminated soils, ground water, surface water, and sediments at the facility. The RI Work Plan is based on data generated during the preliminary investigation performed during the Verification Phase of work at the site. It is the objective of the NSWC RI to generate data that will accurately assess site conditions, and comprehensively identify and evaluate feasible and cost effective remedial actions.

## 1.2 QUALITY ASSURANCE PROJECT PLAN

The Quality Assurance Project Plan (QAPP) is designed to detail the desired data quality goals necessary to provide accurate, precise, and reliable measurements. The QAPP assures that all field, sampling and analytical procedures are conducted within acceptable limits to provide the desired level of data quality. Data quality goals are directly dependent on several key factors including the project team's organization, sampling and sample custody procedures, analytical procedures, calibration procedures, preventative maintenance, data analysis and reporting requirements, and auditing procedures. All of these procedures assure that data generated during the RI are of the highest quality and comply with the overall quality objectives of the project.

The QAPP has been developed in accordance with Naval Energy and Environmental Support Activity (NEESA) Document 20.2-047B and Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80, USEPA, 1980.

## 1.3 SITE BACKGROUND

### 1.3.1 Site Location and Description

NSWC is located in the State of Maryland approximately five miles north of Washington D.C. The facility is located both in Prince

George's and Montgomery Counties. NSWC consists of approximately 730 acres of land bounded on the west by New Hampshire Avenue, the east by residential areas, the north by a mixture of residential, park and industrial/commercial properties, the southeast by the Harry Diamond Laboratory and USNR training center, and the southwest by the Hillandale residential community. A USGS topographic map, detailing the location of the NSWC site, is provided in Figure 1-1.

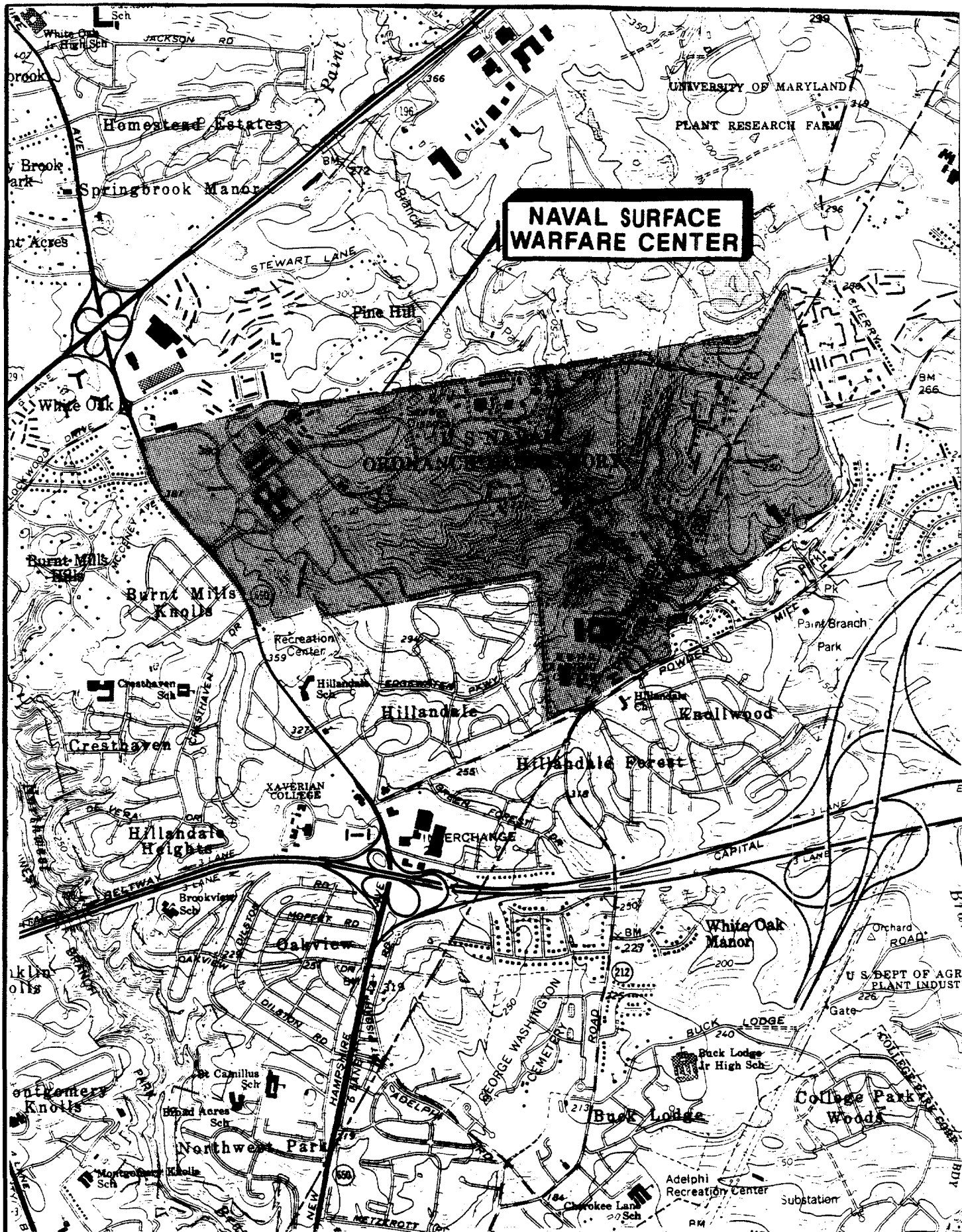
The RI Work Plan addresses the investigation of seven hazardous waste sites, a surface water stream, and two background wells within the NSWC facility. These sites are:

- Apple Orchard Landfill (Site 2)
- Pistol Range Landfill (Site 3)
- Chemical Burial Site (Site 4)
- Ordnance Burn Area (Site 7)
- Abandoned Chemical Disposal Pit (Site 8)
- Industrial Wastewater Disposal Area 300 (Site 9)
- Industrial Wastewater Disposal Area 100 (Site 11)
- Paint Branch Creek
- Background Wells

Each site is described in detail in Section 1.2 of the RI Work Plan. In general, each site represents a potential source area of hazardous materials. The sites were identified during the Initial Assessment Study (IAS) conducted in November 1984.

### 1.3.2 Site History

In 1944, The U.S. Navy acquired 870 acres of land in White Oak, Maryland for the expansion of the Naval Ordnance Laboratory (NOL) which was based at the Washington Navy Yard. The NOL basically carried out research and development projects at the White Oak Facility related to weapons systems and other Naval activities. In 1968 approximately 137 acres of the original tract was transferred to the U.S. Army and eventually became the Harry Diamond Laboratory.




MALCOLM PIRNIE

NSWC, WHITE OAK, MARYLAND

FACILITY LOCATION

MALCOLM PIRNIE, INC.

FIGURE 1-1

N1432

Between 1948 and 1982, laboratory solvents, acid and bases, residuals from explosives, and other solid and liquid wastes were disposed at various sites throughout the facility. Starting in 1984, a series of environmental investigations were performed at the site to assess possible sources of contamination and to study potential contaminant migration pathways. Under the U.S. Navy's Installation Restoration Program (IRP), the facility was evaluated during the Initial Assessment Study (IAS) performed in 1984. A Phase IIA Verification Study was performed following the IAS to investigate the areas of concern in detail. The RI represents the third major investigation to be performed at the site. Its completion is designed to conform with USEPA guidelines as detailed in "Guidance on Remedial Investigations and Feasibility Studies under CERCLA".

## 1.4 INTENDED DATA USES

Data generated during the RI will be used in the following capacities:

- To more fully define the extent and nature of ground water and soil contamination at the facility,
- To develop a more complete understanding of ground water flow directions, gradients and aquifer characteristics,
- To develop a list of Applicable Relevant and Appropriate Requirements (ARARs) for the site,
- To develop data sufficient to prepare a baseline risk assessment for the seven sites, and
- To determine if surface waters have been contaminated by organic/inorganic compounds from the NSWC sites.

Data generation activities are detailed in Section 4.0 of the RI Work Plan. Data will be generated primarily through the collection and analysis of environmental samples. In addition, a substantial amount of data will be generated through field and physical testing. In most cases, these testing procedures do not involve the collection of environmental samples, therefore, error related to the sampling technique employed is not a factor.

Activities that will generate data during the RI include the following:

- Collection and Analysis of ground water, soil, surface water and sediment samples,
- Soil Gas Surveys,
- Geophysical Surveys,
- Physical Soil Testing,
- Soil Screening, and
- Ground Water Elevation Measurements,

For the most part, the collection and analysis of environmental samples for hazardous substances will be the primary data generating activity of the project. The QAPP will focus on these activities to assure the highest data quality possible.

USEPA Contract Laboratory Program (CLP) procedures and other USEPA approved methodologies will be used to assure that data generated from the environmental sampling meets the QA objectives of the project. Malcolm Pirnie Standard Operating Procedures (SOPs) together with the site specific operating procedures contained in the RI Work Plan will be used to generate field and physical testing data that is of the highest quality.

USEPA CLP procedures contain rigorous quality control (QC) checks that are inherently incorporated into the QAPP through the use of the methodologies. The analytical laboratory will be required to meet the QC checks in the CLP procedures as well as the overall project quality assurance objectives detailed in the QAPP.

## 1.5 MEASUREMENT PARAMETERS

A summary of the NSWC RI environmental sampling investigation is provided in Table 1-1. In addition to the environmental samples, a number of QA/QC samples will also be collected. The purpose of these samples is to provide data that will be used to validate the

TABLE 1-1

SUMMARY OF ENVIRONMENTAL SAMPLING PROGRAM

| Sample Matrix | Parameters | Field Samples | | QA/QC Samples | | | Total Samples |
|---|---|---|---|---|---|---|---|
| | | Sediment | Soil | FD | ER | TB | |
| Sediments/Soil | Volatiles | 17 | 2 | 2 | 2 | 4 | 27 |
| | Base Neutrals | 7 | 14 | 3 | 4 | 0 | 28 |
| | PCBs | 13 | 2 | 2 | 1 | 0 | 18 |
| | Metals | 30 | 16 | 5 | 4 | 0 | 55 |
| | Mercury | 6 | 2 | 1 | 0 | 0 | 9 |
| | Chromium VI | 10 | 6 | 2 | 2 | 0 | 20 |
| | Nitroaromatics | 3 | 54 | 6 | 3 | 0 | 66 |
| | TOC | 30 | 8 | 4 | 4 | 0 | 46 |
| | TOX | 30 | 8 | 4 | 4 | 0 | 46 |
| | pH | 30 | 62 | 10 | 0 | 0 | 102 |
| | Sediment/Soil Totals | 176 | 174 | 39 | 24 | 4 | 417 |

| | | Water | | QA/QC Samples | | | Total Samples |
|---|---|---|---|---|---|---|---|
| | | Ground | Surface | FD | ER | TB | |
| Ground/Surface Water | Volatiles | 56 | 18 | 8 | 7 | 8 | 97 |
| | Base Neutrals | 28 | 0 | 3 | 5 | 0 | 36 |
| | PCBs | 6 | 0 | 1 | 2 | 0 | 9 |
| | Metals | 118 | 36 | 16 | 8 | 0 | 178 |
| | Mercury | 12 | 0 | 2 | 2 | 0 | 16 |
| | Chromium VI | 38 | 0 | 4 | 3 | 0 | 45 |
| | Nitroaromatics | 18 | 0 | 2 | 3 | 0 | 23 |
| | TOC | 59 | 18 | 8 | 8 | 0 | 93 |
| | TOX | 59 | 18 | 8 | 8 | 0 | 93 |
| | TDS | 59 | 18 | 8 | 8 | 0 | 93 |
| | TSS | 59 | 18 | 8 | 8 | 0 | 93 |
| | Ground/Surface Water Totals | 512 | 126 | 68 | 62 | 8 | 776 |
| | Project Totals | 688 | 300 | 107 | 86 | 12 | 1193 |

Notes:

FD - Field duplicate sample
ER - Equipment blank.
TB - Trip blank
Metals - Samples will be analyzed for Cd, Cr, Cu, Zn, Pb.

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environmental sampling data from the one sampling event. Internal QA/QC samples will also be analyzed by the laboratory to aid in the validation process.

Field and physical tests will also generate data during the project. A summary of these parameters is presented in Table 1-2.

TABLE 1-2

SUMMARY OF FIELD SAMPLING AND PHYSICAL TESTING PARAMETERS

| Field Sampling Task | Measurement Parameters | Total No. of Measurements | Measurement Units |
|---|---|---|---|
| Soil Gas Survey | Total Volatile Organics | 80-100 | Calibration Gas Equivalents |
| Geophysical Survey | G.P.R. Radio Waves | Continuous over study areas | Nanoseconds |
| Soil Screening | Total Volatile Organics | 50-100 | Calibration Gas Equivalents |
| Air Screening | Total Volatile Organics | Continuous | Calibration Gas Equivalents |
| Soil Testing | Grain Size | 25-100 | Kilograms/mm |
| | Moisture Content | 25-100 | Kilograms |
| | Cation Exchange Capacity | 10 | Milli-equivalents/gram |
| | Permeability | 5 | Cm/Sec. |
| Ground Water Level | Depth to Water | 200-250 | Feet |
| Ground/Surface Water Sampling | pH | 50-100 | pH units |
| | Conductivity | 50-100 | uohms |
| | Temperature | 50-100 | Degrees Celsius |

## 2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The Malcolm Pirnie, Inc. project team selected for this project will perform activities necessary for the successful completion of all field investigations, sampling investigations, and project reporting. The organizational structure for this project is shown in Figure 2-1. Individual project responsibilities are summarized in Section 3.0 of the NSWC RI Work Plan. Project responsibilities, organization structure, and subcontractor qualifications are also outlined in Section 3.0 of the RI Work Plan.

### 2.1 KEY PERSONNEL AND RESPONSIBILITIES - MALCOLM PIRNIE INC.

| Name | Title | Location |
|---|---|---|
| Robert F. Bonner, Jr. | Project Officer | Newport News, VA |
| Richard P. Brownell | Technical Director | Paramus, NJ |
| Terry A. Ritter | Technical Review | Paramus, NJ |
| John Isbister | Technical Review | Paramus, NJ |
| Thomas J. Fisher | Project Manager | Newport News, VA |
| Richard J. Califano | Health and Safety Officer | White Plains, NY |
| Arthur J. Clarke | QA/QC Officer | Paramus, NJ |

The Malcolm Pirnie project office for the NSWC Facility RI will be:

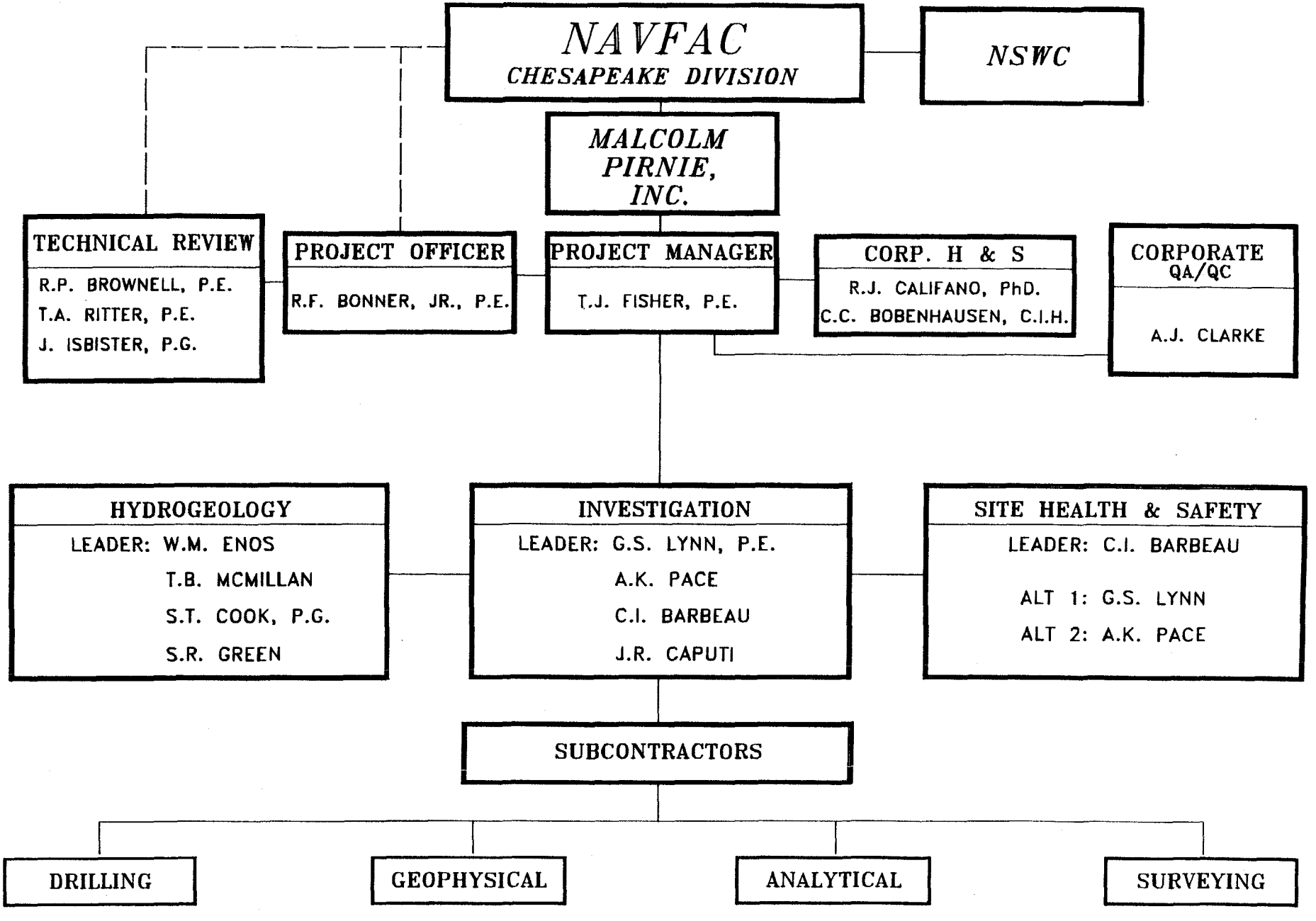
Malcolm Pirnie, Inc.
301 Hiden Boulevard
P.O. Box 6129
Newport News, VA 23606
(804) 599-5511

Administratively, the project office will receive support from Malcolm Pirnie Offices located in White Plains, NY and Paramus, NJ. Technically, the project office will receive support from Paramus, NJ and a Malcolm Pirnie office located in Orlando, FL.

### 2.2 SUBCONTRACTORS

| Organization | Responsibility | Tasks |
|---|---|---|
| Versar, Inc.<br>6850 Versar Center<br>Springfield, VA 22151<br>(703) 750-3000 | Laboratory Analysis,<br>Ground Water Sampling | Collect and analyze environmental and QA/QC samples. |

*FIGURE 2-1*
*PROJECT ORGANIZATION*



| Organization | Responsibility | Tasks |
|---|---|---|
| Hardin - Huber, Inc.<br>1230 Cronson Blvd.<br>Crofton, MD 21114<br>(301) 973-0261 | Drilling and Monitoring Well Installation | Perform drilling for installation of piezometers and monitoring wells. Collect subsurface soil samples and compile bore hole soil logs. |
| STS Consultants, Ltd.<br>3725 Concord Pkwy<br>Chantilly, VA 22021<br>(703) 631-0220 | Perform Ground Penetrating Radar (GPR) Survey | Survey select areas of sites to locate former waste disposal areas. |
| Greenhorn & O'Mara | Survey Monitoring Wells and Piezometers | Determine location and elevation of piezometers and wells throughout the site. |

### 2.2.1 Subcontractor Personnel

The following personnel will be responsible for the management of the subcontractor organizations and the maintenance of each subcontractor's QA/QC program.

| Organization | Employee Name | Title | Telephone No. |
|---|---|---|---|
| Versar, Inc. | Jay Bernarding | Project Coordinator | (703) 750-3000 |
| | Scott Powers | QA/QC officer | (703) 750-3000 |
| Hardin - Huber, Inc. | Don McCleary | Project Manager | (301) 973-0261 |
| STS Consultants, Ltd. | Rick Bohan | Field Coordinator | (703) 631-0220 |
| Greenhorn & O'Mara | (to be determined) | | |

# 3.0 QUALITY ASSURANCE OBJECTIVES

## 3.1 GENERAL

Quality assurance objectives are formulated for the NSWC RI to maintain accuracy, precision, representativeness, sensitivity and completeness for all data generating activities. These activities include field investigations, sampling, and laboratory analyses. To meet the data quality control objectives established for field work conducted at the NSWC site, all field surveys, sampling and laboratory work will be conducted following Level C protocols as outlined in Section 1.3.2 of the NEESA 20.2-047B document. At a minimum, approved USEPA analytical methodologies will be employed for all analytical work. However, since the laboratory subcontractor is qualified under the USEPA Contract Laboratory Program (CLP), the overall QA level for the project will exceed Level C in many cases. CLP protocols will be employed for the analysis of volatile and semivolatile compounds. All other compounds will be analyzed using approved USEPA or Navy approved equivalent methods. The purpose of the quality assurance objectives of each activity is summarized below:

| Activity | General Tasks | Purpose of QA Objectives |
|---|---|---|
| Field Investigations | Water Level Survey<br>Soil Gas Survey<br>Geophysical Survey<br>Air Monitoring | To assure the accuracy, completeness and precision through approved methods for calibration, maintenance and sampling. |
| Sampling | Ground Water Sampling<br>Surface Water Sampling<br>Soil Sampling<br>Sediment Sampling<br>Field Measurements<br>Physical Testing | Prevention of cross-contamination through the use of proper shipping, labeling, sampling and decontamination procedures. Assure collection of representative samples. |
| Laboratory Analyses | Soil, Sediment, Surface Water and Ground Water Analyses.<br>Soil Testing | Maintain high data quality through approved methodologies, accuracy protocols, precision protocols, sensitivity goals, comparability and overall data completeness. |

## 3.2 FIELD AND PHYSICAL TESTING INVESTIGATIONS

Field investigations for the NSWC RI include the following tasks as taken from Chapter 4.0 of the NSWC Work Plan:

- Water Level Survey
- Air Monitoring
- Soil Gas Survey
- Geophysical Survey

These investigations require strict adherence to field operating guidelines and the appropriate physical testing methodologies. Appropriate operating guidelines are included in the SOP Manual. All Engineering, subcontractor, and laboratory personnel responsible for field investigations and physical testing will be required to adhere to these operating guidelines. Table 3-1 provides the QA objectives for the field and physical testing investigations.

## 3.3 SAMPLE COLLECTION

Chapter 4.0 of the NSWC RI Work Plan includes the following tasks associated with sample collection:

- Surface Water and Sediment Sampling
- Surface Soil Sampling
- Subsurface Soil Sampling
- Ground Water Sampling

The precision, accuracy, representativeness and completeness of the sampling efforts to be conducted during the NSWC RI will be determined as follows:

### 3.3.1 Duplicate Samples

Duplicate samples will be submitted to the laboratory for surface water, ground water, soil, and sediment analyses at a rate of one (1) per 10 samples. Field duplicate samples will be used to test the precision and reproducibility of the sampling technique. Two separate

TABLE 3-1

QA SUMMARY TABLE
FOR FIELD AND PHYSICAL
TESTING PARAMETERS

| Parameter | Reference | Matrix | Accuracy[5] |
|---|---|---|---|
| Water Level | SOP[1] 7 | Ground water | ±.01 ft. |
| pH | EPA 150.1[2] | Surface water | ±.01 pH units |
| | | Ground water | ±.01 pH units |
| Conductivity | EPA 120.12 | Surface water | ±2% |
| Temperature | EPA 170.1[2] | Surface water | ±2% |
| | | Ground water | ±2% |
| Total Volatile Organics Photoionization Detector (HNu) | Manufacturer's Instructions/ SOP 11 | Air<br>Soil (head space) | ±5%<br>±5% |
| Total Volatile Organics Flame Ionization Detector (OVA) | Manufacturer's Instructions/ SOP 24 | Air<br>Soil (head space) | ±2%<br>±2% |
| Ground Penetrating Radar (Nanoseconds) | Subcontractor's SOP | Soil | NA |
| Grain size | ASTMD421[3] | Soil | NA |
| Moisture Content | ASTMD422[3] | Soil | NA |

Note:

1. Malcolm Pirnie Standard Operating Procedures Manual, 1987.
2. "Methods for Chemical Analysis of Water Oil Wastes," USEPA, 1983.
3. American Society for Testing Methods.
4. NA - Not Available.
5. Accuracy - Closeness of a sample value to its true value.

aliquots of the sample will be collected at the same sample location. Each portion of the sample will be labeled and submitted to the laboratory independently. Duplicate samples will be labelled in accordance with the site sample numbering plan. The duplicate samples will be recorded in the field notebook for future reference.

### 3.3.2 Blanks

#### 3.3.2.1 Equipment Rinsate Blank

Equipment rinsate blanks are designed to detect possible contamination of samples due to improperly decontaminated sampling equipment. The equipment rinsate blanks will be prepared for each piece of sampling equipment used during a particular sampling event. Equipment is scheduled to be used at multiple sample locations at the site. The equipment blank will be collected after the sampling instrument has been decontaminated. Decontamination procedures are provided in the SOP Manual. Analyze free water, provided by the laboratory, will be poured into or through the equipment and into an approved sample container for the designated parameter group. The blanks will be collected at a frequency of one (1) per day following decontamination of equipment used to sample locations that are the most contaminated.

#### 3.3.2.2 Trip Blanks

Trip blanks are used to detect improper sample container cleaning, contaminated laboratory water or contamination during shipment. Trip blanks are initiated by the laboratory and contain organic free water. The trip blank will be shipped from the laboratory, along with the prepared sample bottles, and is not opened until it arrives back at the laboratory. After accompanying the samples throughout the sampling event, it is shipped back to the laboratory and analyzed. Since the trip blank is primarily used to check for volatile cross contaminants, they will be analyzed for volatiles only. Trip blanks will be submitted to the lab at a rate of one (1) per cooler containing volatile organic samples not to exceed a rate of one (1) per 20 samples.

3.3.2.3 Field Blanks

Field blanks consist of source water used in the decontamination of sampling equipment. One field blank will be collected from each new batch of source water used for decontamination. Where a segregated source of water is not used and decontamination is conducted using water directly from a tap, one field blank per day will be collected.

3.3.2.4 Field, Trip, and Rinsate Blank Evaluation Criteria

Field, trip, and rinsate blank results will be evaluated in conjunction with the laboratory blank results. If the corresponding laboratory blank contains contamination at, above, or below the detection limit and the field, trip, or rinsate blank contains less the an ten times that concentration, then the contamination will be considered a laboratory problem. If the corresponding laboratory blank contains contamination at, above, or below the detection limit and the field, trip, or rinsate blank contains more than ten times that concentration, then the contamination will be considered a field problem and the corresponding samples may need to be recollected and reanalyzed. If the laboratory blank does not contain contamination at any detectable level and the field, trip, or rinsate blank contains contamination greater than ten times the detection limit then the corresponding samples must be recollected and reanalyzed.

Note: The amount of QC sample to be collected is the same as that for the field samples and container sizes are listed in Table 4-10. These containers should be filled for the QC samples.

3.3.3 Sample Containers

Sample containers obtained from Versar, Inc. are prepared according to CLP procedures and are obtained from I-CHEM Research, Inc. All sample containers must be certified clean by the laboratory prior to sample collection to assure no background contamination exists. Trip blanks will be used during the sampling events to evaluate the laboratories and/or bottle supplier cleaning procedures. Trip blanks must contain below detectable levels for all analysis to verify that the bottles are clean. Quality control samples shall be analyzed by the

bottle manufacturer's laboratory at a rate of one sample per QC lot released by the bottle manufacturer.

Procedures for cleaning sample containers are outlined in Versar's Standard Operating Procedures. Cleaning procedures for containers purchased from I-CHEM are outlined in Table 3-2.

### 3.3.4 Representativeness

Data "representativeness" is a qualitative element. Representativeness refers to a sample or a group of samples that reflects the characteristic of the medium at the sampling point. It also includes how well the sampling point represents the actual parameter variation which are under study. Sample representativeness will be determined by the sampling techniques employed during the NSWC RI. These techniques are provided in the SOP Manual and are outlined in Section 4.0, Sampling Procedures. Sampling personnel will strictly adhere to the instructions given in the sampling SOPs in the SOP Manual.

### 3.3.5 Completeness

Completeness is defined as the amount of valid data obtained from a measurement system compared to the amount that was expected and needed to be obtained in meeting the project data goals. The determination of data completeness is the responsibility of the Malcolm Pirnie project manager and will be judged on the percentage of valid data generated during the RI. A goal of 90% or greater has been set for the completeness criteria for this project. Data validity will be judged by the number of data points which lie within acceptable QA/QC criteria. Malcolm Pirnie will consider obtaining an appropriate number of sediment, ground/surface water, and soil samples in duplicate so that if samples are lost or rendered useless prior to analysis, additional "back-up" samples will be available in order that the completeness goal is fully met.

### 3.3.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and

## TABLE 3-2

### SAMPLE BOTTLE CLEANING PROCEDURES

# I-CHEM RESEARCH CLEANING PROTOCOLS FOR THE PREPARATION OF CONTAINERS

- **Amber Glass Bottles**
- **Amber Glass Wide Mouth Jars**
- **Clear Glass Wide Mouth Jars**

1. Wash containers, closures, and teflon liners in hot tap water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse with 1:1 nitric acid.
4. Rinse three times with ASTM Type 1 deionized water.
5. Rinse with pesticide grade methylene chloride.
6. Oven Dry.
7. Remove containers, closures, and teflon liners from oven.
8. Place teflon liners in closures and place closures on containers. Attendant to wear gloves and containers to not be removed from preparation room until sealed.

- **40 ml Borosilicate Glass Vials**
- **40 ml Borosilicate Amber Glass Vials**
- **40 ml Flint Glass Vials**
- **8 oz. & 4 oz. Septum Bottles**

1. Wash vials, septa, and closures in hot tap water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse three times with ASTM Type 1 deionized water.
4. Oven dry vials, septa, and closures.
5. Remove vials, septa, and closures from oven.
6. Place septa in closures, teflon side down, and place on vials. Attendant to wear gloves and vials to not be removed from preparation room until sealed.

- **High Density Polyethylene Bottles**
- **Polyethylene Cubitainers**
- **Genuine Nalgene Products**

1. Wash bottles, closures, and teflon liners with hot tap water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse with 1:1 nitric acid.
4. Rinse three times with ASTM Type 1 deionized water.
5. Air dry in contaminant-free environment.
6. Place liners in closures and place closures on bottles. Attendant to wear gloves and bottles to not be removed from preparation room until sealed.

sample conditions. Comparability is based on, as a minimum, sample collection using comparable and established sampling procedures, analyses using validated analytical procedures with comparable detection limits, and consistent data reporting.

Malcolm Pirnie will assure that all data generated during the NSWC RI meets the comparability criteria by the following procedures:

- Collecting samples in strict accordance with USEPA approved standard operating procedures provided in Appendix A,
- Analyzing samples using USEPA approved methodologies and, whenever possible, by using USEPA CLP procedures,
- Reporting data in parts per billion or parts per million concentrations using uniform reporting packages such as the USEPA CLP package or USEPA Tier II package, and
- Conducting performance and system audits to assure that all the procedures referenced in this section are complied with.

### 3.3.7 Split Samples

One sample from each lot of 20 environmental samples shall be split by the laboratory into triplicates. Two fractions will be analyzed and then spiked with matrix spike compounds and reanalyzed to check precision, accuracy, an matrix effects. The third fraction will be analyzed and the results reported with the remaining samples. The triplicate analyses will be compared to determine the analytical precision of the methodologies. The precision criteria for the triplicate analyses will be 30 percent relative difference between the analytical result of any one fraction and the mean of the three analyses.

## 3.4 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

### 3.4.1 Objectives

The analytical quality assurance/quality control program maintains that all data generated by Versar during the NSWC RI are of acceptable quality. A summary of the QA objectives for the laboratory parameters are presented in Table 3-3. Quality assurance objectives for accuracy, precision, sensitivity/detection limits, completeness and comparability are outlined below:

- Equipment rinsate blanks will be submitted to Versar, Inc. as detailed in Section 3.3.2.1. Rinsate blank data will be used

TABLE 3-3

QA OBJECTIVES FOR LABORATORY ANALYSES

| Parameter | Reference | Matrix | Precision | Accuracy | Completeness |
|---|---|---|---|---|---|
| Volatilies: | CLP | Water | | | |
| Matrix Spikes | | | <14% RFD | 61-145% | 90% |
| Surrogates | | | <25% RFD | 80-147% | 90% |
| Initial Calibration | | | <25% RSD | RF >.3 | 90% |
| Continuing Calibration | | | <25% RFD | RF >.3 | 90% |
| Base/Neutral Extractables: | CLP | Water | | | |
| Matrix Spikes | | | <28-38% RPD | 24-127% | 90% |
| Surrogates | | | <30% RPD | 33-141% | 90% |
| Initial Calibration | | | <30% RSD | RF >.3 | 90% |
| Continuing Calibration | | | <30% RPD | RF >.3 | 90% |
| Volatiles: | CLP | Soil/Sediment | | | |
| Matrix Spikes | | | <21-24% RPD | 59-172% | 90% |
| Surrogates | | | <30% RPD | 70-121% | 90% |
| Initial Calibration | | | <30% RSD | RF >.3 | 90% |
| Continuing Calibration | | | <30% RPD | RF >.3 | 90% |
| Base/Neutral Extractables: | CLP | Soil/Sediment | | | |
| Matrix Spikes | | | <19-50% RPD | 11-142% | 90% |
| Surrogates | | | <30% RPD | 18-137% | 90% |
| Initial Calibration | | | <30% RSD | RF >.3 | 90% |
| Continuing Calibration | | | <30% RPD | RF >.3 | 90% |

Note: RPD - Relative Percent Difference
RSD - Relative Standard Deviation

in association with trip blank data and laboratory reagent blank data to delineate potential sample contamination.

- Trip blanks will be submitted to Versar as described in Section 3.3.2.2. The criteria for evaluating the trip blanks will follow the rationale stated in the rinsate blank objectives. Trip blank data may be used to identify sample transport as a potential source of contamination if the field blank is contaminated.

- One organic laboratory blank per 20 samples or one per every 12 hours, whichever is more frequent, will be run by Versar, Inc. for all analyses. Laboratory blanks must contain less than five times the contract required detection levels (CRDL) for acetone, methylene chloride, and common phthalates and less than the CRDL for all other compounds.

- Inorganic laboratory blanks will be run once per 20 samples or at the frequency required by SW-846 protocols, whichever is more frequent. Inorganic blanks must contain less than one-tenth the concentration of an analyze detected in a corresponding environmental sample.

- One matrix spike and one matrix spike duplicate per 20 samples will be run by Versar for each shipment of surface water, ground water, and soil/sediment samples.

- All samples, matrix spikes, and blanks will be spiked with organic surrogate compounds as stated in the CLP-IFB Statement of Work - 2/88. A 30-peak organic compound library search shall be performed for all samples according to the protocols presented in the CLP-IFB Statement of Work. The CLP-IFB SOW is a contract addendum that gives the lab specific analysis methodologies and procedures when running soil and water samples.

- Performance and system audits will be performed by USEPA, NEESA and various state agencies.

### 3.4.2 Accuracy Objectives

Required organic surrogate spike recoveries are presented in the CLP-IFB Statement of Work - 2/88. All samples and blanks will be spiked with surrogate compounds upon receipt by the laboratory. Accuracy will be measured by percent recovery which indicates the amount of known material recovered from a sample. Matrix spike compounds will be added to a select number of samples to measure accuracy. Surrogate and matrix spike recovery criteria are presented in the CLP-IFB Statement of Work.

Accuracy will also be maintained through the use of analyze calibration curves and calibration checks. All project accuracy objectives are summarized in Table 3-3.

### 3.4.3 Precision Objectives

The precision objective of the project is to have 90 percent of the matrix spike and matrix spike duplicate recoveries display a 25 percent relative percent difference (RPD) or the RPD required by CLP protocols, whichever is less. Although the spike compounds do not consist of all project analyze, the compounds are selected to give the best possible representation of the total analyze list. Twenty five percent RPD is taken from Contract Laboratory Program protocols for evaluating daily calibration checks versus the average response factor for the initial calibration.

### 3.4.4 Sensitivity/Detection Limit Objectives

Table 3-4 provides the detection limits for all project analytes for surface water, sediment, soil and ground water samples. Detection limits are taken from CLP-IFB Organic and Inorganic Statements of Work, USATHAMA methods, and other approved USEPA methodologies.

### 3.4.5 Quality Characteristics Goals

Samples shall be collected in accordance with the Field Operating Guidelines in the SOP Manual. The completeness goal shall be greater than or equal to 90 percent. Comparability between data generated by different laboratories will be met by the above QA goals.

Organic laboratory blanks must contain less than five times the Contract Required Detection Limit (CRDL) for methylene chloride, acetone, toluene and common phthalates and less than the CRDL for all other analytes. Inorganic laboratory blanks must contain less than one-tenth the concentration of an analyte detected in a corresponding environmental sample.

## 3.5 DATA REPORTING

All data generated by the analytical laboratory will conform to the format specified in the QAPP. Data reports are designed to report both

TABLE 3-4

ANALYTICAL METHODS AND DETECTION LIMITS

| Analyte | Methodology Water | Methodology Soil | Detection Limits Water | Detection Limits Soil |
|---|---|---|---|---|
| 1. Metals: | All Metals by SW-846 Methods | | | |
| Cadmium | 3010/6010 | 3050/6010 | 4.0 ug/l | 0.4 mg/kg |
| Chromium | 3010/6010 | 3050/6010 | 6.0 ug/l | 0.6 mg/kg |
| Copper | 3010/6010 | 3050/6010 | 4.0 ug/l | 0.4 mg/kg |
| Lead | 3010/6010 | 3050/6010 | 32.0 ug/l | 3.2 mg/kg |
| Zinc | 3010/6010 | 3050/6010 | 4.0 ug/l | 0.4 mg/kg |
| 2. Mercury | SW-846,7470 | SW-846,7471 | 0.2 ug/l | 0.1 mg/kg |
| 3. Chromium VI | SW-846,7197 | SW-846,7197(a) | 10.0 ug/l | 0.2 mg/kg |
| 4. TOC | MCAWW 415.2 | MCAWW 415.1 | 0.2 mg/l | 100 mg/kg |
| 5. TOX | MCAWW 450.1 | SW-846, 9076 | 10.0 ug/l | 10 mg/kg |
| 6. TSS | MCAWW 160.2 | -- | 1.0 mg/l | -- |
| 7. TDS | MCAWW 160.1 | -- | 10.0 mg/l | -- |
| 8. Nitroaromatics: | USATHAMA Revised Method 8H for Explosives by HPLC for Water and Soil Samples | | | |
| TNT | " | | 0.78 ug/l | 1.920 mg/kg |
| RDX | " | | 0.63 ug/l | 0.977 mg/kg |
| HMX | " | | 1.30 ug/l | 1.270 mg/kg |
| 2,4-DNT | " | | 0.60 ug/l | 0.416 mg/kg |
| 2.6-DNT | " | | 0.55 ug/l | 0.402 mg/kg |
| 1,3,5-TNB | " | | 0.56 ug/l | 2.090 mg/kg |
| 9. PCBs: | EPA 608 Method for Water and Soil Samples | | | |
| Aroclor-1016 | " | | 0.5 ug/l | 80 ug/kg |
| Aroclor-1221 | " | | 0.5 ug/l | 80 ug/kg |
| Aroclor-1232 | " | | 0.5 ug/l | 80 ug/kg |
| Aroclor-1242 | " | | 0.5 ug/l | 80 ug/kg |
| Aroclor-1248 | " | | 0.5 ug/l | 80 ug/kg |
| Aroclor-1254 | " | | 1.0 ug/l | 160 ug/kg |
| Aroclor-1260 | " | | 1.0 ug/l | 160 ug/kg |

TABLE 3-4

ANALYTICAL METHODS AND DETECTION LIMITS
(Continued)

| Analyte | Methodology Water | Methodology Soil | Detection Limits Water | Detection Limits Soil |
|---|---|---|---|---|
| 10. Volatiles: | CLP Package for Water and Soil Samples | | | |
| Chloromethane | " | | 10.0 ug/l | 10 ug/kg |
| Bromomethane | " | | 10.0 ug/l | 10 ug/kg |
| Vinyl Chloride | " | | 10.0 ug/l | 10 ug/kg |
| Chloroethane | " | | 10.0 ug/l | 10 ug/kg |
| Methylene Chloride | " | | 5.0 ug/l | 5 ug/kg |
| Acetone | " | | 10.0 ug/l | 10 ug/kg |
| Carbon Disulfide | " | | 5.0 ug/l | 5 ug/kg |
| 1,1-Dichloroethene | " | | 5.0 ug/l | 5 ug/kg |
| 1,1-Dichloroethane | " | | 5.0 ug/l | 5 ug/kg |
| 1,2-Dichloroethene | " | | 5.0 ug/l | 5 ug/kg |
| Chlorform (THM) | " | | 5.0 ug/l | 5 ug/kg |
| 1,2-Dichloroethane | " | | 5.0 ug/l | 5 ug/kg |
| 2-Butanone (MEK) | " | | 10.0 ug/l | 10 ug/kg |
| 1,1,1-Trichloroethane | " | | 5.0 ug/l | 5 ug/kg |
| Carbon Tetrachloride | " | | 5.0 ug/l | 5 ug/kg |
| Vinyl Acetate | " | | 10.0 ug/l | 10 ug/kg |
| Bromodichloromethane (THM) | " | | 5.0 ug/l | 5 ug/kg |
| 1,2-Dichloropropane | " | | 5.0 ug/l | 5 ug/kg |
| cis-1,3-Dichloropropene | " | | 5.0 ug/l | 5 ug/kg |
| Trichloroethene | " | | 5.0 ug/l | 5 ug/kg |
| Dibromochloromethane (THM) | " | | 5.0 ug/l | 5 ug/kg |
| 1,1,2-Trichlorethane | " | | 5.0 ug/l | 5 ug/kg |
| Benzene | " | | 5.0 ug/l | 5 ug/kg |
| trans-1,3-Dichloropropene | " | | 5.0 ug/l | 5 ug/kg |
| Bromoform (THM) | " | | 5.0 ug/l | 5 ug/kg |
| 4-Methyl-2-pentanone | " | | 10.0 ug/l | 10 ug/kg |
| 2-Hexanone | " | | 10.0 ug/l | 10 ug/kg |
| Tetrachloroethene | " | | 5.0 ug/l | 5 ug/kg |
| Toluene | " | | 5.0 ug/l | 5 ug/kg |
| 1,1,2,2-Tetrachloroethane | " | | 5.0 ug/l | 5 ug/kg |
| Chlorobenzene | " | | 5.0 ug/l | 5 ug/kg |
| Ethyl Benzene | " | | 5.0 ug/l | 5 ug/kg |
| Styrene | " | | 5.0 ug/l | 5 ug/kg |
| Xylene | " | | 5.0 ug/l | 5 ug/kg |
| 11. Semivolatiles: | CLP Package for Water and Soil Samples | | | |
| Phenol | " | | 10.0 ug/l | 330 ug/kg |
| bis(2-Chloroethyl) ether | " | | 10.0 ug/l | 330 ug/kg |
| 2-Chlorophenol | " | | 10.0 ug/l | 330 ug/kg |
| 1,3-Dichlorobenzene | " | | 10.0 ug/l | 330 ug/kg |

TABLE 3-4

ANALYTICAL METHODS AND DETECTION LIMITS
(Continued)

| Analyte | Methodology Water | Methodology Soil | Detection Limits Water | Detection Limits Soil |
|---|---|---|---|---|
| 11. Semivolatiles: (Continued) | CLP Package for Water and Soil Samples | | | |
| 1,4-Dichlorobenzene | | " | 10.0 ug/l | 330 ug/kg |
| Benzyl Alcohol | | " | 10.0 ug/l | 330 ug/kg |
| 1,2-Dichlorobenzene | | " | 10.0 ug/l | 330 ug/kg |
| 2-Methylphenol | | " | 10.0 ug/l | 330 ug/kg |
| bis(2-Chloroisopropyl) ether | | " | 10.0 ug/l | 330 ug/kg |
| 4-Methylphenol | | " | 10.0 ug/l | 330 ug/kg |
| N-Nitroso-di-n-dipropylamine | | " | 10.0 ug/l | 330 ug/kg |
| Hexachloroethane | | " | 10.0 ug/l | 330 ug/kg |
| Nitrobenzene | | " | 10.0 ug/l | 330 ug/kg |
| Isophorone | | " | 10.0 ug/l | 330 ug/kg |
| 2-Nitrophenol | | " | 10.0 ug/l | 330 ug/kg |
| 2,4-Dimethylphenol | | " | 10.0 ug/l | 330 ug/kg |
| Benzoic Acid | | " | 50.0 ug/l | 1600 ug/kg |
| bis(2-Chloroethoxy) methane | | " | 10.0 ug/l | 330 ug/kg |
| 2,4-Dichlorophenol | | " | 10.0 ug/l | 330 ug/kg |
| 1,2,4-Trichlorobenzene | | " | 10.0 ug/l | 330 ug/kg |
| Naphthalene | | " | 10.0 ug/l | 330 ug/kg |
| 4-Chloroaniline | | " | 10.0 ug/l | 330 ug/kg |
| Hexachlorobutadiene | | " | 10.0 ug/l | 330 ug/kg |
| 4-Chloro-3-methylphenol | | " | 10.0 ug/l | 330 ug/kg |
| 2-Methylnaphthalene | | " | 10.0 ug/l | 330 ug/kg |
| Hexachlorocyclopentadiene | | " | 10.0 ug/l | 330 ug/kg |
| 2,4,6-Trichlorophenol | | " | 10.0 ug/l | 330 ug/kg |
| 2,4,5-Trichlorophenol | | " | 50.0 ug/l | 1600 ug/kg |
| 2-Chloronaphthalene | | " | 10.0 ug/l | 330 ug/kg |
| 2-Nitroaniline | | " | 50.0 ug/l | 1600 ug/kg |
| Dimethylphthalate | | " | 10.0 ug/l | 330 ug/kg |
| Acenaphthylene | | " | 10.0 ug/l | 330 ug/kg |
| 2,6-Dinitrotoluene | | " | 10.0 ug/l | 330 ug/kg |
| 3-Nitroaniline | | " | 50.0 ug/l | 1600 ug/kg |
| Acenaphthene | | " | 10.0 ug/l | 330 ug/kg |
| 2,4-Dinitrophenol | | " | 50.0 ug/l | 1600 ug/kg |
| 4-Nitrophenol | | " | 50.0 ug/l | 1600 ug/kg |
| Dibenzofuran | | " | 10.0 ug/l | 330 ug/kg |
| 2,4-Dinitrotoluene | | " | 10.0 ug/l | 330 ug/kg |
| Diethylphthalate | | " | 10.0 ug/l | 330 ug/kg |
| 4-Chlorophenyl-phenyl ether | | " | 10.0 ug/l | 330 ug/kg |
| Fluorene | | " | 10.0 ug/l | 330 ug/kg |
| 4-Nitroaniline | | " | 50.0 ug/l | 1600 ug/kg |
| 4,6-Dinitro-2-methylphenol | | " | 50.0 ug/l | 1600 ug/kg |
| N-nitrosodiphenylamine | | " | 10.0 ug/l | 330 ug/kg |
| 4-Bromophenyl-phenyl ether | | " | 10.0 ug/l | 330 ug/kg |

TABLE 3-4

ANALYTICAL METHODS AND DETECTION LIMITS
(Continued)

| Analyte | Methodology Water | Methodology Soil | Detection Limits Water | Detection Limits Soil |
|---|---|---|---|---|
| 11. Semivolatiles: (Continued) | CLP Package for Water and Soil Samples | | | |
| Hexachlorobenzene | | " | 10.0 ug/l | 330 ug/kg |
| Pentachlorophenol | | " | 50.0 ug/l | 1600 ug/kg |
| Phenanthrene | | " | 10.0 ug/l | 330 ug/kg |
| Anthracene | | " | 10.0 ug/l | 330 ug/kg |
| Di-n-butylphthalate | | " | 10.0 ug/l | 330 ug/kg |
| Fluoranthene | | " | 10.0 ug/l | 330 ug/kg |
| Pyrene | | " | 10.0 ug/l | 330 ug/kg |
| Butylbenzylphthalate | | " | 10.0 ug/l | 330 ug/kg |
| 3,3-Dichlorobenzidine | | " | 20.0 ug/l | 660 ug/kg |
| Benzo(a)anthracene | | " | 10.0 ug/l | 330 ug/kg |
| Chrysene | | " | 10.0 ug/l | 330 ug/kg |
| bis(2-Ethylhexyl)phthalate | | " | 10.0 ug/l | 330 ug/kg |
| Di-n-octylphthalate | | " | 10.0 ug/l | 330 ug/kg |
| Benzo(b)fluoranthene | | " | 10.0 ug/l | 330 ug/kg |
| Benzo(k)fluoranthene | | " | 10.0 ug/l | 330 ug/kg |
| Benzo(a)pyrene | | " | 10.0 ug/l | 330 ug/kg |
| Indeno(1,2,3-cd)pyrene | | " | 10.0 ug/l | 330 ug/kg |
| Dibenz(a,h)anthracene | | " | 10.0 ug/l | 330 ug/kg |
| Benzo(g,h,i)perylene | | " | 10.0 ug/l | 330 ug/kg |

Note: (a) A TCLP extraction will precede the actual analytical method because SW-846 3rd Ed. does not have a method for performing chromium VI analysis on a soil matrix.

analytical results for each sample as well as quality assurance data and data related to the identification and quantitation of detailed analysis. Specifically, all volatile and semivolatile results will be reported via the CLP data package. Data reporting procedure for the CLP package are detailed in the USEPA CLP Statement of Work for Organics Analysis, February, 1988. This package will contain the following information:

- General and Header Information
- Organic Analysis Data Sheets
- Surrogate Recovery Data
- Matrix Spike/Matrix Spike Duplicate Recovery Data
- Method Blank Summary Data
- GC/MS Turning and Mass Calibration Data
- Initial Calibration Data
- Continuing Calibration Data
- Internal Standard Area Summary

A standard commercial laboratory package will be generated to report the remaining parameters including PCB's TOC, TOX, TSS, TDS, nitroaromatics, and metals. Reporting procedures will conform to the NEESA AQ Document (NEESA 20.2-047B), dated June 1988, Section 7.2. The standard commercial package will consist of the following deliverables:

- Data Reporting Sheets
- Case Narrative
- Detection Limit Summary
- QA Data Summary (including lab blank data, method blank data, duplicate data, and spike results)
- Calibration Data Summary

# 4.0 SAMPLING PROCEDURES

## 4.1 OVERVIEW

Development of reliable soil, water quality, air and other environmental data is a critical part of this project. Considerable importance is attached to the design and quality assurance of the sampling, analysis, and data handling. Sampling procedures and collection techniques include a wide range of operating procedures. This plan describes specific numbers and types of samples required to identify the nature and extent of site contamination. This plan also details the type of data and information to be generated and their intended use. The major elements of this chapter are outlined:

- Field Investigations
- Sample Matrices
- Sample Locations
- Preparation of Sample Containers
- Procurement of Sample Containers
- Preservation/Holding Times
- Filtration Procedures

Collection protocols and decontamination procedures are provided in the SOP Manual. Field sampling teams will be provided by Malcolm Pirnie, Inc., except where noted. All personnel will follow Sampling Operating Guidelines to assure consistency in sample collection.

## 4.2 FIELD INVESTIGATIONS

The following RI activities involve the collection of data through in field screening and sampling techniques:

- Health and Safety Monitoring
- Water Level Survey/Piezometer Installation
- Soil Screening

- Soil Gas Survey
- Geophysical Survey

4.2.1 Soil Gas Survey

Soil gas surveys will be conducted as part of the field investigations to determine the approximate boundaries of existing landfills present at the NSWC site. Approximate physical boundaries of the landfills will be delineated by screening vapor vents made in the upper 12-inches of soil by using a plunger bar. Screening will be conducted by using an HNu photoionization detector (PID), OVA flame ionization detector (FID), and an explosimeter. Soil gas surveys will be performed at Sites 2, 3, 4, 9 and 11 as indicated on the site figure maps included in Section 4.0 of the RI Work Plan.

Field Equipment

- Foxboro Century FID, OVA 128
- HNu PID Model PI 101
- 10.2 eV Lamp
- MSA Explosimeter
- Calibration Gas
- Recharger
- Plunger Bar
- Field Log Book

Field Procedures

Field procedures for conducting soil gas surveys are provided in the SOP Manual.

4.2.2 Geophysical Survey

In addition to soil gas methods, geophysical surveys will be performed at Sites 4 and 8 in an attempt to more accurately define the vertical and horizontal extent of the disposal areas. The geophysical surveys to be performed during the NSWC field investigations will involve the use of ground penetrating radar. A geophysical contractor

will be responsible for conducting these geophysical surveys under subcontract to Malcolm Pirnie, Inc.

Field Equipment

To be provided by the geophysical contractor.

Field Procedures

Field procedures for geophysical surveying will be provided by the geophysical contractor.

### 4.2.3 Health and Safety Monitoring

Ambient air quality during all field activities performed at NSWC will be monitored consistent with health and safety protocols. Air quality monitoring will be performed using a HNu Model PI 101 photo-ionization detector fitted with a 10.2 eV lamp or the Century OVA Model 128. Readings will be entered into the field logbook during monitoring activities. All monitoring activities will be performed in accordance with the Health and Safety Plan.

Field Equipment

- Foxboro Century Flameionization Detector OVA 128
- HNu Photoionization Detector Model PI 101
- 10.2 eV Lamp
- Calibration Gases
- Rechargers
- Field logbook

Field Procedures

Procedures for conducting air monitoring are outlined in the Project Health and Safety Plan.

### 4.2.4 Soil Screening

Split-spoon sampling will be conducted at all new monitoring well locations. Sampling will be continuous at all deep monitoring wells that are situated in monitoring well clusters. The shallow monitoring

well of the cluster will not be sampled. Five foot sampling intervals will be used at remaining well locations. Soil samples will be examined by an on-site geologist who will screen the lower 6-inches of the collected sample with the photoionization detector after the sample has been placed into an 8-ounce jar. Readings will be entered on the Boring Logs located in the SOP Manual.

Field Equipment

- HNu Photoionization Detector Model PI 101
- 10.2 eV Lamp
- Two foot stainless steel split-spoon samplers
- Trowels
- Field logbook
- Calibration Gases

Field Procedures

Field procedures for soil boring screening are provided in the SOP Manual. Procedures are taken from Malcolm Pirnie Standard Operating Procedures.

4.2.5 Water Level Survey/Piezometer Installation

Nine (9) piezometers will be installed during the Remedial Investigation at Sites 7, 8, 9 and 11. Following installation and surveying, water level measurements will be taken from the newly installed piezometers and Phase I monitoring wells to determine the ground water flow direction. After establishing a ground water gradient, permanent monitoring wells will be installed accordingly for the collection of ground water samples.

Field Procedures

Procedures and construction details for the installation of the piezometers are outlined in The SOP Manual.

## 4.3 SAMPLING

Sampling of environmental matrices for chemical analysis depends on proper collection, preservation, shipping, labeling, custody and preparation techniques to guarantee representative samples. Unpreserved or improperly shipped samples may jeopardize sample integrity and influence data quality. Decontamination of sampling equipment between sampling locations reduces the risks of carry over of compounds from one site to the next. Decontamination procedures are provided in the SOP Manual. Operating guidelines have also been complied by Malcolm Pirnie, Inc. for sample collection, preservation, shipment, custody and preparation. These guidelines are provided in the SOP Manual and apply to the following sampling tasks:

- Surface Water Sampling
- Sediment Sampling
- Surface Soil Sampling
- Subsurface Soil Sampling
- Ground Water Sampling
- Grain Size Analysis

### 4.3.1 Surface Water Sampling

Surface water samples will be collected at various locations at the NSWC site. The locations of the surface water sampling are shown on the individual site maps included in Chapter 4.0 of the NSWC Work Plan.

Surface water samples will be analyzed for the parameters listed in Tables 4-1 through 4-9. Rationale for selection of surface water sampling locations can be found in the NSWC Work Plan. These locations were chosen in order to obtain additional information regarding the nature and spatial extent of contamination and to identify high concentration areas.

Field Equipment

- Dipper
- Sample Bottles

**TABLE 4-1**

**SUMMARY OF ENVIRONMENTAL SAMPLING**

**BACKGROUND WELLS**

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 0 | 0 | 0 | 0 | 0 | 0 |
| | BASE NEUTRALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOX | 0 | 0 | 0 | 0 | 0 | 0 |
| | pH | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 0 | 0 | 0 | 0 | 0 | 0 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 2 | 0 | 0 | 1 | 1 | 4 |
| | BASE NEUTRALS | 2 | 0 | 0 | 1 | 0 | 3 |
| | PCBs | 2 | 0 | 0 | 1 | 0 | 3 |
| | METALS | 4 | 0 | 0 | 1 | 0 | 5 |
| | MERCURY | 4 | 0 | 0 | 1 | 0 | 5 |
| | CHROMIUM VI | 4 | 0 | 0 | 1 | 0 | 5 |
| | NITROAROMATICS | 2 | 0 | 0 | 1 | 0 | 3 |
| | TOC | 2 | 0 | 0 | 1 | 0 | 3 |
| | TOX | 2 | 0 | 0 | 1 | 0 | 3 |
| | TDS | 2 | 0 | 0 | 1 | 0 | 3 |
| | TSS | 2 | 0 | 0 | 1 | 0 | 3 |
| | TOTAL | 28 | 0 | 0 | 11 | 1 | 40 |
| | TOTAL / TOTAL | 28 | 0 | 0 | 11 | 1 | 40 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

**TABLE 4-2**

**SUMMARY OF FIELD ENVIRONMENTAL SAMPLING**

**SITE - 2**

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 10 | 2 | 1 | 1 | 1 | 15 |
| | BASE NEUTRALS | 0 | 2 | 0 | 1 | 0 | 3 |
| | PCBs | 10 | 2 | 1 | 1 | 0 | 14 |
| | METALS | 10 | 2 | 1 | 1 | 0 | 14 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 10 | 0 | 1 | 1 | 0 | 12 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 10 | 2 | 1 | 1 | 0 | 14 |
| | TOX | 10 | 2 | 1 | 1 | 0 | 14 |
| | pH | 10 | 2 | 1 | 0 | 0 | 13 |
| | TOTAL | 70 | 14 | 7 | 7 | 1 | 99 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 4 | 6 | 1 | 1 | 1 | 13 |
| | BASE NEUTRALS | 4 | 0 | 0 | 1 | 0 | 5 |
| | PCBs | 4 | 0 | 1 | 1 | 0 | 6 |
| | METALS | 8 | 12 | 2 | 1 | 0 | 23 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 8 | 0 | 2 | 1 | 0 | 11 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 4 | 6 | 1 | 1 | 0 | 12 |
| | TOX | 4 | 6 | 1 | 1 | 0 | 12 |
| | TDS | 4 | 6 | 1 | 1 | 0 | 12 |
| | TSS | 4 | 6 | 1 | 1 | 0 | 12 |
| | TOTAL | 44 | 42 | 10 | 9 | 1 | 106 |
| | TOTAL / TOTAL | 114 | 56 | 17 | 16 | 2 | 205 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

**TABLE 4-3**

**SUMMARY OF ENVIRONMENTAL SAMPLING**

**SITE - 3**

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 0 | 0 | 0 | 0 | 0 | 0 |
| | BASE NEUTRALS | 0 | 2 | 0 | 1 | 0 | 3 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 4 | 2 | 1 | 1 | 0 | 8 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 4 | 0 | 0 | 1 | 0 | 5 |
| | TOX | 4 | 0 | 0 | 1 | 0 | 5 |
| | pH | 4 | 0 | 0 | 0 | 0 | 4 |
| | TOTAL | 16 | 4 | 1 | 4 | 0 | 25 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 4 | 4 | 1 | 1 | 1 | 11 |
| | BASE NEUTRALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 8 | 8 | 2 | 1 | 0 | 19 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 4 | 4 | 1 | 1 | 0 | 10 |
| | TOX | 4 | 4 | 1 | 1 | 0 | 10 |
| | TDS | 4 | 4 | 1 | 1 | 0 | 10 |
| | TSS | 4 | 4 | 1 | 1 | 0 | 10 |
| | TOTAL | 28 | 28 | 7 | 6 | 1 | 70 |
| | TOTAL / TOTAL | 44 | 32 | 8 | 10 | 1 | 95 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

TABLE 4-4

SUMMARY OF ENVIRONMENTAL SAMPLING

SITE - 4

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 0 | 0 | 0 | 0 | 0 | 0 |
| | BASE NEUTRALS | 0 | 4 | 1 | 1 | 0 | 6 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 0 | 6 | 1 | 1 | 0 | 8 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 6 | 1 | 1 | 0 | 8 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 0 | 6 | 1 | 1 | 0 | 8 |
| | TOX | 0 | 6 | 1 | 1 | 0 | 8 |
| | pH | 0 | 6 | 1 | 0 | 0 | 7 |
| | TOTAL | 0 | 34 | 6 | 5 | 0 | 45 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 13 | 0 | 1 | 1 | 1 | 16 |
| | BASE NEUTRALS | 13 | 0 | 1 | 1 | 0 | 15 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 26 | 0 | 2 | 1 | 0 | 29 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 26 | 0 | 2 | 1 | 0 | 29 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 13 | 0 | 1 | 1 | 0 | 15 |
| | TOX | 13 | 0 | 1 | 1 | 0 | 15 |
| | TDS | 13 | 0 | 1 | 1 | 0 | 15 |
| | TSS | 13 | 0 | 1 | 1 | 0 | 15 |
| | TOTAL | 130 | 0 | 10 | 8 | 1 | 149 |
| | TOTAL / TOTAL | 130 | 34 | 16 | 13 | 1 | 194 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

**TABLE 4-5**

**SUMMARY OF ENVIRONMENTAL SAMPLING**

**SITE - 7**

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 0 | 0 | 0 | 0 | 0 | 0 |
| | BASE NEUTRALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 54 | 6 | 3 | 0 | 63 |
| | TOC | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOX | 0 | 0 | 0 | 0 | 0 | 0 |
| | pH | 0 | 54 | 6 | 0 | 0 | 60 |
| | TOTAL | 0 | 108 | 12 | 3 | 0 | 123 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 0 | 0 | 0 | 0 | 0 | 0 |
| | BASE NEUTRALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 6 | 0 | 0 | 1 | 0 | 7 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 3 | 0 | 1 | 1 | 0 | 5 |
| | TOC | 3 | 0 | 0 | 1 | 0 | 4 |
| | TOX | 3 | 0 | 0 | 1 | 0 | 4 |
| | TDS | 3 | 0 | 0 | 1 | 0 | 4 |
| | TSS | 3 | 0 | 0 | 1 | 0 | 4 |
| | TOTAL | 21 | 0 | 1 | 6 | 0 | 28 |
| | TOTAL / TOTAL | 21 | 108 | 13 | 9 | 0 | 151 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

**TABLE 4-6**

**SUMMARY OF ENVIRONMENTAI SAMPLING**

**SITE - 8**

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 0 | 0 | 0 | 0 | 0 | 0 |
| | BASE NEUTRALS | 0 | 2 | 0 | 0 | 0 | 2 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 0 | 2 | 0 | 0 | 0 | 2 |
| | MERCURY | 0 | 2 | 0 | 0 | 0 | 2 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOX | 0 | 0 | 0 | 0 | 0 | 0 |
| | pH | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOTAL | 0 | 6 | 0 | 0 | 0 | 6 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 4 | 0 | 1 | 1 | 1 | 7 |
| | BASE NEUTRALS | 4 | 0 | 1 | 1 | 0 | 6 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 8 | 0 | 2 | 1 | 0 | 11 |
| | MERCURY | 8 | 0 | 2 | 1 | 0 | 11 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 4 | 0 | 1 | 1 | 0 | 6 |
| | TOX | 4 | 0 | 1 | 1 | 0 | 6 |
| | TDS | 4 | 0 | 1 | 1 | 0 | 6 |
| | TSS | 4 | 0 | 1 | 1 | 0 | 6 |
| | TOTAL | 40 | 0 | 10 | 8 | 1 | 59 |
| | TOTAL / TOTAL | 40 | 6 | 10 | 8 | 1 | 65 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

TABLE 4-7

SUMMARY OF ENVIRONMENTAL SAMPLING

SITE - 9

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 1 | 0 | 0 | 1 | 1 | 3 |
| | BASE NEUTRALS | 1 | 2 | 1 | 1 | 0 | 5 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 10 | 2 | 1 | 1 | 0 | 14 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 10 | 0 | 1 | 1 | 0 | 12 |
| | TOX | 10 | 0 | 1 | 1 | 0 | 12 |
| | pH | 10 | 0 | 1 | 0 | 0 | 11 |
| | TOTAL | 42 | 4 | 5 | 5 | 1 | 57 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 13 | 3 | 2 | 1 | 1 | 20 |
| | BASE NEUTRALS | 5 | 0 | 1 | 1 | 0 | 7 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 26 | 6 | 4 | 1 | 0 | 37 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 13 | 0 | 1 | 1 | 0 | 15 |
| | TOC | 13 | 3 | 2 | 1 | 0 | 19 |
| | TOX | 13 | 3 | 2 | 1 | 0 | 19 |
| | TDS | 13 | 3 | 2 | 1 | 0 | 19 |
| | TSS | 13 | 3 | 2 | 1 | 0 | 19 |
| | TOTAL | 109 | 21 | 16 | 8 | 1 | 155 |
| | TOTAL / TOTAL | 151 | 25 | 21 | 13 | 2 | 212 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

TABLE 4-8

SUMMARY OF ENVIRONMENTAL SAMPLING

SITE - 11

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 3 | 0 | 0 | 0 | 1 | 4 |
| | BASE NEUTRALS | 3 | 2 | 0 | 0 | 0 | 5 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 3 | 2 | 0 | 0 | 0 | 5 |
| | MERCURY | 3 | 0 | 0 | 0 | 0 | 3 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 3 | 0 | 0 | 0 | 0 | 3 |
| | TOX | 3 | 0 | 0 | 0 | 0 | 3 |
| | pH | 3 | 0 | 0 | 0 | 0 | 3 |
| | TOTAL | 21 | 4 | 0 | 0 | 1 | 26 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 16 | 2 | 1 | 1 | 1 | 21 |
| | BASE NEUTRALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 32 | 4 | 2 | 1 | 0 | 39 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 16 | 2 | 1 | 1 | 0 | 20 |
| | TOX | 16 | 2 | 1 | 1 | 0 | 20 |
| | TDS | 16 | 2 | 1 | 1 | 0 | 20 |
| | TSS | 16 | 2 | 1 | 1 | 0 | 20 |
| | TOTAL | 112 | 14 | 7 | 6 | 1 | 140 |
| | TOTAL / TOTAL | 133 | 18 | 7 | 6 | 2 | 166 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

**TABLE 4-9**

**SUMMARY OF ENVIRONMENTAL SAMPLING**

**SITE - PAINT BRANCH CREEK**

| SAMPLE MATRIX | PARAMETERS | FIELD SAMPLES SEDIMENT | FIELD SAMPLES SOIL | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| SEDIMENTS/SOIL | VOLATILES | 3 | 0 | 1 | 0 | 1 | 5 |
| | BASE NEUTRALS | 3 | 0 | 1 | 0 | 0 | 4 |
| | PCBs | 3 | 0 | 1 | 0 | 0 | 4 |
| | METALS | 3 | 0 | 1 | 0 | 0 | 4 |
| | MERCURY | 3 | 0 | 1 | 0 | 0 | 4 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 3 | 0 | 0 | 0 | 0 | 3 |
| | TOC | 3 | 0 | 1 | 0 | 0 | 4 |
| | TOX | 3 | 0 | 1 | 0 | 0 | 4 |
| | pH | 3 | 0 | 1 | 0 | 0 | 4 |
| | TOTAL | 27 | 0 | 8 | 0 | 1 | 36 |

| | | WATER GROUND | WATER SURFACE | QA/QC SAMPLES FD | QA/QC SAMPLES ER | QA/QC SAMPLES TB | TOTAL SAMPLES |
|---|---|---|---|---|---|---|---|
| GROUND/SURFACE WATER | VOLATILES | 0 | 3 | 1 | 0 | 1 | 5 |
| | BASE NEUTRALS | 0 | 0 | 0 | 0 | 0 | 0 |
| | PCBs | 0 | 0 | 0 | 0 | 0 | 0 |
| | METALS | 0 | 6 | 2 | 0 | 0 | 8 |
| | MERCURY | 0 | 0 | 0 | 0 | 0 | 0 |
| | CHROMIUM VI | 0 | 0 | 0 | 0 | 0 | 0 |
| | NITROAROMATICS | 0 | 0 | 0 | 0 | 0 | 0 |
| | TOC | 0 | 3 | 1 | 0 | 0 | 4 |
| | TOX | 0 | 3 | 1 | 0 | 0 | 4 |
| | TDS | 0 | 3 | 1 | 0 | 0 | 4 |
| | TSS | 0 | 3 | 1 | 0 | 0 | 4 |
| | TOTAL | 0 | 21 | 7 | 0 | 1 | 29 |
| | TOTAL / TOTAL | 27 | 21 | 15 | 0 | 2 | 65 |
| | TOTAL ALL SITES | 688 | 300 | 107 | 86 | 12 | 1193 |

NOTES:

FD - Field Duplicate Sample
ER - Equipment Rinsate Sample
TB - Trip Blank Sample
Metals - Cd, Cr, Zn, Pb, Hg and CrVI, filtered and unfiltered fractions will be collected for each water analysis.

- PID or FID
- Field Maps
- Logbook

Sampling Procedures

Surface water sampling procedures are provided in the SOP Manual.

4.3.2 Stream Sediment Sampling

A number of stream sediment samples will be collected during the NSWC RI. Proposed locations of sediment samples are indicated on the individual site maps included in Chapter 4.0 of the NSWC RI Work Plan. Tables 4-1 through 4-9 illustrate the sediment sampling program and includes the number of samples to be collected together with the compounds to be analyzed at each of the individual sites.

Field Equipment

- Sample Bottles
- Stainless Steel Pans
- Core Sampler
- Trowels/Scoops
- PID or FID
- Field Map and Logbook

Sampling Procedures

The stream sediment sampling procedures are provided in the SOP Manual. Procedures are taken from Malcolm Pirnie, Inc. SOPs.

Sample Containers

Containers for surface water and soil samples will be supplied by Versar, Inc. A summary of the type of containers to be used is provided in Table 4-10. All sample containers, size specified in Table 4-10, should be filled to the top to ensure adequate sample volume collected. This sample volume requirement was taken into account when the size of the container was selected. This applies to all types of samples to include ground water, surface water, and soil samples.

## TABLE 4-10

## SAMPLE COLLECTION AND ANALYSIS REQUIREMENTS

| Matrix | Parameters | Methodology | Containers | Preservatives | Holding Times |
|---|---|---|---|---|---|
| Water | Metals | SW-846/3010,6010 | 1 liter plastic | Nitric acid to pH<2 | 6 mos |
| | Mercury | SW-846, 7470 | 1 liter plastic | Nitric acid to pH<2 | 28 days |
| | Chromium VI | SW-846, 7197 | 1 liter plastic | Cool to 4 degrees C | 24 hrs |
| | TSS | MCAWW 160.2 | 1 liter plastic | Cool to 4 degrees C | 7 days |
| | TDS | MCAWW 160.1 | 1 liter plastic | Cool to 4 degrees C | 7 days |
| | Nitroaromatics | USATHAMA 8H Method by HPLC | 1 liter amber glass w/teflon-lined cap | Cool to 4 degrees C | 7 days*<br>40 days** |
| | PCBs | EPA 608 | 1 liter amber glass w/teflon-lined cap | Cool to 4 degrees C | 7 days*<br>30 days** |
| | Base-neutrals | CLP | 1 liter amber glass w/teflon-lined cap | Cool to 4 degrees C | 7 days*<br>40 days** |
| | TOC | MCAWW 415.2 | 500 ml amber glass w/teflon-lined cap | Sulfuric acid to pH<2 | 28 days |
| | TOX | MCAWW 450.1 | 500 ml amber glass w/teflon-lined cap | Sulfuric acid to pH<2 | None Established |
| | Volatiles | CLP | 40 ml vials with teflon-lined septa | Cool to 4 degrees C | 14 days |

Notes: * - days until extraction
** - days after extraction

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TABLE 4-10
(Continued)

SAMPLE COLLECTION AND ANALYSIS REQUIREMENTS

| Matrix | Parameters | Methodology | Containers | Preservatives | Holding Times |
|---|---|---|---|---|---|
| Soil | Metals | SW-846/3050,6010 | 500 ml clear glass | Cool to 4 degrees C | 6 mos |
| | Mercury | SW-846, 7471 | 500 ml clear glass | Cool to 4 degrees C | 28 days |
| | Chromium VI | SW-846, 7197 | 500 ml clear glass | Cool to 4 degrees C | None Established |
| | Nitroaromatics | USATHAMA 8H Method | 125 ml amber glass w/teflon-lined cap | Cool to 4 degrees C | 7 days*<br>40 days** |
| | PCBs | EPA 608 | 500 ml clear glass w/teflon-lined cap | Cool to 4 degrees C | 7 days*<br>30 days** |
| | Base-Neutrals | CLP | 500 ml clear glass w/teflon-lined cap | Cool to 4 degrees C | 7 days*<br>40 days** |
| | TOC | MCAWW 415.1 | 250 ml clear glass | Cool to 4 degrees C | 28 days |
| | TOX | SW-846, 9076 | 250 ml clear glass | Cool to 4 degrees C | None Established |
| | Volatiles | CLP | 125 ml amber glass w/teflon-lined cap | Cool to 4 degrees C | 14 days |

Notes: * - days until extraction
** - days after extraction

### 4.3.3 Ground Water Samples

In addition to the existing monitoring wells already located on-site, 25 new wells will be constructed as part of the NSWC RI. One round of samples will be collected from each of the existing and newly constructed wells. Data obtained from ground water sampling will be used in conjunction with the results of the Phase IIA sampling to determine the extent of contamination and the potential for migration. The ground water sampling program is outlined in Tables 4-1 through 4-9. Locations of existing monitoring wells are shown on the individual site maps that can be found in Chapter 4.0 of the NSWC RI Work Plan. Ground water sampling will be performed by the Versar, Inc Sampling team.

Field Equipment

- Bailers
- Clamps
- Disposable Hose
- Field Book
- Wrench
- Intake Hoses
- Submersible Pump
- Electrical Generator
- Centrifugal Pump
- PID or FID
- pH/Temperature meter
- Specific Conductivity meter

Sampling Procedures

Sampling procedures for the collection of ground water are outlined in the SOP Manual. The procedures are taken from the Versar, Inc. standard operating procedures.

Sampling Containers

Containers for ground water samples will be provided by Versar, Inc. A summary of the type of sampling containers to be used for ground water sampling is provided in Table 4-10.

### 4.3.4 Subsurface Soils

Six (6) subsurface soil samples will be collected as part of the NSWC RI. Samples will be collected using a split-spoon sampler with an outside diameter of 2-inches and a length of 2 feet. Subsurface soil sampling will be performed consistently with the precedures in the SOP

Manual.

Specifically, soil sampling will be performed in areas 4SD1A&B, 4SD2A&B and 4SD3A&B. Two samples will be collected at each location, with one sample being collected above the water table and the other below the water surface. Samples will be analyzed for the parameters shown in Tables 4-1 through 4-9.

Field Equipment

- Split Spoon Sampler
- Trowel
- HNu PID w/10.2 eV Lamp
- Calibration Gas
- Field Logbook

Sampling Procedures

Procedures for sampling of subsurface soils are outlined in the SOP Manual. Procedures are taken from Malcolm Pirnie, Inc. standard operating procedures.

Sampling Containers

Containers for subsurface soil samples will be provided by Versar Laboratories. The summary of the type of containers to be used for soil sampling is provided in Table 4-10.

### 4.3.5 Soil Sampling

Soil sampling will be performed during the NSWC RI and submitted to Versar, Inc. for analytical analysis. A summary of the soil sampling plan is outlined Tables 4-1 though 4-9. Locations of sampling are illustrated on the individual site sampling maps found in Chapter 4.0 of the NSWC RI Work Plan. Rationale for selecting sampling locations together with sampling objectives are also addressed in the NSWC Work Plan.

Samples collected at each location will be composite samples of three separate sample aliquots collected from 0-6 inches, 6-12 inches and 12-18 inches below the ground surface. Samples will be collected using a stainless steel hand auger, which will be decontaminated between

sampling locations. Decontamination procedures are outlined in the SOP Manual.

Sampling Equipment

- Trowels
- Stainless Steel Pans
- Stainless Steel Hand Auger
- PID or FID
- Field Map and Logbook
- Stainless Steel Spatulas

Sampling Procedures

Procedures for the collection of soil samples are presented in the SOP Manual.

Sample Containers

Sample containers for soil samples will be provided by Versar, Inc. A summary of the type of containers to be used is provided in Table 4-10.

4.3.7 Grain Size Analysis

Grain size analysis (ASTM D-422) will be conducted from a section of the Shelby tube sampler prior to vertical hydraulic conductivity tests.

Location for both thin wall and soil sampling are illustrated on the individual site maps located in Chapter 4.0 of the NSWC RI Work Plan.

Field Equipment

- Shelby Tube Sampler
- Sample Shipping Containers
- Sealing Wax
- Knife
- Split Spoon Sampler

- HNU PID
- Field Logbook

Sample Procedures

Procedures for Shelby Tube Sampling and soil sampling can be found in the SOP Manual.

Sample Containers

Shelby tube samples and containers for soil samples used for sieve analysis will be provided by the drilling contractor.

# 5.0 SAMPLE CUSTODY PROCEDURES

## 5.1 OVERVIEW

Sample custody during the NSWC site investigation will be categorized into three phases. Field custody procedures will be employed during sample collection, pre-laboratory treatment procedures (preservation), packaging, and shipping. Sample shipment will be the second custody phase where mode of shipment, airbill numbers, dates and times are documented. The third phase involves the custody procedures employed by Versar, Inc.

All three phases of sample custody will assure that the following custody objectives are met:

- All samples are uniquely identified,
- The correct samples are tested and are traceable to their source,
- Important sample characteristics are preserved,
- Samples are protected from loss or damage,
- Any alteration of samples from preservation or filtration is documented, and
- A record of sample integrity is established and maintained through the entire custody process.

## 5.2 FIELD CUSTODY PROCEDURES

These procedures provide a method of completing and transferring chain-of-custody records. Use of the chain-of-custody guidelines creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis and its introduction as evidence. The guidelines are applicable to chain-of-custody control for samples collected during project activities.

Chain-of-custody records begin in the field at the time of sampling. A person is in custody of a sample if the sample is:

- In that person's physical possession,
- In view after being in that person's physical possession,

- Placed in a locked repository by that person, or
- Placed in a secure, restricted area by that person.

Chain-of-custody forms will be completed for each sample at the time of collection and will be maintained with the samples while shipping them to the laboratory. Figure 5-1 provides a sample custody form.

## 5.3 SAMPLE IDENTIFICATION

The NSWC investigation will require that all samples collected from the vicinity of the site be identified with a sample label in addition to an entry on a chain-of-custody record. Indelible ink will be used to complete sample labels. Labels will then be covered with clear plastic waterproof tape. The label will be identified upon receipt by the laboratory and cross-referenced to the chain-of-custody record. When the sample arrives at the laboratory following shipment, the sample is received by the sample custodian. Versar employs a full-time sample custodian, and the sample handling procedures utilized by them are described in their Standard Operating Procedures. Any inconsistencies will be noted on the custody record. Laboratory personnel will notify the Malcolm Pirnie Quality Control Officer and the Project Manager immediately if any inconsistencies exist in the paperwork associated with the samples.

### 5.3.1 Identification Procedure

A sample numbering system will be used to identify each sample. This system will provide a tracking procedure to allow retrieval of information pertaining to a particular sample and assure that each sample is uniquely numbered. The sample identification numbers will be composed of four (4) components as described below:

- Project Identification - A seven number designation will be used to identify the project site where the sample is collected. For this project the seven number designation will be "0931-02-1".

- Sample Type - Each sample collected during the investigation will be identified by sample matrix by a alpha code as follows:
  GW - Ground Water/Monitoring Well

Versar INC

# CHAIN OF CUSTODY RECORD

| PROJECT NO. | PROJECT NAME | | | | | PARAMETERS | INDUSTRIAL HYGIENE SAMPLE | Y / N |
|---|---|---|---|---|---|---|---|---|
| SAMPLERS: *(Signature)* | | | | | (Printed) | | | |

| FIELD SAMPLE NUMBER | DATE | TIME | COMP. | GRAB | STATION LOCATION | NO. OF CONTAINERS | | | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
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| Relinquished by: *(Signature)* | Date / Time | Received by: *(Signature)* | Relinquished by: *(Signature)* | Date / Time | Received by: *(Signature)* |
|---|---|---|---|---|---|
| (Printed) | | (Printed) | (Printed) | | (Printed) |

| Relinquished by: *(Signature)* | Date / Time | Received for Laboratory by: *(Signature)* | Date / Time | Remarks |
|---|---|---|---|---|
| (Printed) | | (Printed) | | |

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

EXAMPLE CUSTODY FORM
VERSAR, INC.

Versar INC

FIGURE 5-1

SW - Surface Water

SL - Surface/Subsurface Soil

SD - Stream Sediment

- Sample Location - A four to six digit and alpha code will be used to indicate a specific sample location by 25GW4, the first number designates the site, the middle alpha characters designate the sample matrix and the final number indicates the site location number.

- Sample Number - A two (2) digit number will follow the sample identification outlined above. This number will be used to consecutively number sequential samples taken at a particular sampling site. Examples of sample identification are:

  02GW07-01: Site 2, Ground Water/Monitoring Well #7 Sample Number 1.

  07SL04-02: Site 7, Soil Sample, Location 4, Sample Number 2.

Sample depths will be recorded in the field book and boring logs. Duplicate and blank samples will be prepared and numbered as if they were separate samples. A record of identification numbers will be maintained for samples, blanks and duplicates collected during the investigation.

## 5.4 SAMPLE LABELS

Sample labels will require the field team to complete the following information for each sample bottle:

1. Site Name
2. Job Number
3. Sample Number
4. Sample Description
5. Company Name
6. Fraction to be Analyzed
7. Date
8. Time
9. Preservation Technique Employed

Sample labels will be attached to the sample bottles. Figure 5-2 provides an example of a typical sample label.

FIGURE 5-2

MALCOLM PIRNIE INC. Sample No.:

Tag No.:

Job Name :
Job Number :
Sample Type :
Sample point : Date :
Fraction : Time :
Preservative : By :

MALCOLM PIRNIE INC. Sample No.:

Tag No.:

Job Name :
Job Number :
Sample Type :
Sample point : Date :
Fraction : Time :
Preservative : By :

EXAMPLE SAMPLE
LABEL AND TAG

## 5.5 COMPLETION OF CHAIN-OF-CUSTODY RECORD

A chain-of-custody record is a printed three-part form that accompanies a sample or group of samples as custody is transferred from person to person. Chain-of-custody records document custody transfer from person to person. A chain-of-custody record is a controlled document.

As soon as practical after sample collection, preferably after decontamination, the following information must be entered on the chain-of-custody form. All information is to be recorded in ink.

1. Project Number - Enter the alphanumeric designation assigned by the field team that uniquely identifies the project site.

2. Project Name - Enter the site name.

3. Samplers - Sign the name(s) of the sampler(s).

4. Station Number - Enter the sample number for each sample in the shipment. This number appears on the sample identification label.

5. Date - Enter a six-digit number indicating the year, month and day of sample collection.

6. Time - Enter a four-digit number indicating the military time of collection; for example, 1354.

7. Composite or grab. Indicate the type of sample.

8. Station location. Describe the location where the sample was collected.

9. Number of containers. For example, enter the number of sample bottles that are contained in the shipment.

10. Remarks. Enter any appropriate remarks.

## 5.6 TRANSFERRING CUSTODY OF SAMPLES TO SHIPPER

Samplers will transfer custody of samples to a field team shipper as follows:

1. Sign, date, and enter time of chain-of-custody report under "Relinquished by".

2. Make certain that shipper signs the "Received by" entry.

3. Enter name of the carrier under next "Relinquished by" category. Receiving laboratory will sign "Received for Laboratory by" on lower line and enter date and time.

## 5.7 TRANSFERRING CUSTODY FROM SHIPPER TO COMMON CARRIER

Instructions for the field team shipper transferring custody of samples to common carrier are given below:

1. Sign, date and enter time under "Relinquished by" entry.

2. Enter name of carrier (e.g., UPS, Federal Express) under "Received by."

3. Enter bill-of-lading or Federal Express airbill number under "Remarks."

4. Place the original of the chain-of-custody form in the appropriate sample shipping package. Retain a copy with field records.

5. Sign and date the custody seal. An example of the custody seal to be used is shown in Figure 5-3. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samplers after they have been collected in the field.

6. Wrap the seal across filament tape that has been wrapped around the hinges of the shipping package at least twice.

7. Fold the custody seal over on itself so that it sticks together.

8. Complete other carrier-required shipping papers.

Common carriers will usually not accept responsibility for handling chain-of-custody forms; this necessitates packing the record within the sample package.

## 5.8 TRANSFERRING CUSTODY FROM FIELD SAMPLER DIRECTLY TO CARRIER

To transfer custody of samples from the sampler directly to a carrier, proceed as above, except eliminate the field team shipper's signature.

## 5.9 SAMPLE RECEIPT FORMS

If samples are to be split with a property owner, or with another interested party, or if samples are collected from a potentially responsible party's property a record of the transaction must be completed.

FIGURE 5-3

| UNITED STATES ENVIRONMENTAL PROTECTION AGENCY OFFICIAL SAMPLE SEAL | SAMPLE NO. | DATE | SEAL BROKEN BY |
|---|---|---|---|
| | SIGNATURE | | |
| | PRINT NAME AND TITLE *(Inspector, Analyst or Technician)* | | DATE |

EPA FORM

USEPA
OFFICIAL CUSTODY SEAL

Figure 5-4 is an example of the form to be completed. The completed form will indicate whether an owner accepted or declined to split samples. With the signature of the owner or agent the form also serves as evidence of actual sample collection. The owner will be provided a copy of the form. The original will be returned and placed in the filed log to be placed in the evidence files. If the owner or agent are not available to sign the form, then the sampling team leader will note such in the field log.

## 5.10 SAMPLE SHIPMENT

Custody of samples must be maintained through the shipment of samples to the selected laboratory(ies). All samples will be packaged and shipped daily to ensure that no sample is held at the site more than 24 hours. Samples will be delivered directly to the laboratory by sampling personnel or shipped via the following procedures:

- Use waterproof high-strength plastic ice chests or coolers only.
- After filling out the pertinent information on the sample label and tag, put the sample in the bottle or vial and screw on the lid. For bottles other than VOA vials, secure the lid with strapping tape. (Tape on VOA vials may cause contamination).
- Mark volume level on bottle with grease pencil.
- Place about 3 inches of inert cushioning material such as vermiculite or styrofoam "popcorn" in the bottom of the cooler.
- Enclose the bottles in clear plastic bags through which sample labels are visible, and seal the bag. Place bottles upright in the cooler in such a way that they <u>do not touch</u> and <u>will not</u> touch during shipment.
- Put in additional inert packing material to partially cover sample bottles (more than half-way). Place bags of ice or ice-gel packs around, among and on top of the sample bottles.
- Fill cooler with cushioning material.
- Put paperwork (chain-of-custody record) in a waterproof plastic bag and tape it with masking tape to the inside lid of the cooler.

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
Building 53, Box 25227, Denver Federal Center
Denver, Colorado 80225

## RECEIPT FOR SAMPLES

| PROJ NO. | PROJECT NAME | Name of Facility |
|---|---|---|
| SAMPLERS: *(Signature)* | | Facility Location |
| Split Samples Offered ( ) Accepted ( ) Declined | | |

| STA NO | DATE | TIME | COMP | GRAB | SPLIT SAMPLES | TAG NUMBERS | STATION DESCRIPTION | NO OF CON-TAINERS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
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| Transferred by: *(Signature)* | | Received by *(Signature)* | | Telephone |
|---|---|---|---|---|
| Date | Time | Title | Date | Time |

Distribution: Original to Coordinator Field Files; Copy to Facility

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FIGURE 5-4

II-22
(6/85)

- Tape the drain shut.
- Secure lid by taping. Wrap the cooler completely with strapping tape at a minimum of two locations. Do not cover any labels.
- Attach completed shipping label to top of the cooler.
- Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of coolers containing glass containers.
- Ship the cooler by overnight express to the respective laboratory.

Remember that each cooler cannot exceed the weight limit set by the shipper (maximum 150 pounds for Federal Express) unless delivered by hand. Appropriate samples will be packaged and shipped via overnight delivery service to the lab unless shipped by hand. Custody forms for the samples will be signed by the field team member who is relinquishing custody. The custody form will include the airbill number, method of shipment, and time and date of the transfer of custody. Custody forms will be placed in a "ziplock" bag and enclosed in the shipping cooler.

Samples shipped via air express to the laboratory will be packaged according to CLP procedures. Custody seals will be applied to the front and back of the sample coolers and the coolers will be sealed with strapping tape applied over both hinges. A shipping label with return address will be applied as will the air express bill and any DOT required labels or markings.

## 5.11 Laboratory Custody Procedures

Once the samples arrive at the labs via the various shipment methods, custody of the samples will be maintained by laboratory personnel. Versar, Inc. has written SOPs for maintaining security of samples and tracking the work performed on samples through the entire analytical process. The SOP requires the following stages of analysis be documented by the laboratory:

- Sample Receipt
- Sample Extraction/Preparation

- Sample Analysis
- Data Reduction
- Data Reporting

# 6.0 CALIBRATION PROCEDURES AND FREQUENCY

Calibration procedures for field and laboratory instrumentation used during the project are discussed in this section. Reference information for this section is obtained from Malcolm Pirnie Operating Guidelines and Laboratory SOPs. Where applicable, the reference information has been appended for easy referral.

## 6.1 FIELD SCREENING INSTRUMENTATION CALIBRATION PROCEDURES

### 6.1.1 Instrumentation

The following table provides a list of the field instruments to be employed during field screening operations.

| Task | Field Instrumentation |
|---|---|
| Air Monitoring | Photoionization Detector<br>Flame Ionization Detector |
| Soil Monitoring/<br>Sampling | Photoionization Detector<br>Flame Ionization Detector |
| Soil<br>Gas Monitoring | Photoionization Detector<br>Explosimeter |
| Water Level Survey | Photoionization Detector |
| Ground Water Sampling<br>Surface Water Sampling<br>Soil/Sediment Sampling | Photoionization Detector<br>Temperature Probe<br>Specific Conductivity Meter<br>pH Meter/Temperature probe |

### 6.1.2 Frequency

Each field instrument shall be initially calibrated prior to the project. Check standards will be analyzed daily to verify the initial calibration. This assures accurate readings for each day of use. Dates and times of calibration, serial numbers and calibration techniques as well as the signature of the calibrating technician will be entered into the intrument's log book and on the field equipment log form located in the SOP Manual. All field instruments will be calibrated using NBS traceable standards supplied by Alphagaz, Inc. of Cambridge, Maryland. The gases include those used to callibrate the HNu Photoionization Detector, Foxboro OVA Flame Ionization Detecter, and MSA Explosimeter. Each calibrant to gravimetrically traceable to NBS certified weights on

a weight basis. Other information regarding the gases can be obtained from the Material Safety Data Sheets (MSPS).

Photoionization Meter

With the probe attached to the instrument turn the function switch to the battery check position. The needle on the meter should read within or above the green battery area on the scale plate. If the needle is in the lower position of the battery arc, the instrument should be recharged prior to any calibration. If red LED comes "on", the battery should be recharged. Next, turn the function switch to the on position. In this position the UV light source should be on.

To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection while the counterclockwise rotation yields a downscale deflection. If the span adjustment setting is changed after zero is set, the zero should be rechecked and adjusted if necessary. Wait 15-20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero.

The instrument is now ready for calibration by switching the function switch to the proper measurement range.

Using nontoxic analyzed gas mixtures available from the manufacturer in pressurized containers, connect the cylinder with the analyzed gas mixture at the end of the probe with a piece of tubing. Open the valve of the pressurized container until a slight flow is indicated and the instrument draws in the volume of sample required for detection. Now adjust the span potentiometer so that the instrument is reading the stated value of the calibration gas.

If the instrument span setting is changed, the instrument should be turned back to the standby position and the electronic zero should be readjusted if necessary. If the instrument does not calibrate, it may be necessary to clean the probe or the lamp connection.

Flame Ionization Detector/Organic Vapor Analyzer (OVA)

The OVA is designed to detect, measure, characterize, and identify organic gases and vapors found in the ambient air. Its application is broad, since it has a chemically resistant sampling system and it can be calibrated to quantitatively respond to many different organic com-

pounds. It is extremely sensitive, and in the "survey mode" it provides an accurate indication of organic gas and vapor concentrations in three ranges: 0 to 10 ppm, 0 to 100 ppm, and 0 to 1,000 ppm. While designed as a lightweight, portable instrument, it can be readily adapted to remote monitoring applications. In addition, the OVA can function as a gas chromatograph ("GC mode") and can thus be used to characterize and identify organic material.

Primary calibration of the OVA is accomplished at the factory by using methane in air samples of known concentration and making adjustments to four potentiometers located on the circuit board inside the instrument. This primary adjustment is relatively stable over time and should not concern field operators. The primary calibration may be checked during factory maintenance procedures which will be required for each unit. Maintenance schedules will be established by the Project Manager.

All OVAs will be calibrated daily to methane, and records kept on file to document the procedure. A 5 liter gas sampling bag is filled with "clean" air. One cubic centimeter (cc) of a pure methane gas from a calibration cylinder is injected through the septum of the gas sampling bag. The sampling bag is then agitated to ensure complete diffusion of the sample. The concentration in parts per million (ppm) (volume/volume) will be equal to the sample size in cc, divided by the volume of the bag in cc, times 1,000,000. Therefore,

$$\frac{1 \text{ cc}}{5{,}000 \text{ cc}} \times 1{,}000{,}000 = 200 \text{ ppm}$$

Note: 1 liter = 1,000 cc

The outlet of the sampling bag is connected to the air sampling line of the OVA. The GAS SELECT knob is then adjusted until the meter reading on the OVA is 200 ppm.

Since the instrument is calibrated to methane, the concentrations read for other compounds must be expressed as "methane equivalent" concentrations. it is possible to calibrate the instrument to other organic vapors by adjusting the GAS SELECT knob on the Sidepack control panel. However, this requires a supply of the gas of interest at a known concentration. Cylinders of various gases are commercially

available and should be requested with the gas of interest and the balance as air. The calibration gas should be withdrawn from the cylinder and placed in a sample bag of known volume from which it may be drawn into the OVA. By making the appropriate calculations, samples of known concentration can be prepared. As the OVA draws in the sample, the GAS SELECT knob is turned until the calculated concentration of sample, the GAS SELECT knob is turned until the calculated concentration of the sample is read on the meter. The instrument is now calibrated to read directly the concentration of the compound of interest.

Temperature Probe

1. Using a National Bureau of Standards-approved thermometer, immerse both probes into a beaker of water and note any differences for the field probe.

2. Recalibrate as necessary.

Specific Conductance Meter

1. Calibrate meter and probe using the calibration control and the red-line on the meter dial (Y.S.I. S-C-T Meter, Model No. 33).

2. Turn the function switch to read conductivity x 10 and then depress the call test button, noting the deflection. If the needle falls more than 2 percent of the reading, clean the probe and retest.

3. Using at least two buffer solutions, which will most likely bracket the expected values for conductivity, note accuracy of the water and probe and clean probe if necessary.

pH Meter

1. Place electrodes and buffer solutions in a water bath at the temperature of the water to be sampled. After temperature equilibrium, measure temperature and adjust the temperature compensation knob for this temperature.

2. If using refillable probes, remove electrode cap and check that filling solution is above the filling mark.

3. Immerse the probe in the pH 7 buffer solution and adjust the calibration control to read the appropriate pH. Check the pH buffer solution for correct pH value at the equilibrated temperature.

4. Remove the probe, rinse with distilled water and then immerse in either the pH 4 or pH 10 buffer solution, depending on the expected pH of the sample.

5. If the meter does not register the correct pH for that buffer solution, adjust the calibration knob on the back of the instrument to obtain the pH of the buffer.

6. After rinsing, insert the pH probe into the flow cell and allow the probe to come to equilibrium with the sample water.

7. The pH probe is stored in the ambient air overnight.

## 6.2 LABORATORY CALIBRATION PROCEDURES

### 6.2.1 Instrumentation

The laboratory will employ methods which use GC/MS Systems for the analysis of volatiles, base/neutrals and acid compounds; GC/EC systems for pesticide/ PCB compounds; and ICP or AA systems for metals.

### 6.2.2 Frequency

All instruments employed by the laboratory will be calibrated at the frequencies described in the CLP Statement of Work or the SW-846 Laboratory Analysis document.

### 6.2.3 Procedures

The calibration procedures for the laboratory are derived from the CLP-IFB Statement of Work for Organics and Inorganics and SW-846.

# 7.0 ANALYTICAL PROCEDURES

| Analysis | Matrix | Procedure | Method Reference |
|---|---|---|---|
| TOC | Water | 415.2 | 1 |
| TOX | Water | 450.1 | 1 |
| TSS | Water | 160.2 | 1 |
| TDS | Water | 160.1 | 1 |
| Nitroaromatics | Water | 8H | 5 |
| TCL-Volatiles | Water | CLP | 3 |
| TCL-Semi-Volatiles | Water | CLP | 3 |
| PCBs | Water | EPA 608 | 3 |
| Metals: | | | |
| Cadmium | Water | 3010/6010 | 2 |
| Chromium | Water | 3010/6010 | 2 |
| Copper | Water | 3010/6010 | 2 |
| Lead | Water | 3010/6010 | 2 |
| Zinc | Water | 3010/6010 | 2 |
| Mercury | Water | 7470 | 2 |
| Chromium VI | Water | 7197 | 2 |
| TOC | Soil | 415.1 | 1 |
| TOX | Soil | 9076 | 2 |
| Nitroaromatics | Soil | 8H | 5 |
| TCL-Volatiles | Soil | CLP | 3 |
| TCL-Semi-Volatiles | Soil | CLP | 3 |
| PCBs | Soil | EPA 608 | 3 |
| Metals: | | | |
| Cadmium | Soil | 3050/6010 | 2 |
| Chromium | Soil | 3050/6010 | 2 |
| Copper | Soil | 3050/6010 | 2 |
| Lead | Soil | 3050/6010 | 2 |
| Zinc | Soil | 3050/6010 | 2 |
| Mercury | Soil | 7471 | 2 |
| Chromium VI | Soil | 7197(a) | 2 |

Notes:

1. "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," USEPA Environmental Monitoring and Support Laboratory, 1982.

2. "Test Methods for Evaluating Solid Waste," 3rd Edition, USEPA Office of Solid Waste and Emergency Response, 1986.

3. "Statement of Work for Organics and Inorganics Analysis," Multi Concentration, Multi Media - Invitation for Bid, February, 1988.

4. "Methods for Chemical Analysis of Water and Wastes," USEPA Environmental Monitoring and Support Laboratory, 1983.

5. "USATHAMA Revised Method 8H", Explosives via HPLC for Water and Soil.

# 8.0 DATA REDUCTION, VALIDATION AND REPORTING

## 8.1 DATA REDUCTION

Data reduction is the process by which raw analytical data generated from the laboratory instrument systems is converted into usable mass concentrations. The raw data, which may take the form of area counts, instrument responses or observations, is processed by the lab and converted into concentrations expressed in parts per million or parts per billion.

The analytical laboratory has developed SOPs for data reduction that are consistent with the data handling requirements of the CLP-IFB Statement of Work, page E-7. These SOPs provide procedures for calculating and reporting concentrations from data generated by the GC/MS, GC, ICP, and AA. Raw data from these systems include compound identifications, concentrations, retention times and data system print-outs. Raw data is usually reported in graphic form, bar-graph form or tabular form.

## 8.2 VALIDATION

The laboratory shall validate data prior to release to Malcolm Pirnie. The laboratories are required to evaluate their ability to meet the QA objectives stated earlier in this document. Outlying data shall be flagged in accordance with laboratory SOPs and corrective action shall take place to rectify any problems.

The laboratory's validation SOPs are modelled after those appearing in the CLP-IFB Statement of Work, page E-7. Limits and evaluation criteria for operational parameters, calibration data, measurement checks, statistical checks and nominal checks have been established under CLP and will be adhered to during this project. Data validation procedures and results will be recorded on standard laboratory forms in the project log book and any outlying parameters will be detailed in the case narrative. The narrative will appear in each data report provided to Malcolm Pirnie.

## 8.3 REPORTING

The analytical laboratory will report TCL data via the CLP data package. TCL parameters for the NSWC RI will consist of a truncated list which includes volatiles, base neutral and acid extractables. The remaining parameters will be reported via a standard commercial data package. The standard commercial package will apply to PCBs, TOC, TOX, TSS, TDS, nitroaromatics, and 7 metals. Sample and QA data will be reported consistently with EPA requirements. One copy of the data package will be delivered to Malcolm Pirnie for data assessment within 40 days of sample receipt by the laboratory.

# 9.0 INTERNAL QUALITY CONTROL

The analytical laboratory will exercise internal quality control in a manner consistent with the requirements of CLP. Control checks and internal QC audits are required under this program. These include reference material analysis, blank analysis, matrix spike analysis, duplicate analysis and internal audits.

The laboratory will perform the QC checks required by this program with the following frequency. Reagent and method blanks will be run at a rate of one per 20 samples or one per 12 hours, whichever is more frequent. One matrix spike and one matrix spike duplicate will be run per 20 samples as part of a batch QC program. Performance Evaluation samples will be run at a rate of once per calendar quarter or at a frequency determined by USEPA - Evnironmental Monitoring System Laboratory (EMSL) - Las Vegas. Internal P.E. samples will be run at a frequency determined by the internal QC staff.

The internal QC program is to be performed in conjunction with the QC samples that will be initiated in the field. Field QC samples include field duplicates, equipment rinsate blanks, trip blanks and field blanks. The criteria for evaluating the field QC samples were detailed in Section 3.0 of this document.

Internal quality control checks and audits are to meet the following criteria:

Matrix Spike/Matrix Spike Duplicate - Are to meet the percent recovery criteria for spiked compounds as set by USEPA CLP Methodologies. Acceptable precision will be determined by meeting the RPD criteria of the CLP methods.

Surrogate Recovery - Surrogates recoveries must be within the limits established in the USEPA CLP Statement of Work.

Reagent/Method Blanks - Must contain less than 5 times the contract required detection limit (CRDL) for common organic lab contaminants (Methylene Chloride, Acetone, Toluene, Phthalates) and less than the CRDL for all other analytes. Inorganic reagent blanks must contain less than one-tenth the concentration of analytes found in the corresponding environmental samples.

Internal QC Audits - Evaluation will follow the same criteria as the example Systems Audit presented in the CLP-IFB Statements of Work.

Calibration - A 5-point calibration curve will be developed for each analyte at the start of the program for all TCL compounds. A 3-point curve will be used for other analyses as appropriate. The initial curve will be confirmed on a daily basis by analyzing the midpoint concentration for all compounds to be analyzed. Percent recovery for the check compound must be within the limits specified in either the appropriate USEPA Method or the USEPA CLP criteria for the initial curve for a specified compound to be valid. If the curve is not validated, the laboratory must re-construct the initial calibration curve using the appropriate standards.

# 10.0 PERFORMANCE AND SYSTEMS AUDITS

Performance and systems audits will be used to monitor project activities to assure compliance with QA objectives and procedures. In addition, the analytical laboratory will be required to gain approval for the project from the Navy by performing satisfactorily on QA tests developed by NEESA. Laboratory audits will be performed by either Malcolm Pirnie, Navy, or USEPA QA staff members. Field audits will be performed by Malcolm Pirnie personnel. Responsible auditing personnel from Malcolm Pirnie have been identified in Section 2.1 The following sections summarize the proposed field and laboratory audits to be conducted during the project and detail the Navy QA tests to be administered.

## 10.1 FIELD AUDITS

Internal audits of field activities will be conducted by Malcolm Pirnie personnel. USEPA field audit procedures will be used to conduct the audits. Field audits will monitor sample holding times, preservation techniques, field quality control, equipment calibration, monitoring well installation, monitor well sampling, and soil sampling. One audit of the field operations will be performed during each quarter the project requires field work. Audit results will be reported to the project manager in a quarterly QA report.

## 10.2 LABORATORY AUDITS

Performance Audits

The analytical laboratory will perform internal QC sample runs on an independent basis. Samples will be run once per quarter and will be analyzed as single-blind samples that are mixed in with other commercial cases. Results of internal QC performance audits are available upon request from the laboratory QA officer, Scott Powers.

Versar, Inc. actively participates in a number of QA/QC programs at the State and Federal levels. These programs require the laboratory to perform satisfactorily during performance audits. The

USEPA Contract Laboratory Program (CLP) requires that Versar successfully analyzes one TCL performance evaluation sample, with full CLP reporting, once every quarter. Under the NEESA program, the laboratory must successfully analyze performance evaluation samples once per year. In addition to the federal programs, the laboratory participates in 9 different state programs. Each state may require performance evaluation samples for a variety of different parameters.

The NSWC RI will require that the laboratory perform satisfactorily on both the USEPA CLP audit and the NEESA audit. If either of these programs fail to give the laboratory a satisfactory grade, the laboratory must submit a corrective action plan to the Malcolm Pirnie project manager detailing the specific actions the lab will take to improve their performance and regain acceptance into the program. If the lab's performance fails to improve, the project manager may drop the lab from the analytical program.

Systems Audits

System audits will be performed on a regular basis by the laboratory's QA staff. In addition, one system audit per year is performed by both USEPA and NEESA. Unsatisfactory performance on these audits must be reported to the Malcolm Pirnie project manager in a corrective action plan.

## 10.3 NAVY QA TESTING

The Navy reserves the right to approve the analytical laboratory selected by Malcolm Pirnie for the project. The approval process will contain the following elements.

- Proficiency Testing through analysis of Performance Samples
- Laboratory Inspections and Audits
- Review of Laboratory QA Plans
- Review of Site Specific QC Plans
- Review of Sampling Plans and Procedures

Martin Marietta will also visit the lab and perform a system audit. The lab's QA plans have been submitted to both NEESA and Malcolm Pirnie for evaluation. These documents contain both site specific and generic SOPs for analysis and sampling.

# 11.0 PREVENTIVE MAINTENANCE

## 11.1 FIELD EQUIPMENT

Preventive maintenance of field equipment is performed routinely before each sampling event; more extensive maintenance is performed based on hours of use. Delays in project schedules, poor output performance and erroneous results in investigative operations can result from improperly maintained equipment. The overall responsibility for the preventive maintenance program lies with the project manager, however, certain maintenance programs will be overseen by project task leaders. The preventive maintenance SOP for the project is presented in the SOP Manual.

## 11.2 ANALYTICAL LABORATORY INSTRUMENTATION

Makes and model numbers for laboratory instrumentation are provided in SOPs for preventive maintenance. Some labs rely on local service representatives of the appropriate manufacturers for preventative maintenance. Day to day maintenance is conducted by in-house technicians. SOPs for preventive maintenance include details on equipment log records, routine maintenance and troubleshooting.

Equipment maintenance schedules, problem identification procedures and failure analysis protocols are provided with the preventive maintenance protocols in the lab's SOP Manual.

# 12.0 DATA ASSESSMENT

Validated Data packages from the laboratories will be assessed for quality by Malcolm Pirnie, Inc. Data packages will be reviewed in accordance with EPA - CLP review document, "Laboratory Data Validation - Functional Guidelines for Evaluating Organic Analyses," TDD No. HQ-8410-01, USEPA 1988 and "Guidelines for the Evaluation of Metals Data for the Hazardous Waste Program" SOW 7/85. The protocol contained in these documents will be modified for the QA objectives applicable to the other analytical methodologies and procedures to be performed during this project.

## Organics

Organic data will be assessed for the following QA parameters:

- Sample Holding Times
- GC and GC/MS Tuning and Performance
- Calibration
- Blanks
- Surrogate Recovery
- Matrix Spike/Matrix Spike Duplicate
- Compound Identification
- System Performance
- Overall Assessment of Data

The organic data assessment checklist is provided in Appendix A.

## Inorganics

Inorganic data will be assessed for the following QA parameters:

- Data Sheets
- Package Completeness
- Blanks
- Calibration Checks

- ICP Interferences
- Duplicates
- Matrix Spikes
- Field QC

The Inorganic data assessment checklist is provided in Appendix A.

# 13.0 CORRECTIVE ACTION

## 13.1 LABORATORY CORRECTIVE ACTION

Correction actions will be implemented if unsatisfactory performance and/or system audit results are recorded. Corrective action, such as rejection of data and reanalysis at lab's cost, may also be implemented if the results of a data assessment or internal QC check warrants such action. The following is an outline of protocols for corrective action to be used during the project.

Non conformances resulting from formal audits, internal audits or data assessments, will be addressed by taking corrective action. Such action(s) are usually initiated by the laboratory QA manager who is responsible for assessing the action for its appropriateness and completeness.

The laboratory QA Officer is responsible for filing a non-compliance report to the project management. Quality control charts are used in the lab to monitor day to day variations in precision and accuracy. Means and standard deviations are determined for historical data generated by the lab. This enables the use of statistical analysis in evaluating lab data and determining the need for corrective action.

Short term corrective actions are initiated as a result of malfunctioning equipment or improper use of analytical methodologies. Long term actions are initiated through the QA Officer who assigns personnel to the investigation of the problem. A series of evaluations then follow to assure the action is necessary and the results complete. More comprehensive corrective actions may be required if the lab fails a performance evaluation for the CLP program or NEESA QA program. These actions must be initiated by the lab manager to the satisfaction of the project manager and project QA Officer. The mechanism for corrective action review is detailed in Section 19.0 of the Versar QA Plan.

## 13.2 FIELD CORRECTIVE ACTION

Field audits conducted by the appropriate personnel may yield results that do not satisfy the QA objectives of the project. Corrective actions will be initiated by the Malcolm Pirnie project

manager. These actions may range from altering solvent washes used in decontamination to changing the sampling strategy to obtain representative samples. The project manager has the ability to stop all work if audit results warrant such action.

Field corrective actions may be required following a field audit. The auditor would perform the audit following the procedures presented in Section 10.1, Field Audits. After the audit is complete, the auditor would file the audit report to the project QA Officer who will review the report and identify areas where corrective actions are needed, if any. The QA Officer will then review the corrective actions with the Project Manager who will be responsible for implementing these actions immediately. Once the corrections have been made, the project manager will issue a corrective action report to the QA Officer who will evaluate it for consistency with the audit report. Once the QA Officer is satisfied the actions have sufficiently corrected the problem, he will approve the report and enter it into the project file.

# 14.0 REPORTS TO MANAGEMENT

## 14.1 LABORATORY

Non-compliance reports will be filed to laboratory management whenever an out of control situation occurs. Reports will include a summary of accuracy and precision data, quality problems and the status of corrective actions.

Weekly meetings will be held between the laboratory management and the QA staff to alert the appropriate personnel of problems needing corrective action. A quality assurance report is filed based on the findings of the meetings. Appropriate actions and modifications are incorporated into the lab's operating procedures each week as a result of the previous week's findings.

Corrective actions, data assessment results and validation results will be documented in a manner consistent with CLP protocols. Data assessment checklists will be generated by Malcolm Pirnie for review by the internal QC staff on a per-case basis. The laboratory will submit a case narrative with each set of sample analyses. The narrative will describe any QC problems encountered in the analysis and any corrective actions taken by the lab.

Ultimately, any corrective action or other significant QA violation must be reported to the project manager and project QA officer. These individuals will contact NEESA to report the QA violation. QC actions will be summarized in monthly reports per NEESA Document 20.2-047B to Martin Marietta Energy Systems. A final report will also be provided by Versar, Inc. to Martin Marietta Energy Systems, Inc. to include a QC summary section.

## 14.2 FIELD ACTIVITIES

Malcolm Pirnie will be responsible for documenting the results of all field audits. Audit results shall be documented in the QA log book to be kept for all field audits. A report will be filed identifying corrective actions for field activities and describing the schedule and progress of the actions.

# SOP WORK SHEETS FOR VOLATILES

## HOLDING TIMES

| SAMPLE NO * | PRESERVED | | CONC LEVEL / MATRIX | DATE SAMPLED | DATE RECEIVED | DATE ANALYZED | TIME ANALYZED | INSTRUMENT I D | CONTRACT HOLDING TIME MET | | 40 CFR 136 HOLDING TIME MET | | ACTION |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR VOLATILES

## GC / MS TUNING AND PERFORMANCE

| SAMPLE NO * | DATE TUNED | TIME TUNED | BFB ION ABUNDANCE CRITERIA MET | | ION ABUNDANCE CRITERIA NOT MET | SKEWED OR DISTORTED SPECTRA | | FREQUENCY OF TUNE > 12 HRS. | | ACTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | YES | NO | | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR VOLATILES

## INITIAL CALIBRATION

| SAMPLE NO * | DATE | TIME | DESCRIBE CHROMATO-GRAPHIC PROBLEMS | SPCC CRITERIA MET | | CCC CRITERIA MET | | ALL COMPOUNDS RF > 0 | | ANY HSL COMPOUND RF < 0.05 | | ANY HSL COMPOUND RSD > 30% | | ACTION |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR VOLATILES

## CONTINUING CALIBRATION

| SAMPLE NO.* | DATE | TIME | SPCC CRITERIA MET | | CCC CRITERIA MET | | ALL COMPOUNDS RF>0 | | CALIBRATION WITHIN 12 HRS. OF SAMPLE ANALYSIS | | ANY HSL COMPOUND RF<0.05 | | ANY HSL COMPOUND %D>25 | | ACTION |
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| | | | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR VOLATILES

## BLANKS

| SAMPLE NO | DATE ANALYZED | TIME ANALYZED | APPROPRIATE METHOD BLANK FOR EACH GC/MS SYSTEM | | BLANK ANALYSIS EVERY 12 HOURS OR EVERY 20 SAMPLES | | CRITERIA OF <5XCRDL FOR MELTHYLENE CHLORIDE,ACET ONE AND TOLUENE MET | | CRITERIA OF < CRDL FOR ALL OTHER HSL COMPOUNDS MET | | ACTION |
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# SOP WORK SHEETS FOR VOLATILES

## SURROGATES

| SAMPLE NO * | BLANK SURROGATES CRITERIA MET | | IF "NO" WERE ALL ASSOCIATED SAMPLES RE-PURGED | | SAMPLE SURROGATE RECOVERIES MET CRITERIA | | IF "NO" WAS SAMPLE RE-PURGED | | RE-PURGED SAMPLE MET CRITERIA | | SURROGATES OUTSIDE CRITERIA | ACTION |
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| | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR VOLATILES

| MATRIX SPIKE / MATRIX SPIKE DUPLICATE | | | | | | | |
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| SAMPLE NO * | MATRIX SPIKES FOR EVERY 20 SAMPLES | | ADVISORY LIMITS FOR SPIKE RECOVERY MET | | ADVISORY LIMITS FOR SPIKE RPDs MET | | ACTION |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR VOLATILES

## COMPOUND IDENTIFICATION

| SAMPLE NO | HSL COMPOUNDS WITHIN ±0.06 RRT UNITS OF STANDARD | | SAMPLE vs STANDARD SPECTRAL CRITERIA MET | | ACTION ON HSL COMPOUNDS | NON-HSL COMPOUND IDENTIFICATION CRITERIA MET | | ALL SPECTRA PRESENT | | ACTION ON NON-HSL COMPOUNDS |
|---|---|---|---|---|---|---|---|---|---|---|
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# SOP WORK SHEETS FOR VOLATILES

## SYSTEM PERFORMANCE / OVERALL ASSESSMENT

| SAMPLE NO.* | IDENTIFY FACTORS THAT INDICATE INSTRUMENT PERFORMANCE PROBLEMS (e.g. BASELINE SHIFTS, I.S. ABSOLUTE AREA CHANGES, ETC.) | OVERALL ASSESSMENT OF DATA FOR THE SAMPLE (e.g. U, J, R, N, QUALIFERS) |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY _____



# SOP WORK SHEETS FOR EXTRACTABLES

## HOLDING TIMES

| SAMPLE NO. * | CONC LEVEL / MATRIX | DATE SAMPLED | DATE RECEIVED | DATE EXTRACTED | DATE ANALYZED | TIME ANALYZED | INSTRUMENT I D | CONTRACT HOLDING TIME MET | | 40 CFR 136 HOLDING TIME MET | | ACTION |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

LABORATORY _____

# SOP WORK SHEETS FOR EXTRACTABLES

## GC / MS TUNING AND PERFORMANCE

| SAMPLE NO * | DATE TUNED | TIME TUNED | DFTPP ION ABUNDANCE CRITERIA MET + | | ION ABUNDANCE CRITERIA NOT MET | SKEWED OR DISTORTED SPECTRA | | FREQUENCY OF TUNE > 12 HRS | | ACTION |
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| | | | YES | NO | | YES | NO | YES | NO | |
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*INCLUDES MATRIX SPIKES, BLANKS AND RE - RUNS HERE

+ MAY WANT TO CONSIDER EXPANDED CRITERIA. "LABORATORY DATA VALIDATION FUNCTIONAL GUIDELINES FOR EVALUATING ORGANICS ANALYSES", TDD NO. HQ-8410-01, USEPA, P.13.

LABORATORY_____



# SOP WORK SHEETS FOR EXTRACTABLES

## INITIAL CALIBRATION

| SAMPLE NO * | DATE | TIME | DESCRIBE CHROMATAGRAPHY PROBLEMS | SPCC CRITERIA MET | | CCC CRITERIA MET | | ALL COMPOUNDS $\overline{RF} > 0$ | | ANY HSL COMPOUND $\overline{RF} < 0.05$ | | ANY HSL COMPOUNDS RSD > 30% | | ERRATIC RF's | | ACTION |
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| | | | | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY _____



# SOP WORK SHEETS FOR EXTRACTABLES

## CONTINUING CALIBRATIONS

| SAMPLE NO * | DATE | TIME | SPCC CRITERIA MET | | CCC CRITERIA MET | | ALL COMPOUNDS RF > 0 | | CALIBRATION WITHIN 12 HRS OF SAMPLE ANALYSIS | | ANY HSL COMPOUND RF < 0.05 | | ANY HSL COMPOUND %D > 25 | | DESCRIBE CHROMATAGRAPHY PROBLEMS | ACTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY _____



# SOP WORK SHEETS FOR EXTRACTABLES

## BLANKS

| SAMPLE NO * | DATE ANALYZED | TIME ANALYZED | APPROPRIATE METHOD BLANK | | BLANK ANALYSIS EVERY 12 HRS OR EVERY 20 SAMPLES | | CONTAINS <5XCRDL PER COMMON PHTHALATES | | CONTAINS <CRDL FOR ALL OTHER TCL COMPOUNDS | | ACTION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | YES | NO | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

LABORATORY _____

# SOP WORK SHEETS FOR EXTRACTABLES

## SURROGATES

| SAMPLE NO. * | BLANK SURROGATE CRITERIA MET | | IF 'NO': WERE ALL ASSOCIATED SAMPLES RE-ANALYZED | | SAMPLE SURROGATE RECOVERY CRITERIA MET | | IF 'NO': WAS SAMPLE RE-EXTRACTED/RE-ANALYZED | | RE-ANALYZED SAMPLE MET CRITERIA | | SURROGATES OUTSIDE CRITERIA | ACTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR EXTRACTABLES

## MATRIX SPIKE / MATRIX SPIKE DUPLICATE

| SAMPLE NO * | MATRIX SPIKES FOR EVERY 20 SAMPLES, EACH MATRIX AND EACH LEVEL | | ADVISORY LIMITS FOR SPIKE RECOVERY MET | | ADVISORY LIMITS FOR SPIKE RPDs MET | | ACTION |
|---|---|---|---|---|---|---|---|
| | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

LABORATORY _____

# SOP WORK SHEETS FOR EXTRACTABLES

## COMPOUND IDENTIFICATION

| SAMPLE NO * | HSL COMPOUNDS WITHIN 0.06 RRT UNITS OF ASSIGNED INTERNAL STANDARD | | SAMPLE VS STANDARD SPECTRAL CRITERIA MET | | ACTION ON HSL COMPOUNDS | NON-HSL COMPOUND IDENTIFICATION CRITERIA MET | | ALL SPECTRA PRESENT | | ACTION |
|---|---|---|---|---|---|---|---|---|---|---|
| | YES | NO | YES | NO | | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR EXTRACTABLES

## SYSTEM PERFORMANCE / OVERALL ASSESSMENT

| SAMPLE NO * | IDENTIFIY FACTORS THAT INDICATE INSTRUMENT PERFORMANCE PROBLEMS ( e.g. RIC BASELINE SHIFTS I. S. ABSOLUTE AREA CHANGES , ETC.) | OVERALL ASSESSMENT OF DATA FOR THE SAMPLE ( e.g. U , J , R, Q, N, QUALIFIERS ) |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY_____



# SOP WORK SHEETS FOR PESTICIDES / PCBs

## HOLDING TIMES

| SAMPLE NO.* | CONC. LEVEL / MATRIX | DATE SAMPLED | DATE RECEIVED | DATE EXTRACTED | DATE ANALYZED | TIME ANALYZED | INSTRUMENT I.D | CONTRACT HOLDING TIME MET | | 40 CFR 136 HOLDING TIME MET | | ACTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY_____



# SOP WORK SHEETS FOR PESTICIDES / PCBs

## INSTRUMENT PERFORMANCE

| SAMPLE NO. * | DDT PACKED COLUMN RT > 12 MIN | | RT WINDOW CRITERIA MET | | 72 HOUR ANALYTICAL SEQUENCE CRITERIA MET | | DDT BREAKDOWN > 20 % | | ENDRIN BREAKDOWN > 20% | | RETENTION TIME SHIFT FOR DBC CRITERIA MET | | ACTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY_____



# SOP WORK SHEETS FOR PESTICIDES / PCBs

| CALIBRATION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE NO.* | DATE | TIME | % RSD < 10 % FOR LINEARITY CHECK COMPOUNDS | | % D > 15 % DURING 12 hr. PERIOD | | IF "YES" WERE ANALYSES REPEATED | | % D > 20 % DURING 12 hr. PERIOD | | ACTION |
| | | | YES | NO | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY_____



# SOP WORK SHEETS FOR PESTICIDES / PCBs

| BLANKS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE NO.* | DATE ANALYZED | TIME ANALYZED | APPROPRIATE REAGENT BLANK FOR EACH GC SYSTEM | | BLANK CONTAINS <CRDL FOR ALL PESTICIDES/PCBs | | BLANK ANALYSIS FREQUENCY CRITERIA MET | | ACTION |
| | | | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

CASE NO. _____
LABORATORY_____



# SOP WORK SHEETS FOR PESTICIDES / PCBs

## SURROGATE RECOVERY

| SAMPLE NO.* | SURROGATE RECOVERY CRITERIA MET | | FACTORS AFFECTING SURROGATE RECOVERY | ACTION |
|---|---|---|---|---|
| | YES | NO | | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR PESTICIDES / PCBs

## MATRIX SPIKE / MATRIX SPIKE DUPLICATE

| SAMPLE NO.* | MATRIX SPIKES FOR EACH MATRIX IN EACH CASE ( OR EVERY 20 SAMPLES ) | | ADVISORY LIMITS FOR SPIKE RECOVERIES MET | | ADVISORY LIMITS FOR SPIKE RECOVERIES RPDs MET | | ACTION |
|---|---|---|---|---|---|---|---|
| | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR PESTICIDES / PCBs

| COMPOUND IDENTIFICATION | | | | | | | |
|---|---|---|---|---|---|---|---|
| SAMPLE NO.* | COMPOUND RETENTION TIMES WITHIN STANDARD WINDOWS FOR PRIMARY COLUMN | | COMPOUND RETENTION TIMES WITHIN WINDOWS FOR CONFIRMATION COLUMN | | GC / MS CONFIRMATION OF COMPOUNDS | | ACTION |
| | YES | NO | YES | NO | YES | NO | |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE

# SOP WORK SHEETS FOR PESTICIDES / PCBs

| OVERALL ASSESSMENT | | |
|---|---|---|
| SAMPLE NO * | IDENTIFY FACTORS CONTRIBUTING TO OVERALL ASSESSMENT | OVERALL ASSESSMENT OF DATA FOR THE SAMPLE (e.g. U,J,R,Q, N QUALIFIERS) |
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* INCLUDE MATRIX SPIKES, BLANKS AND RE-RUNS HERE