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NWS EARLE
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# FOSTER WHEELER ENVIRONMENTAL CORPORATION

May 29, 1996
File #: 1284-0017-06-0307

Commanding Officer
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, PA 19113
ATTN: Code 4023 (D. Cooper)

Subject: US NAVY CONTRACT NO. N62472-94-D-0398
DELIVERY ORDER #0017
NAVAL WEAPONS STATION-EARLE, COLTS NECK, NJ
WORK PLAN FOR BIOSLURPING PILOT STUDY

Dear Mr. Cooper:

The subject project has been awarded for the remediation of free product, soils and groundwater at the Naval Weapons Station-Earle, located in Colts Neck, New Jersey under the Northern Division, Naval Facilities Engineering Command Remedial Action Contract (RAC) Program. The preconstruction document is provided herein for your review and comments. It is requested that all reviews performed by others of this submission be provided in written form to Mr. David Cooper no later than June 7, 1996.

In order to ensure that all base operational requirements, scheduling aspects and project details are incorporated in the early development of this project, it is requested that you thoroughly review these documents for base specific needs prior to our mobilization (which is scheduled for June 17, 1996). This review should be directed towards: (1) utility tie-ins and supporting systems; (2) the project's relationship to existing facilities such as structures, roads, utilities and conformance with base functions; (3) scheduling difficulties which may be encountered due to continued operational requirements or other conflicting construction; (5) regulatory coordination or needs by either the Base environmental coordinator or Northern Division; (5) traffic patterns, site layout, aesthetics and project appearance for compliance with the Base needs; (6) assurance that the project meets the requirements of the Base fire and security departments.

The bioslurping system mobilization is scheduled for June 17, 1996. If additional review time is needed or if the proposed mobilization date is not acceptable, please contact the Northern Division design manager (D. Cooper), who can be reached at (610)595-0590.

NV/96-166 2300 LINCOLN HIGHWAY EAST, ONE OXFORD VALLEY, SUITE 200, LANGHORNE, PA 19047-1829
TEL: 215-702-4000 FAX: 215-702-4045

May 29, 1996
File #: 1284-0017-96-0307

If you have any questions or comments concerning this submission, please contact me at (2150)702-4033.

Very truly yours,

Tim Silar

Tim Silar
Project Manager

TS/eh
Enclosure

cc: G. Goepfert (NWS-Earle; 2 copies)
J. Gratz (USEPA; 1 copy)
R. Marcolina (NJDEP; 1 copy)
A. Aziz (FWENC)
File Copy

# WORK PLAN
# FOR
# BIOSLURPING PILOT STUDY
# AT
# NAVAL WEAPONS STATION - EARLE
# COLTS NECK, NEW JERSEY

**Naval Facilities Engineering Command**
**10 Industrial Highway**
**Lester, PA 19113**

***Prepared by:***


**Foster Wheeler Environmental Corporation**
**2300 Lincoln Highway**
**One Oxford Valley - Suite 200**
**Langhorne, PA 19047 - 1829**


***May 1996***


**REMEDIAL ACTION CONTRACT N62472-94-D-0398**
**DELIVERY ORDER NO. 0017**

**WORK PLAN FOR BIOSLURPING PILOT STUDY AT**
**NAVAL WEAPONS STATION - EARLE**
**COLTS NECK, NJ**
**REMEDIAL ACTION CONTRACT N62742-94-D-0398**
**DELIVERY ORDER NO. 0017**

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## 1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) has been contracted by the Northern Division, Naval Facilities Engineering Command (NORDIV) to perform a bioslurping pilot study in the vicinity of Building C-16 (also referred to as Site 16/F) at Naval Weapons Station (NWS) Earle located in Colts Neck, NJ. This Work Plan is being submitted to satisfy the pre-construction submittal requirements included in paragraph 1.2.1, Pre- and Post-Construction Documentation of the Statement of Services for Delivery Order No. 0017 under Remedial Action Contract No. N62472-94-D-0398. Post-construction submittals will include a pilot test Evaluation Report.

The following documents furnished by the Navy were reviewed and incorporated into this Work Plan:

- Draft Remedial Investigation, Section 18, Brown and Root Environmental.
- Site Characterization at Naval Weapons Station Earle, Colts Neck, New Jersey, Site 16F, Site Specific Report SSR-2187-ENV, Site Characterization and Analysis Penetrometer System (SCAPS Report), Naval Facilities Engineering Service Center, Port Hueneme, CA, February 1996.
- Best Practices Manual for Bioslurping, Battelle

Bioslurping is a innovative remedial technology which utilizes vacuum-enhanced dewatering technology to remediate petroleum hydrocarbon contaminated sites. Bioslurping systems are designed to recover light non-aqueous phase liquids (LNAPLs) via vacuum enhanced pumping while remediation of the vadose zone via bioventing. Therefore, bioslurping simultaneously accomplishes source removal and remediation of the vadose zone. The bioslurper system withdraws free product, small volumes of groundwater and soil gas in the same process stream using a single pump. Free product is recovered while groundwater and soil gas are treated (when required) and discharged.

Bioslurping enhances free product recovery by creating a pressure gradient to force movement of LNAPL into the well. The system operates with minimal fluid drawdown in the aquifer, thereby reducing problems associated with LNAPL smearing and entrapment. Bioventing of the vadose zone is achieved by withdrawing of soil gas in the recovery well. The system alternates between withdrawing product (and small amount of groundwater) and soil gas. The rate of soil gas extraction is dependent on the rate of LNAPL recovery. The slurping action also greatly reduces the amount of groundwater discharge when compared to conventional dual-phase extraction systems.

Bioslurping has effectively been implemented at several sites including the Fallon Naval Air Station located in Nevada, and the Willow Grove Naval Air Station located in Pennsylvania. Bioslurping technology has been demonstrated to be cost-competitive with dual phase extraction systems. Bioslurping is more cost-effective for larger sites since the incremental cost for this technology is lower than an extraction technology which requires pumps at each well. In addition, initial results indicate that bioslurping removes free product faster than other technologies (e.g., dual-phase extraction systems and skimmer systems), therefore the restoration timeframe is reduced resulting in lower operation and maintenance cost.

The objective of the bioslurping pilot test is to evaluate its technical feasibility at the subject site. The bioslurping technology was selected based on the positive results of initial studies and site-specific conditions (i.e., silty sands and low volatile diesel fuel).

## 2.0 PROJECT LOCATION AND DESCRIPTION

NWS Earle is located in east-central Monmouth County in the town of Colts Neck, NJ, as depicted in Figure 2-1. Site 16/F (Building C-16) is located in the north-central portion of NWS Earle as shown in Figure 2-2.

An underground fuel line located in the area north of Building C-19 was used to transport diesel fuel from an UST located at the northeastern corner of Building C-18 to a dispensing station near Building C-50. A leak in the fuel line was discovered in 1977 and use of the pipeline was discontinued after the leak was discovered and excavated. Part or all of the former underground diesel transfer line is still in place.

A site investigation was conducted in 1992. As part of this investigation, five soil borings were completed in the area north of Building C-18, the reported location of the underground fuel line leak. Each boring was completed to the water table, and one sample was collected approximately 8 feet below ground surface (bgs), below the level of the fuel pipeline and above the water table. All soil samples collected contained elevated levels of TPH ranging from 4,700 mg/kg to 22,000 mg/kg. Low levels of semi-volatiles were also detected. A geophysical survey of the area indicated a number of buried lines at the site; however, the exact location of the leaking fuel line was not determined.

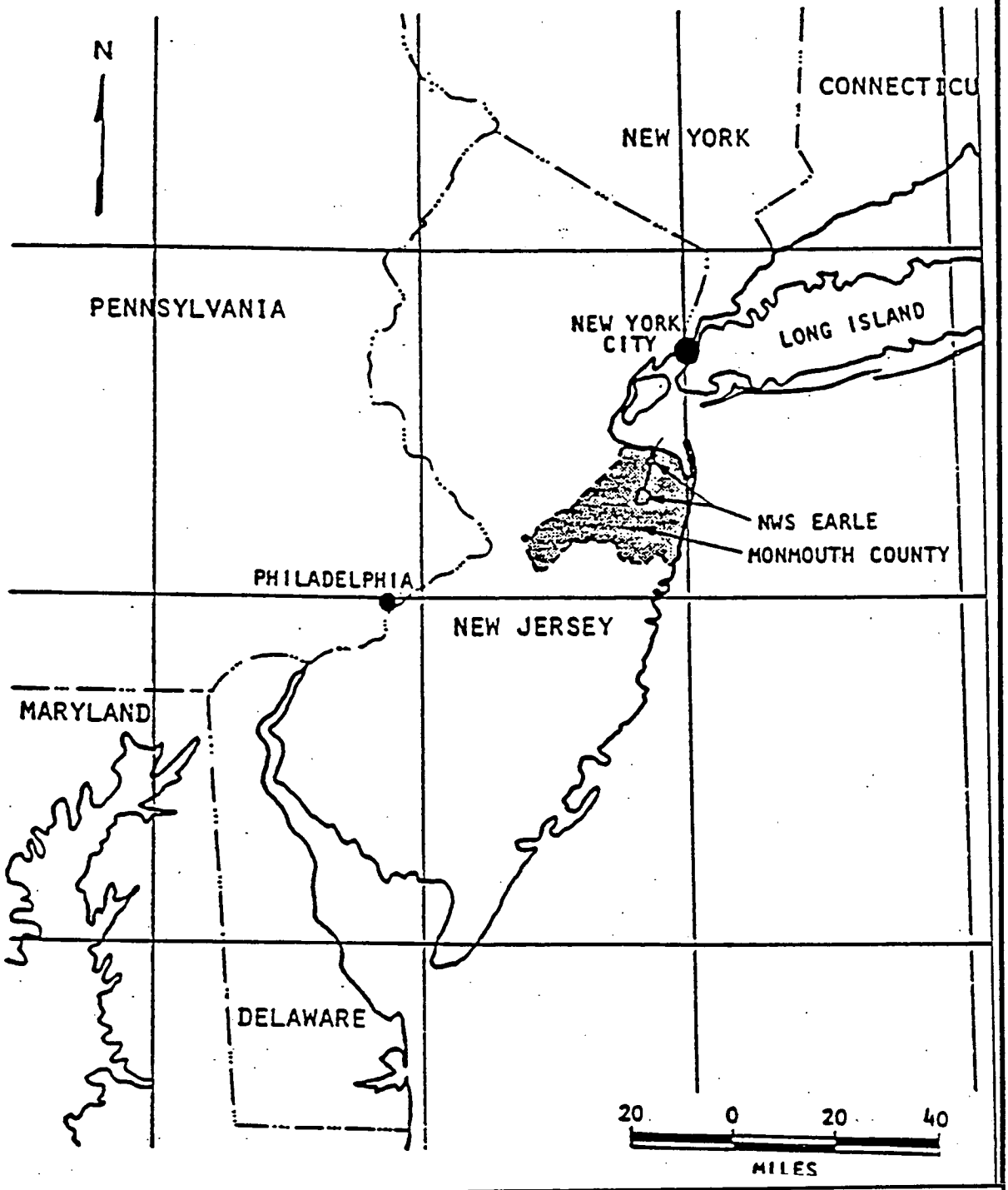
Between June and October of 1995, Brown & Root Environmental conducted the following activities at Site 16/F:

- Soil gas survey
- Sampling and analysis of subsurface samples from 20 soil borings
- Sampling and analysis of surface soil
- Sampling and analysis of sediment
- Drilling and installation of six shallow permanent monitoring wells
- Sampling and analysis of groundwater from the wells
- Measurement of static-water levels in the wells
- Performance of slug testing in three of the wells

Sampling and well locations are depicted in Figure 2-3.

The Remedial Investigation Report prepared by Brown & Root Environmental subsequent to the 1995 field investigation concluded that hydrocarbons detected in the subsurface have impacted the groundwater. The groundwater contamination (primarily volatile organics and fuel constituents) is associated with a free-product LNAPL layer. This floating product is a source of organics to groundwater. In addition, there is a potential for residual leaching of aromatic volatiles and the lighter PAHs from subsurface soils into groundwater because of the significant concentrations present.

Underground storage tanks (USTs) and/or piping leaks have occurred at the NWS Earle supply gasoline station (Building C-17). The piping was replaced in 1995. The USTs are known to have stored diesel fuel and unleaded gasoline. Gauging activities conducted during the 1995 Remedial Investigation indicate an "apparent" thickness of up to 2 feet of product in monitoring well MW16-04, and up to 8 inches in monitoring well MW16-05. Free product was not detected in any of the other monitoring wells installed across the site. The 1995 SCAPS Investigation delineated the extent of petroleum-impacted soils across the site; however, additional monitoring wells are needed to provide the basis for estimating the actual volume of recoverable LNAPL in the subsurface.




U.S. Navy RAC
NWS Earle, Colts Neck, N.J.

Figure 2-1
Site Location Map

SOURCE: SCAPS REPORT

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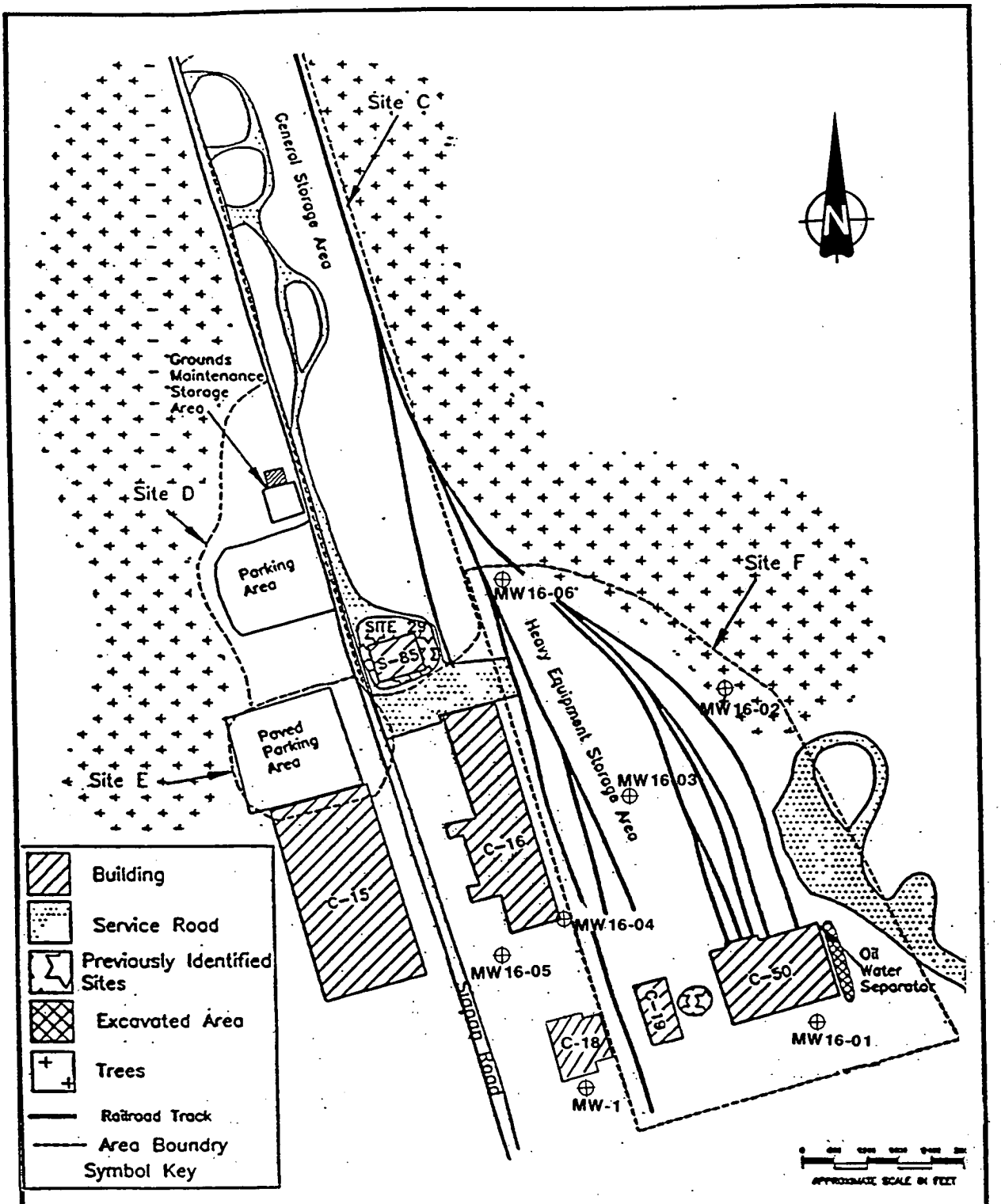
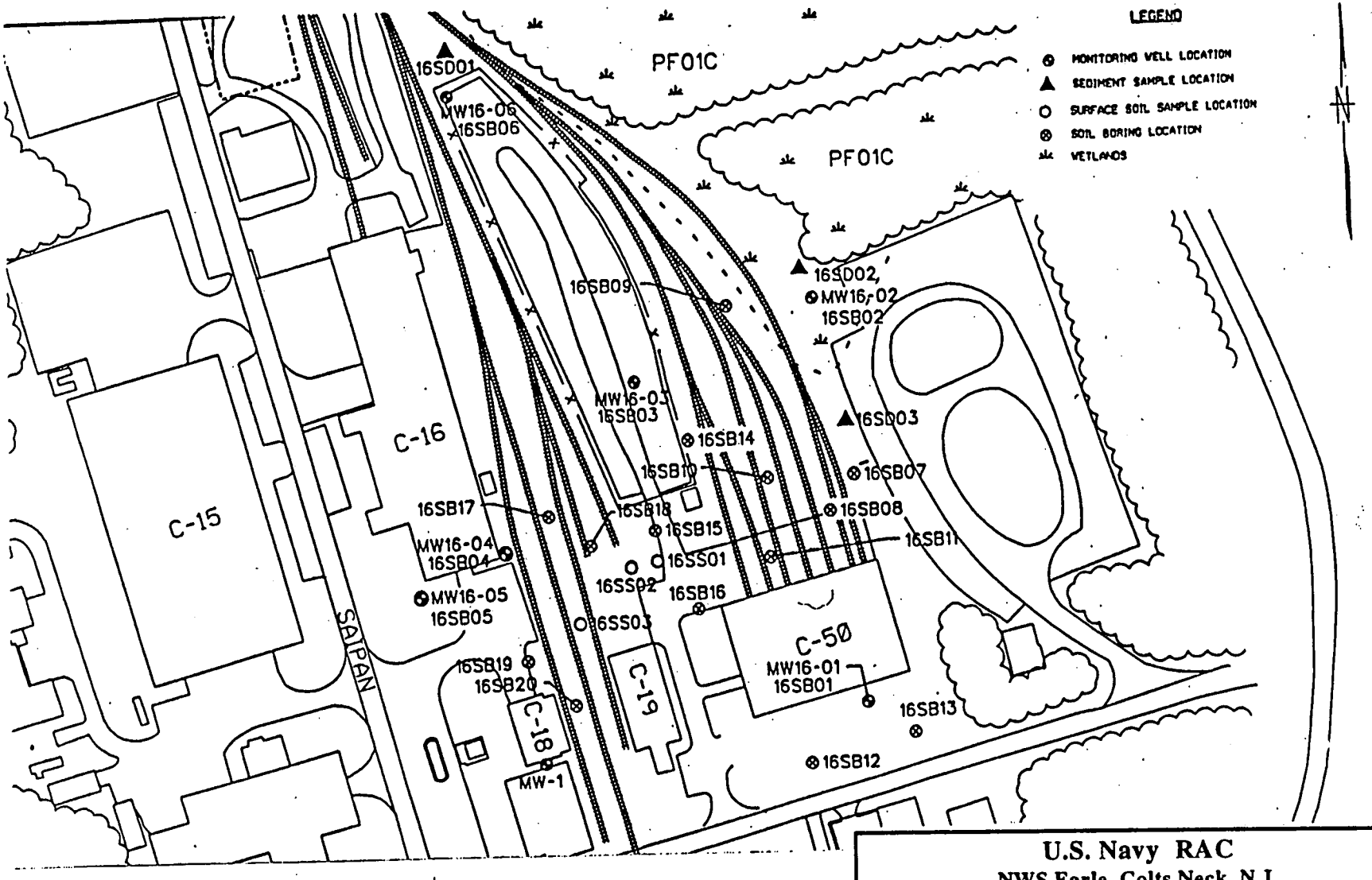



U.S. Navy RAC
NWS Earle, Colts Neck, N.J.

Figure 2-2
Site Layout Map

SOURCE: SCAPS REPORT

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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**NWS Earle, Colts Neck, N.J.**

Figure 2-3
Site Investigation Sampling Locations

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## 3.0 SCOPE OF WORK

The objective of the bioremediation pilot study is to install a pilot scale free product recovery system to evaluate the potential for removal of the product layer. The technology evaluated is bioslurping, a combination of enhanced vapor extraction and bioventing. Prior to installing the bioslurping system, Foster Wheeler Environmental will operate a skimmer collection system to collect as much of the LNAPL as possible.

In a bioslurping system, a vacuum is applied to the extraction well above the LNAPL layer. The resulting "slurping" action draws the free product from the well and creates a slight depression of the LNAPL layer to induce movement toward the well. This also helps minimize the amount of groundwater that is withdrawn, reducing the amount of water requiring treatment and disposal. In addition to LNAPL extraction, oxygen is drawn into the subsurface, enhancing biodegradation of the contamination in the vadose zone. The withdrawn liquids and vapor are separated in an air-liquid separation tank. The liquid waste stream is passed through an oil-water separator and the extracted free product is collected while groundwater is treated and discharged. The air stream is passed through a separate treatment system if required to meet air discharge requirements. Treatment typically consists of one or more activated carbon adsorption units in series.

### 3.1 TASK 1 - PROJECT PLANNING/MANAGEMENT

Project Planning/Management activities include the preparation of pre-construction submittals, mobilization to the site, and providing home office support functions during the estimated period of performance. The subtasks involved in Project Planning/Management are described below.

#### 3.1.1 Subtask 1A - Pre-construction Submittals

Foster Wheeler Environmental will prepare and submit the following pre-construction documents to the Navy:

***Work Plan***
The Work Plan presents Foster Wheeler Environmental's approach to executing the project, including the site description, statement of work, procurement approach, system information, materials, quality control plan, erosion controls, engineering data, the proposed submittal register, transportation and disposal data, and sampling and analytical requirements.

***Health and Safety Plan (HASP)***
The HASP includes Foster Wheeler Environmental's approach to providing for the health and safety of its employees during the project.

***Equipment Submittals***
The Flow Diagram and Electrical Diagram for the bioslurping system will be submitted for review prior to procurement of the system.

#### 3.1.2 Subtask 1B - Mobilization/Facilities

Mobilization will consist of contacting appropriate Navy personnel at NWS Earle to arrange for contractor passes and to coordinate support requirements for installation of the skimmer collection system and the bioslurping system. As discussed with the electrical foreman at NWS Earle, the Navy

will provide an electrical service connection from Building C-16. Due to the small project scope, Foster Wheeler Environmental will not mobilize a construction trailer to NWS Earle. Site operations will be managed from Foster Wheeler Environmental's Langhorne, PA office.

### 3.1.3 Subtask 1C - Home Office Support

Foster Wheeler Environmental will provide home office support for the six-month project duration. Home office support includes the preparation of the required monthly progress, financial, and technical reports.

## 3.2 TASK 2 - SITE CHARACTERIZATION

Foster Wheeler Environmental will conduct the site characterization activities necessary to supplement the data provided by the Navy in the RI Report and the SCAPS Report. The basis for additional site characterization is provided in the Best Practices Manual for Bioslurping, prepared by Battelle.

### 3.2.1 Subtask 2A - Installation of Soil Gas Monitoring Points

The current construction of the monitoring well network will not provide for the monitoring of soil gas composition and pressure during the bioslurping pilot test. Therefore, Foster Wheeler Environmental will supplement the existing network with three new soil gas monitoring points. The points will be installed in a straight line radially from the bioslurping well (MW16-04) at intervals of 10, 20 and 40 feet. Each monitoring point will be screened at three intervals to evaluate site heterogeneities. Anticipated screened intervals include 1 foot above the water table (8-9 feet below ground surface [bgs]), 3-4 feet bgs, and 5-6 feet bgs.

Monitoring points will be constructed in general accordance with the specification shown in Figure 3-1 and in accordance with NJDEP guidelines. During monitoring well installation, one soil sample will be collected from each monitoring point boring from the capillary fringe (approximately 6 to 8 feet) in order to establish baseline condition and assist in design of the full scale system. Soil samples will be analyzed for BTEX, TPH and physical parameters including grain size distribution, bulk density, porosity, and moisture content.

In addition, one composite sample of drill cuttings will be collected and analyzed for full TCLP for disposal purposes. Foster Wheeler Environmental will subcontract for disposal of drill cuttings.

### 3.2.2 Subtask 2B - Monitoring Well Gauging

Foster Wheeler Environmental will measure water levels and thickness of the LNAPL layer in the six existing monitoring wells, during operation of SkimRite™ system (Section 3.3), to establish baseline conditions.

Subsequent to removal of the Skimrite™ system and prior to installation of the bioslurping system, baildown testing will be conducted on monitoring wells MW16-04 and MW16-05. Baildown testing will be performed to estimate the true thickness of LNAPL and estimate the recoverable volume of LNAPL. Initial soil gas pressure and levels of oxygen, carbon dioxide, and TPH will be measured in the soil gas monitoring points. Levels of oxygen, carbon dioxide and TPH will also be measured in the existing monitoring wells.

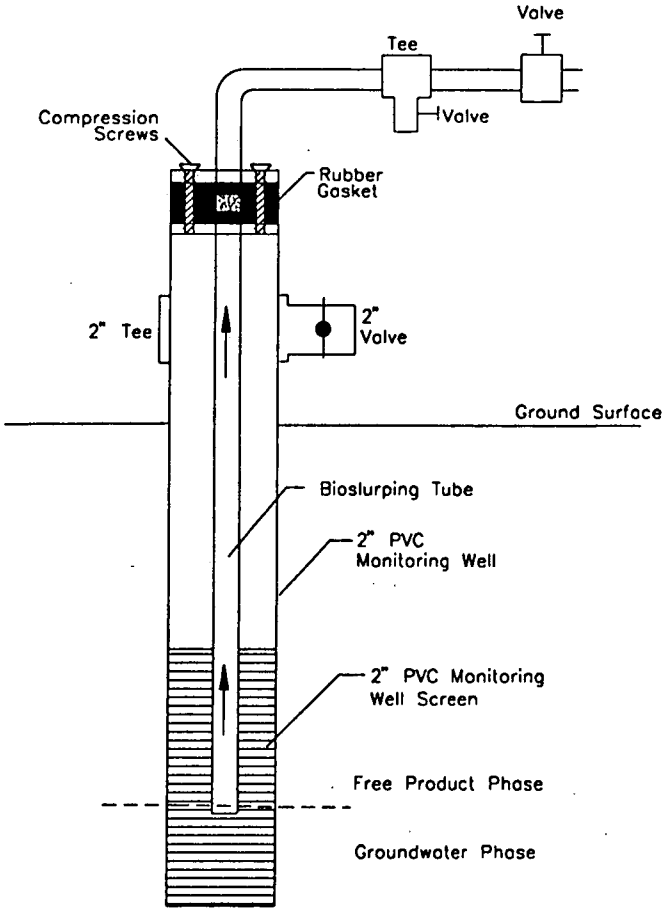


Diagram of a Typical Bioslurper Well

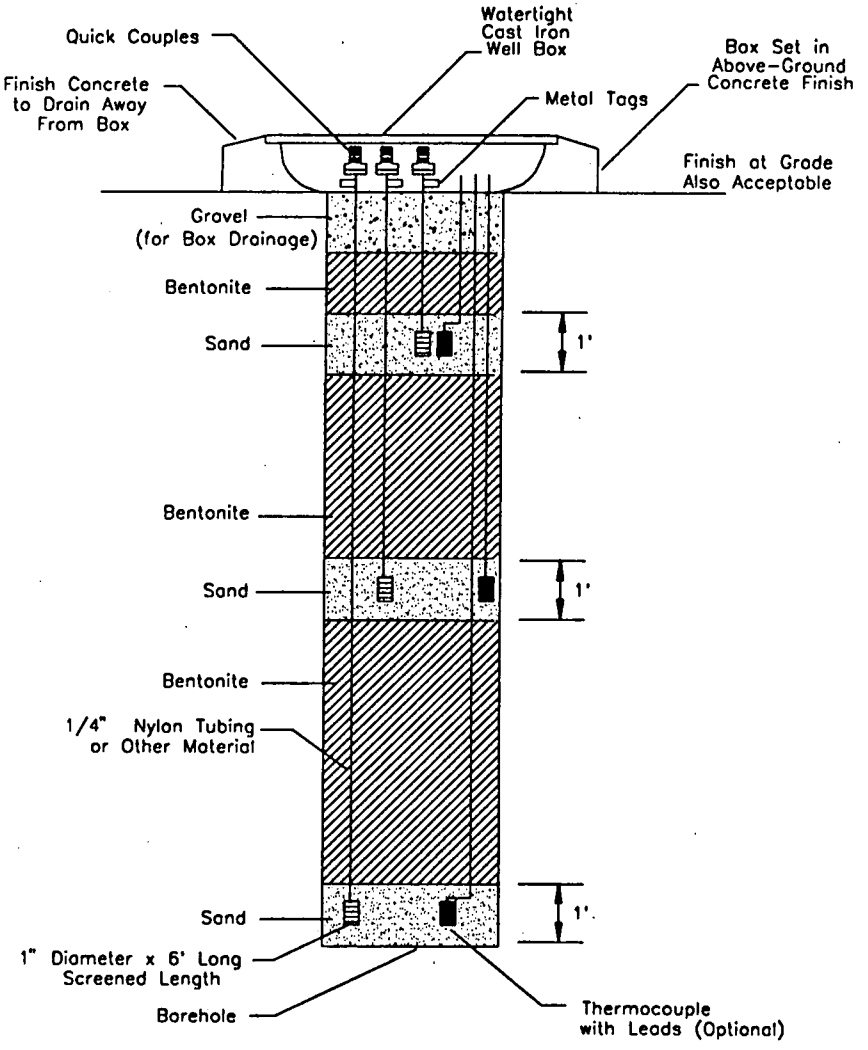


Diagram of a Typical Soil Gas Monitoring Point

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NWS Earle, Colts Neck, N.J.

Figure 3-1

Well Construction Diagrams

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## 3.3 TASK 3 - INSTALLATION AND OPERATION OF SKIMMER COLLECTION SYSTEM

This task requires the specification, purchase, installation and operation of a skimming system to collect free product from the subsurface. The system to be installed is the SkimRite™ Standard System consisting of the following components:

- SkimRite™ PSC (Pump, Skimmer, and Controller) unit
- 1.5 HP Air Compressor
- Air/Dryer/Filter with Product Tank Overfill Protection
- 150 feet of 3/8 inch ID polyethylene discharge hose
- 150 feet of 5/16 inch OD nylon air supply line
- 150 feet of 3/8 inch OD nylon vent line
- 2-inch locking well cap

The SkimRite™ free-product recovery system has been developed by Enviro Products, Inc., based in Lansing, Michigan. The technical specifications for this system are presented in Appendix A of this Work Plan. The system incorporates a pump, skimmer, and controller into a single downhole tool measuring 1.75 inches in diameter and 66 inches in length. The downhole assembly is suspended in the well via product and air-supply tubing connected to a locking well cap. A floating hydrophobic skimmer buoy in the downhole tool removes hydrocarbon product to a sheen, while accommodating water level fluctuations up to 24 inches. A 1.5 HP compressor with a 3.8 gallon air tank is used to operate the system at a rate of approximately five gallons/hour. The actual rate of product recovery is dependent upon product thickness and viscosity.

Recovered product is discharged through a 3/8 inch polyethylene hose connecting the SkimRite™ tool to an aboveground drum. An intrinsically-safe tank overfill protection device (float switch assembly) is used to monitor the product level within the drum. When the float switch senses the product level to be 8 inches below the top of the drum, the system is shut down. A schematic of the system is presented in Figure 3-2.

Installation of the SkimRite™ system at monitoring well MW16-04 will involve the following steps:

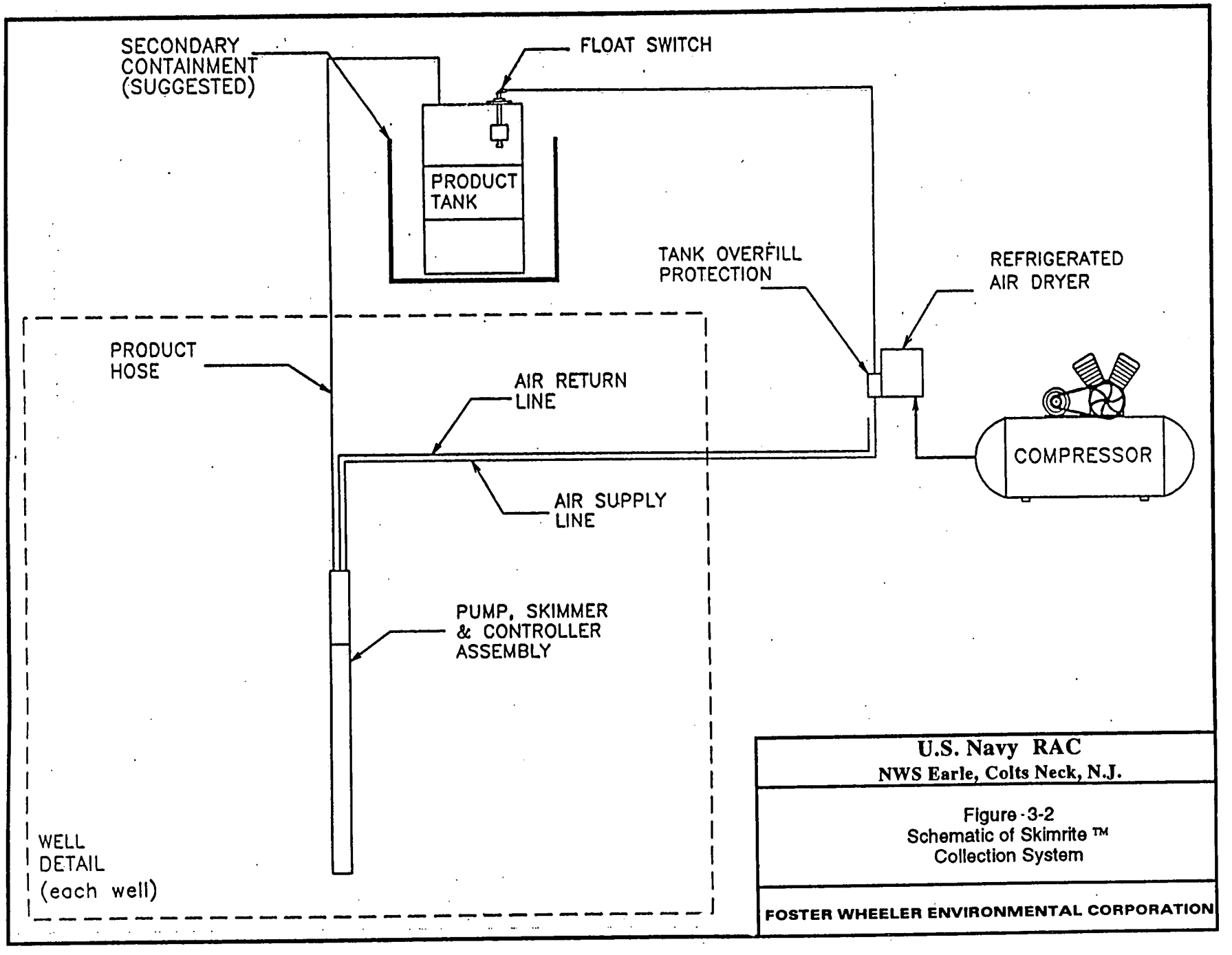
- Using an oil/water interface probe, measure the depth to LNAPL product in monitoring well MW16-04.

- Feed a length of 3/8 inch ID polyethylene hose, 5/16 inch OD nylon air supply line, and 3/8 inch nylon air vent line (equivalent to the measured depth to water/product less 30 inches), through the locking well cap. This will ensure the downhole probe and skimming buoy is centered at the product/air interface.

- Connect the product line and air lines to the downhole probe using stainless steel hose clamps.

- Lower the SkimRite™ tool down the well and position the locking well cap on the wellhead.

- Position the air compressor and controller box/regulator adjacent to Building C-16. The compressor and controller box/regulator will be housed within a prefabricated 4 feet by 2 feet by 2 feet painted steel outdoor enclosure, manufactured and supplied by Enviro Products, Inc. A 120 VAC, 30 amp, single-phase electrical line from Building C-16 will supply power to the air compressor. The

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**NWS Earle, Colts Neck, N.J.**

Figure-3-2
Schematic of Skimrite ™
Collection System

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electrical service connection will be provided by the electrical foreman at NWS Earle. Since the compressor will be located more than 25 feet from the wellhead and collection vessel, NFPA and NEC do not require that the compressor be explosion-proof. This modification of the statement of services has been discussed with and approved by the Navy Design Manager.

- Connect the air supply and vent lines to the controller box/regulator, as per Enviro Products instructions. The air supply vent line and overflow signal wire will be enclosed in a polyethylene hose run between the wellhead and compressor. Feed the product recovery hose from the wellhead into the storage shed, through the side of the product storage shed. Connect the product line to the product recovery drum. Leave at least 5 feet of slack line to allow for subsequent downhole depth adjustments, as needed.

- Connect a short section of 3/8 inch OD nylon vent line to the air dryer (controller/regulator box) to drain moisture from the system.

- Connect the air supply line from the compressor to the controller box/regulator. The prefabricated outdoor enclosure supplied by Enviro Products will be equipped with an air-activated valve that is used to drain condensate from the compressor holding tank. The valve operates from the bleed air on the compressor and therefore does not require electric power.

- Install the overfill protection float switch to the product recovery tank/drum and wire to the controller box. The float switch shall mount in a 2-inch bung opening on the top of the product recovery tank/drum.

- Plug the air compressor power cord into the power supply and start the compressor. Follow Enviro Product instructions regarding oil-fill levels and pressure-relief settings for compressor operation.

Foster Wheeler Environmental anticipates that recovered product will be collected in DOT-17E drums which will be placed inside a product storage shed. The shed will be equipped with spill containment protection. Appendix B provides the manufacturer's specifications for the product storage shed. One sample of the recovered product will be collected and sent to an off-site laboratory for analysis for volatile organic compounds, BTU content, flash point, PCBs, total organic halogens, and suspended solids. Disposal of the collected product will be coordinated with the NWS Earle Environmental Coordinator.

It is anticipated that the system will operate continuously for nine weeks. Initially, Foster Wheeler Environmental personnel will check the system on a daily basis to verify operation and measure the amount of free product in the drum. Following initial start-up, the system will be checked twice per week to ensure optimal 24-hour operation and to exchange/replace the storage drum upon filling to capacity.

As part of routine maintenance, the water/product level in monitoring well MW16-04 will be measured to ensure the downhole SkimRite™ tool is positioned at the water/product air-interface. Water table fluctuations of plus or minus 1 foot (2 feet total range) can be accommodated without repositioning the SkimRite™ tool.

Air lines and the product lines will be inspected to ensure that no kinks/blockages have occurred. The oil level in the air compressor will be checked/topped off to ensure proper lubrication of the unit. Operation and maintenance activities will be documented in the monthly project report.

At the conclusion of the nine-week operation period, the system components will be removed for installation of the bioslurping system.

## 3.4 TASK 4 - INSTALLATION AND OPERATION OF A BIOSLURPING SYSTEM

At the conclusion of the nine-week operational period for the skimmer system, Foster Wheeler Environmental will install a bioslurping pilot system. The subtasks detailed below define the scope of work associated with the bioslurping pilot study.

### 3.4.1 Subtask 4A - Permitting

Operation of the bioslurping system will produce air emissions that require a permit from NJDEP. Foster Wheeler Environmental has prepared the applicable permit applications for Navy submission (Appendix C). The maximum duration of the pilot test air permit is 90 days. Therefore, it may be necessary to prepare a permit extension or new permit based on air quality data collected during the six week pilot test, to cover the balance of the 10 week operating period. Discharge of extracted groundwater will be accomplished under existing Navy permits and will be coordinated through the NWS Earle Environmental Coordinator.

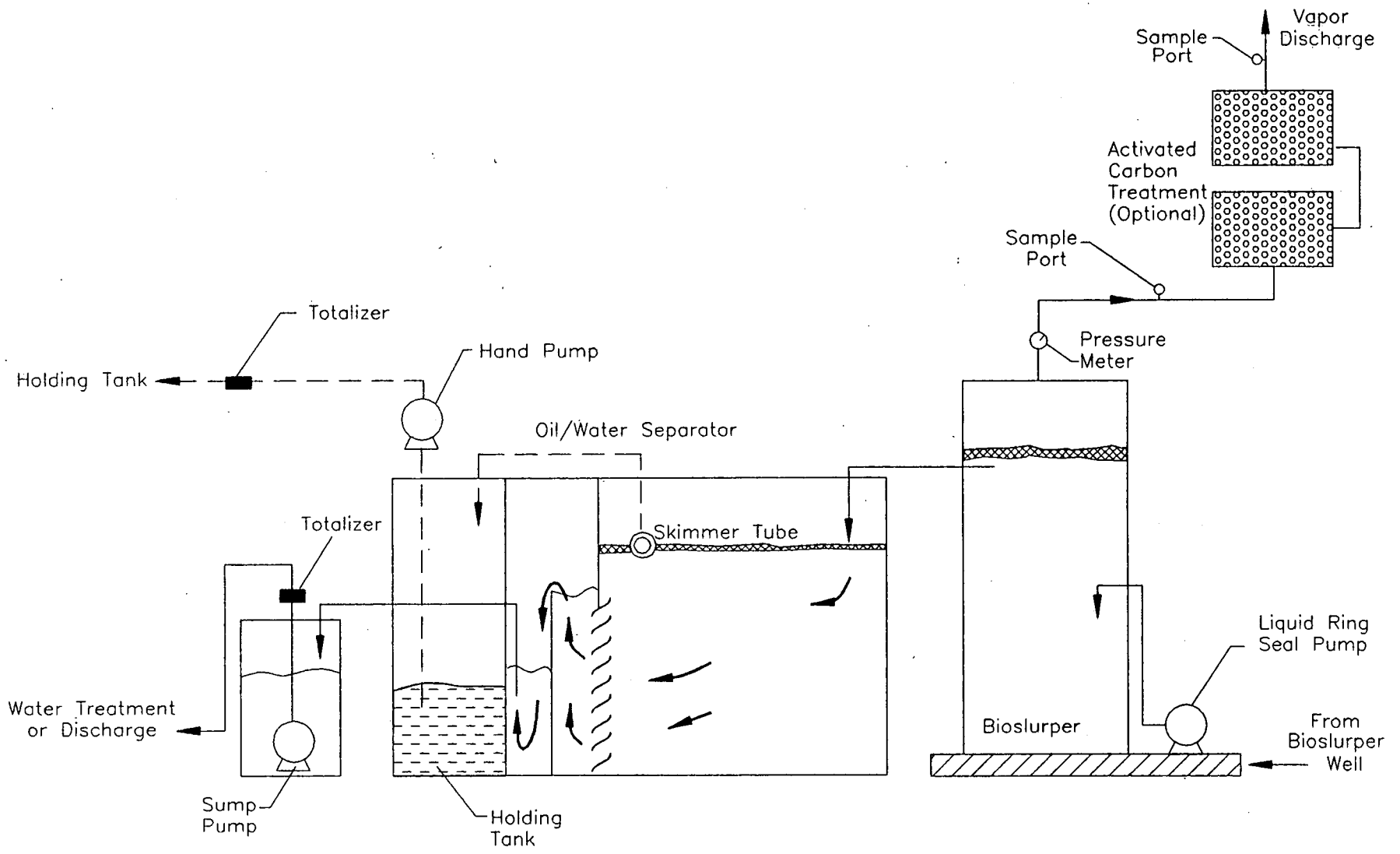
### 3.4.2 Subtask 4B - Installation of the Bioslurping System

This subtask requires the specification, procurement, and installation of a vacuum enhanced extraction/bioslurping system. The principal components of the system, diagrammed in Figure 3-3, are listed below.

- Liquid ring pump (minimum 3 HP)
- Air-liquid separation tank (120 gallon capacity)
- Oil-water separator
- Holding tank for recovered product
- Transfer tank for extracted and separated groundwater
- Hand pump
- Sump pump
- Activated carbon columns

Foster Wheeler Environmental has evaluated costs associated with purchase versus rental of a bioslurping system. Upon approval from the Navy, Foster Wheeler Environmental will purchase a bioslurping system from Carbitrol Corporation. Detailed equipment specification for the Carbitrol system, as submitted to the Navy on May 17, 1996, are included in Appendix D. This system is skid mounted and will be installed in a 10x10 pre-fabricated shed. Required electrical power to the shed/system is 230 VAC (3 phase), 30 amp and will be coordinated through the NWS Earle Electical Foreman. The system will be installed and the existing monitoring well (MW16-04) retrofitted for the bioslurping system. The bioslurping well construction is shown in Figure 3-1.

As discussed in the March 7, 1996 site visit and confirmed telephonically with the NWS Earle Environmental Coordinator on March 22, extracted product will be collected for disposal by the Navy. Separated water will be containerized during the system startup. A representative sample will be collected and analyzed for BTEX, TOX, and inorganics for subsequent disposal to the storm sewer. After installation, a brief startup test will be conducted to ensure that all system components are operating properly.




Not to Scale

U.S. Navy RAC
NWS Earle, Colts Neck, N.J.

Figure 3-3

Schematic of Bioslurping System

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### 3.4.3 Subtask 4C - System Operation

System operation includes the component system shakedown, system startup, and system monitoring. Each component is discussed below.

A brief startup test will be conducted to ensure that all components of the system are operating properly. An example component checklist is included in Appendix E. During the startup a groundwater sample will be collected after treatment and analyzed for BTEX, TOX and TAL inorganics. Results will be returned in 24 hours and submitted to the NWS Earle Environmental Coordinator. The NWS Earle Environmental Coordinator will determine the disposition of the recovered groundwater based on the results. It is anticipated that recovered groundwater will be discharged to the storm sewer following treatment with activated carbon.

Following successful completion of the system shakedown and determination of groundwater disposition system startup will commence. The system will be monitored on a full-time basis for the first week, thereafter it will be checked twice per week for the remaining five weeks of the pilot study.

The following sampling/monitoring will be conducted during the pilot study.

During the initial week of operation, soil gas pressure and soil gas levels of oxygen, carbon dioxide, and TPH will be collected daily from the soil gas monitoring points and the monitoring wells. In addition, the LNAPL thickness in monitoring well MW16-05 will be recorded daily. These measurements will be collected twice a week during the remainder of the pilot test.

During the end of the first week of operation and prior to completion of the test pilot, samples will be collected of the groundwater and vapor discharge. Samples will be analyzed for BTEX and TPH. Samples will be collected prior to any discharge treatment. Results will be evaluated to estimate the amount of product recovered.

Throughout the pilot test, the discharge rates of LNAPL, vapor, and groundwater will be monitored and recorded to estimate volume recovered/discharged. Discharge rates, coupled with sample concentrations, will enable an estimate of total recovered LNAPL volume.

At shutdown of the pilot test (after six weeks), an in-situ aeration/respiration test will be conducted. Soil gas levels for oxygen, carbon dioxide and TPH will be monitored at the three soil gas monitoring points during the test. Readings will be collected from each monitoring point and interval at 2, 4, 6, 8, 12, 24, 36 and 48 hours after shutdown of the bioslurping system. The respiration test will provide data on oxygen utilization which in turn will be utilized to estimate the rate of hydrocarbon degradation in the vadose zone and effectiveness of the bioslurping process.

Subsequent to completion of the respiration test, the system will be restarted for a 10-week operation period.

## 3.5 TASK 5 - EVALUATION REPORT

At the conclusion of the six-week pilot period, Foster Wheeler Environmental will evaluate the pilot study data and prepare a summary report for submittal to the Navy. The report will contain all analytical and field data. The report will provide an analysis of the feasibility/effectiveness of bioslurping for source removal and site remediation and develop a conceptual approach for a full scale bioslurping

system. Major elements of the report will include: site characterization, soil gas survey/monitoring results, LNAPL characterization, pressure radius, bioslurping extraction rates, and in-situ aeration/respiration test results.

## 4.0 SAMPLING AND ANALYSIS REQUIREMENTS

The bioremediation pilot study requires field sampling and analysis data for evaluating system performance and scale-up requirements. Table 4-1 provides the types, quantities, and rationale for the data that will be collected. Detailed sample collection and handling procedures and analytical protocols will be provided in a separate Sampling and Analysis Plan, which is attached to this Work Plan as Appendix F.

## 5.0 HEALTH AND SAFETY REQUIREMENTS

The site-specific Health and Safety Plan (HASP) is provided as a separate submittal. As required by paragraph 1.2.1, Pre- and Post-Construction documentation, the HASP includes organizational information, a potential hazards assessment, protective equipment requirements, air monitoring, site controls and protective zones, medical surveillance procedures, emergency response and spill control measures, and training requirements.

## 6.0 WASTE REMOVAL/REGULATORY COMPLIANCE

This section addresses how the various waste streams generated during the bioslurping pilot study activities will be handled. These waste streams include air emissions, groundwater, recovered free product, and investigation derived wastes.

### 6.1 AIR EMISSIONS

Air emissions from the bioslurper will require a permit under Chapter 17 of NJDEP Regulations. Air emissions will not require monitoring.

### 6.2 GROUNDWATER

Groundwater discharged during the bioslurping process will initially be collected and sampled for BTEX, TOX and TAL inorganics prior to determining final disposition. It is anticipated that treated groundwater will be discharged to the storm sewer.

### 6.3 RECOVERED FREE PRODUCT

Recovered free product will be containerized in the system product tank and periodically pumped to a tanker for subsequent disposal/recycling.

### 6.4 INVESTIGATION DERIVED WASTES

As part of the bioslurping pilot study, several investigation derived waste streams will be generated. These include soil cuttings, decontamination fluids, PPE, and other miscellaneous debris. These wastes

**TABLE 4-1**
**SAMPLING AND ANALYSIS REQUIREMENTS**

| *Media* | *Analyses* | *Frequency* | *Quantity ** | *Method* | *Rationale* |
|---|---|---|---|---|---|
| Soil | BTEX, TPH | Samples will be collected during soil gas monitoring point installation. One sample will be collected from the capillary fringe (6 to 8 feet) at each location (3). | 3 total samples for each parameter | BTEX - EPA 8020 / 624 / 8240<br>TPH - EPA Modified 8015 / 5030 | Analysis will establish baseline conditions of subsurface soil contamination. |
| Soil | Grain Size, Porosity, Bulk Density, Moisture Content | Samples will be collected during soil gas monitoring point installation. One sample will be collected from the capillary fringe (6 to 8 feet) at each location (3). | 3 total samples for each parameter | Grain Size - ASTM D422<br>Porosity - ASTM D2434<br>Bulk Density - ASTM D4531<br>Moisture Content - ASTM D2216 | These geophysical parameters will be used to evaluate the subsurface conditions affecting the feasibility of full-scale bioslurping operations. |
| Soil | TCLP Characteristics | One composite soil sample of cuttings from the soil gas monitoring points. | 1 | TCLP Volatiles - EPA 8240<br>TCLP Metals - EPA SW-846 | Analytical results will be used to classify drill cuttings for disposal. |
| LNAPL | VOCs, BTU Content, Flash Point, PCBs, TOX, TSS | Samples will be taken from the collection drum during operation of the skimmer. | 1 | VOA - EPA 8240<br>BTU - ASTM D240<br>Flash Point - EPA SW-846 / 1010<br>TSS - EPA 160.2<br>TOX - SW-846 / 9020<br>PCBs - EPA 8080 | Analytical results will be used to evaluate the potential for recycling/reuse of the recovered product. |
| Water | BTEX, TOX, TAL Inorganics | One sample will be collected from the bioslurper effluent. | 1 | TOX - EPA SW-846 / 9020<br>BTEX - EPA 8020 / 624 / 8240<br>TAL Inorganics - EPA SOW 390 ILMO.3 | Analytical results will be used to determine if discharge to the NWS Earle storm sewers is permissible. |
| Water | BTEX, TPH | During first week of pilot test and during final week of pilot test. | 2 | BTEX - EPA 8020 / 624 / 8240<br>TPH - SW-846 / 8015B | Analytical results will be used to estimate the volume of contaminant removed. |
| Gas | BTEX, TPH | During first week of pilot test and during final week of pilot test. | 2 | BTEX - EPA 8020 / 624 / 8240<br>TPH - SW-846 / 8015B | Analytical results will be used to estimate the volume of contaminant removed. |

* Quantities do not include quality assurance samples.

will be collected, stored separately and tested for constituents of concern, which will depend upon the analytical requirements of the chosen disposal facility. Investigation derived wastes will be disposed of appropriately, based upon the analytical results.

### 6.5 MANIFESTING

When required, Foster Wheeler Environmental will provide completed manifest and transport documentation to the Navy for review and signature.

### 6.6 WASTE TRANSPORT AND DISPOSAL

Foster Wheeler Environmental will subcontract for waste transport and disposal (T&D) services. The T&D subcontractor will be competitively procured from the five firms with which Foster Wheeler Environmental has preplaced basic ordering agreements. This assures the Navy that wastes will be sent to an EPA-approved facility for the waste stream of concern.

## 7.0 PROJECT MANAGEMENT

### 7.1 PROJECT SCHEDULE

The project schedule is provided as Figure 7-1.

### 7.2 MEETINGS

A review meeting was held at NWS Earle on May 16, 1996 to discuss overall project scope and schedule. There are no additional meetings or reviews scheduled at this time. However, Foster Wheeler Environmental will attend project meetings as requested by the Navy.

## 8.0 QUALITY ASSURANCE/QUALITY CONTROL

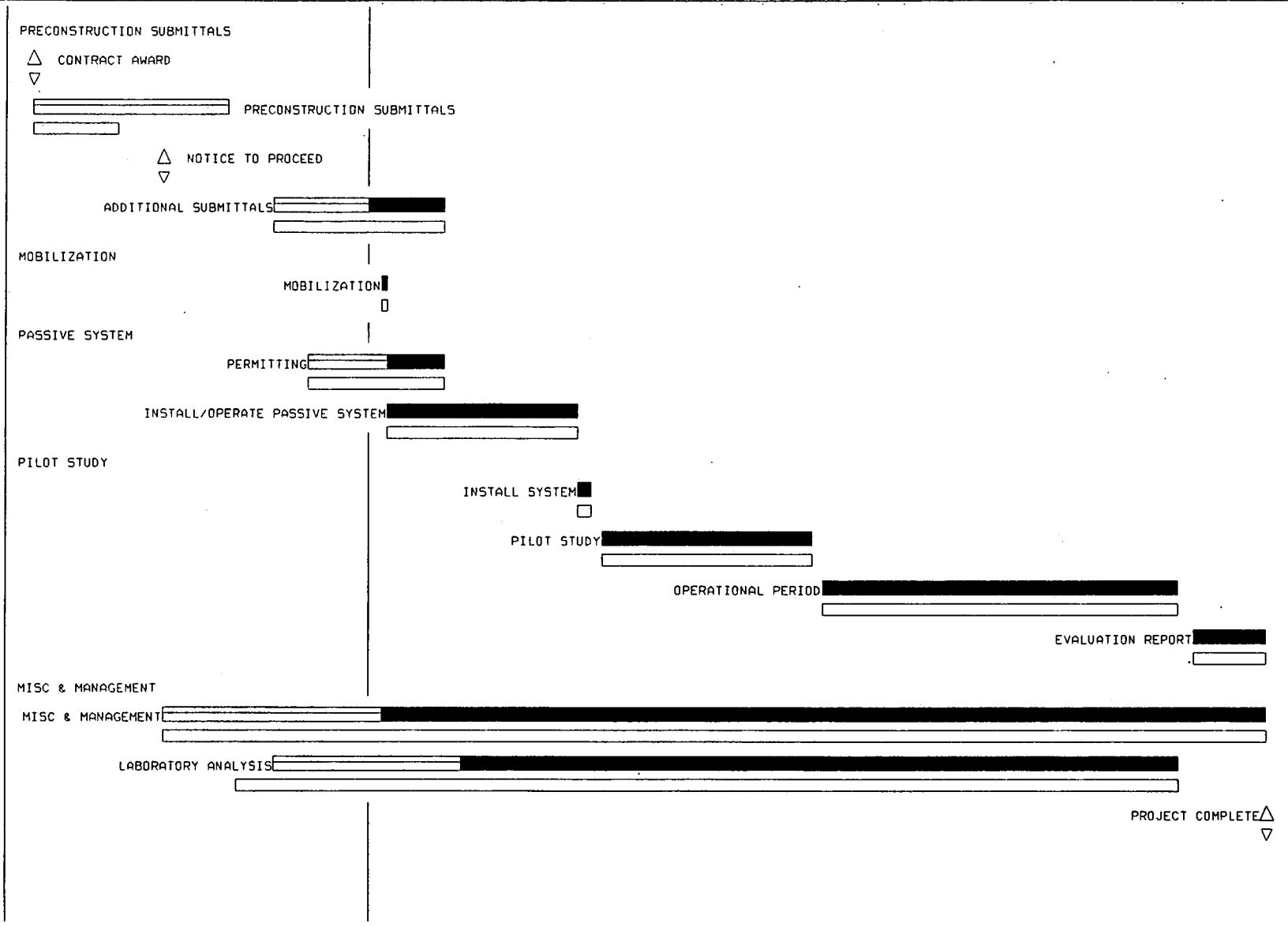
This Quality Assurance/Quality Control (QA/QC) section describes the organization, inspections, tests, procedures, and documentation necessary to produce a completed project which complies with the governing regulations and the technical statement of work.

### 8.1 ORGANIZATION AND RESPONSIBILITIES

QA/QC duties are the responsibility of the Project Manager. He will employ physical inspections, direct measurement, and confirmatory laboratory testing to verify that work is being performed in accordance with the project plans. All subcontractors will conform to and participate in the program described herein as part of a unified team.

Foster Wheeler Environmental will direct and maintain responsibility for the overall QA/QC program and will manage subcontractors in a manner to maintain project requirements. Subcontractors will be used for drilling, laboratory analysis, waste disposal, and delivery/setup of the bioslurper unit.

| EARLY START | EARLY FINISH | |
|---|---|---|
| | | PRECONSTRUCTION SUBMITTALS |
| 07MAR96A | 06MAR96A | CONTRACT AWARD |
| 07MAR96A | 12APR96A | PRECONSTRUCTION SUBMITTALS |
| 01APR96A | 29MAR96A | NOTICE TO PROCEED |
| 22APR96A | 24MAY96 | ADDITIONAL SUBMITTALS |
| | | MOBILIZATION |
| 13MAY96 | 13MAY96 | MOBILIZATION |
| | | PASSIVE SYSTEM |
| 29APR96A | 24MAY96 | PERMITTING |
| 14MAY96 | 18JUN96 | INSTALL/OPERATE PASSIVE SYSTEM |
| | | PILOT STUDY |
| 19JUN96 | 21JUN96 | INSTALL SYSTEM |
| 24JUN96 | 02AUG96 | PILOT STUDY |
| 05AUG96 | 11OCT96 | OPERATIONAL PERIOD |
| 15OCT96 | 28OCT96 | EVALUATION REPORT |
| | | MISC & MANAGEMENT |
| 01APR96A | 28OCT96 | MISC & MANAGEMENT |
| 22APR96A | 11OCT96 | LABORATORY ANALYSIS |
| 29OCT96 | 28OCT96 | PROJECT COMPLETE |




DESC
MILESTONE
CRITICAL
PROGRESS
PLANNED

FOSTER WHEELER ENVIRONMENTAL CORPORATION
PROGRAM MANAGER: A. HOLCOMB
DOM: T. SILAR
MOD 2

RUN DATE 15MAY96
START DATE 01MAR96
DATA DATE 10MAY96
FINISH DATE 28OCT96

SURETRAK

NWS EARLE
D. O. 0017
DESPORTION PILOT STUDY
BASELINE VS CURRENT

NWS EARLE,NJ

## 8.2 PROBLEM OR WORK DEFICIENCY MEETINGS

If a major problem or deficiency occurs or is likely to occur, a special meeting to address related issues will be held. The meeting may be attended by the Project Manager, Navy Representative(s) and others, as required. Meetings may be conducted at NWS Earle, NORDIV, or by teleconference. The purpose of the meeting will be to define and resolve potential problems or work deficiencies in the following manner:

- Define and discuss the problem or deficiency
- Review alternative solutions, including their effects on schedule and budget
- Implement plan to resolve the problem or deficiency

## 8.3 SUBMITTALS

The Submittal Register is provided as Appendix G.

The Quality Control Manager is responsible for maintaining the submittal register and reviewing and certifying that submittals are in compliance with the contract requirements. All submittals will be accompanied by a transmittal form which will identify the submittal and provide a unique tracking number. A copy of the transmittal form is provided as Figure 8-1.

## 8.4 TESTS AND INSPECTIONS

Foster Wheeler Environmental will perform preparatory, initial, and follow-up inspections as presented in Table 8-1.

## 8.5 CHANGES

If circumstances develop during the project that make it necessary or advisable to revise the Work Plan in order to accomplish project objectives, a Field Change Request (FCR) will be forwarded to the Navy for approval. Events such as a change in the site conditions or system performance may result in a FCR. Changes may be discussed with the Navy Design Manager telephonically and followed up with a FCR to avoid negative impacts on the project budget.

## 8.6 DOCUMENTATION

Documentation of operations recordkeeping, photographic evidence or work performed, and as-built drawings will be provided to the Navy in the Evaluation Report.

### 8.6.1 Operations Recordkeeping

All field inspection and testing activities will be documented in a project logbook. The project logbook will be maintained in accordance with the relevant Foster Wheeler Environmental Field Technical Guidelines. The Project Manager will maintain records of quality control operations and activities for subcontractors and suppliers.

Prepare in quintuplicate (original and 4 copies)

CONTRACTOR DRAWINGS & INFORMATION SUBMITTAL
NORTHNAVFACENGCOM 4335/3 (Rev. 6/80)

CONTROL NO.

| CONTRACT NO. | DELIVERY ORDER # | ACTIVITY LOCATION |
|---|---|---|
| N62472-94-D-0398 | | |

PROJECT TITLE:

| FROM: | DATE |
|---|---|
| TO: | DATE |

1. THE CONTRACTOR SUBMITTALS LISTED BELOW ARE FORWARDED FOR YOUR REVIEW AND RECOMMENDATIONS.
   (a) APPLY APPROPRIATE STAMP IMPRINT TO EACH SUBMITTAL AND INDICATE REVIEW COMMENTS, AS REQUIRED.
   (b) RETAIN ONE (1) COPY OF THIS TRANSMITTAL FORM AND RETURN REMAINING COPIES WITH REVIEWED SUBMITTALS TO ROICC.
2. THESE SUBMITTALS SHOULD BE RETURNED TO THIS OFFICE BY _____
3. _____

COPY TO:

☐ ROICC ☐ DESIGNER ☐ OTHER

SIGNATURE AND DATE

| FROM: DESIGNER | DATE |
|---|---|
| TO: ROICC | DATE |

1. THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE RETURNED, WITH ACTION TAKEN AS INDICATED.
2. _____

COPY TO:

☐ ROICC ☐ DESIGNER

SIGNATURE AND DATE

| FROM: ROICC | DATE |
|---|---|
| TO: CONTRACTOR | DATE |

1. THE SUBMITTALS LISTED BELOW HAVE BEEN REVIEWED AND ARE APPROVED/DISAPPROVED AS SHOWN BELOW AND ON EACH STAMP IMPRINT.

COPY TO:

☐ ROICC ☐ OTHER

FOR COMMANDING OFFICER, NORTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND — DATE

| TRANSMITTAL NO. | SUBMITTAL DESCRIPTION | PREPARED/ SUBMITTED BY | APPROVED | DISAPPROVED | REMARKS |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

MISC\96-184.DOC

TABLE 8-1
INSPECTION SCHEDULE
BIOSLURPING PILOT STUDY
NAVAL WEAPONS STATION - EARLE
DELIVERY ORDER #0017
FOSTER WHEELER ENVIRONMENTAL CORPORATION

| *Activity* | *Preparatory* | *Done* | *Initial* | *Done* | *Follow-up* | *Done* |
|---|---|---|---|---|---|---|
| Installation of soil gas monitoring points | Materials meet specification requirements, drilling subcontractor meets state requirements | | Soil gas monitoring points are properly installed | | Proper maintenance, waste materials properly disposed | |
| Well gauging | Gauging to be carried out in accordance with approved procedures | | Collect well readings with oil/water interface probe | | Proper maintenance of probe | |
| Installation/operation of skimmer collection system | Installation and operation to be carried out in accordance with manufacturer approved procedures | | Proper installation | | Proper maintenance and period inspections for proper operation | |
| Installation/operation of bioslurping system | Installation and operation to be carried out in accordance with manufacturer approved procedures | | Proper installation | | Proper maintenance and period inspections for proper operation | |
| Storage of waste | Storage of waste to be carried out in accordance with approved procedures | | • Waste solids shall be stored in DOT 17C specific drums<br>• Liquids shall be stored in DOT 17E lined drums<br>• All drums shall be stored within portable hazardous waste storage building<br>• Storage location must be approved by Navy and meet all applicable regulations<br>• Proper labeling and inventory of stored drums | | On-going inspection of stored drums<br>Drums must be shipped for off-site disposal within 90 days of generation | |
| Transportation and disposal of waste | Transportation and disposal of waste to be carried out in accordance with approved procedures and regulations | | Proper segregation of waste until final disposal | | Proper transportation and disposal of waste | |

### 8.6.2 Photographic Documentation

Still 35mm color photographs will be taken as needed to record work progress. At a minimum, photographs will be taken of the existing conditions before work begins, during the installation of the passive system, during monitoring well installation, and during installation of the bioslurping system. Photograph location, date and description of the activity recorded will be entered in a photo documentation log. The photographs and log will be submitted with the Evaluation Report

### 8.6.3 As-Built Drawings/Technical Information

System as-built drawings and technical information will be submitted as part of the Evaluation Report.

# APPENDIX A

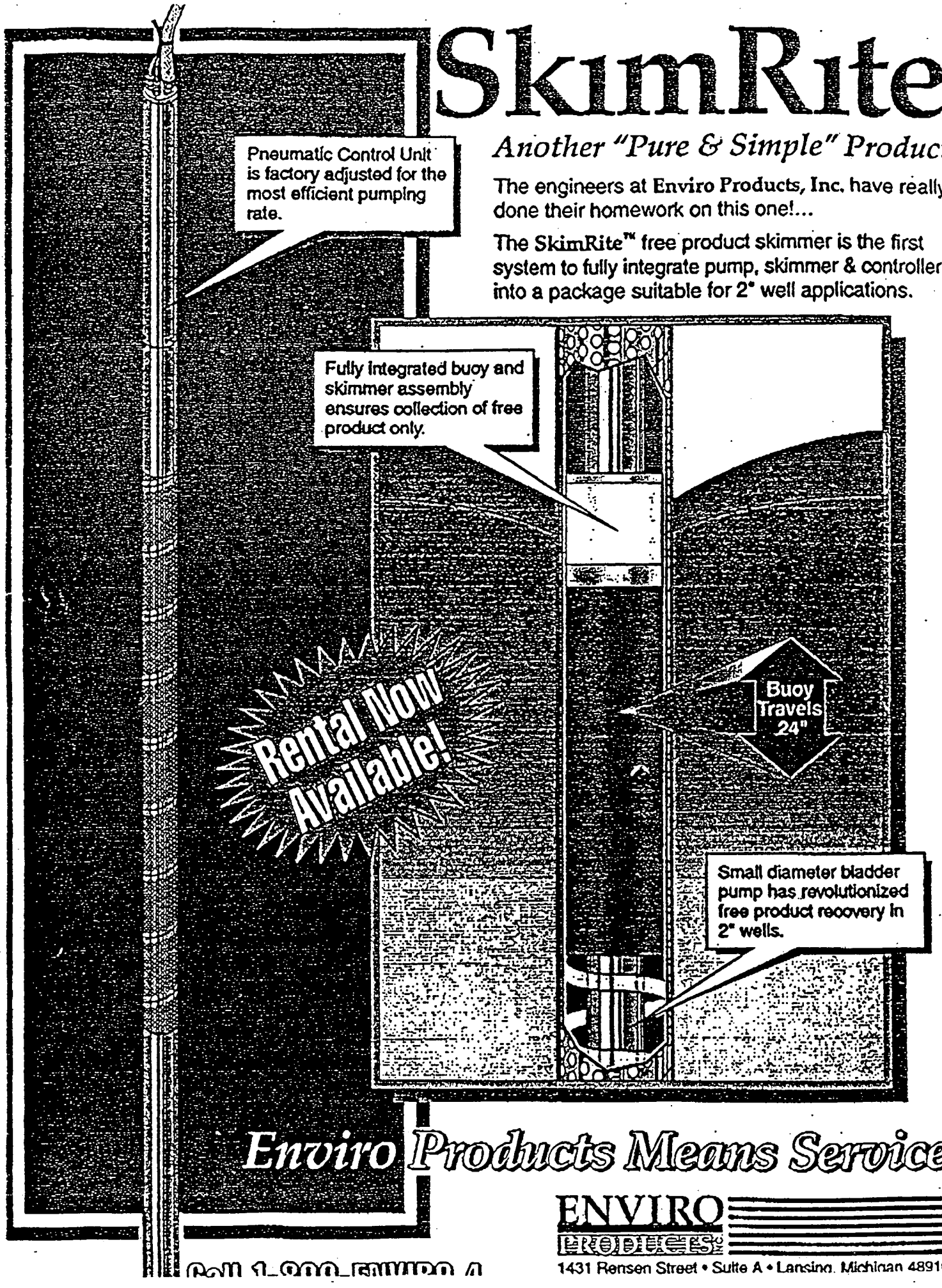
# SKIMRITE™ TECHNICAL SPECIFICATIONS

# SkimRite™

*Another "Pure & Simple" Product*

The engineers at Enviro Products, Inc. have really done their homework on this one!...

The SkimRite™ free product skimmer is the first system to fully integrate pump, skimmer & controller into a package suitable for 2" well applications.




***Enviro Products Means Service!***

ENVIRO PRODUCTS

1431 Rensen Street • Suite A • Lansing, Michigan 48910

Call 1-800-ENVIRO-4

ENVIRO PRODUCTS
nvironmental Equipment and Supplies
:31 Rensen Street, Suite A • Lansing, Michigan 48910
17) 887-1222 • 1-800-ENVIRO 4 • Fax: (517) 887-8374

# EQUIPMENT DESCRIPTION

## SkimRite™ Standard System

The standard SkimRite™ system comes complete with the following components:

- SkimRite™ PSC (Pump, Skimmer & Controller) unit
- 1.5 HP Air Compressor
- Air Dryer/Filter with Product Tank Overfill Protection
- 100' of 3/8" I.D. polyethylene discharge hose
- 100' of 5/16" O.D. nylon air supply line
- 100' of 3/8" O.D. nylon vent line
- Choice of 2", 4" or 6" locking well cap

The SkimRite™ free product skimming system incorporates pump, skimmer, and controller into one unit that is 1.75 inches in diameter. The SkimRite™ is suspended in a well with a 2 inch or greater diameter using a locking well cap. The floating skimmer buoy removes product to a sheen while accommodating water table fluctuations as great as 24 inches. The minimum water level required in the well is 19 inches.

A 1.5 H.P. compressor with 3.8 gallon air tank is used to operate the system. The compressor's dimensions are 25" L X 18" W X 12" H and requires 120VAC, 17 Amps. Air consumption for each SkimRite™ PSC is 0.4 CFM. A 5/16 inch O.D. air supply line and a 3/8 inch O.D. air vent is connected to the top of the SkimRite™. The pumping rate using pure unleaded gasoline is greater than 5.0 GPH. The rate of recovery is dependent upon product thickness (See SkimRite™ Recovery Rate Data on product literature). Recovered product is discharged through a 3/8 inch I.D. polyethylene hose which is used with a locking well cap (choice of 2, 4, or 6 inch) to suspend the SkimRite™. Total power required by the system is 19 Amps, 120 VAC.

Air from the compressor is processed through an air dryer to remove moisture; a requirement for the SkimRite™ controller. The air dryer has a pre-filter to remove particulates and bulk moisture from the incoming air. A regulator is provided with the system to control air pressure supplied to the pump. The compressor and air dryer are connected by a flexible air line.

An intrinsically safe tank overfill protection unit is used to monitor the product storage tank. This is incorporated into the same package as the air dryer. The tank is monitored using a float switch assembly which mounts in a 2 inch NPT bung opening on the top of the tank. The float switch senses the overfill level to be 8 inches below the top of the tank and shuts the system down if this level is reached. There is a 50 foot weather-resistant control cable provided.

*It is recommended that secondary containment be used around the product tank.*

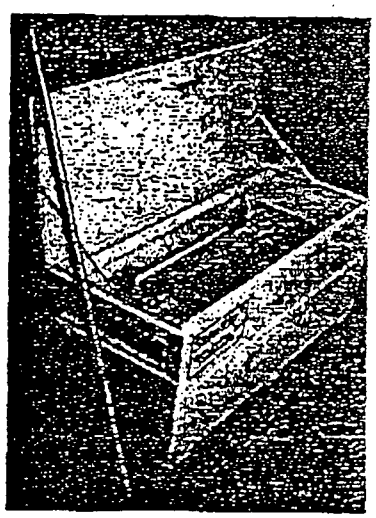
## Description:

Introducing the SkimRite™ system. The SkimRite™ is a unique free product skimmer system that incorporates pump, skimmer and controller into one package for use in 2" or larger wells. The SkimRite™ utilizes a small diameter bladder pump with proven durability and performance. The unique design uses a floating buoy which travels along the length of the pump to accommodate fluctuations in water table.

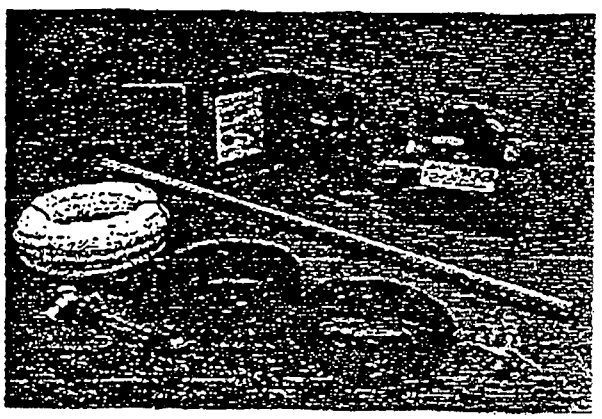
State of the art engineering has produced an extremely efficient air consumption to product ratio. Even while providing 120 gallons per day of pure product, the SkimRite™ requires only 0.4 CFM of compressed air.

## System Specifications:

| | |
|---|---|
| Diameter | 1.75" |
| Length | 66.0" |
| Weight | 10.5 lbs. |
| Air Consumption | .40 CFM |
| Pumping Rate | >5.0 GPH |



Outdoor Enclosure (Optional)



Complete System

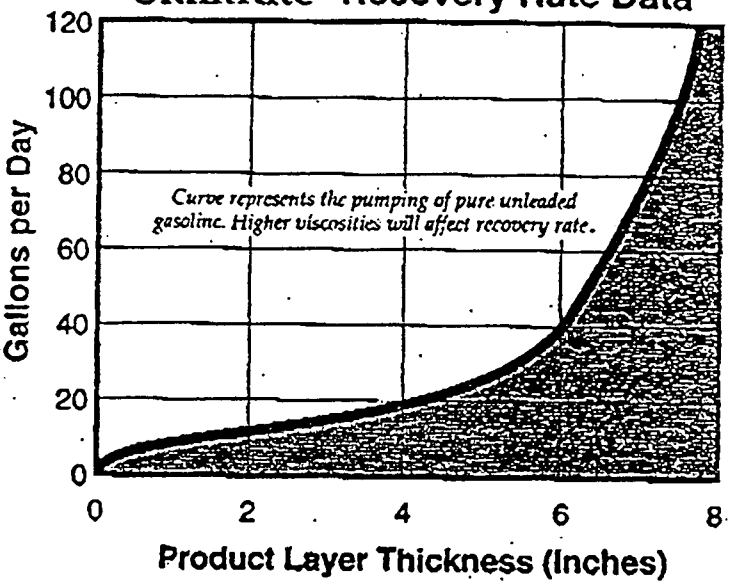
** Full Product Warranty!*

**Call 1-800-ENVIRO 4**

## Features:

- Installs in minutes
- No controller adjustments necessary
- High recovery rate (greater than 120 GPD)
- One size for all wells 2" and larger
- Effective with petroleum fuels
- Accommodates groundwater fluctuations as great as 24"
- Compact size—full scale performance
- Lightweight and portable

### SkimRite™ Recovery Rate Data




## Standard System Includes:

- SkimRite™ PSC (Pump/Skimmer/Controller)
- 1.5 h.p. air compressor, 115 v.a.c. with air filtration
- Product tank overfill protection
- 100 ft. of 3/8" polyethylene discharge line
- 100 ft. of 5/16" nylon air line
- 100 ft. of 3/8" nylon vent line
- Choice of 2", 4", or 6" well cap

## Options:

- Multiple pump systems
- Outdoor enclosure for compressor
- Custom well head configurations to accommodate depression pumps, sensors, etc.
- Custom hose lengths
- RiteTank™ – A revolutionary combination of a double wall tank, overfill protection, interstitial sensor, and an equipment storage enclosure.

*For wells where a very low yield of free product is expected, consider using a PetroTrap™, EPI's passive skimmer system.*


ENVIRO PRODUCTS
1431 Rensen Street • Suite A • Lansing, Michigan 48910
(517) 887-1222 • 1-800-ENVIRO 4 • Fax: (517) 887-2871

# SkimRite™ OPTIONS/ACCESSORIES

## Additional SkimRite™ Pumps

(For Multiple Well Installation)

The SkimRite™ PSC will be provided for each additional well location. Each SkimRite™ PSC includes 100 feet of 3/8 inch vent line, 5/16 inch supply line, 3/8 inch product discharge hose and either a 2, 4 or 6 inch locking well cap. The standard system's 1.5 HP air compressor can service up to four SkimRite™ PSCs. For larger systems, a larger compressor can be specified (please contact Enviro Products, Inc. for this information).

## Manifold Block

The air supply for additional pumps is provided through a manifold block. The manifold block has valved outputs to allow up to four PSCs to be operated at one time.

## Outdoor Enclosure Option

The 48" L X 24" W X 24" H painted steel enclosure is used to house the system's air compressor and tank overfill/air dryer. All interior components are securely fastened to the enclosure. Electrical wiring is routed through conduit and junction boxes. The air and power connections are brought outside the enclosure and connected as panel-mount fixtures where possible. The enclosure is vented by forced air ventilation (a fan) which cools the internal components (Also see Heat Option). The SkimRite™ PSC stores securely inside a special compartment. This lockable steel enclosure is ideal for locations that are remote or where an additional measure of security is desired. This option includes the auto drain option described below.

## Heat Option

In addition to the installation detailed in the description for the Outdoor Enclosure Option, the enclosure is insulated and equipped with a heater and a thermostat to protect the equipment in cold environments. A thermal sensing unit is used to energize and de-energize a 500 watt convection heater with a 1706 BTU/hr rating. The thermostat is set at 50° F.

*This option requires an additional 6.25 Amps input at 120VAC.*

## Auto Drain Option for Compressor Tanks

The compressor will be equipped with an air-actuated valve that is used to drain condensation from the compressor holding tank. The valve operates from the bleed air on the compressor and therefore does not require electrical power. The auto drain will discharge accumulated moisture for two seconds after each compression cycle and will then rest. The addition of this auto drain feature extends the operating lifetime of the system and reduces required maintenance.

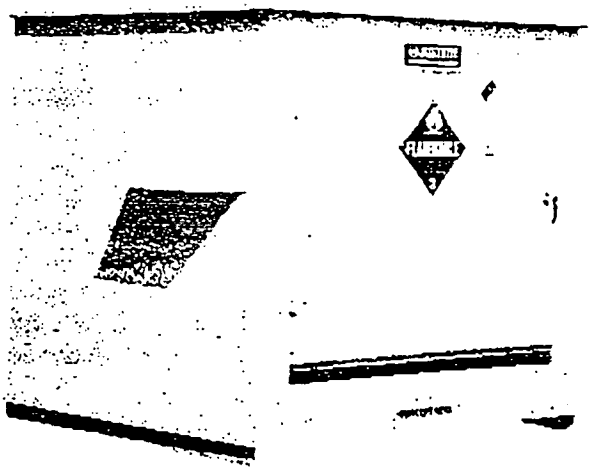
# APPENDIX B

# SPECIFICATIONS FOR PRODUCT STORAGE SHED

*Vault-Like*

# *Non-Combustible Outdoor Cabinets for Hazardous Material Storage.*

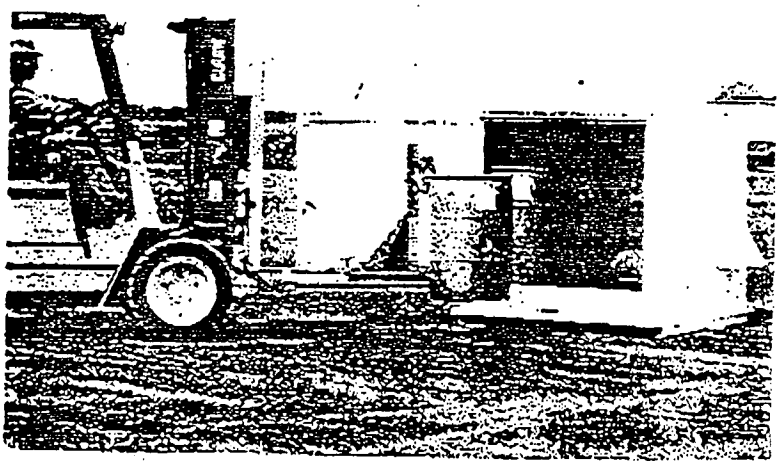
Rugged, weatherproof vault-like cabinets provide safety, security, segregation, and secondary containment of flammable and combustible materials.



4 55-gallon drum capacity Outdoor Cabinet

- ★ Heavy 12 gage steel walls and roof formed and welded for strength, fully factory assembled.
- ★ Exceeds EPA requirements for secondary containment.
- ★ Meets NFPA Fire Code for outdoor storage of flammable and combustible liquids.[1]
- ★ Available for quick delivery in 2, 4, and 6 - drum capacities. Ask for details on capacities over 6 drum.

[1] Outdoor Storage Cabinets are FM approved except for the storage of Class 1A or dispensing of Class 1B flammable liquids as defined by NFPA 30.

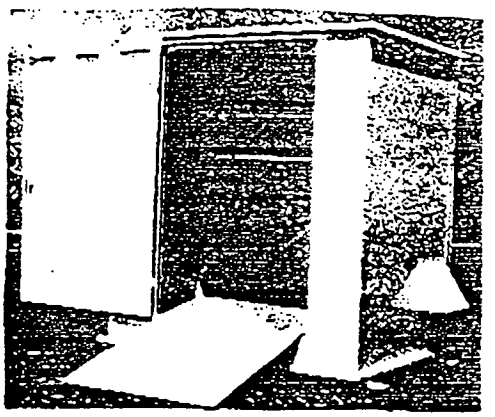


Large door opening facilitates loading and removal f drums, whether loading full skids or single drums.

LAB SAFETY
401 S. WRIGHT ROAD
P.O. BOX 1368
JANESVILLE, WI 53547-1368
CALL TOLL FREE 1-800-356-0783

Rugged, weatherproof vault-like cabinets may be used anytime flammable hazardous waste materials must be accumulated on site. Protects drums from rusting and physical abuse that might render them unacceptable under EPA regulations. RCRA requires the minimization of threats to the environment which would be caused by the release f 'ous waste. The Handbook for the Management f Hazardous Waste, ed by the Environmental Resource Center, includes the following statements in a . "Design Features and Operational Practices that minimize threats to the environment."

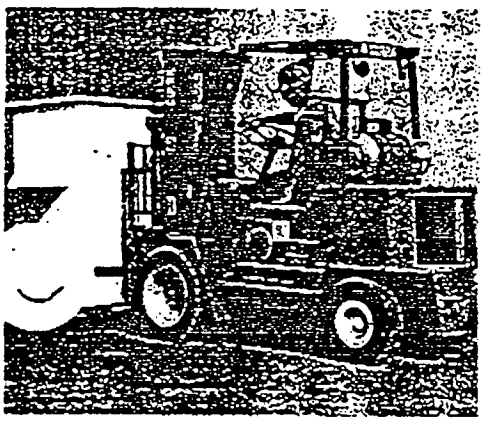
"Cover containers accumulated outdoors with a roof... to protect volatile materials from direct sunlight."
"Erect a fence with a means to control entry around the accumulation point to prevent the unknowing or unauthorized entry of personnel."
"Install a containment system designed to contain the volume of the largest container or ten percent of the volume of all containers."



6 drum unit shown with optional ramps and shelves.

40CFR 264.175 requires that storage areas have a containment system with sufficient capacity to contain 10% of the volume of the containers or the volume of the largest container, whichever is greater.

Justrite Outdoor Cabinets meet all three of the above criteria - shelter, security and secondary containment.



All units are easily relocatable with standard fork lift truck.

## STANDARD FEATURES

- Heavy 12 gage steel walls and roof formed and welded for strength
- Extra wide door with 3 point locking system
- Large spill containment sump (over 25% of listed storage capacity) surpasses EPA 40 CFR requirements. Hydrostatically tested to be liquid tight
- Fork lift channels for easy handling with standard 36" forks
- DOT placard; NFPA 704 rating signs
- LTL shippable by common carrier
- Exterior finish - weather resistant
- Interior finish - chemical resistant
- FM Approved [1]
- Steel grate flooring on 2 and 4 drum units; plywood flooring on 6 drum unit. Removable sectional flooring for easy sump inspection and cleaning

## DESIGN CHARACTERISTICS

- Floor Load.....250 psf
- Snow Load.....40 psf
- Wind Load.....30 psf (110mph)

**SPECIFICATIONS: Non-Combustible Cabinets**

| LAB SAFETY SUPPLY P.N. | Model | Capacity | Outside Dimensions | Inside Dimensions | Shelves | Doors | Sump Capacity | Weight |
|---|---|---|---|---|---|---|---|---|
| 13199 | 2-20 | 2 Drums | 64H X 68W X 36D | 50.5H X 64W X 32D | 54W X 48H | 1 | 60 Gal. | 1000# |
| 13200 | 4-40 | 4 Drums | 64H X 68W X 66D | 50.5H X 64W X 62D | 54W X 48H | 1 | 120 Gal. | 1425# |
| 13201 | 6-60 | 6 Drums | 96H X 90W X 66D | 82.5H X 86W X 62D | 54W X 80H | 1 | 160 Gal. | 1800# |

**ACCESSORIES**

| Model | Ramps | Shelves | Shelves | Shelves | Hold Down Brackets |
|---|---|---|---|---|---|
| 2-20 | #28132 | #28193 | – | #28185 | ~~28180~~ |
| 4-40 | #28132 | #28195 | – | #28185 | ~~28180~~ |
| 6-60 | #28132 | #28194 | #28170 | #28185 | ~~28180~~ |

# APPENDIX C

# AIR PERMIT APPLICATION PACKAGE

# FOSTER WHEELER ENVIRONMENTAL CORPORATION

May 28, 1996
File #: 1284-0017-96-0305

Mr. Robert Marcolina
NJ Department of Environmental Protection
Division of Responsible Party Site Remediation
401 East State Street
Trenton, NJ 08625

Subject: US NAVY CONTRACT NO. N62472-94-D-0398
D.O. #0017 - Naval Weapons Station-Earle, Colts Neck, NJ
Permit Application for Bioremediation Pilot Study

Dear Mr. Marcolina:

Attached are one original and two copies of permit application forms VEM-003, VEM-004 and VEM-051 for the Bioremediation Pilot Study to be conducted by Foster Wheeler Environmental Corporation at the Naval Weapons Station (NWS)-Earle in Colts Neck, New Jersey.

Attachments A and B are brief explanations of the system and vapor calculations. Additional information is also contained in the Work Plan for Bioremediation Pilot Study at NWS-Earle forwarded to you on March 29, 1996. Forms DEQ-069G, DEQ-069T were not completed since they were not applicable. The $250 review fee is also included.

Please contact me at (215)702-4033 if you have any questions. Thank you for your assistance.

Very truly yours,

Tim Silar

Tim Silar
Delivery Order Manager

TS/eh
Enclosure

cc: G. Goepfert
A. Holcomb
P. Briegel
File

NV/96-169 2300 LINCOLN HIGHWAY EAST, ONE OXFORD VALLEY, SUITE 200, LANGHORNE, PA 19047-1829
TEL: 215-702-4000 FAX: 215-702-4045

VEM-003
2/92

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
BUREAU OF NEW SOURCE REVIEW

# APPLICATION FOR PERMIT TO CONSTRUCT, INSTALL OR ALTER CONTROL APPARATUS OR EQUIPMENT AND CERTIFICATE TO OPERATE CONTROL APPARATUS OR EQUIPMENT

TO: New Jersey Department of Environmental Protection and Energy
Bureau of New Source Review
CN 027, Trenton, N.J. 08625-0027

*Read Instructions Before Completing Application*

**SECTION A**

1. Full Business Name: United States Navy
2. Mailing Address: Naval Weapons Station Earle, Colts Neck, Monmouth Co., NJ 07722-5014
   (No. / Street / City / County (if NJ) / State / Zip Code)
3. Division and/or Plant Name: 
4. Plant Location: Building C-16, Saipan Rd. Colts Neck, Monmouth Co.
   (No. / Street / City / County)
5. Location of Equipment on Premises (bldg., dept., area, etc.): Southeast corner of building C-16

**SECTION B**

REASON FOR APPLICATION *(Check One)*

- [X] New Equipment without Control Apparatus
- [ ] New Equipment with Control Apparatus
- [ ] New Control Apparatus on Existing Equipment
- [ ] Other (Explain)
- [ ] Modification to Existing Equipment
- [ ] Modification to Existing Control Apparatus
- [ ] Five Year Renewal of Cert. No. (Note: Complete 5 & 6 below)

1. Nature of Business: Remediation of soil and groundwater
2. Estimated Starting Date of Construction: June 17, 1996
3. Date Equipment to be put in use: June 17, 1996
4. Plant Contact: Greg Goepfert, P.E. (Name (print or type)) Environmental Engineer (Title) (908) 866-2515 (Telephone No.)
5. APC Plant ID: N/A
6. NJ Stack #: N/A

**SECTION C**

STACK INFORMATION (EQUIVALENT STACK INFORMATION)

1. Company Designation of Stack(s): Bioslurping Pilot Study Stack
2. Previous Certificate Numbers (if any for this stack): N/A
3. a. Number of Sources Venting to this Stack: One (Complete a separate VEM-004 for each source)
   b. Number of Stacks Venting Source Operation(s): One (Complete a separate VEM-003 for each stack)
4. Distance to the nearest Property Line (ft.): 3,000 (Approx)
5. Stack Diameter (inches): 4
6. Discharge Height Above Ground (ft.): 10.0
7. Exit Temperature of Stack Gases: Ambient
8. Vol. of Gas Discharged at Stack Conditions (ACFM): 100(max.)
9. Discharge Directions: [ ] Horizontal [X] Up [ ] Down

I certify under penalty of law that the information provided in this document is true, accurate and complete. I am aware that there are significant civil and criminal penalties, including fines or imprisonment or both, for submitting false, inaccurat or incomplete information.

GREGORY J. GOEPFERT (Name (print or type)) ENV. ENGINEER (Title) Gregory J. Goepfert (Signature) 5/28/96 (Date)
for NWS EARLE

This application will not be processed unless proper fee is submitted.

FOR ASSISTANCE CALL 1-800-441-0065
OUT OF NEW JERSEY - 609-292-6716

FOR DEPARTMENT USE ONLY Log No. [ ][ ]-[ ][ ]-[ ][ ][ ][ ] Fee _____ Eval. _____

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
## AIR QUALITY REGULATION PROGRAM

## APPLICATION TO PERFORM AN ENVIRONMENTAL IMPROVEMENT PILOT TEST
## SOIL VAPOR EXTRACTION (SVE) - IN SITU PILOT TEST

**Mail application and check to:**
NJDEP - Air Quality Regulations Program
Bureau of New Source Review - CN 027
401 East State Street
Trenton, New Jersey 08625-0027

**For assistance, please call:**
(609) 292 - 6716 outside NJ
(800) 441 - 0065 within NJ

An "Environmental Improvement Pilot Test" is defined as a sampling and analytical program using prototype equipment or processes n a temporary basis for the purpose of collecting data necessary for the design of a full scale process to achieve an environmental improvement, or for the purpose of determining the feasibility of using the equipment or process for a particular environmental improvement (as defined by N.J.A.C. 7:27-8.1).

Reasons for pilot tests would include items such as: data collection, evaluation of a new technology, evaluation of whether a technology would work at a site, or the sizing of an air pollution control device. Remediation action for the purpose to decrease the contamination at a site would not be approved as a pilot test.

## SECTION A - Facility Identification Information

1. Applicant business name: United States Navy
2. Applicant mailing address: Naval Weapons Station Earle Colts Neck, NJ 07722-5014
3. Remediation site name: Building C-16
4. Remediation site location (Street, City, County): Saipan Rd. Colts Neck, Monmouth Co.
5. Contact Person: Mr. Greg Goepfert, P.E. Phone No.: (908) 866-2515 Fax No.:
6. NJDEP Site Remediation Contact Person: (if any) Mr. Bob Marcolina
7. Applicant designation of pilot test: BIOSLURPING
8. Estimated start date of pilot test: June 17, 1996
9. APC Plant ID (if known): N/A
10. If this is a pilot test on existing SVE equipment, check here ☐ and attach explanation with certificate or Log #
    Pilot test is for bioslurping

## SECTION B - Pilot Test Information

1. Type and source of contamination (with estimated amount, if known): The types of contamination is Petroleum Hydrocarbons, and the source is leaking underground storage tanks/piping.
2. Estimated length of full clean-up (range is acceptable): 6 wks pilot study followed by app. 10 wks operation
3. Reason for pilot test (if over 8 hours): Evaluate bioslurping as a remedial option for site.
4. Operating schedule: maximum hours/day 24 maximum hours for the total pilot test 2,688
5. (If pilot test is over 8 hours in length, give reason why that amount of time is needed More time is needed to collect representative data for evaluation of full scale system.)
6. Maximum volume of gas discharged: 100 CFM
7. Distance to nearest property line: Approximately 3,000 feet

"I certify under penalty of law that I believe the information provided in the permit application is true, accurate, and complete. For those portions of the above information based on estimates, those estimates are the result of good faith application of sound professional judgment, using techniques, factors, or calculations approved by the Department, or EPA, or generally accepted in the trade. I am aware that there are significant civil and criminal penalties, including fines or imprisonment or both, for submitting false, inaccurate or incomplete information.

| GREGORY J. GOEPFERT | ENVIRONMENTAL ENGINEER | Gregory J. Goepfert | 5/28/96 |
|---|---|---|---|
| Name (print or type) | Title | Signature | Date |

for NWS Earle

For Department Use Only Log _____ Fee _____ Eval. _____ rev. 3/95

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
BUREAU OF NEW SOURCE REVIEW



# APPLICATION FOR PERMIT TO CONSTRUCT, INSTALL OR ALTER CONTROL APPARATUS OR EQUIPMENT AND CERTIFICATE TO OPERATE CONTROL APPARATUS OR EQUIPMENT

## Source Emissions and Source Data Form

(Complete this form for each source and submit with application Form VEM-003)

**SECTION E**

**SOURCE INFORMATION**

1. Source Description: Bioslurping System Pilot Plant

2. Operating Schedule: 24 Hours/Day; 2,688 Hours/Year; June 17, 1996 Operation Starting Date

3. % Annual Production Throughput By Quarter: 0 Jan.-Mar.; 12.5 Apr.-June; 81.25 July-Sept.; 6.25 Oct.-Dec.

4. Volume Of Gas Discharged From This Source (ACFM): 100 CFM; Source Discharge Temperature (°F): Ambient

**SECTION F**

**CONTROL APPARATUS ON SOURCE**

| | | Capital Cost (Dollars) | Annual Operating Cost (Dollars) | No. of Sources Connected |
|---|---|---|---|---|
| Primary | None | | | |
| Secondary | | | | |
| Tertiary | | | | |

**SECTION G**

**AIR CONTAMINANTS FROM SOURCE**

| CONTAMINANT NAME | Maximum Emissions w/o Control (lbs./hr.) | Maximum Emissions with Control (lbs./hr.) | How Determined |
|---|---|---|---|
| Total VOC as benzene | 0.045 | 0.045 | See Attachments A and B |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

* Use VEM-004 Supplement if additional space if required.

TO INSURE PROPER COORDINATION BETWEEN VEM-003 and VEM-004 FORMS, INSERT IDENTICAL COMPANY NAME AND DESIGNATION OF STACK FROM VEM-003, SIDE 1.

| FOR DEPT. USE ONLY |
|---|
| Referenced Log No. ___-___-_____ |

Full Business Name: United States Navy

Company Designation of Stack(s): Bioslurping Pilot Study Stack

(over)

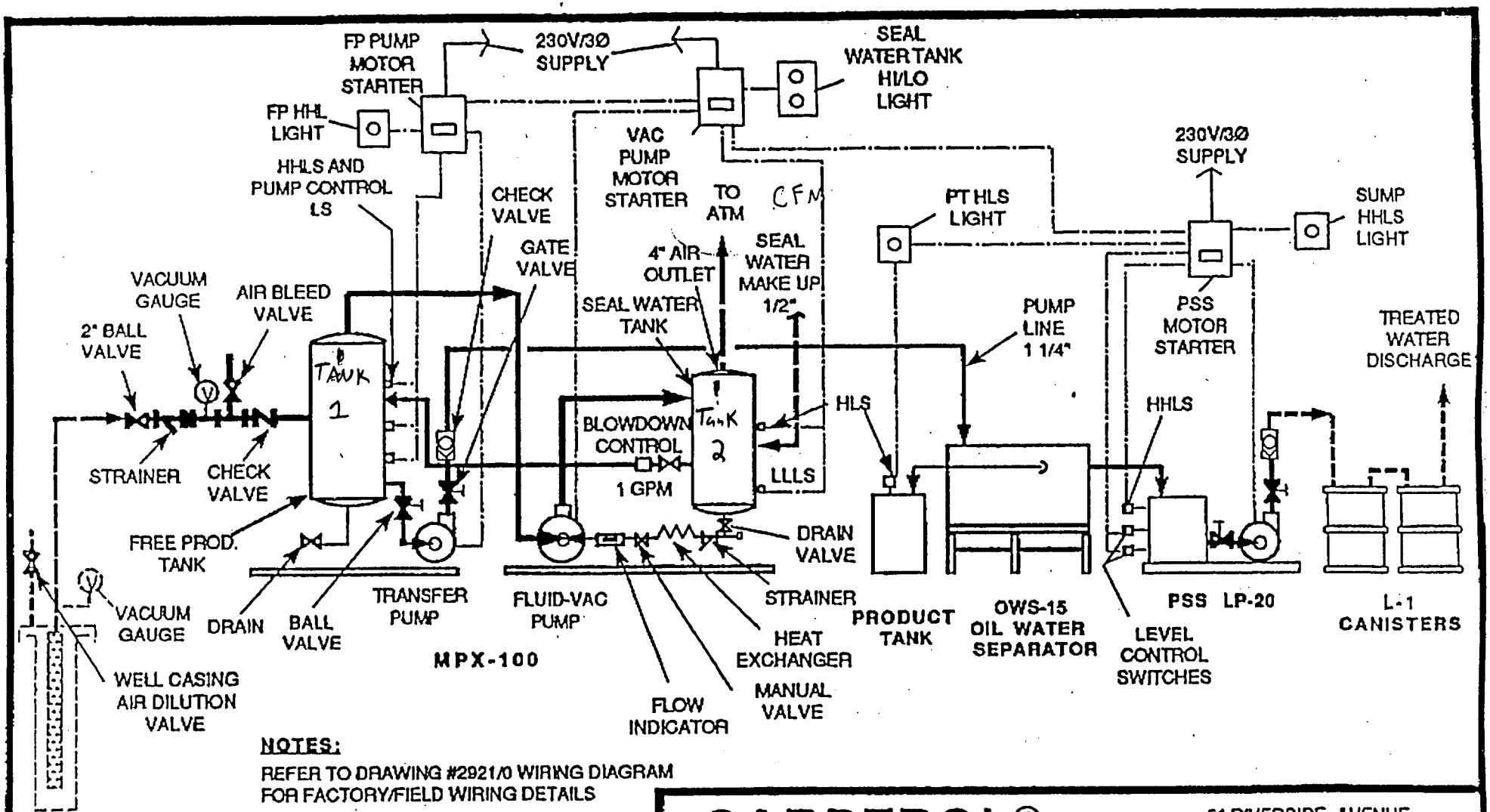
## ATTACHMENT A

The objective of the bioremediation pilot study is to install a pilot scale free product recovery system to evaluate the potential for removal of the product layer. The technology evaluated is bioslurping, a combination of enhanced vapor extraction and bioventing. Currently, a skimmer product recovery collection system is being operated.

Bioslurping combines vacuum-enhanced free-product recovery with bioventing to simultaneously recover free product and remediate the vadose zone. Therefore, the bioslurping system remediates the two media simultaneously. A single pump is used to extract free-phase product and groundwater while bioventing the vadose zone soils.

Groundwater, soil gas vapors and free-product enter the system and are pumped to Tank 1 (see attached flow diagram). Groundwater and free product are separated from soil vapors and pumped to the oil-water separator. Gas vapors are pumped to Tank 2 where they are vented to the atmosphere.

Groundwater is separated from free product utilizing an oil-water separator and treated via granular activated carbon before discharge. Free-product is retained for reuse/recycling.

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(203) 226-5642

| | | |
|---|---|---|
| SCALE — | FOSTER WHEELER | BY MTB |
| DATE 5-15-96 | #18804 | REV |

# MULTI-PHASE EXTRACTION SYSTEM

FLOW DIAGRAM | S | DWG 2926/0

## ATTACHMENT B

**Foster Wheeler Environmental Corporation**

**BY:** Joseph Gray

**CLIENT:** Department of the Navy

**PROJECT:** Naval Weapons Station, Earle, New Jersey

**SUBJECT:** Air Emission Calculation for the Bioslurping Pilot Study

**BACKGROUND:**

Brown & Root environmental conducted a soil gas survey in the vicinity of the proposed Bioslurping Pilot Study from June 5, 1995 to June 8, 1995. Soils were sampled for total BTEX, benzene, toluene, ethylbenzene and xylenes, trichloroethylene and tetrachloroethene. The highest soil gas reading was taken at location 16SG89 (located approximately 50 feet south of the proposed bioslurping well) at a depth of 4 feet. The sample result was 38 ppm total BTEX. To be conservative, we will assume that the 38 ppm is comprised only of benzene.

**ASSUMPTIONS:**

| | |
|---|---|
| Concentration of benzene in air: | 38 ppm (38 $ft^3$ benzene/$10^6 ft^3$ air) |
| Molecular weight of benzene: | 78 lb/lb mole |
| Maximum system vapor flow rate: | 100 $ft^3$/min |
| Ideal gas volume: | 387 lb - mole/$ft^3$ |

**CALCULATION:**

Total VOC as Benzene lbs/hr = 38 $ft^3$ Benzene/$10^6$ $ft^3$ Air x 78 lb/lb mole x 100 $ft^3$/min x lb-mole/387 $ft^3$ x 60 min/hr = 0.045 lbs/hr

Total VOCs contain benzene, toluene, ethylbenzene, xylene, trichloroethylene and tetrachloroethene. Benzene, trichloroethylene and tetrachloroethene are regulated under NJAC 7:27-17. Therefore, as a worst-case scenario, total VOC emissions are calculated as benzene.

**REGULATORY COMPLIANCE ASSESSMENT:**

(1) Compliance with NJAC 7:27-16:

Total VOC emission rate from the pilot plant is 0.045 lbs/hr as benzene. This emission rate is based on 38 ppmv concentration of volatile organic compounds in the exhaust flow.

Based on 38 ppmv concentration and 1.53 p>1A vapor pressure of benzene, according to Table 16B, the source gas range is Range A.

According to Table 16A, maximum allowable emission rate for Range A is 3.5 lbs/hr.

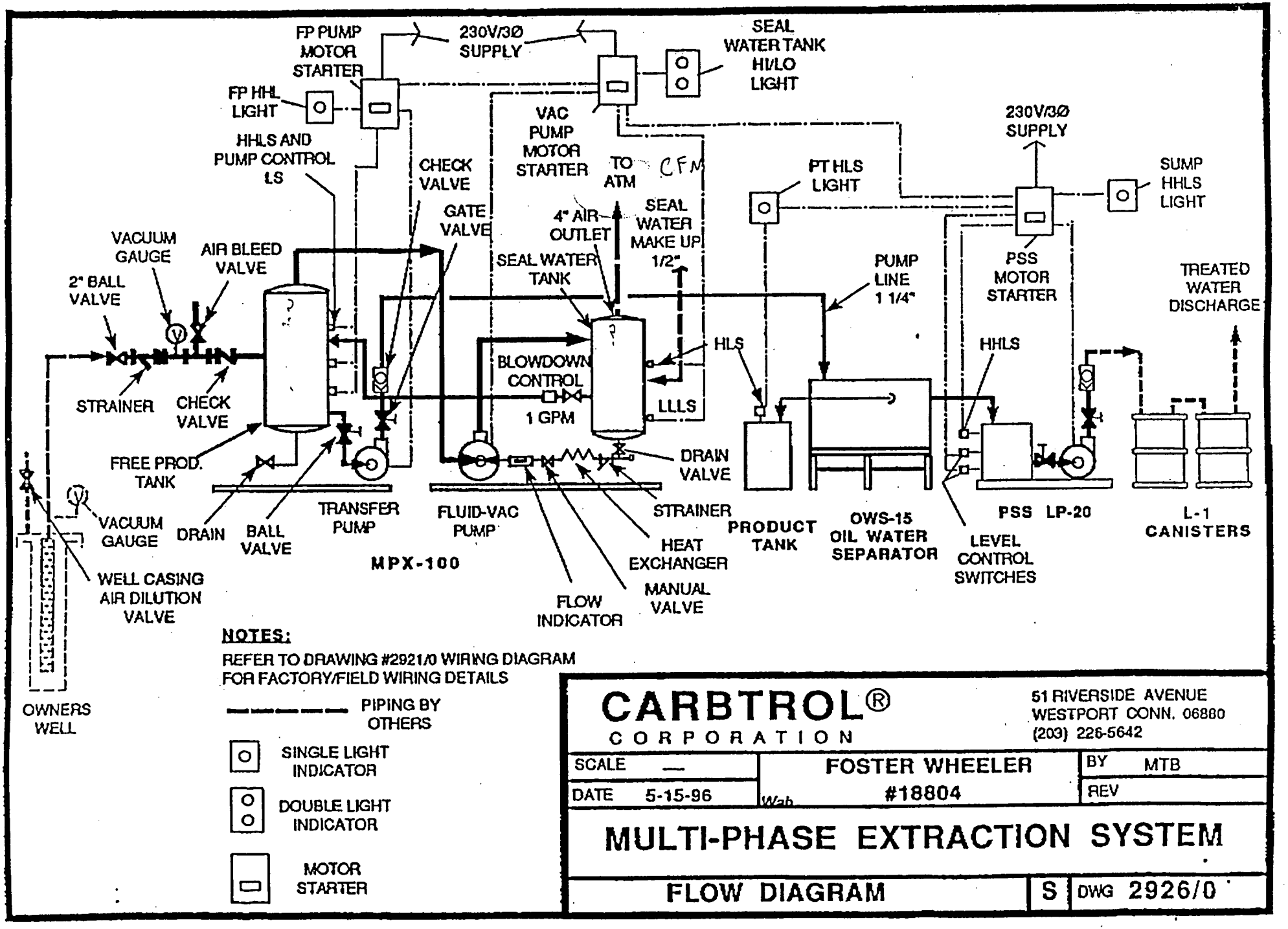
The calculated total VOC emissions from the process is 0.045 lbs/hr. Therefore, no control is required.

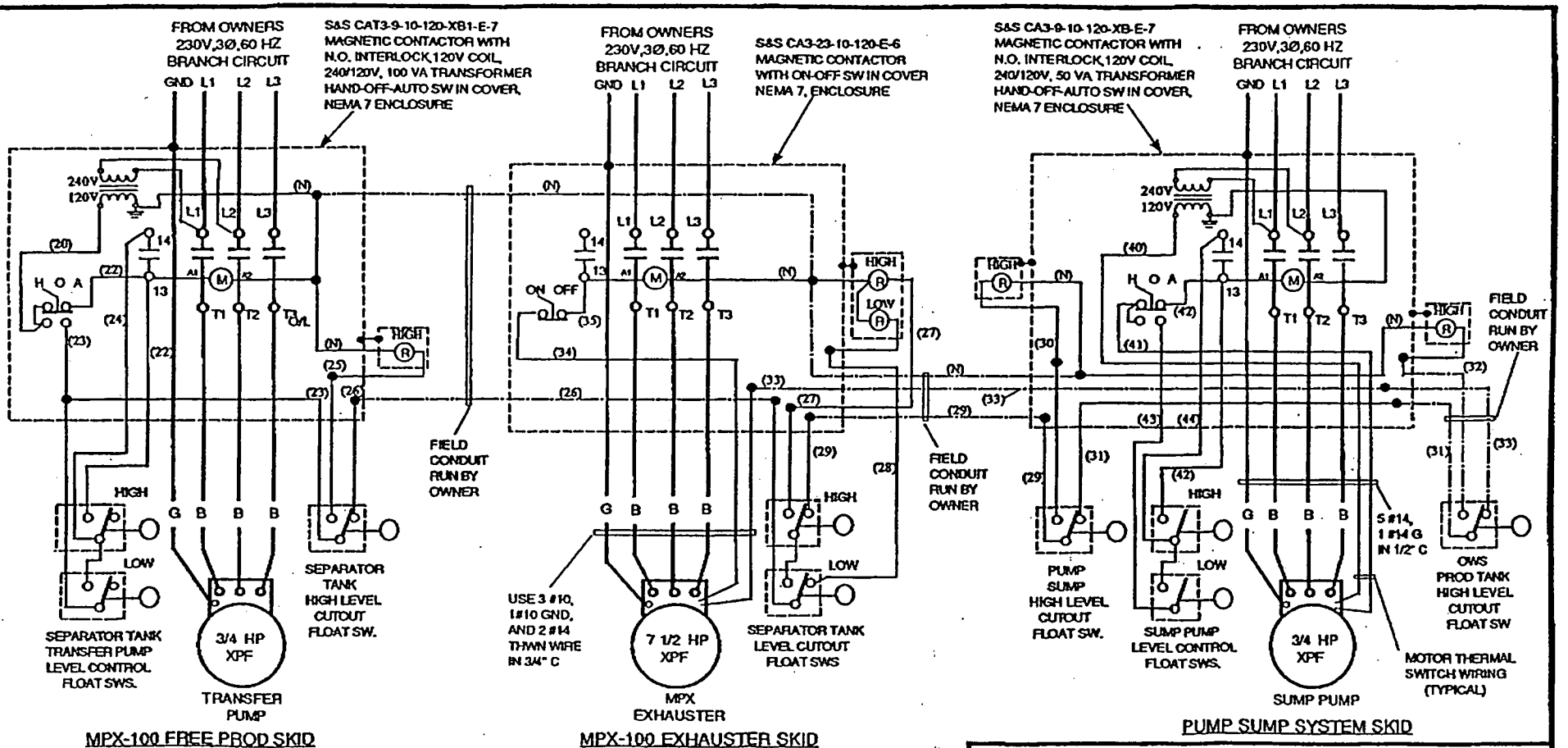
(2) Compliance with NJAC 7:27-17:

Total TXS emissions from the pilot plan is 0.045 lbs/hr. According to NJAC 7:27-7.9.3, source operation emitting total TXS less than 0.1 lbs/hr is exempted from the requirements of NJAC 7:27-17.

# APPENDIX D

# SPECIFICATIONS FOR BIOSLURPING SYSTEM


FP PUMP MOTOR STARTER
230V/3Ø SUPPLY
SEAL WATER TANK HI/LO LIGHT
FP HHL LIGHT
HHLS AND PUMP CONTROL LS
VAC PUMP MOTOR STARTER
TO ATM
CFM
CHECK VALVE
GATE VALVE
4" AIR OUTLET
SEAL WATER MAKE UP 1/2"
SEAL WATER TANK
PT HLS LIGHT
230V/3Ø SUPPLY
SUMP HHLS LIGHT
PSS MOTOR STARTER
PUMP LINE 1 1/4"
TREATED WATER DISCHARGE
VACUUM GAUGE
AIR BLEED VALVE
2" BALL VALVE
STRAINER
CHECK VALVE
BLOWDOWN CONTROL
1 GPM
HLS
LLLS
HHLS
FREE PROD. TANK
DRAIN VALVE
VACUUM GAUGE
DRAIN
BALL VALVE
TRANSFER PUMP
FLUID-VAC PUMP
STRAINER
HEAT EXCHANGER
MANUAL VALVE
FLOW INDICATOR
MPX-100
PRODUCT TANK
OWS-15 OIL WATER SEPARATOR
LEVEL CONTROL SWITCHES
PSS LP-20
L-1 CANISTERS
WELL CASING AIR DILUTION VALVE
OWNERS WELL
NOTES:
REFER TO DRAWING #2921/0 WIRING DIAGRAM FOR FACTORY/FIELD WIRING DETAILS
PIPING BY OTHERS
SINGLE LIGHT INDICATOR
DOUBLE LIGHT INDICATOR
MOTOR STARTER
CARBTROL®
CORPORATION
51 RIVERSIDE AVENUE
WESTPORT CONN. 06880
(203) 226-5642
SCALE —
DATE 5-15-96
FOSTER WHEELER
#18804
BY MTB
REV
MULTI-PHASE EXTRACTION SYSTEM
FLOW DIAGRAM
S
DWG 2926/0




NOTES:- USE #14 THWN WIRE EXCEPT AS SHOWN

(23) = WIRE NUMBER

——— = FACTORY WIRING

- - - - = WIRING TO BE INSTALLED IN THE FIELD.

C = RIGID CONDUIT

- ALL FIELD SWITCHES XPF NEMA-7

| | | |
|---|---|---|
| CARBTROL ® CORPORATION | | 51 RIVERSIDE AVENUE WESTPORT CONN. 06880 (203) 226-5642 |
| SCALE —— | FOSTER WHEELER | BY WH |
| DATE 5-7-96 | Wah O #18804 | REV |
| MPX - 100 MULTI-PHASE EXHAUSTER SYSTEM | | |
| WIRING DIAGRAM | S | DWG 2921/0 |

# APPENDIX E

# BIOSLURPING SYSTEM COMPONENT CHECKLIST

## APPENDIX E
## Checklist for System Shakedown

Site: _____

Date: _____ Operator's Initials: _____

| EQUIPMENT | CHECK IF OKAY | COMMENTS |
|---|---|---|
| Liquid Ring Pump | | |
| Aqueous Effluent Transfer Pump | | |
| Oil/Water Separator | | |
| Vapor Flowmeter | | |
| Fuel Flowmeter | | |
| Water Flowmeter | | |
| Emergency Shutoff Float Switch<br>Effluent Transfer Tank | | |
| Analytical Field Instrumentation<br>Gas Tech™ $O_2/CO_2$ Analyzer<br>TraceTector™ Hydrocarbon Analyzer<br>Oil/Water Interface Probe<br>Magnehelic Boards<br>Thermocouple Thermometer | | |

# APPENDIX F

# SAMPLING AND ANALYSIS PLAN

# SAMPLING AND ANALYSIS PLAN
# FOR
# BIOSLURPING PILOT STUDY
# AT
# NAVAL WEAPONS STATION - EARLE
# COLTS NECK, NEW JERSEY

Naval Facilities Engineering Command
10 Industrial Highway
Lester, PA 19113

*Prepared by:*

**Foster Wheeler Environmental Corporation**
2300 Lincoln Highway
One Oxford Valley - Suite 200
Langhorne, PA 19047 - 1829

*May 1996*

REMEDIAL ACTION CONTRACT N62472-94-D-0398
DELIVERY ORDER NO. 0017

**SAMPLING AND ANALYSIS PLAN FOR**
**BIOSLURPING PILOT STUDY**
**NAVAL WEAPONS STATION - EARLE**

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# 1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (FWENC) is submitting this Sampling and Analysis Plan (SAP) for the bioslurping pilot study in the vicinity of Building C-16 (also referred to as Site 16/F) at Naval Weapons Station (NWS) Earle located in Colts Neck, NJ. The purpose of the sampling is to analyze the effectiveness of the bioslurping system in remediating the soil and groundwater contamination and recovering the light nonaqueous phase liquid (LNAPL) present on the water table. This work is being performed under Delivery Order No. 0017 to Navy Contract N62472-94-D-0398

The SAP presents the procedures to be followed during the pilot study activities. The SAP specifically addresses the following areas:

- Analytical Requirements
- Responsibilities of Site Personnel
- Sample Analytical Program
- Sample Packing and Shipping
- Documentation
- Field Sampling Program
- Quality Assurance/Quality Control
- Procedures for Field Changes and Corrective Actions

The Quality Assurance Project Plan (QAPP), included in Section 5, establishes the structure of the quality assurance plan for field activities. Site-specific Standard Operating Procedures have been included (Section 4) to describe the sampling procedures. Any modifications necessary to these SOPs due to field conditions or other unforeseen situations shall be recorded in the site logbook, documented on the appropriate Field Change Request (FCR) forms by site personnel, and approved by the Project Manager (see Section 4.2).

## 1.1 SITE LOCATION

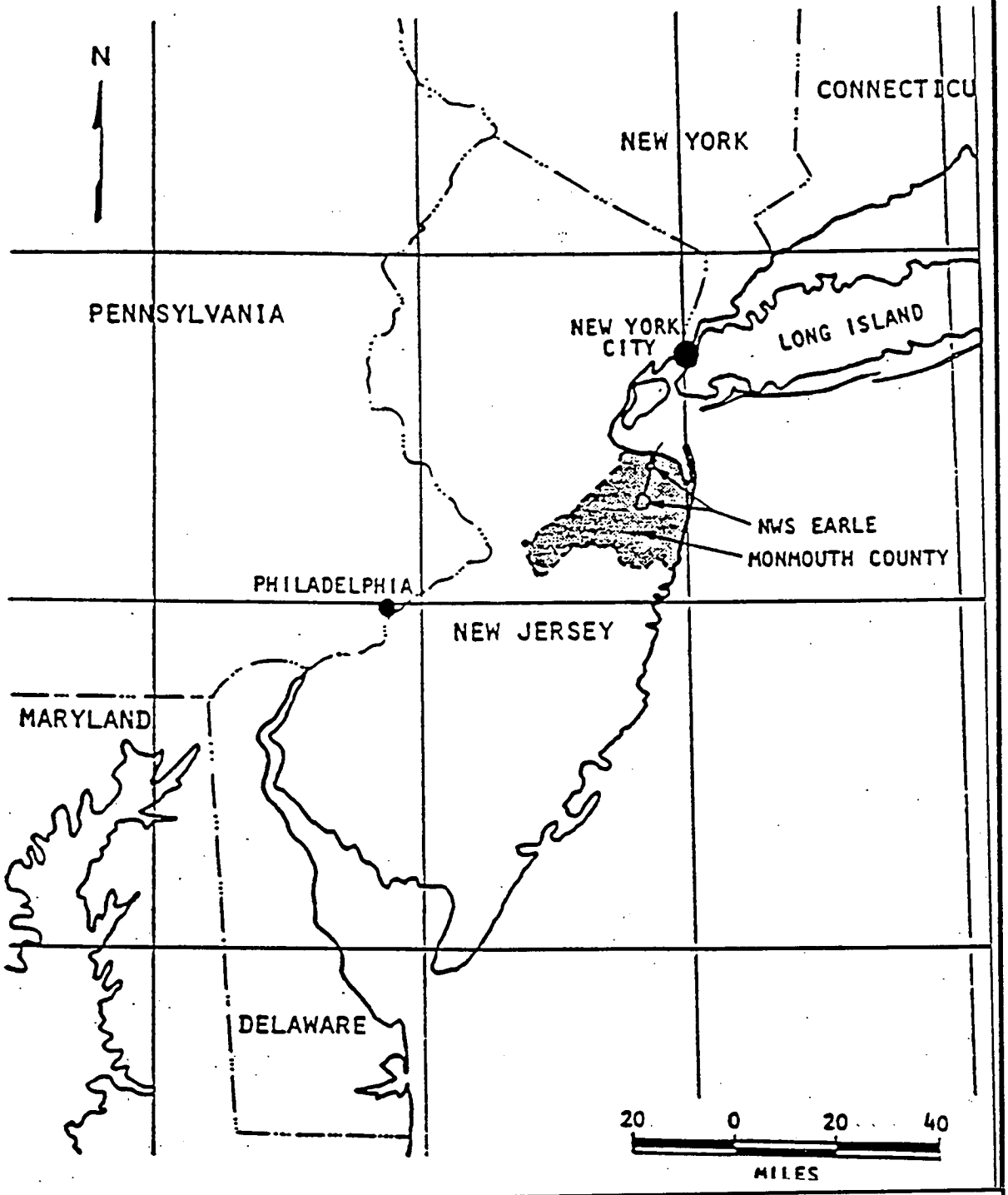
The NWS Earle is located in east-central Monmouth County in the town of Colts Neck, New Jersey, as depicted in Figure 1-1. Site 16/F is located in the north-central portion of NWS Earle as depicted in Figure 1-2.

## 1.2 SITE DESCRIPTION AND HISTORY

NWS Earle is located in east-central Monmouth County in the town of Colts Neck, NJ, as depicted in Figure 1-1. Site 16/F (Building C-16) is located in the north-central portion of NWS Earle as shown in Figure 1-2.

An underground fuel line located in the area north of Building C-19 was used to transport diesel fuel from an UST located at the northeastern corner of Building C-18 to a dispensing station near Building C-50. A leak in the fuel line was discovered in 1977 and use of the pipeline was discontinued after the leak was discovered and excavated. Part or all of the former underground diesel transfer line is still in place.

A site investigation was conducted in 1992. As part of this investigation, five soil borings were completed in the area north of Building C-18, the reported location of the underground fuel line leak. Each boring was completed to the water table, and one sample was collected approximately 8 feet below ground surface (bgs), below the level of the fuel pipeline and above the water table. All soil samples

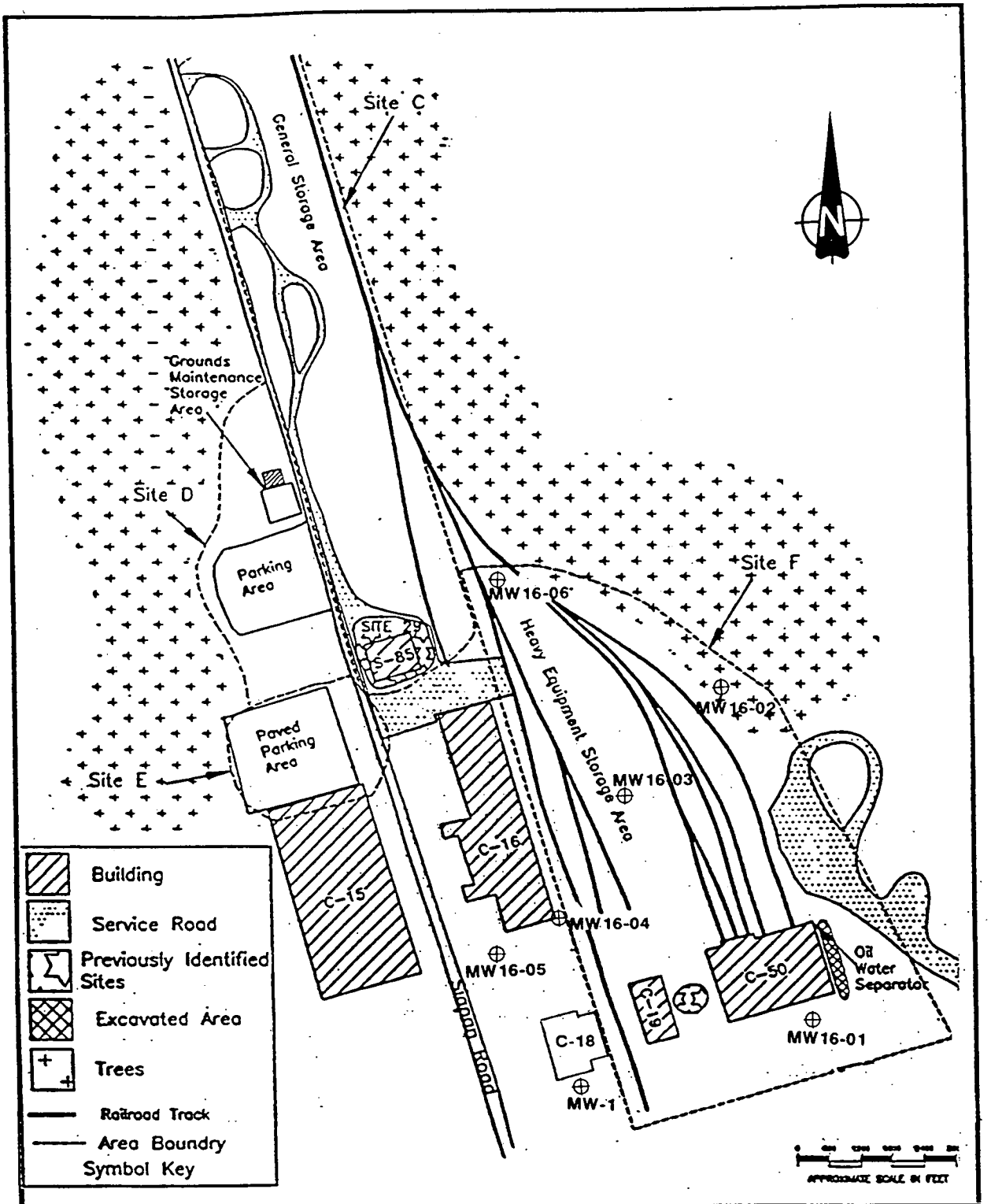



U.S. Navy RAC
NWS Earle, Colts Neck, N.J.

Figure 1-1
Site Location Map

SOURCE: SCAPS REPORT

FOSTER WHEELER ENVIRONMENTAL CORPORATION




**U.S. Navy RAC**
**NWS Earle, Colts Neck, N.J.**

Figure 1-2
Site Layout Map

SOURCE: SCAPS REPORT

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

collected contained elevated levels of TPH ranging from 4,700 mg/kg to 22,000 mg/kg. Low levels of semi-volatiles were also detected. A geophysical survey of the area indicated a number of buried lines at the site; however, the exact location of the leaking fuel line was not determined.

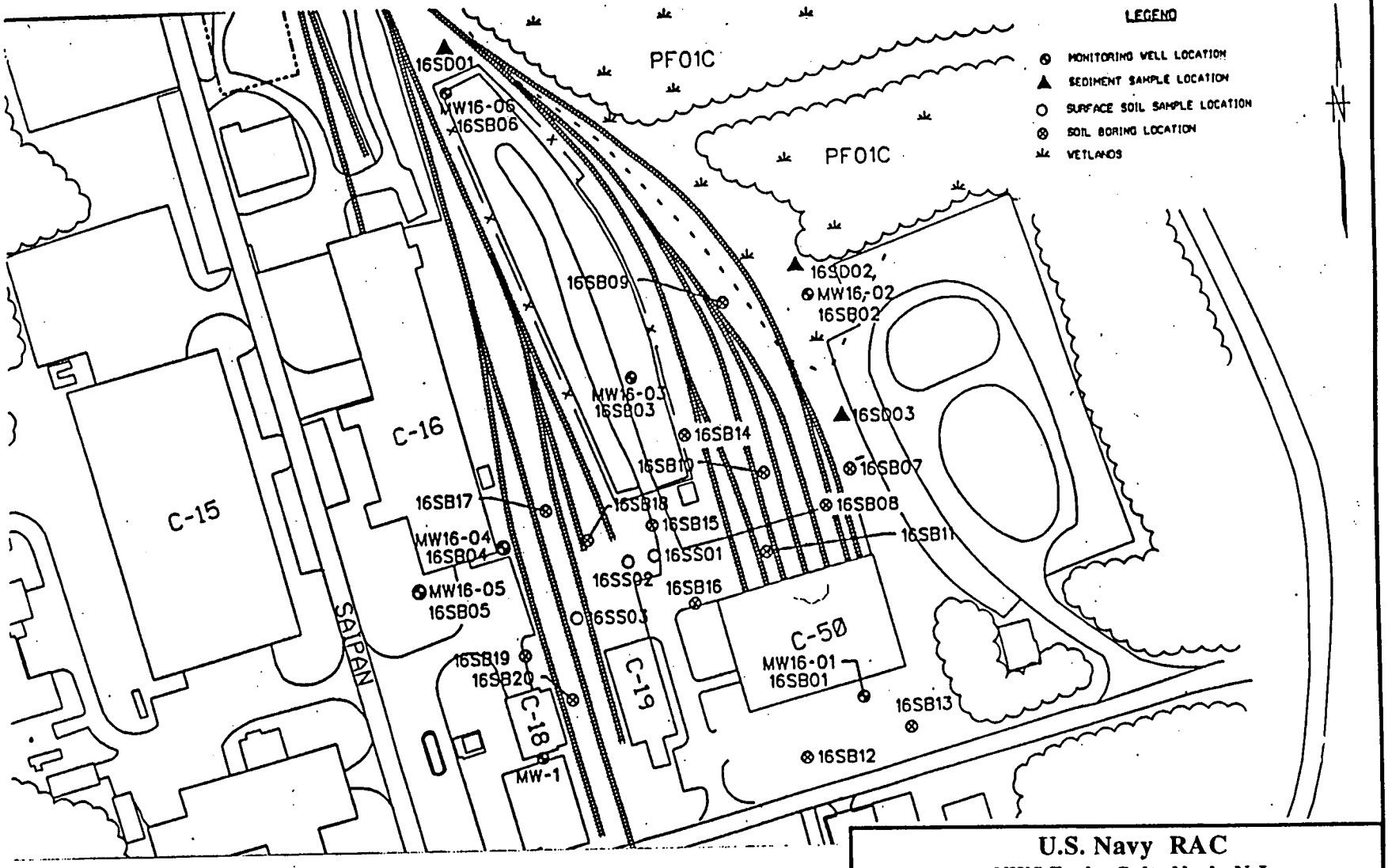
Between June and October of 1995, Brown & Root Environmental conducted the following activities at Site 16/F:

- Soil gas survey
- Sampling and analysis of subsurface samples from 20 soil borings
- Sampling and analysis of surface soil
- Sampling and analysis of sediment
- Drilling and installation of six shallow permanent monitoring wells
- Sampling and analysis of groundwater form the wells
- Measurement of static-water levels in the wells
- Performance of slug testing in three of the wells

Sampling and well locations are depicted in Figure 1-3.

The Remedial Investigation Report prepared by Brown & Root Environmental subsequent to the 1995 field investigation concluded that hydrocarbons detected in the subsurface have impacted the groundwater. The groundwater contamination (primarily volatile organics and fuel constituents) is associated with a free-product LNAPL layer. This floating product is a source of organics to groundwater. In addition, there is a potential for residual leaching of aromatic volatiles and the lighter PAHs from subsurface soils into groundwater because of the significant concentrations present.

Underground storage tanks (USTs) and/or piping leaks have occurred at the NWS Earle supply gasoline station (Building C-17). The piping was replaced in 1995. The USTs are known to have stored diesel fuel and unleaded gasoline. Gauging activities conducted during the 1995 Remedial Investigation indicate an "apparent" thickness of up to 2 feet of product in monitoring well MW16-04, and up to 8 inches in monitoring well MW16-05. Free product was not detected in any of the other monitoring wells installed across the site. The 1995 SCAPS Investigation delineated the extent of petroleum-impacted soils across the site; however, additional monitoring wells are needed to provide the basis for estimating the actual volume of recoverable LNAPL in the subsurface.




**U.S. Navy RAC**
**NWS Earle, Colts Neck, N.J.**

Figure 1-3
Site Investigation Sampling Locations

**FOSTER WHEELER ENVIRONMENTAL CORPORATION**

## 2.0 PROGRAM OBJECTIVES

### 2.1 DESCRIPTION OF FIELD INVESTIGATION

The field investigation will consist of the following tasks:

- Mobilization/Demobilization
- Soil Gas Monitoring Point Installation
- Subsurface Soil Sampling
- Effluent Sampling
- LNAPL Sampling
- Water Level/LNAPL Thickness Measurements
- Soil Gas Monitoring

Laboratory analyses of the environmental samples will be conducted in accordance with the NJDEP Field Sampling Procedures Manual (May 1992) and the US Environmental Protection Agency (EPA) methodologies. The soil samples will undergo analyses for benzene, toluene, ethylbenzene, and total xylenes (BTEX), total petroleum hydrocarbons (TPH) and TCLP characterization for disposal. Soil samples collected during soil gas monitoring point installation will also be analyzed for grain size distribution, moisture content, porosity and bulk density. Recovered product will undergo analysis for volatile organic compounds, BTU, flashpoint, PCBs, total organic halogens, and total suspended solids. Effluent groundwater samples will undergo analysis for BTEX, TAL inorganics and total organic halogens. Effluent air samples will be analyzed for organic compounds. In addition, soil gases will be monitored for oxygen, carbon dioxide, and combustible gases. These data will be used to assess the extent of petroleum hydrocarbon contamination and evaluate the potential application of bioslurping technologies for site remediation.

### 2.2 PERSONNEL RESPONSIBILITIES

The project team will include the following personnel:

The Project Manager (PM) has final responsibility for the development of the SAP and management of the project team.

The Field Operations Lead (FOL) is responsible for assuring that proper collection, packaging, preservation, and shipping of samples is performed in accordance with the SAP. In addition, the FOL is responsible for coordinating with the subcontracted laboratory during sample analysis and for reviewing the analytical data received from the laboratory.

The Site Health and Safety Officer (SHSO) is responsible for the safety of all site personnel as detailed in the site-specific Health and Safety Plan (HASP), presented under separate cover.

The Drilling Subcontractor is responsible for supplying all services (including labor), equipment, and material required to perform the drilling, including all maintenance and quality control of such equipment. The drilling subcontractor will be responsible for all required drilling permits, licenses, and clearances. The drilling subcontractor will also be responsible for following decontamination procedures specified in the bid package. Upon completion of work, the drilling

subcontractor will be responsible for demobilizing all equipment and restoring the work area to original conditions.

The Laboratory Subcontractor is responsible for supplying all services (including labor), equipment, and material required to perform the analysis of the environmental samples. The laboratory subcontractors are responsible for following all specified methodology protocols, including quality assurance/quality control (QA/QC) requirements. In addition, the laboratory subcontractors are responsible for the proper disposal, including all associated costs, of the environmental samples upon completion of the analytical work.

The Bioslurping Subcontractor is responsible for manufacture and installation of the bioslurping unit.

## 3.0 FIELD SAMPLING ACTIVITIES

This section addresses the field investigation activities, including:

- Sample Tracking System
- Sample Analytical Requirements
- Sample Packaging and Shipping
- Sample Documentation

### 3.1 SAMPLE TRACKING SYSTEM

The objective of the sample identification system is to provide a framework for developing sample numbers that are unique to that sample and convey information regarding sample type that will enable data users to easily identify sample locations. The procedures outlined in this section are consistent with the NJDEP Field Sampling Procedures Manual (May 1992).

Each sample will be designated by an alpha-numeric code which will identify the matrix sampled and contain a sequential sample number. Location types will be identified by a two-letter code. Each matrix sampling location will be identified with a two-digit number. Sequential samples numbers at each location for each sample type will begin with 01 and increase accordingly. Sampling events, or rounds, will be numbered in a sequence beginning with "1."

The following general guide for sample identification will be used:

| FIRST SEGMENT | | SECOND SEGMENT | | THIRD SEGMENT |
|---|---|---|---|---|
| A | AA | NN | N | NN |
| SAMPLE TYPE | LOCATION TYPE | SPECIFIC LOCATION | SAMPLING EVENT | SAMPLE IDENTIFIER |

**Symbol Definition:**

A = Alphabetic
N = Numeric

**Sample Type:**

S = Sample as required in the FSP
D = Duplicate sample

**Location Type:**

WS = Waste Samples
RB = Rinsate Blank
GW = Groundwater Sample
SG = Soil Gas
SB = Subsurface Soil
TB = Trip Blank
FB = Field Blank

For soil samples, the sample identifier will be used as an indication of the bottom depth of the two-foot sample interval. For example, a soil sample collected from 2-4 feet below grade at Soil Gas

Monitoring Point 1 will have a sample identifier of 04 (S-SB01-1-04); one collected from 6-8 feet below grade will have a sample identifier of 08 (S-SB01-1-08).

A cumulative sampling master log will be maintained as the field program progresses. The samples taken will be referenced to each sampling location in the master log and on a detailed site map.

All location information for the samples will be recorded in the field sampling logbook (Section 3.4).

## 3.2 SAMPLE ANALYTICAL REQUIREMENTS

Table 3-1 summarizes the analytical program.

Table 3-2 specifies location, number of samples and duplicates, matrix, sampling device, sample container requirements, sample preservation, holding times, laboratory analyses, and field analyses performed on each sample type. Specific procedures governing sample preservation are presented below.

Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or added in the field. In general, aqueous samples of low concentration organics (or soil samples of low or medium concentration organics) are cooled to 4°C. Medium and high hazard aqueous or high hazard soil samples are not preserved. Low concentration aqueous samples for metals are acidified with $HNO_3$ while medium concentration and high hazard aqueous metal samples are not preserved. Soil samples for metals are not preserved.

The following subsections describe the procedures for preparing and adding chemical preservatives. In most cases, preservatives will be added to the sample bottleware by the subcontracted laboratory prior to shipment to the site.

Addition of the following acids or bases may be specified for sample preservation:

| Acid/Base Acidification | | Concentration | Amount for Normality |
|---|---|---|---|
| HCl * | 1:1 dilution of concentrated HCl | 6N | 5-10 ml |
| $H_2SO_4$ * | 1:1 dilution of concentrated $H_2SO_4$ | 18N | 2-5 ml |
| $HNO_3$ * | Undiluted concentrated $HNO_3$ | 16N | 2-5 ml |
| NaOH ** | 400g solid NaOH in 870 ml water | 10N | 2 ml |

*Amount of acid to add (at the specified strength) per liter of water to reduce the sample pH to less than 2, assuming that the water is initially at pH 7, and is poorly buffered and does not contain particulate matter.

** Amount of base to raise pH of 1 liter of water to 12.

These reagents should be reagent (AR) grade and should be diluted to the required concentration with double-distilled, deionized water.

**TABLE 3-1**
**SAMPLING AND ANALYSIS REQUIREMENTS**

| *Media* | *Analyses* | *Frequency* | *Quantity* * | *Method* | *Rationale* |
|---|---|---|---|---|---|
| Soil | BTEX, TPH | Samples will be collected during soil gas monitoring point installation. One sample will be collected from the capillary fringe (6 to 8 feet) at each location (3). | 3 total samples for each parameter | BTEX - EPA 8020 / 624 / 8240<br>TPH - EPA Modified 8015 / 5030 | Analysis will establish baseline conditions of subsurface soil contamination. |
| Soil | Grain Size, Porosity, Bulk Density, Moisture Content | Samples will be collected during soil gas monitoring point installation. One sample will be collected from the capillary fringe (6 to 8 feet) at each location (3). | 3 total samples for each parameter | Grain Size - ASTM D422<br>Porosity - ASTM D2434<br>Bulk Density - ASTM D4531<br>Moisture Content - ASTM D2216 | These geophysical parameters will be used to evaluate the subsurface conditions affecting the feasibility of full-scale bioslurping operations. |
| Soil | TCLP Characteristics | One composite soil sample of cuttings from the soil gas monitoring points. | 1 | TCLP Volatiles - EPA 8240<br>TCLP Metals - EPA SW-846 | Analytical results will be used to classify drill cuttings for disposal. |
| LNAPL | VOCs, BTU Content, Flash Point, PCBs, TOX, TSS | Samples will be taken from the collection drum during operation of the skimmer. | 1 | VOA - EPA 8240<br>BTU - ASTM D240<br>Flash Point - EPA SW-846 / 1010<br>TSS - EPA 160.2<br>TOX - SW-846 / 9020<br>PCBs - EPA 8080 | Analytical results will be used to evaluate the potential for recycling/reuse of the recovered product. |
| Water | BTEX, TOX, TAL Inorganics | One sample will be collected from the bioslurper effluent. | 1 | TOX - EPA SW-846 / 9020<br>BTEX - EPA 8020 / 624 / 8240<br>TAL Inorganics - EPA SOW 390 ILMO.3 | Analytical results will be used to determine if discharge to the NWS Earle storm sewers is permissible. |
| Water | BTEX, TPH | During first week of pilot test and during final week of pilot test. | 2 | BTEX - EPA 8020 / 624 / 8240<br>TPH - SW-846 / 8015B | Analytical results will be used to estimate the volume of contaminant removed. |
| Gas | BTEX, TPH | During first week of pilot test and during final week of pilot test. | 2 | BTEX - EPA 8020 / 624 / 8240<br>TPH - SW-846 / 8015B | Analytical results will be used to estimate the volume of contaminant removed. |

* Quantities do not include quality assurance samples.

TABLE 3-2
SUMMARY OF SAMPLING AND ANALYSIS
(Page 1 of 2)

| Sample Matrix | Number of Samples[a] | Sample Location | Sample Container | Laboratory Analysis | Preservation | Holding Times[b] |
|---|---|---|---|---|---|---|
| Surface Soil | 4 | NE-SS-01 through NE-SS-03 | Two (2) 40 ml glass vials with Teflon septum caps | BTEX - EPA 8020/624/8240 | Cool to 4°C | 10 days |
| | | | One (1) 8 oz glass jar | TPH - EPA Modified 8015/5030 | Cool to 4°C | 28 days |
| | 3 | NE-SS-04 through NE-SS-06 | Shelby tubes | Grain size - ASTM D422<br>Porosity - ASTM D2434<br>Bulk density - ASTM D4531<br>Moisture content - ASTM D2216 | N/A | N/A |
| | 1 | NE-SS-07 | Two (2) 40 ml glass vials with Teflon septum caps | TCLP Organics - EPA 8240 | Cool to 4 °C | 7 days to extraction; 40 days to analysis |
| | | | One (1) 8 oz glass jar | TCLP Metals - EPA SW-846 | Cool to 4 °C | 180 days to extraction; 180 days to analysis. For Hg: 28 days to extraction; 28 days to analysis |
| Product Samples | 1 | NE-WS-08 | Two (2) 40 ml glass vials with Teflon septum caps | VOA - EPA 8240 | HCL to pH < 2; Cool to 4°C | 10 days |
| | | | One (1) 32 oz amber glass bottle | BTU - ASTM D240<br>Flashpoint - EPA SW-846/1010<br>TSS - EPA 160.2<br>TOX - SW-846/9020 | Cool to 4°C | N/A<br>TSS: 7 days<br>TOX: 28 days |
| | | | One (1) 1-liter amber glass bottle | PCBs - EPA 8080 | Cool to 4°C | 14 days to extraction: 40 days to analysis |

TABLE 3-2
SUMMARY OF SAMPLING AND ANALYSIS
(Page 2 of 2)

| Sample Matrix | Number of Samples[a] | Sample Location | Sample Container[b] | Laboratory Analysis | Preservation | Holding Times[c] |
|---|---|---|---|---|---|---|
| Groundwater | 1 | NE-W-09 | Two (2) 40 ml glass vials with Teflon septum caps | BTEX - EPA 8020/624/8240 | HCl to pH<2; Cool to 4°C | 10 days |
| | | | One (1) 1-liter amber glass bottle | TOX - EPA SW-846/9020 | $H_2SO_4$ to pH<2 : Cool to 4 °C | 28 days |
| | | | One (1) 1-liter polyethylene bottle | TAL Inorganics EPA SOW 390 ILM0.3 (2/93) or most recent revision | $HNO_3$ to pH<2; Cool to 4 °C | 6 months (Hg-28 days) |
| Groundwater | 2 | NE-W-10 through NE-W-11 | Two (2) 40 ml glass vials with Teflon septum caps | BTEX - EPA 8020/624/8240 | HCl to pH<2; Cool to 4°C | 10 days |
| | | | One (1) 8 oz glass jar | TPH - SW-846/8015B | N/A | 28 days |
| Soil Gas | 2 | NE-GS-12 through NE-GS-13 | 6-liter stainless steel Summa canisters | BTEX - EPA 8020/624/8240 TPH - SW-846/8015B | N/A | N/A |
| Trip Blanks(c) | 2 | N/A | Two (2) 40 ml glass vials with Teflon septum caps | TCL Volatile Organics CLP SOW OLM01.9 (7/93) or most recent revision | HCl to pH<2; Cool to 4°C | 10 days |

NOTES:
(a) The number of samples includes the number of duplicate samples to be taken.
(b) Holding times are from Verified Time of Sample Receipt (VTSR) at the laboratory.
(c) The number of field blank, DI water blank and trip blank samples is estimated.

The approximate volumes needed to acidify one liter of neutral water to a pH of less than 2 (or raise the pH to 12) are shown in the last column of the above table. These volumes are only approximate; if the water is more alkaline, contains inorganic or organic buffers, or contains suspended particles, more acid may be required. The final pH must be checked using narrow range pH-paper.

Sample acidification or base addition should proceed as follows:

1. Check initial pH of sample with wide range (0-14) pH paper.

2. Fill sample bottle to within 5-10 ml of final desired volume and add about 1/2 of the estimated acid or base required, stir gently and check pH with medium range pH paper (pH 0-6 or pH 7.5-14, respectively).

3. Add acid or base a few drops at a time while stirring gently. Check for final pH using narrow range (0-2.5 or 11-13, respectively) pH paper; when desired pH is reached, cap sample bottle and seal.

Never dip pH paper into the sample; apply a drop of sample to the pH paper while using the stirring rod.

## 3.3 SAMPLE PACKAGING AND SHIPPING

The objective of the sample packaging and shipping requirements are to maintain sample integrity from the time a sample is collected until it is received at the analytical laboratory. Chain-of-custody (COC) forms, sample labels, custody seals, and other sample documents will be completed to maintain sample integrity. Specific procedures for packaging and shipping of environmental samples are presented below. These procedures were obtained from the USEPA Compendium of Superfund Field Operations Methods.

### 3.3.1 Environmental Samples

Low-concentration samples are defined as environmental samples and should be packaged for shipment as follows:

1. A sample label is attached to the sample bottle. The label should be taped over with clear packing tape to preserve legibility.

2. A picnic cooler (such as a Coleman or other sturdy cooler) is typically used as a shipping container. In preparation for shipping samples, the drain plug is taped shut from the inside and outside, and a large plastic bag is used as a liner for the cooler. Approximately 1 inch of packing material, such as asbestos-free vermiculite, perlite, or styrofoam beads, is placed in the bottom of the liner.

3. The sample bottles are placed in the lined picnic cooler. Cardboard separators, and/or additional packing material, should be placed between the bottles to prevent breakage during shipping.

4. Aqueous samples for low or medium-level analysis must be shipped cooled to 4°C with ice. No ice is used in shipping high-level aqueous samples, or soil samples, or dioxin samples. Ice is not

required in shipping soil samples, but may be utilized at the option of the sampler. All cyanide samples, however, must be shipped cooled to 4°C.

5. The lined cooler is filled with packing material (such as asbestos-free vermiculite, perlite, or styrofoam beads), and the large inner liner is taped shut. Sufficient packing materials should be used to prevent sample containers from making contact during shipment.

6. The paperwork being shipped to the laboratory is placed inside a plastic bag. The base is sealed and taped to the inside of the cooler lid. A copy of the COC form should be included in the paperwork sent to the laboratory. The last block on the COC form should indicate the overnight carrier and airbill number. The airbill must be filled out before the samples are handed over to the carrier. The laboratory should be notified if the shipper suspects that the sample contains any substance for which the laboratory personnel should take safety precautions.

7. The cooler is taped shut with strapping tape (filament-type).

8. At least two signed custody seals are placed on the cooler, one on the front and one on the back.

9. The cooler is handed over to the overnight carrier. A standard airbill is necessary for shipping environmental samples.

3.3.2 Hazardous Samples

Medium- and high-concentration samples are defined as hazardous and must be packaged as follows:

1. A sample label is attached to the sample bottle. The label should be taped over with clear packaging tape to preserve legibility.

2. Each sample bottle is placed in a plastic bag, and the bag is sealed. For medium-concentration water samples, each VOA vial is wrapped in a paper towel, and the two vials are placed in one bag. As much air as possible is squeezed from the bags before sealing.

3. Each bottle is placed in a separate paint can, the paint can is filled with vermiculite, and the lid is fixed to the can. The lid must be sealed with metal clips, or with filament or evidence tape; if clips are used, the manufacturer normally recommend six clips.

4. Arrows are placed on the can to indicate which end is up.

5. The outside of each can must contain the proper DOT shipping name and identification number for the sample. The information may be placed on stickers or printed legibly. A liquid sample of an uncertain nature is shipped as a flammable liquid with shipping name "FLAMMABLE LIQUID, N.O.S." and the identification number "UN1993." A solid sample of uncertain nature is shipped as a flammable solid with the shipping name "FLAMMABLE SOLID, N.O.S." and the identification number "UN1325." If the nature of the sample is known, 49 CFR 171-177 is consulted to determine the proper labeling and packaging requirements.

6. The cans are placed upright in a cooler lined with a plastic garbage-type bag, with the drain plug taped shut inside and out. Asbestos-free vermiculite, perlite, or styrofoam is placed in the bottom of the cooler. Two sizes of paint cans are used: half-gallon and gallon. The half-gallon

paint cans may be stored on top of each other; however, one-gallon cans are too high to stack. The cooler is filled with packing material and the plastic liner is taped shut.

7. The paperwork going to the laboratory is placed inside a sealable plastic bag and taped to the inside of the cooler lid. A copy of the COC form must be included in the paperwork sent to the laboratory. The sampler keeps one copy of the COC form. The laboratory should be notified if the sample is suspected of containing any substance for which laboratory personnel should take safety precautions.

8. The cooler is closed and sealed with strapping tape. At least two custody seals are placed on the outside of the cooler (one on the front and one on the back).

9. The following markings are placed on top of the cooler:

    - Proper shipping name (49 CFR 172.301)
    - DOT identification number (49 CFR 172.301)
    - Shipper's or consignee's name and address (49 CFR 172.306)
    - "This End Up" legibly written if shipment contains liquid hazardous materials (49 CFR 172.312)

10. The following labels are required on top of the cooler (49 CFR 172.406e):

    - Appropriate hazard class label (placed next to the proper shipping name)
    - "Cargo Aircraft Only" (if applicable as identified in 49 CFR 172.101)

11. Arrow symbols indicating "This Way Up" should be placed on the cooler in addition to the marking and labels described above.

12. Restricted-article airbills are used for shipment indicating the following:

    - Number of packages or number of coolers.

    - Proper shipping name. If unknown, use FLAMMABLE SOLID, N.O.S. or FLAMMABLE LIQUID, N.O.S.

    - Classification; if unknown, use flammable solid or flammable liquid.

    - Identification number; if unknown, use UN1325 (for flammable solids) or UN1993 (for flammable liquids).

    - Net quantity per package or amount of substance in each cooler.

    - Radioactive materials section (leave blank).

    - Passenger or cargo aircraft (cross off the nonapplicable). Up to 25 pounds of flammable solid per cooler can be shipped on a passenger or cargo aircraft. Up to 1 quart of flammable liquid per cooler can be shipped on a passenger aircraft, and up to 10 gallons of flammable liquids per cooler can be shipped on a cargo aircraft).

- Name and title of shipper (printed).
- An emergency telephone number at which the shipper can be reached within 24-48 hours.
- Shipper's signature.

NOTE: The penalties for improper shipment of hazardous materials are severe. A fine of $25,000 and five years imprisonment can be imposed for each violation.

## 3.4 SAMPLE DOCUMENTATION

The following documentation is associated with sample collection and transfer:

- Field Logbooks
- Site Logbooks
- Master Sample Log
- Sample Label
- Chain-of-Custody Form
- Custody Seals
- Shipping Airbill.

# 4.0 FIELD INVESTIGATION ACTIVITIES

## 4.1 STANDARD OPERATING PROCEDURES (SOPs)

Technical guidelines used in preparing this SAP were obtained primarily from the following sources:

- June 1988 Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, NESSA 20.2-047B
- The USEPA REM III/ARCS II Program Field Technical Guidelines, prepared for the USEPA by FWENC under Contract Number 68-01-7250 (Field Technical Guidelines)
- The New Jersey Department of Environmental Protection (NJDEP) Field Sampling Procedures Manual (May 1992)

All of the aforementioned guidance documents were consulted in preparation of this SAP to ensure that the procedures presented in this SAP are consistent with each document.

## 4.2 FIELD INVESTIGATION PROGRAM

The following sections detail the field investigation program. Primary tasks of the program include Mobilization/Demobilization (Section 4.2.1), Soil Investigation (Section 4.2.2), Soil Gas Monitoring Point Installation (Section 4.2.3), Soil Gas Sampling (Section 4.2.4), Evaluation of LNAPL, Groundwater and Air (Section 4.2.5), and Product and Water Level Measurements (Section 4.2.6).

### 4.2.1 Mobilization and Demobilization

This activity will include the mobilization/demobilization of field personnel and equipment to/from the site. Prior to mobilization, an orientation of field personnel will be held to review site history and layout, health and safety training, and field procedures.

Field equipment will include the following:

- Sampling Equipment
- Equipment decontamination materials
- Health and Safety Equipment
- Remediation Equipment (skimmer and bioslurping systems)

All underground utilities in the immediate vicinity of the site will be contacted prior to the start of the subsurface investigation. Any underground utilities will be staked and flagged for the duration of the field investigation.

### 4.2.2 Soil Investigation

***Objectives***

The objectives of the soil investigation are to characterize the baseline conditions of the subsurface contamination in the area of the pilot study, evaluate the geotechnical parameters of the soil and to classify the drill cuttings for proper disposal.

***Sampling Equipment and Procedures***

Subsurface Soil Samples

Subsurface soil samples will be collected using decontaminated split spoons advanced via hollow stem auger (HSA) drill rig. Geotechnical samples will be collected utilizing thin wall sheet tubes (shelby tubes) using the drill rig. The subsurface soil samples collected with a 2-inch outside diameter (OD) split spoon sampler will be driven by a 140-pound hammer from a HSA drill rig. Samples will be collected continuously at two-foot increments until total depth.

The following method is to be used for split spoon sampling:

1. Clean out the hole to the desired sampling depth using equipment that will ensure that the material to be sampled is not disturbed by the operation. In saturated sands and silts, withdraw the drill bit slowly to prevent loosening of the soil around the hole.

2. Hollow-stem augers with a center plug shall be used for soil borings involving split spoon sampling. The center plug will be withdrawn upon reaching the desired sampling depth, and the split spoon sampler and drive rods will be inserted through the augers.

3. The 2-inch OD spilt spoon sampler should be driven with blows from a 140-pound hammer falling 30 inches, in accordance with ASTM D1586-84, Standard Penetration Test. Blow counts must be recorded at six-inch depth increments by the drilling subcontractor. A summary of the blow counts for each borehole must be reported to the Site Geologist.

4. Repeat this operation at 2-foot sampling intervals until reaching the total depth.

5. Record on the boring log form or field logbook the number of blows required to attain each 6 inches of penetration, or fraction thereof. The first 6 inches is considered to be a seating drive. The sum of the number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N. If the sampler is driven less than 18 inches, the penetration resistance is that for the last 1 foot of penetration. (If less than 1 foot is penetrated, the logs shall state the number of blows and the fraction of 1 foot penetrated).

6. Bring the sampler to the surface and remove both ends and one half of the split barrel so that the recovered soil rests in the remaining half of the barrel. Describe carefully the recovery (length), composition, structure, consistency, color, condition, etc. of the recovered soil. The soil will be field screened with a HNu/OVA. A representative sample of each recovered two-foot split spoon sample will be placed in the appropriate laboratory sample containers for possible laboratory analysis. Samples will be chosen for laboratory analysis based on the field screening results and observations by the Site Geologist.

7. Affix labels to the sample jar, and complete chain-of-custody and other required sample data forms. Protect samples against extreme temperature changes and breakage by placing them in sample coolers stored in a protected area.

Each boring will be logged. Each soil boring location shall be marked using labeled pinflagging for subsequent surveying.

Shelby tubes, thin-walled seamless tube samplers, will be used to retrieve undisturbed samples of soil for the geotechnical analyses. A Shelby Tube sampler, whether constructed of carbon steel or stainless steel, shall not be used to obtain soil samples for VOA analyses. The following method applies to collected undisturbed core samples via Shelby Tube:

1. Clean out the hole to the sampling elevation being careful to minimize the chance for disturbance or contamination of the material to be sampled. In saturated materials, withdraw the drill bit slowly to prevent loosening of the soil around the hole to maintain the water level in the hold at or above groundwater level.

2. The use of bottom discharge bits or jetting through an open-tube sampler to clean out the hole shall not be allowed. Any side discharge bits are permitted.

3. The sampler must be of a stationary piton-type, to limit sample disturbance and aid in retaining the sample. Either the hydraulically operated or control rod activated-type of stationary piston sampler may be used. Prior to inserting the tube sampler in the hole, check to insure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out of the tube sampler during sample withdrawal, and to maintain a suction within the tube to help retain the sample.

4. With the sampling tube resting on the bottom of the hole and the water level in the boring at the natural groundwater level or above, push the tube into the soil by a continuous and rapid motion, without impacting or twisting. In no case shall the tube be pushed further than the length provided for the soil sample. Allow a free space in the tube for cuttings and sludge.

5. After pushing the tube, the device should remain stationary for 15 minutes prior to removal. Immediately before removal, the cored sample must be sheared by rotating the rods with a pipe wrench, or kelly bushing, a minimum of two revolutions.

6. Upon removal of the sampler tube from the hole, measure the length of sample in the tube and also the length penetrated. Remove disturbed material at both ends of the tube and measure the length of sample again. After removing at least an inch of soil from the lower end and after inserting an impervious disk, seal both ends of the tube with at least a 1/2-inch thickness of wax applied in a way that will prevent the wax from entering the sample. Newspaper or other types of filler must be placed in voids at either end of the sampler prior to sealing with wax. Place plastic caps on the ends of the sampler, tape them into place, and then dip the ends in wax to seal them.

7. Affix labels to the tubes and record sample number, depth, penetration, and recovery length on the label. Mark the same information and the "up" direction on the tube with indelible ink, and mark the end of the sample. Complete Chain-of-Custody and other required forms. Do not allow tubes to freeze. The core tubes should be stored vertically (with the same orientation they had in the ground,

i.e., top of sample is up) in a cool place, out of the sun at all times. Shelby Tube samples should be shipped in a protective wooden box with suitable resilient packing material to reduce shock, vibration, and disturbance.

8. Using soil removed from the ends of the tube, carefully describe the sample.

Thin-walled, undisturbed tube samplers are restricted in their usage by the consistency of the soil to be sampled. Often, very loose and/or wet samples cannot be retrieved by the samplers, and soils with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Dension or Pitcher cores can be used in conjunction with the tube samplers to obtain undisturbed samples of stiff soils. Using these devices normally increases sampling costs, therefore, their use should be weighed against the increased cost and the need for an undisturbed sample. In any case, if a sample cannot be obtained with a tube sampler, an attempt should be made with a split spoon sampler at the same depth so that a sample can at least be obtained for classification purposes.

***Sample Analysis***

One soil sample, collected from each boring associated with the installation of a soil gas monitoring point, will be analyzed for BTEX and TPH, as described in Table 2-2. The sample will be collected from 6-8 feet below ground surface (bgs).

One undisturbed soil sample will be collected at each monitoring point and analyzed for geotechnical parameters including grain size, porosity, bulk density, and moisture content as described in Table 3-2.

One soil sample collected from drummed soil cuttings will be analyzed for TCLP characteristics for waste disposal as described in Table 3-2.

### 4.2.3 Soil Gas Monitoring Point Installation

***Objectives***

The objective of the soil gas monitoring point installation is to ensure that there is an adequate radius of monitoring points around the pilot vacuum extraction system to monitor the soil gas composition and pressure.

***Sample Location and Frequency***

Three soil gas points, installed in a straight line radially from the bioslurping well (MW16-05), and spaced at distances of 10, 20, and 40 feet, will be installed at the site.

***Drilling Equipment and Procedures***

The soil gas monitoring points will be drilled using the hollow stem auger method. The monitoring well borings will be approximately 4-inches in diameter, sufficient for the installation of the monitoring points.

Soil samples will be collected continuously at two-foot increments using 2-inch diameter split spoons according to the procedures detailed in Section 3.2.4.

*Soil Gas Monitoring Point Installation Procedure*

Construction details for the soil gas monitoring points are shown in Figure 4-1. The points will be installed in accordance with the following procedure:

1. The Site Geologist will determine the depth of the point based on location of the water table. It is anticipated that the point will be approximately 10 feet deep.

2. Drilling will be performed via hollow stem auger (HSA) drilling techniques.

3. During drilling operation 2-inch OD split-spoon soil samples will be taken continuously at 2-foot increments. Samples will be taken in accordance with ASTM D-1586-84.

4. A 6-inch well screen, with 0.01 inch slot size, will be set at three locations in the borehole, with nylon tubing extending to the ground surface.

5. The annular space around each screen will be backfilled with clean uniform fine-to-medium grained sand (Morie #1 or equivalent). A bentonite seal will be placed between the sand intervals and allowed to hydrate.

6. A flush mount 6-inch diameter steel security casing with locking well cap will be installed.

7. A 2 to 3-foot diameter cement pad will be installed around the security casing and mounded in such a way as to direct surface runoff from the casing will be locked and keyed-alike.

8. A boring log will be maintained by FWENC. In addition, the drilling subcontractor should prepare a separate written boring log, which will be submitted to FWENC. The boring log should describe lithologies encountered, depths of various formations, sample location, sample data (recovery, blow counts, etc.), water levels, total depth, soil gas monitoring point construction summary, and any other pertinent data. Details of well logging are presented in this section.

Soil gas monitoring point installation will be supervised by the Site Geologist and will be performed in accordance with these guidelines and the drilling specification. The site Geologist will prepare a construction diagram for the monitoring point.

*Sample Handling and Analysis*

Soil samples collected from split spoon samplers will be handled in accordance to guidelines detailed in Section 3.3.

*Documentation Procedures*

During installation procedures, a detailed record of drilling operations and geological material will be maintained in a field sampling logbook. General guidance for logging soil and preparing well construction diagrams are provided below. These procedures were obtained from the USEPA Compendium of Methods.

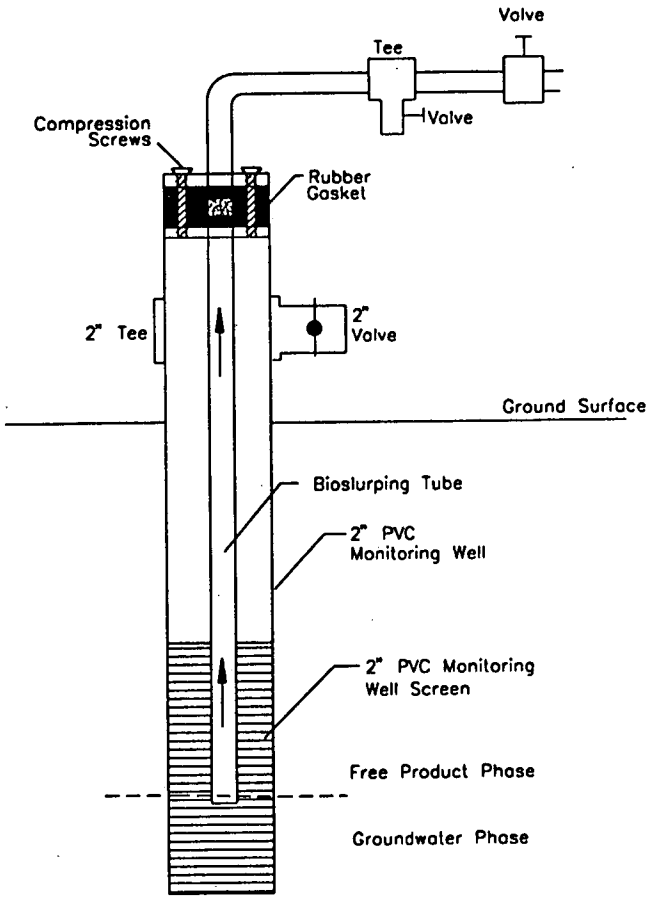



Diagram of a Typical Bioslurper Well

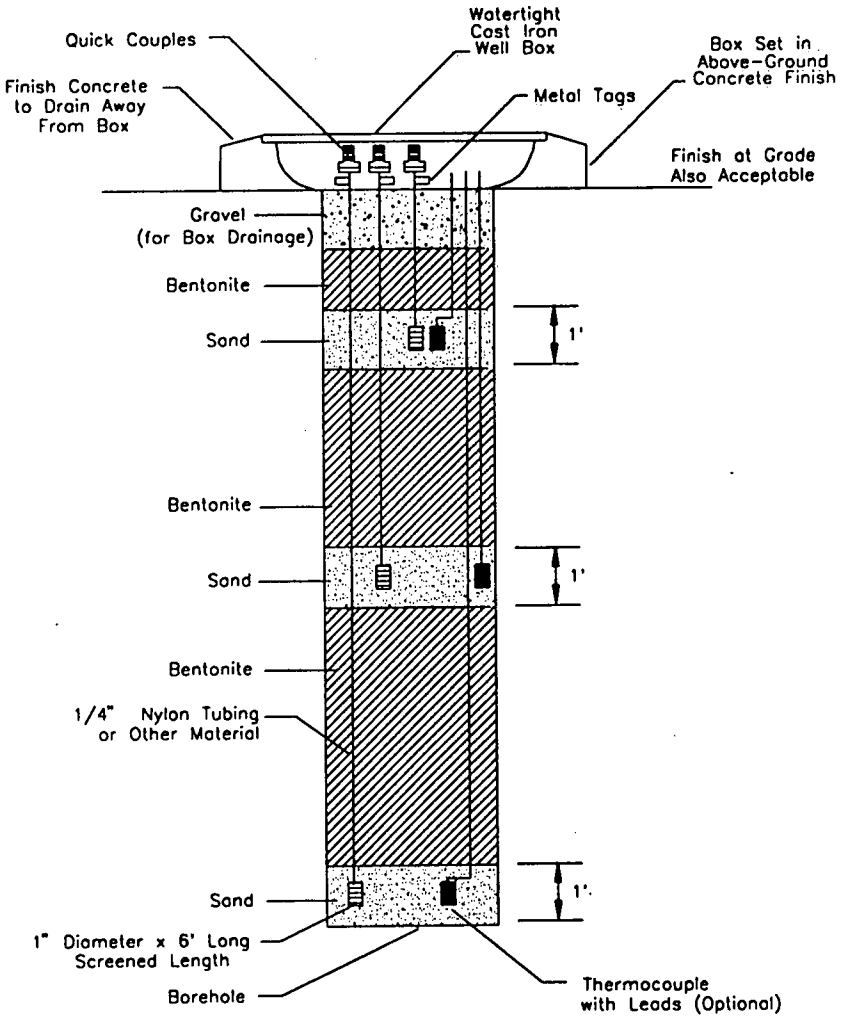



Diagram of a Typical Soil Gas Monitoring Point

U.S. Navy RAC
NWS Earle, Colts Neck, N.J.

Figure 4-1

Soil Gas Monitoring Point Construction Sketch

FOSTER WHEELER ENVIRONMENTAL CORPORATION

navyrac\coltwell

Boring Logs

The lithologic descriptions for all soil borings should be kept in a field logbook and subsequently transferred to a standard borehole log form. The following basic information should be entered on the heading of each log sheet:

- Project name and number
- Boring or well number
- Location (approximate in relation to an identifiable landmark)
- Elevation (approximate at the time)
- Name of drilling contractor
- Drilling method and equipment
- Water level
- Start and finish (time and date)
- Name of geologist

The following technical information is recorded on the logs:

- Depth of sample below surface
- Sample interval
- Sample type and number
- Length of sample recovered
- Standard penetration test (ASTM-D1586) results, if applicable
- Soil description and classification
- Graphic lithologic symbols

In addition to the items listed above, all pertinent observations about drilling rate, equipment operation, or unusual conditions should be noted. Such information might include the following:

- Size of casing used and method of installation
- Rig reactions such as chatter, rod drops, and bouncing
- Drilling rate changes
- Depth and percentage of fluid losses
- Changes in fluid color or consistency
- Material changes
- Zones of caving or heaving

Description of soils is based on the Unified Soil Classification System (USCS) as described in ASTM D2487-69(1975) Test Method for Classification of Soils for Engineering Purposes and ASTM D2488-69(1975) Recommended Practice of Description of Soils (Visual-Manual Procedure). Classification and logging procedures should be done in accordance to the guidelines for classification of soils detailed below.

These guidelines provide reference information and technical guidance on borehole and sample logging. Borehole logs provide information which is used in the determination of geological conditions (stratification, relative permeability, et.) and ultimately in the assessment of contaminant distribution and in evaluations of remedial actions. Borehole logging is also performed to assure that each well is constructed according to specifications. These guidelines will provide descriptions of the standard techniques for the logging of soil samples. These techniques should be used during each borehole

construction in order to obtain a uniform description of the subsurface lithology. It is particularly important that each person logging boreholes does so in a consistent fashion, to ensure that strata and contaminant distribution can be correlated from borehole to borehole.

Soils

1. Definitions

Soil Classification Abbreviations - Abbreviations may be used in the description of a rock or soil. However, they should be kept at a minimum. Following are some of the abbreviations that may be used:

| | | | |
|---|---|---|---|
| C | Coarse | BR | Broken |
| Med | Medium | BL | Blocky |
| F | Fine | M | Massive |
| V | Very | Br | Brown |
| Sl | Slight | Gn | Green |
| Occ | Occasional | Gr | Grey |
| Tr | Trace | Bk | Black |
| Lt | Light | Yl | Yellow |
| Dk | Dark | Or | Orange |
| Bl | Black | Rd | Red |
| Wh | White | Tn | Tan |

Bedding - Term signifying the existence of beds or layers (strata), laminae, or other tabular and essentially horizontal units.

Cohesive - Having the capacity to stick or adhere together. In effect, the cohesion of soil is that part of its shear strength which does not depend on interparticle friction.

Fabric - The orientation of the particles composing a soil or rock.

Friable - Easily crumbled.

Grading - Degree of mixing of size classes in a sedimentary material. Well graded implies more or less uniform distribution from coarse to fine; poorly graded implies uniformity in size or lack of a continuous distribution.

Plasticity - The property of a material which enables it to undergo permanent deformation without appreciable volume change or elastic rebound, and without rupture.

Texture - Geometric aspects of the component particles of a soil or rock, including size, shape, and arrangement.

2. USCS Classification

All classification data should be written directly on the boring log (if there is enough space), or in a field sampling logbook. The method of deriving the classification should be according to this plan. Handling of samples during soil classification should be coordinated with chemical sampling activities, if appropriate. Soils are to be classified according to the Unified Soil Classification System (USCS). This method of classification identifies soil types on the basis of grain size and liquid limits, and categorizes them by two-letter symbols.

In the USCS system, fine grained soils, or fines, are classified as those which will pass through a No. 200 US standard sieve (0.074 mm) and are of two types: silt (M) and clay (C). Some classification systems define size ranges for these soil particles, but for field classification purposes, they are identified by their respective behaviors only. Organic material (O) is a common component of soil but has no size range, and is recognized by its composition. Coarse-grained soils are divided into two types: rock fragments and sand or gravel. Graveling soils are identified by a (G) as the first letter in the two-letter symbol, whereas sandy soils are identified with an (S). The term rock fragments should be used to indicate granular materials resulting from the breakup of rock. These materials are normally angular, indicating little or no size designation such as "1/4"- 1/2" diameter" or "coarse-sand size", either immediately after the entry, or in the remarks column. The USCS classification would not be affected by this variation in terms. The second letter in the two-letter USCS symbol provides information about the grain size distribution of granular soils, or the plasticity characteristics of fine-grained soils. These second-letter modifiers are (P) poorly graded/well sorted, (W) well graded/poorly sorted, (C) clayey, (M) silty, (L) low plasticity, or (H) high plasticity. Peat and other highly organics soils are classified as (Pt).

3. Color

Soil colors should be described utilizing a single color descriptor preceded, when necessary, by a modifier to denote variations in shade or color mixtures. A soil could therefore be referred to as "gray" or "light gray" or "blue-gray". Since color can be utilized in correlating units between sampling locations, it is important that color descriptions be kept consistent throughout the field operations. Colors must be described while the sample is still moist. Soil samples should be broken or split vertically to describe colors. Soil sampling devices tend to smear the sample surface creating color differences between the sample interior and exterior. Munsell Color Charts or equivalent should be used.

4. Relative Density and Consistency

To classify the relative density and /or consistency of a soil, the geologist must first identify the soil type. Granular soils contain predominantly sands and gravel, and are generally noncohesive (particles do not adhere well when compressed). Finer grained soils (silts and clays) are cohesive (particles will adhere together when compressed). The density of noncohesive, granular soils is classified according to standard penetration resistance obtained during split-spoon sampling. Those designations are:

| Standard Penetration Designation | Resistance (Blows/Foot) |
|---|---|
| Very Loose | 0 to 4 |
| Loose | 5 to 10 |
| Medium Loose | 11 to 30 |
| Dense | 31 to 50 |
| Very Dense | Over 50 |

Standard penetration resistance is the number of blows required to drive a split-spoon sampler with a 2-inch outside diameter, 12 inches into the material using a 140-lb hammer falling freely through 30 inches. The sampler is driven through an 18-inch or 24-inch sample interval and the number of blows is recorded for each 6-inch increment. The density designation of granular soils is obtained by adding the number of blows required to penetrate the second and third 6-inches of each sample interval. It is important to note that if gravel or rock fragments are broken by the sampler, or if rock fragments are lodged in the tip, the resulting blow count will be erroneously high, reflecting a higher density than actually exists. This should be noted on the log and referenced to the sample number. The consistency of cohesive soils is determined either by blow counts, or most accurately by a pocket penetrometer or field Torvane device in accordance with ASTM D2573-72 (1978). The pocket penetrometer method is conducted on a selected sample of the soil, preferably the deepest 0.5 feet of the sample in the split-spoon sampler. The sample should be broken in half, and the penetrometer pushed into the end of the sample to determine consistency. Do not determine consistency by attempting to penetrate a rock fragment. If the sample is decomposed rock, it is classified as a soft decomposed rock rather than a hard soil. The pocket penetrometer or Torvane may be used in conjunction with blow counts to determine cohesive soil consistency.

5. Soil Components

In nature, soils are comprised of particles of varying size and shape and are combinations of the various soil types. Grain size classifications to be used in describing soils should follow the USCS. The following items are useful in the description of soil components:

| Terms Identifying Proportion of the Component | Defining Range of Percentages by Weight |
|---|---|
| Trace | 0-10 |
| Little | 11-20 |
| Some | 21-35 |
| "And" | 36-50 |

These descriptions are adopted from the Burmeister Classification System.

6. Moisture

Moisture content is estimated in the field according to four categories: dry, moist, wet, and saturated. In dry soil, there appears to be no water. Saturated samples obviously have all the water they can hold. Moist and wet classifications are somewhat subjective and often are determined by the individual's judgment. A suggested parameter for judging this in a fine-grained soil would be to call a soil wet if rolling it in the hand, or on a porous surface liberates water, i.e. dirties or muddies the surface. Whatever method is adopted for describing moisture, it is important that the method used by an individual remains consistent throughout an entire drilling job.

7. Stratification

Stratification can only be determined after the sample barrel is opened. The stratification or bedding thickness in for soil and rock is dependent on grain size and composition. The classification to be used for stratification description is shown below:

| Thickness (Metric) | Approximate English Equivalent | Classification |
|---|---|---|
| > 1 meter | > 3.3' | Very Thick |
| 30 cm - 1 meter | 1.0' - 3.3' | Thick Bedded |
| 10 cm - 30 cm | 4.0" - 1.0' | Medium Bedded |
| 3 cm - 10 cm | 1.0" - 4.0" | Thin Bedded |
| 1 cm - 3 cm | 2/5" - 1.0" | Very Thin Bedded |
| 3 mm - 1 cm | 1/8" - 2/5" | Laminated |
| 1 mm - 3 mm | 1/32" - 1/8" | Thinly Laminated |
| < 1 mm | < 1/32" | Micro Laminated |

8. Additional Descriptors

Geologic descriptors of soils encountered in borings should be included, if appropriate, even though they are not required for soil classification by the USCS. For example, the angularity of non-cohesive soils (rounded, subrounded, angular, subangular), the shape of the grains, cementation, and carbonate content (HCl reaction). The classification or identification of soils using a system other than USCS may be added, but must be identified.

9. Quick Field Identification Aids and Helpful Hints

In addition to visual observation of the soils recovered in sampling devices, certain quick field tests may be performed to assist in classifying these soils. Since many of these quick field tests require some additional handling of the samples, they should only be used in cases where doing so will not be hazardous. Some of these aids in soil identification are:

- To evaluate plasticity to distinguish between clay and silts, dry a pat of soil quickly by placing it on a hot surface (e.g.. exhaust pipe of the drill rig). Attempt to crumble the fully dried pat in the hand. Clays will tend to break into fragments, with increasing strength displayed by clays of greater plasticity (CH soils). Conversely, pure silt will have virtually non internal cohesion and will very easily pulverize to a very fine powder.

- When a pat of wet silt is held in the hand and shaken (by tapping one hand against the other), free water will appear on the surface of the soil, which when touched will recede back into the pat of the soil.

- Clays are sticky to the touch, while silts give no such sticky feeling. Highly plastic clay (CH) will exhibit a greasy feeling.

- Organic soils are usually dark in color (dark brown or black), have an organic (earthy) order, and often contain remnants of the vegetable matter from which they were formed. When hydrogen peroxide id applied to organic soils, it will bubble and fizz; however, the same reaction can also be caused by certain metals (e.g. iron) in the soil.

- With experience, the percentage of fines in granular soils can be judged by the degree to which handling the wet soil dirties or stains one's hand or gloves. Relatively clean (<5% fines) soils (SP, GP, SW, GW) leave little or no stain, while soils with more than 12% fines (SC, SM, GC, GM) will leave a noticeable stain when handled wet.

- The ability to roll a "thread" of a fine grained soil is an indication of its plasticity. In a moist state, highly plastic soils (CH) can be rolled into a very thin (1/16") diameter without breaking, while non-cohesive pure silt cannot be rolled to a thread without crumbling.

- Well graded granular soils, within the limited definition of USCS (SW or GW), do not frequently occur in nature. Therefore, while a sample may appear to contain all the sizes for a granular soil (fine, medium, and coarse), it is not likely to contain them in the proper proportions to meet the USCS definitions for well graded soil. Thus, field classifying such soils as poorly graded (SP or GP) is more likely to be correct in most cases.

Since hard rocks are not anticipated to be encountered during drilling activities, a narrative of hard rock lithologic descriptors will not be included in this SAP.

### 4.2.4 Soil Gas Sampling

***Objectives***

Gasses in the monitoring wells will be monitored in order to evaluate the extent of aeration and microbial activity. Oxygen readings will be used to determine if aerobic conditions are being maintained. Carbon dioxide, which is emitted as a result of aerobic biodegradation, will be used to evaluate the biodegradation. The measurement of combustible gases will also be measured and used to evaluate anaerobic microbial activity.

***Equipment and Procedures***

The three new soil gas monitoring points will be equipped with air tight locking caps. Each well cap will be modified with a piece of 3/16" diameter polypropylene tube with a plug. The polypropylene tube will enable the well to remain air tight until the evaluation of gas build-up in the well is performed.

Prior to sampling, each well will be purged of two volumes. The probes will be purged by connecting a portable vacuum pump (SKC Model 224-43XR) to the quick-connect sampling port. The vacuum pumps are capable of purging up to 5,000 ml/min. After purging, the following field equipment will be used for the collection of air samples:

1. A Landtec portable GEM-500 unit will be used to field screen directly for the measurement of percent Lower Explosion Limit (%LEL), Oxygen ($O_2$), Carbon Dioxide ($CO_2$), and Methane ($CH_4$). This unit can also be used to measure BTU content, flowrate, and temperature.

2. A Photoionization Detection Unit (PID) will be used to field screen for total VOCs. The PID will be calibrated with isobutylene and a zero gas to read a benzene equivalent.

***Sample Analysis***

The air in the monitoring wells will be evaluated twice per week during the duration of the pilot study. The air in the monitoring wells will be evaluated in the manner described earlier.

### 4.2.5 Evaluation of LNAPL, Groundwater and Air

***Objectives***

The objectives of analyzing the LNAPL, groundwater and air sample collected during the pilot study are to evaluate the potential of recycling/reusing the recovered product, determining the disposal options for the recovered groundwater and evaluating the effectiveness of the remedial technology.

***Equipment and Procedures***

A sample of the LNAPL will be collected directly from the collection drum during the operation of the skimmer. The groundwater and air samples will be obtained from the bioslurper effluent as it is being discharged.

***Sample Analysis***

The LNAPL will be analyzed for VOAs, PCBs, TOX, total suspended solids, flash point, and BTU content as described in Table 3-2.

The groundwater effluent will be analyzed for BTEX, TOX and TAL inorganics as described in Table 3-2.

Air samples will be evaluated for organics.

### 4.2.6 LNAPL and Water Level Measurements

***Objective***

Water level measurements and LNAPL thickness will be collected from six existing monitoring wells in order to evaluate baseline groundwater conditions and evaluate the performance of the pilot study. In addition, bail tests will be conducted to estimate actual LNAPL thickness.

***Location and Frequency***

LNAPL thickness and groundwater elevations will be measured from the six monitoring wells on a weekly basis in conjunction with the weekly maintenance of the skimmer and bioslurping system.

***Equipment and Procedures***

Water level measurements of all monitoring wells will be taken according to the following method:

Check operation of the recording equipment above ground. Prior to opening the well, don personal protective equipment as required.

Record all information specified below in a field log book.

Record the well number, depth to water, and total well depth. Water levels shall be taken from the surveyed reference mark on the top edge of the inner well casing.

Record water level to the nearest 0.01 foot.

Record the time and day of the measurement.

Bail tests to estimate the volume of free product will e conducted in accordance with FWENC and NJDEP guidelines.

*Measuring Devices*

A Solinst Model 121 interface meter will be used to measure product thickness and groundwater levels. All product thickness and groundwater level measurements will be made to the nearest 0.01' and recorded in a Field Logbook. In measuring groundwater levels, there shall be a clearly-established reference point of known elevation, which is normally identified by a painted mark at one point on the upper edge of the inner well casing. The field notes recorded must clearly describe the reference used. To be useful, the reference point should be tied in with an established USGS benchmark or other properly surveyed elevation datum.

For accurate readings, the probe shall be lowered into the well. The electric tape is marked at the measuring point where contact with the water surface was indicated. The distance from the mark to the nearest tape band is measured using an engineer's folding rule or steel tape, and added to the band reading to obtain the depth to water. Band spacing will be checked periodically and recorded in the logbook.

Water level measurements will be compared from each round to develop a potentiometric map of the shallow water table aquifer, as well as determine any local anomalies in the groundwater flow pattern.

*Analyses*

Water level measurements will be converted to true elevations and interpreted as part of the pilot study evaluation. Potentiometric maps will be developed, and the horizontal and vertical hydraulic gradients will be established for the pilot study area.

## 4.3 DECONTAMINATION

The objective of this section is to provide the methodology for the proper decontamination procedures to be used on chemical sampling and field analytical equipment.

In order to assure that chemical analysis results are reflective of the actual concentrations present at sampling locations, chemical sampling and field analysis equipment must be properly decontaminated prior to the field effort, during the sampling program (i.e. between sample points), and at the conclusion of the sampling program. This will minimize the potential for cross-contamination between sample points and the transfer of contamination off-site.

Prior to sampling, equipment will be decontaminated using the following procedures:

1. Potable water rinse.

2. Alconox or Liquinox detergent wash.

3. Scrubbing with a scrub brush may be required if the equipment is heavily contaminated with heavy or extremely viscous compounds (not anticipated).

4. Potable water rinse.

5. Rinse with 10% nitric acid solution

6. Distilled, deionized water rinse.

7. Methanol rinse.

8. Distilled, deionized water rinse.

9. Air dry.

10. Wrap sampling equipment in aluminum foil (shiny side out).

Decontamination fluids containing nitric acid and methanol rinse solutions should be containerized separately from rinse water consisting of water and soap only.

# 5.0 QA/QC VERIFICATION OF FIELD SAMPLING AND PROCEDURES FOR FIELD CHANGES AND CORRECTIVE ACTION

## 5.1 QA/QC FIELD AUDITS

Quality assurance and quality control during the sampling program will be performed by the Foster Wheeler Environmental Field Operations Lead. The FOL will supervise all sampling and documentation and subcontractor operations to ensure that all activities are being performed in accordance with the SAP. The FOL will report all findings to the Site Manager (SM).

## 5.2 FIELD CHANGES AND CORRECTIVE ACTIONS

The SM or his designee is responsible for all site activities. In this role, the SM is required at times to adjust the field program to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible sampling personnel will notify the SM of the anticipated changes prior to implementation. Changes will only be acted upon with the SM's concurrence. The SM will consult with the Navy Technical Representative (NTR) ahead of time for major changes and receive his/her approval. If changes are implemented that are subsequently determined to be unacceptable, the actions taken during the period of deviation will be evaluated to determine the significance of any departure from established program practices.

The changes in the program will be documented on a Field Change Request (FCR) Form, which will be signed by the FOL and the SM. A typical FCR Form used to document field changes is provided as Figure 5-1. The FCRs for each change will be numbered sequentially starting with the number "01." A copy of the FCR will be attached to the file copy of the SAP. The SM is responsible for controlling, tracking, and implementing the identified changes.

## FIGURE 5-1

## FIELD CHANGE REQUEST FORM

| Project Name: | Project No: | Field Change Request No.: FCR- |
|---|---|---|
| To: | Location: | Date: |

Description:

Reason for Change:

Recommended Disposition:

| Name of Requester | Signature of Requester | Date |
|---|---|---|

Disposition:

| Name of Project Manager | Signature | Date |
|---|---|---|

# APPENDIX G

# SUBMITTAL REGISTER

# SUBMITTAL REGISTER

Contract Number: N62472-94-D-0398 D.O. # 0017 Project Title: Bioremediation Pilot Study NWS Earle

LOCATION: Earle, NJ CONTRACTOR: Foster Wheeler Environmental Corporation

| | | | | | | | CONTRACTOR ACTION | | | APPROVING AUTHORITY ACTION | | | | CONTR | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPEC SECTION NO. | SD NO. & TYPE OF SUBMITTAL-MATL OR PRODUCT | SPEC PARA NO. | CLASSIF/ APPR BY CO * | GOVT OR A/E REVR | TRANS CONTL NO. | PLANNED SUBMITTAL DATE | ACT. CODE | DATE OF ACTION | DATE FWD TO APPR AUTH / DATE RECD FROM CONTR | DATE FWD TO OTHER REVIEWER | DATE RECD FROM OTHER REVIEWER | ACT. CODE | DATE OF ACTION | MAILED TO CONTR / RECD FROM APPR AUTH | REMARKS |
| (a) | (b) | (c) | (d) | (e) | (f) | (g) | (h) | (I) | (j) | (k) | (l) | (m) | (n) | (o) | (p) |
| | SD-18, Records | | | | | | | | | | | | | | |
| | Draft Work Plan | N/A | | | 1 | 3/26/96 | | | | | | | | | |
| | SD-18, Records | | | | | | | | | | | | | | |
| | Draft Health & Safety Plan | N/A | | | 2 | 4/8/96 | | | | | | | | | |
| | SD-18, Records | | | | | | | | | | | | | | |
| | Sampling and Analysis Plan | N/A | | | 3 | 4/12/96 | | | | | | | | | |
| | SD-18, Records | | | | | | | | | | | | | | |
| | Final Work Plan | | | | | 5/28/96 | | | | | | | | | |
| | SD-18, Records | | | | | | | | | | | | | | |
| | SD-04, Drawings | | | | | | | | | | | | | | |
| | Multi-Phase Extraction System Flow Diagram and Wiring Diagram | | | | 4 | 5/16/96 | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | Final Health & Safety Plan | | | | | 5/28/96 | | | | | | | | | |
| | Equipment Submittals | | | | | 5/17/96 | | | | | | | | | |
| | Evaluation Report | | | | | 8/30/96 | | | | | | | | | |

ACTION CODES: NR: Not Reviewed AN: Approved as Noted A: Approved
RR: Disapproved; Revise and Resubmit (Others may be prescribed by the Transmittal Form

* Navy Notes:
Approved by:
G: Contracting Officer
Blank: CQC Manager

* NASA Notes:
Approved by:
Blank: Contracting Officer

*Army Notes:
Classification:
GA: Gov't Approval
FIO: For Infor ONLY