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WORK PLAN
FOR
SOIL STABILIZATION AND REMOVAL
AT NAVAL EDUCATION AND TRAINING CENTER
PORTSMOUTH, RHODE ISLAND

Northern Division
Naval Facilities Engineering Command
10 Industrial Highway
Lester, PA 19113

PREPARED BY:

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

May, 1996

REMEDIAL ACTION CONTRACT N62472-94-D-0398
DELIVERY ORDER 0011

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1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (Foster Wheeler) has been contracted by the Northern Division, Naval Facilities Engineering Command (NORDIV) to sample the stockpiled soils removed from the Melville North Landfill, stabilize the soil as necessary, and dispose of the soil in the McAllister Point Landfill. This Work Plan is being submitted to satisfy the typical requirements for PRE AND POST CONSTRUCTION DOCUMENTATION under Remedial Action Contract No, N62472-94-D-0398.

2.0 PROJECT LOCATION AND DESCRIPTION

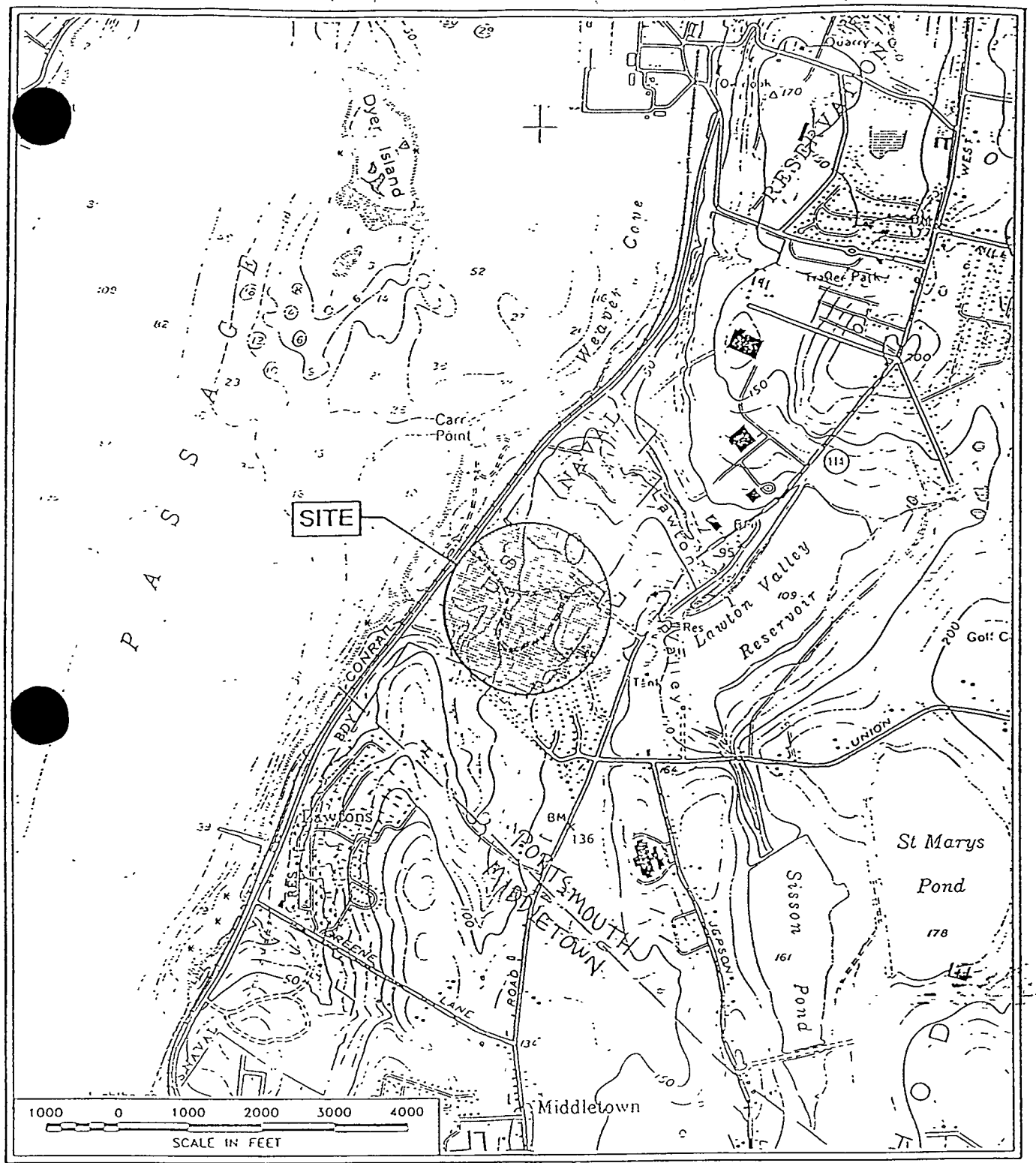
The Naval Education and Training Center (NETC) Melville is located approximately 25 miles southeast of Providence, Rhode Island in the Town of Portsmouth, Newport County, as shown in Figure 2-1. The site, located on the NETC, consists of six stockpiles of soil under a plastic cover, reported surrounded by haybales. Under contract to the Navy, OHM stockpiled approximately 7,619 cubic yards (cy) of soil removed from the remediation of the Melville North Landfill. A schematic drawing of the stockpile area, with quantities and source areas of the piles indicated, is presented in Figure 2-2..

The Navy has provided the following information concerning the chemical characteristics of the stockpiles:

- Approximately 6,156 cubic yards of soil were removed from Areas S and N and have been placed in Stockpiles 1, 2, 3, and 4. Analytical data provided by OHM (through the Navy) indicates that the contaminant of concern, total petroleum hydrocarbons (TPH), is present at levels ranging from 1,000 ppm to 90,000 ppm. PCB levels are below 10 ppm, with the exception of Soil Pile 1 which had a single sample occurrence of 20.6 ppm. Leachable concentrations of metals, including lead, are all below RCRA levels. There are trace concentrations of asbestos present in some samples, but all are below 1%. The degree of quality control/quality assurance used in sample collection is unknown. Information concerning the physical characteristics of the soil has not been provided.

- A total of 904 cubic yards of soil removed from Area N has been placed in Stockpile 5. Analytical data provided by OHM (through the Navy) indicates that the contaminant of concern, TPH, is present at levels ranging from 15,300 ppm to 16,900 ppm. PCB levels are all below detection limits. Leachable concentrations of lead in the two samples provided exceeded the RCRA level of 5 mg/*l*, ranging from 6.62 mg/*l* to 46.3 mg/*l*. Asbestos concentrations range from trace to 20%. Information concerning the physical characteristics of this material has not been provided.

- A total of 559 cubic yards of soil are identified as coming from "chasing". No data on the chemical or physical characteristics of this material have been provided.



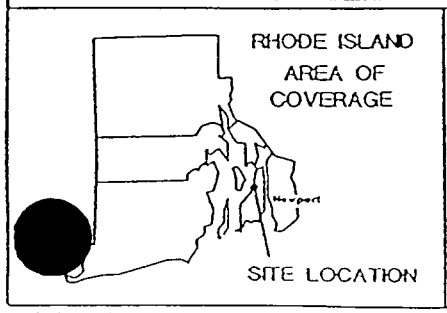


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FIGURE 2-1

Naval Education and Training Center
Newport, Rhode Island

SITE LOCATION MAP

SCALE: AS SHOWN	PROJ. NO. 1284.0013.0103

CADFILE 1284FG11 DWG

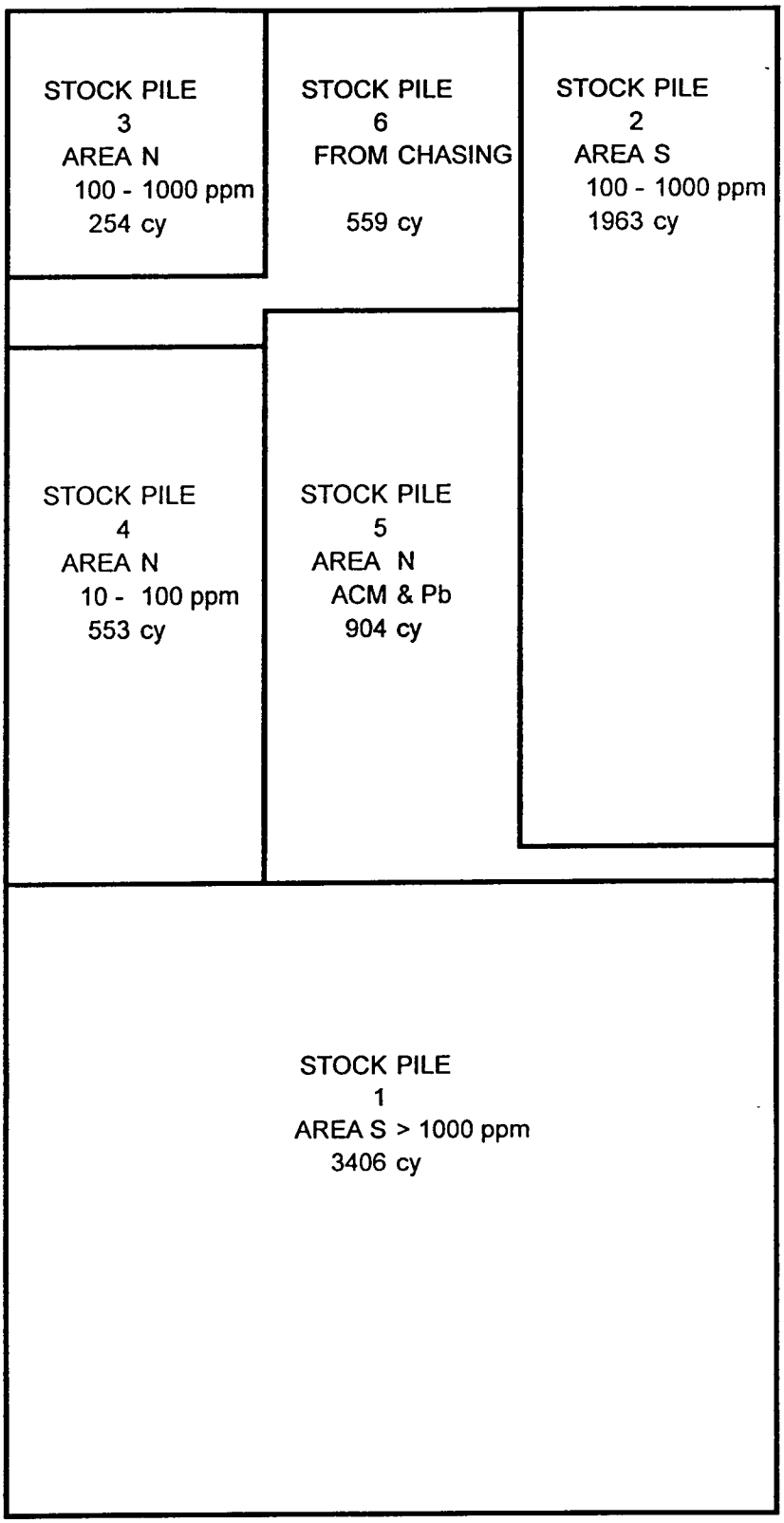


FIGURE 2-2 - SCHEMATIC OF STOCK PILE AREA
(from OHM)

3.0 SCOPE OF WORK

The objective of this delivery order is to dispose of the stockpiled soils in the McAllister Point Landfill. In order to achieve this goal, Foster Wheeler is required to perform the following tasks:

- Task 1 - Soil Sampling
- Task 2 - Mobilization
- Task 3 - Stabilization and Disposal of Stockpile 5
- Task 4 - Transport and Disposal of Stockpiles 1, 2, 3, 4, and 6
- Task 5 - Site Restoration and Demobilization

The concepts for the execution of each of these tasks are discussed in detailed below.

3.1 TASK 1 - SOIL SAMPLING

Foster Wheeler will and collect soil samples for chemical and geotechnical analysis in accordance with Section 4 of this Work Plan and the Sampling and Analysis Plan. Samples from Stockpiles 1 through 4 and 6 will be sent to off-site laboratories for TCLP and RCRA characterization for off-site disposal and geotechnical parameter testing for compaction, liquid limit, and plasticity in accordance with the appropriate ASTM standards. Soil from Stockpile 1 will also be sent for PCB analysis based upon the results reported by OHM. Samples from Stockpile 6 will be sent for analyses for PCBs, volatile organics, TCLP volatile organics, TCLP semivolatile organics, TCLP metals, RCRA characteristics, total organic carbon, and Paint Filter Liquid Test. Facsimile copies of sample results will be received within 5 working days, and the complete report forwarded within 10 working days.

Soils from Stockpile 5 will be sent to Groundwater Technology Government Services (GTGS) for a treatability study to demonstrate if the mix proportions provided in OHM's November 15, 1995 treatability study Report of Findings are effective in stabilizing the soil with an initial TCLP-lead concentration above RCRA requirements for land disposal (5 mg/ℓ). GTGS is a team subcontractor under the NORDIV RAC. The treatability study scope of work consists of the following elements:

- Foster Wheeler will collect and send 3 soil samples (2.5 kg) from Stockpile 5 to GTGS for analysis for lead content by EPA 6010A/7000A TCLP methodology. If the results of the TCLP-lead extraction and analysis are under 5 mg/ℓ, Foster Wheeler will consult with the Navy by teleconference to determine if the remainder of the treatability study needs to be performed. If TCLP-lead concentrations are low, treatment of the soil from Stockpile 5 may not be required.

- The moisture contents, liquid limits, and plastic limits will be determined for the 3 samples.

- GTGS will divide each of the 3 soil samples into thirds. The nine samples will be mixed with the optimal ration of Portland cement, kiln dust, and/or hydrated lime with water as recommended by the OHM in their November 15, 1995 report of findings.

- The 9 samples will be analyzed for lead using TCLP methodology to confirm that the lead had been stabilized by the formulation.

- Compaction, liquid limit, and plastic limit testing will be performed on the 9 treated samples. Compaction testing will be done by cone penetrometer. The liquid and plastic limit testing will be done in accordance with the methodologies described in "Soil Mechanics Lab Manual," by B.M. Das. Moisture content for the 9 treated samples will also be determined.

GTGS will forward the data package to Foster Wheeler within one week of receipt of samples. Foster Wheeler will consolidate the chemical and geotechnical results and forward them to NORDIV within 3 days of data receipt.

3.2 TASK 2 - MOBILIZATION

Upon receipt of a Notice to Proceed from the Navy, Foster Wheeler will mobilize to the field to perform the stabilization, loading, transport, and disposal of the stockpiled soils. Mobilization activities will include procurement, receipt, and inspection of equipment, materials and labor; establishment of environmental protection and site security measures; construction of site support facilities; initial health and safety training; quality control preparatory inspections; and coordination with the ROICC. Foster Wheeler will take advantage of the field facilities already mobilized to the McAllister Point Landfill. Therefore, a field trailer and other support equipment will not be required. A detailed Site Plan will be provided as a required submittal.

3.3 TASK 3 - STABILIZATION AND DISPOSAL OF STOCKPILE 5

Foster Wheeler will stabilize the lead contaminated soils in Stockpile 5 using Portland cement, cement kiln dust, hydrated lime, or a combination of these reagents. Optimal mix proportions were developed in a treatability study performed by OHM (November 1995). GTGS will validate these formulae in the treatability study described under Task 1. Based upon discussions with the Navy, Foster Wheeler will select a reagent mix based upon effectiveness in reducing the leachable level of lead, cost, and ease of use.

Stabilization will be accomplished using a pugmill or two 8 cy mobile mixers, depending upon equipment availability and cost. The pugmill/mixers will be charged with the appropriate mixture of contaminated soil, stabilization reagent, and potable water. Ingredients will be measured on a volumetric basis. Processing will be accomplished in a manner to minimize fugitive dust emissions. Foster Wheeler will perform work zone and perimeter air monitoring in accordance with the Health and Safety Plan, provided as a separate submittal. After mixing, the stabilized soils will be staged for curing within the

existing stockpile area. Foster Wheeler will inspect the area and upgrade as necessary to meet the following requirements of 40 CFR Chapter 1, Subpart L (Waste Piles):

- Impermeable base
- Run-on/run-off controls
- Collection and holding for run-on/run-off
- Protection from precipitation
- No placement of liquid wastes

The initial production of stabilized soils will be allowed to cure for 24 hours. Samples will collected and sent to an off-site laboratory for TCLP-lead analysis. If the analysis indicates that the TCLP-lead level is less than 5 mg/l, Foster Wheeler will begin loading of the stabilized soils for shipment to the McAllister Point Landfill. If the stabilized soils do not pass the TCLP-lead analysis, Foster Wheeler will adjust the mix proportions, reprocess, and resample the stabilized mixture. The analytical results will be submitted to the Navy for review and approval. During curing, the pile will be mixed periodically to enhance evaporation and prevent clumping.

The area where the stabilization operation will be performed will be graded and sloped to contain runoff and spills that may occur. Measures to be taken include installation of diversion ditches to prevent upgrade runoff from entering the area, collection of runoff generated within the operations area, and containment of the overall work area using haybales and other protective measures. Foster Wheeler will also construct a temporary decontamination pad to clean truck tires and remove visible spillage from the sides of the roll-off containers before transport vehicles depart from the site. A site environmental protection plan will be submitted for approval prior to the start of operations as required by Section 7 of this Work Plan.

Optimal production will be achieved using a pugmill. However, in the event that mobile mixers are used, the total batch time is estimated at 30 minutes per batch. Batching and loading is estimated at 10 minutes. Mixing time is estimated at 3 minutes (specifications for mixing of Portland cement usually required a minimum of up to 1 cy capacity with an increase of 15 seconds for each additional 1 cy, or fraction thereof [Design and Control of Concrete Mixtures, 12th edition, Portland Cement Association, Skokie, IL, 1979]). Discharging and positioning of the treated soils is estimated at 7 minutes. An assumed efficiency rate of 67% was applied to the total cycle time. Based upon these estimates, Foster Wheeler anticipates the following duration for the stabilization operation:

Quantity of soil to be treated = (904 cy)(1.1*) = 995 cy

*1.1 factor applied to convert the mix ratio of .125 lbs of Portland cement/lb of soil (OHM, November, 1995) to a volumetric basis, using a factor of 90 lbs/cf for Portland cement and 76 lbs/cf for moist, loose earth (Field Engineers handbook, McGraw-Hill, 1981, p. 123).

Daily production = (8 cy/mixer)(2 mixers/batch)(2 batches/hr)(6 hrs/day**) = 192 cy/day

Mixing duration = (995 cy)/(192 cy/day) = 5.2 days

Assuming a 48 hour curing process, add 2 days to the mixing duration for a total duration of 7.2 days.

**6 hours per day of actual operational time was assumed to allow for equipment maintenance and repair, weather delays, and other unforeseen events.

The stabilized soils will be loaded into dump trucks for movement to the McAllister Point Landfill. Transport vehicles will be weighed prior to loading and before departure for the McAllister Point Landfill. In accordance with DOT requirements, a bill of lading will accompany each truckload of stabilized soil. Foster Wheeler will submit copies of the bills of lading to the Navy.

3.4 TASK 4 - TRANSPORT & DISPOSAL OF STOCKPILES 1, 2, 3, 4 AND 6

Based upon the information provided by the Navy, Stockpiles 1, 2, 3, 4, and 6 currently contain 6,715 cy of TPH contaminated, RCRA nonhazardous soil. Approximately 3,500 cy of soil from the Melville stockpiles will be required to complete the McAllister Point Landfill. Of this total, approximately 995 will come from Stockpile 5. The remaining 2,505 cy will be drawn from Stockpiles 1, 2, 3, 4, and 6. This will leave a balance of 4,210 cy of soil requiring off-site disposal.

Soils will be loaded into dump trucks using a bucket loader. Soils will be loaded in a manner to minimize dust emissions. Loading will be performed within the area contained by the existing erosion control measures. Trucks will be weighed empty upon arriving at the site and prior to departure. Truck tires and sides will be decontaminated prior to leaving the site to remove all visible signs of contamination. Truck beds will be lined and covered during transit. A bill of lading will accompany each load in accordance with DOT requirements. Soils designated for off-site disposal will be sent to an approved facility or landfill. Foster Wheeler will submit copies of the bills of lading to the Navy.

Foster Wheeler will confirm that all contaminated soils have been removed by sampling the surface soils under the stockpile liners. Samples will be collected along the centerline and each edge of the stockpile area at an interval of approximately 50'. Samples will be sent for laboratory analysis for TPH. The analytical results will be submitted to the Navy for review and approval prior to the commencement of site restoration activities.

3.5 TASK 5 - SITE RESTORATION AND DEMOBILIZATON

Following removal of the stockpiled soils, Foster Wheeler will restore the site and demobilize. The stockpile area will be graded to match surrounding contours. Disturbed

areas will be seeded and covered. All equipment, materials, and wastes will be removed from the site.

4.0 SAMPLING AND ANALYSIS REQUIREMENTS

Foster Wheeler will use the data provided by the Navy from the previous investigation performed by OHM to characterize the soils for disposal. The analyses performed by OHM are summarized in Table 4-1. Foster Wheeler will only perform additional characterization sampling to determine the chemical and geophysical properties of the soils as presented in Table 4-2. Foster Wheeler will also perform sampling to provide control of the stabilization process and confirm that all contaminated soils have been removed, as shown in Table 4-2. Detailed sample collection and handling procedures and analytical protocols are contained in the Sampling and Analysis Plan, provided as a separate submittal.

5.0 HEALTH AND SAFETY REQUIREMENTS

The site-specific Health and Safety Plan (HASP) is provided as a separate submittal. As required, 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

6.1 PURPOSE

This section presents Foster Wheeler's approach to how the various materials generated from the site removal activities will be handled. Foster Wheeler will provide a detailed Waste Removal Plan as a separate submittal. The materials expected to be generated include contaminated and stabilized soils, personal protective equipment, and decontamination fluids.

6.2 WASTE HANDLING

6.2.1 Wastewater

Wastewater collected from personnel protection and heavy equipment decontamination will be collected, placed into DOT approved containers and tested for constituents of concern. The wastewater will be disposed off-site at a Navy and FWENC approved RCRA Subtitle C Wastewater Treatment Facility.

TABLE 4-1

CHEMICAL PARAMETERS ANALYZED FOR SOIL CHARACTERIZATION IN PREVIOUS INVESTIGATIONS

PARAMETER	UNITS	PARAMETER	UNITS
Conventional Data:		**TCLP Semi-Volatiles:**	
Flash Point	Degree C	2,4-Dinitrotoluene	mg/l
Reactive Cyanide	mg/kg	Hexachlorobenzene	mg/l
Reactive Sulfide	mg/kg	Hexachloroethane	mg/l
Paint Filter Test	Pass/Fail	Hexachlorobutadiene	mg/l
pH	Standard	2-Methylphenol	mg/l
Total Organic Carbon	mg/kg	4-Methylphenol	mg/l
Total PCB	mg/kg	Nitrobenzene	mg/l
		Pentachlorophenol	mg/l
RCRA TCLP:		Pyridine	mg/l
Arsenic	mg/l	2,4,5-Trichlorophenol	mg/l
Barium	mg/l	2,4,6-Trichlorophenol	mg/l
Cadmium	mg/l		
Chromium	mg/l	**8260 Volatiles:**	
Lead	mg/l	Total VOC's	mg/kg
Mercury	mg/l	Total HVOC's	mg/kg
Selenium	mg/l		
Silver	mg/l		
TCLP Volatiles:			
Benzene	mg/l		
Carbon Tetrachloride	mg/l		
Chlorobenzene	mg/l		
Chloroform	mg/l		
1,4-Dichlorobenzene	mg/l		
1,2-Dichloroethane	mg/l		
1,1-Dichloroethylene	mg/l		
Methyl Ethyl Ketone	mg/l		
Tetrachloroethylene	mg/l		
Trichloroethylene	mg/l		
Vinyl Chloride	mg/l		

TABLE 4-2

SUMMARY OF ADDITIONAL CHARACTERIZATION SAMPLING REQUIREMENTS

PARAMETER	RATIONALE	SOIL PILE No.					
		1	2	3	4	5	6
PCBs	Confirm levels from previous sampling	5					
TCL VOCs	No existing data provided						5
TCLP VOCs	Characterization for off-site disposal	1	1	1	1	1	5
TCLP Semi-volatiles	Characterization for off-site disposal	1	1	1	1	1	5
TCLP Inorganics	Characterization for off-site disposal	1	1	1	1	1	5
RCRA Characteristics	Characterization for off-site disposal	1	1	1	1	1	5
TPH	No existing data provided						5
Paint Filter Liquid Test	No existing data provided						5
Compaction	Characterization of suitability for use at McAllister Point LF	1	1	1	1	1	1
Liquid Limits	Characterization of suitability for use at McAllister Point LF	1	1	1	1	1	1
Plasticity	Characterization of suitability for use at McAllister Point LF	1	1	1	1	1	1
Treatability Study	Stabilization of lead and geophysical properties of stabilized soil for characterization of suitability for use at McAllister Point LF					3	

6.2.2 Contaminated and Stabilized Soils

TPH contaminated and stabilized lead contaminated soils will be loaded into dump trucks and transported to the McAllister Point Landfill for disposal. Since the lead contaminated soils have been chemically stabilized to meet the RCRA Land Disposal Restriction (LDR) Treatment Standards (40 CFR 268.40) for D008 soils, the soils are considered to be decharacterized and are no longer subject to regulation under RCRA Subtitle C and can be land disposed in a RCRA Subtitle D landfill such as McAllister Point Landfill. Hazardous waste manifesting is not required for decharacterized and TPH contaminated soil shipments. However, transport trucks will be weighed and a Bill of Lading will prepared for each truck in accordance with DOT requirements for shipment of hazardous materials. Although the stabilized soils are no longer regulated as RCRA waste they may still be subject to DOT hazardous material shipping requirements because each shipment may contain a total quantity of lead above the DOT Reportable Quantity of one pound for lead. FWENC will provide completed Bills of Lading to the Navy for review and signature prior to shipment.

6.2.3 Other Non-hazardous Wastes

Non-hazardous wastes and debris that are not disposed of in the McAllister Point Landfill will be directly loaded into containers for disposal at a Navy and FWENC approved Subtitle D solid waste landfill. Soils, cncrete, grubbings, PPE and other miscellaneous waste will be placed in appropriate approved containers. Container contents will be recorded and records maintained at the field office. Foster Wheeler will provide Bills of Lading to the Navy for review and signature prior to shipment.

6.2.4 Hazardous Wastes

RCRA regulated hazardous wastes, if present will be placed into appropriate DOT approved containers for disposal. Documentation of container contents will be maintained at the field office. Hazardous wastes other than D008 lead contaminated soil will be disposed off-site at a FWENC and Navy approved RCRA Subtitle C TSDF. Lead contaminated D008 soil will be stabilized on-site to meet RCRA LDR treatment standards (40 CFR 268.40), tested via TCLP to confirm stabilization and if acceptable will be disposed in the McAllister Point Landfill as non-hazardous waste. FWENC will prepare Waste Profiles, Hazardous Waste Manifests, LDR Notification Forms and other shipping documentation for Navy review and signature prior to off-site disposal. Copies of certified weight tickets , TSDF signed manifests and all disposal documentation documents will be forwarded to the Navy by the Foster Wheeler Project Manager .

If on-site storage of hazardous wastes is required, the proposed hazardous waste storage area will meet generator requirements for less than 90 day storage of hazardous waste as per 40 CFR 262.34 and RIDEM 12:030:003:

- All stored hazardous wastes will be removed from the project site for off-site disposal within 90 days of first being accumulated .

- Each container will be marked with the date on which the accumulation period begins.

- All hazardous waste storage areas will be marked with a sign stating "Hazardous Waste"

- For waste containers containing free liquids , the container storage areas will have a containment system capable of collecting and holding spills , leaks and precipitation. The containment system shall have an impervious base underlying the containers which is free of leaks, gaps or cracks. The capacity will be sufficient to contain the entire volume of the largest container or 10 % of the entire volume of all of the containers whichever is largest. Run on into the containment system will be prevented .Spilled or leaked waste and accumulated precipitation will be removed from the containment system in as timely a manner as necessary to prevent overflow of the containment system.

- For waste containers which do not contain free liquids, a secondary containment system will not be required or provided, however the storage area will be designed and operated to drain and remove liquid resulting from precipitation or the containers will be elevated and removed from contact with accumulated precipitation.

- Containers holding reactive or ignitable waste will be stored at least 50 feet (15 meters) from the property line.

- Each container of hazardous waste will be marked and labeled in accordance with US DOT requirements under 40 CFR 172.

- Hazardous Waste Containers will meet US DOT requirements under 40 CFR Parts 173, and 178.

- Each container of hazardous waste of 110 gallons or less will be marked in accordance with US DOT requirements under 49 CFR 173.204 with the following:

  HAZARDOUS WASTE - FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. If found contact the nearest police or public safety authority or the Environmental Protection Agency.

  Generator name and Address _____
  Manifest Document Number _____

- Waste will be placed in containers in good condition. If container begins to leak, the contents will be transferred from the defective container into a good container.

- The containers used will be made of or lined with a material that does not react with and is compatible with the waste.

- The containers shall remain closed during storage except when waste is added to or removed from the container.

- The containers will not be opened, stored, or handled in a manner which will cause the container to leak.

- The containers will be labeled to accurately identify their contents.

- The storage area and containers will be inspected at least weekly to identify leaks and/or deterioration. Inspection reports will be documented in writing.

- Incompatible wastes will not be placed within the same container or in an unwashed container that previously held an incompatible waste or material.

- A container holding a waste that is incompatible with other wastes or materials will be segregated from the other materials or protected by means of a an impermeable dike, wall, berm or other device.

- Upon project closure, all hazardous waste and hazardous waste residues will be removed from the containment system. The containment system will be decontaminated and all wastes will be disposed off-site at a permitted disposal facility.

- Appropriate hazardous training is provided to site personnel as per 40 CFR 265.16

- A Contingency Plan will be developed to handle any fire, spill, or emergency and appropriate emergency response equipment (spill cleanup materials, fire protection equipment, communication devices and alarms) to notify workers of an emergency are will be present as required under 40 CFR 265 Subparts C & D .

7.0 ENVIRONMENTAL PROTECTION AND REGULATORY COMPLIANCE

7.1 PURPOSE

This section discusses the measures to be taken to protect the environment and ensure compliance with all required laws and regulations during the execution of the delivery order scope of work.

7.2 PERMITS

Foster Wheeler is not required to obtain any permits under the scope of work. A RCRA Permit is not required for the on-site stabilization of lead contaminated soils as long as the

site activities are being conducted under the RIDEM Site Remediation Program and have been approved by RIDEM. A RCRA permits is not required for on-site hazardous waste storage because wastes will be stored for less than 90 days. Since all wastewaters generated will be disposed off-site at a permitted TSDF, there will be no discharges to POTW's or surface waters. The on-site soil mixers are not expected to generate any point source emissions of VOC's, NOx, SOx, CO or particulates therefore no air discharge permits are required. All fugitive dust emissions from material handling and construction activities will be controlled by Best Management Practices (BMW).

Soils removed from the site are anticipated to be classified as RCRA non-hazardous because the TPH contaminated soils have been classified as non-hazardous by TCLP analysis and the lead contaminated (D008) soils will be stabilized to meet the RCRA LDR's at which point the soils are considered to be decharacterized and will no longer regulated as a RCRA hazardous waste.

Any soils which can not be stabilized to meet the RCRA LDR's and any other RCRA hazardous wastes generated during on-site activities will be disposed off-site at a Navy approved permitted TSDF's.

7.3 US EPA /STATE WASTE IDENTIFICATION NUMBERS

US EPA Hazardous Waste Generator Identification Numbers must be obtained prior to any activities if the wastes being disposed contain EPA or Rhode Island State Hazardous Wastes. Identification numbers will be obtained from the Navy and verified prior to commencement of any activity. If the maunders have not already been obtained , FWENC will obtain and prepare the "Notification of Hazardous Waste Activity " and any other required forms and forward them to the Navy for review and signature prior to submittal to the appropriate agencies. Transporter and TSDF EPA ID numbers will also be obtained and verified.

7.4 WASTE MANAGEMENT

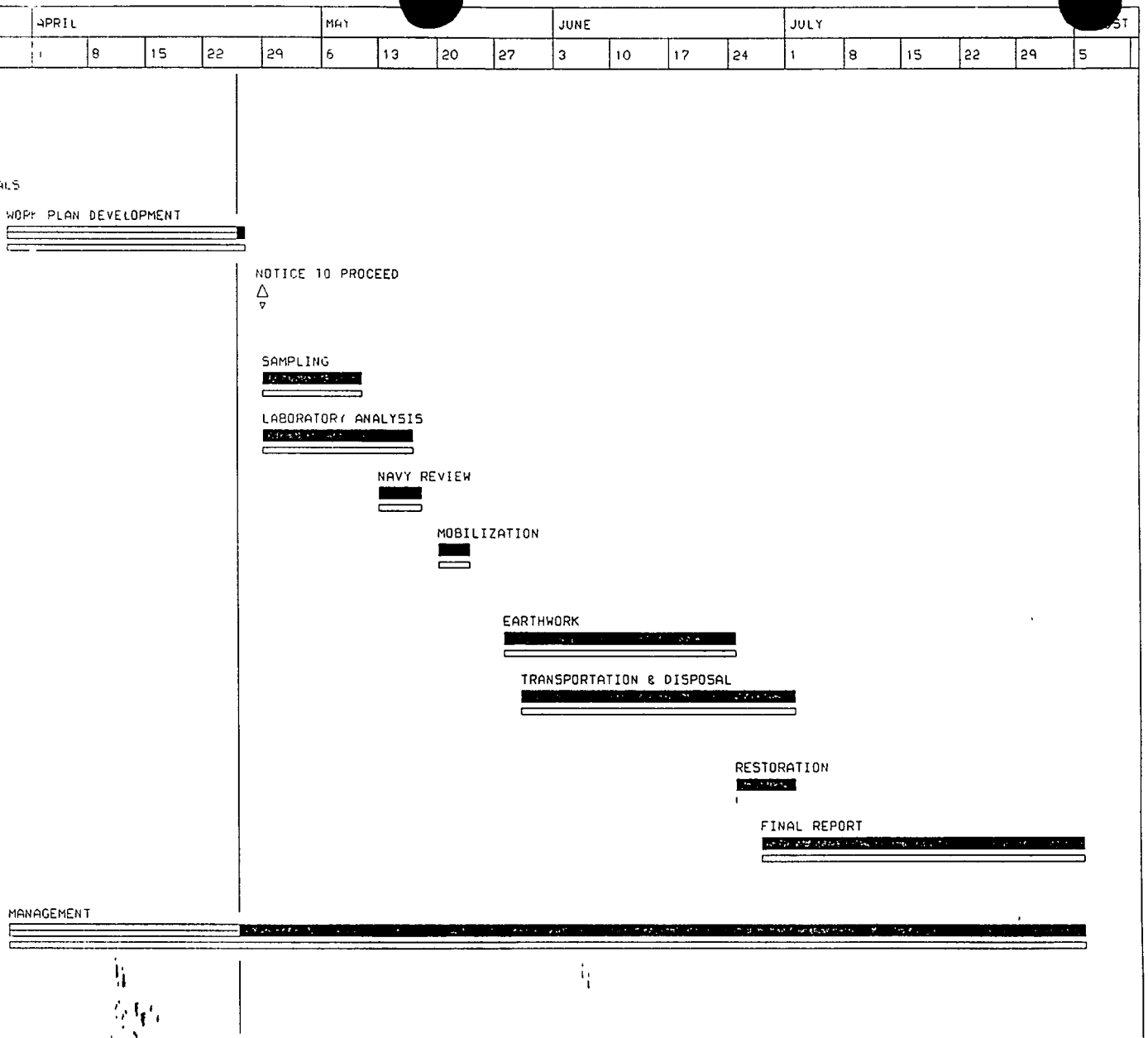
Permits will not be required for on-site storage or treatment of RCRA hazardous wastes as long as all wastes are stored on-site for less than 90 days and RIDEM has approved the lead soil stabilization activities under RIDEM's Site Remediation Program. All on-site hazardous waste storage and treatment will be conducted in accordance with RCRA generator requirements as discussed in Section 6.0 Waste Management.

8.0 PROJECT MANAGEMENT

8.1 PROJECT SCHEDULE

The Project Schedule is provided as Figure 8-1. Foster Wheeler will adjust the schedule as necessary to meet the requirements for closure of the McAllister Point Landfill.

EARLY START	EARLY FINISH	
		CONTRACT AWARD
07MAR96A	06MAR96A	CONTRACT AWARD
		PRECONSTRUCTION SUBMITTALS
24MAR96A	26APR96	WORK PLAN DEVELOPMENT
29APR96	26APR96	NOTICE TO PROCEED
		MOBILIZATION
29APR96	10MAY96	SAMPLING
29APR96	15MAY96	LABORATORY ANALYSIS
13MAY96	17MAY96	NAVY REVIEW
20MAY96	23MAY96	MOBILIZATION
		REMOVAL ACTION
28MAY96	24JUN96	EARTHWORK
30MAY96	01JUL96	TRANSPORTATION & DISPOSAL
		DEMOBILIZATION
25JUN96	01JUL96	RESTORATION
28JUN96	05AUG96	FINAL REPORT
		MISC & MANAGEMENT
29MAR96A	05AUG96	MANAGEMENT



DESC

MILESTONE

CRITICAL

PROGRESS

PLANNED

FOSTER WHEELER ENVIRIONMENTAL CORPORATION

PROGRAM MANAGER A HOLCOMB

DOM H LAZARUS

FIGURE B-1

RUN DATE	26APR96
START DATE	04MAR96
DATA DATE	26APR96
FINISH DATE	05AUG96

SURETRAK

NETC MELVILLE, RI

D 0 0011 MOD 2

REMOVAL ACTION

BASELINE VS CURRENT

SOILS REMOVAL MELVILLE NETC,RI

8.2 PROJECT STAFFING PLAN

The project staffing requirements are depicted in Figure 8-2.

The Project Manager is responsible for overall execution of the delivery order. He reports directly to the NORDIV RAC Program Manager and is the Navy's principal point of contact. The Project Manager is responsible for the preparation of all project submittals, making coordination with all host facility personnel, ensuring compliance with project technical specifications, and enforcing budget and schedule compliance.

Task 1 (Soil Sampling) will be supervised by the Field Operations Lead (FOL). The FOL reports directly to the Project Manager and is responsible for collecting the chemical and geotechnical samples and coordinating laboratory analyses. The FOL will be assisted by a field chemist who is cross-trained as a Health and Safety Officer.

Tasks 2 (Mobilization), 3 (Soil Stabilization), 4 (Transport and Disposal), and 5 (Site Restoration and Demobilization) will be supervised by the Project Superintendent. The Superintendent reports directly to the Project Manager and is responsible for ensuring that all site work is performed in accordance with the project technical, regulatory, and health and safety requirements. The Superintendent will be supported by a Health and Safety Officer and Field Technician and will oversee the craft labor employed on site.

8.3 MEETINGS

There are no scheduled meetings or reviews within the scope of work. However, Foster Wheeler will attend project meetings as requested by the Navy.

9.0 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.

9.1 ORGANIZATION AND RESPONSIBILITIES

QA/QC duties are the responsibility of the Project Manager, assisted by the on-site Contractor Quality Control System Manager (CQCSM). He will employ physical inspections, direct measurements, 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. Due to the limited scope and duration of this project, the Project Superintendent will also serve as the CQCSM.

FIGURE 8-2

STAFFING PLAN

	TASK				
PERSONNEL	**1**	**2**	**3**	**4**	**5**
Project Manager	1	1	1	1	1
Field Operations Lead	1				
Field Chemist/HSO	1				
Site Superintendent		1	1	1	1
Site Health & Safety Officer		1	1	1	1
CRAFT LABOR					
Laborers		2	2	2	2
Equipment Operators		3	3	3	3
Teamsters		1	1	1	1
SUBCONTRACTS					
Analytical Laboratory	X		X	X	
Geotechnical Laboratory	X				
Treatability Study	X				
Transportation/Disposal		X	X	X	
Hydroseed					X
MAJOR EQUIPMENT					
Pickup Truck		1	1	1	1
Water Truck		1	1	1	1
Excavator		1	1	1	
Bucket Loader		1	1	1	
Pugmill*		1	1	1	

*Two 8 cy mobile concrete mixers may be substituted for the pugmill.

Foster Wheeler 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 laboratory analyses, geotechnical testing, treatability study, and transport of contaminated soils.

9.2 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 Design Manager, Resident Office in Charge of Construction, and others as required. Meetings may be conducted at NETC Melville, NORDIV, or by teleconference. The purpose of each 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 a plan to resolve the problem or deficiency

9.3 SUBMITTALS

The Project Manager is responsible for maintaining the submittal register and reviewing and certifying that submittals are in compliance with the contract requirements. An independent review will be performed by the Program QC Manager. Submittals will be approved by the QC Manager before release to NORDIV. All submittals will be accompanied by a transmittal form which will identify the submittal and provide a unique tracking number. The project Submittal Register is provided as Table 9-1.

9.4 TESTS AND INSPECTIONS

9.4.1 Production Testing

Foster Wheeler will collect a sample for TCLP-lead analysis from the initial production of stabilized soil produced, and every 10% (on a flow rate basis if a pugmill is used or every 10th batch if mobile mixers are used). The tests will be performed by an off-site laboratory under an expedited turnaround.

9.4.2 Preparatory Inspections

A preparatory inspection will be performed at each major definable stage of the remediation project. These will typically include the following:

- Review of the work plans and Standard Operating Procedures

- Examination of the work area in question to assure that all preliminary work necessary for the next phase of remediation to occur has been completed

TABLE 9-1

SUBMITTAL REGISTER

TASK	DESCRIPTION	INFO	REVIEW	APPROVAL
SCOPING	Work Plan		X	X
	Health and Safety Plan		X	X
1	Sampling and Analysis Plan		X	X
	Sampling Results Summary		X	
2	Detailed Site Plan		X	
	Contingency Plan		X	
	Photographs of Existing Site Conditions	X		
3	Site Environmental Protection Plan		X	X
	TCLP-Lead Analytical Results for Stabilized Soils		X	
	Bills of Lading for Transported Soils	X		
	Progress Photographs	X		
4	Bills of Lading for Transported Soils	X		
	Certificates of Disposal	X		
	Confirmatory Sampling Results		X	X
	Completion Photographs	X		
	Closure Report		X	X

- Verification of all field measurements
- Physical examination of material and equipment to verify their presence and sufficient quantity, as well as conformance to submittals and work plans
- Verification of proper bill of lading and acceptance of material disposal

The Project manager will be advised of inspection results. Deficient work activities may required a more rigorous schedule of reinspection or stop work until problems or deficiencies have been resolved. Deficiencies and the results of follow-up inspections will be documented on the appropriate inspection sheet.

9.4.3 Confirmatory Sampling

Foster Wheeler will conduct confirmatory sampling for total petroleum hydrocarbons (TPH) upon removal of the contaminated soils. The analytical results will be forwarded to the Navy for review and approval prior to final seeding of the area.

9.4.4 Completion Inspections

The Project Superintendent and SHSO will jointly conduct a completion inspection at any increment of work established in the work plans and Standard Operating Procedures, as well as at the completion of all work. Any punchlist items will be reviewed to assure that all items have been completed and corrected. The Navy may elect to accompany the inspection team or perform supplemental QA inspections. Any nonconformance noted will processed by the Project Superintendent and resolved in a timely manner and identified in a final punchlist, as needed. Final inspection items may include material conformance, final grading and seeding, and receipt of bills of lading and/or weight tickets.

9.5 CHANGES

If circumstances develop during the project that make it necessary or advisable to revise the Work Plan or Sampling and Analysis Plan in order to accomplish project goals, 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 an FCR. Changes may be discussed with the Navy Design Manager telephonically and followed up with an FCR to avoid negative impacts on the project budget.

9.6 DOCUMENTATION

Documentation of operations recordkeeping, photographic evidence of work performed, and as-built drawings will be provided to the Navy as part of project closeout.

9.6.1 Operations Recordkeeping

All inspection and testing activities will be documented with appropriate forms. These will address each work activity inspected by the Project Superintendent according to established acceptance criteria. The Project Superintendent will maintain current records of quality control operations and activities and tests performed, including the work of subcontractors and suppliers. These records will include factual evidence of the required quality control activities performed, including:

- Work performed daily, giving location, description, and staff
- Results of tests and QC activities with references to specifications/plan requirements. The control phases involved for each definable work feature (i.e. preparatory, completion) will be identified. Any deficiencies and corrective actions will be noted
- Materials received, with statement of its acceptability and storage
- Submittals, reviewed with contract reference, including staff and action taken
- Results, instructions, and/or corrective actions taken as a result of specific job safety evaluations
- Any instructions given or received, conflicts in plans or specifications and status of resolving these issues
- Subcontractors' verification statements and certifications
- Completed Field Change Requests
- QC Daily Log
- Photographic Log

Operations records will include a description of trades working on the project, the number of personnel working, weather conditions, and any delays. These records will also include both conforming and deficient features of work.

9.6.2 Photographic Documentation

Still 35mm color photographs will be taken as needed to record work progress conditions. Premobilization photos will be taken to record any on-site and off-site features that may be susceptible to damage from project activities. Progress photos will be taken at the same locations, if possible, to record the same perspective throughout the project.

Progress photos will be taken to document milestone events, unique operations, or non-conforming situations.

The photo log will include the date the photo was taken, initials of photographer, and a description of the view shown in the photo.

U.S. NAVY NORTHERN DIVISION
REMEDIAL ACTION CONTRACT
CONTRACT NO. N62472-94-D-0398
DELIVERY ORDER NO. 0011

WORK PLAN

TANK 50
TANK FARM NO. 5 REMEDIAL ACTIONS
NAVAL EDUCATION AND TRAINING CENTER (NETC)
NEWPORT, RHODE ISLAND

July 1996

Prepared by

Foster Wheeler Environmental Corporation
470 Atlantic Avenue
Boston, MA 02210

Revision	Date	Prepared By	Approved By	Pages Affected
1	7/3/96	R. Donati, P.E.	D. McCarron, P.E.	All

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FOSTER WHEELER ENVIRONMENTAL CORPORATION

July 3, 1996
1284-0011-96-0395
No Response Required

Mr. Paul Briegel
Contracting Officer's Technical Representative
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, PA 19113

Subject: REMEDIAL ACTION CONTRACT (RAC) N62472-94-D-0398
DELIVERY ORDER NO. 11, MODIFICATION NO. 4
NETC - NEWPORT TANK 50 REMEDIAL ACTION

Enclosure: RAC WORK PLAN RESPONSES TO COMMENTS

Dear Mr. Briegel:

Enclosed please find responses prepared by Foster Wheeler Environmental Corporation to the comments attached to your memorandum dated June 13, 1996. Based on the comments, revisions were made to several pages of the Work Plan and are attached to replace the former pages. In addition, Appendix E (attached) is added to the Work Plan to provide information relative to the pilot test equipment.

If you have any questions or comments concerning this submission, please contact me at (617) 457-8244.

Sincerely,

David McCarron, P.E.
Delivery Order Manager

cc: A. Holcomb
A Aziz
File: 2.1; Langhorne (P. Dowling)

NC96-008

470 ATLANTIC AVENUE, BOSTON, MA 02210
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FOSTER WHEELER ENVIRONMENTAL CORPORATION
NAVAL EDUCATION AND TRAINING CENTER (NETC)
TANK 50
NEWPORT, RHODE ISLAND

DRAFT ANNOTATED RESPONSES TO NORTHDIV REVIEW COMMENTS

Reviewer: P. Briegel, NORTHDIV June 13, 1996

The following are responses to NORTHDIV review comments on the Draft Work Plan for the Tank 50 Bioremediation Study, dated June 13, 1996. The NORTHDIV comments are provided in italic type followed by Foster Wheeler Environmental's responses in bold type.

Comment 2: *The field test does not include injection of nutrients. Considering the contaminant, depth of contamination and tightness of the soil, I consider this a critical evaluation which should occur in-situ. Please provide the rationale for not conducting this testing. I would consider this more representative than simply conducting bench scale testing. Also, if bench scale testing utilizes unlimited supplies of oxygen and nutrients, how does the contractor intend to correlate these results to a field application?*

Response: **Field-scale application of bioventing has shown that, in most cases, adequate biodegradation rates can be achieved by aeration alone with natural infusion of moisture and nutrients sufficient to sustain biological activity (Air Force Center For Environmental Excellence (AFCEE), "Test Plan and Technical Protocol for a Field Treatability Test for Bioventing." May 1992). The additional data gathered on nutrient enhancement in the bench-scale study will be sufficient to assess the practical advantage, if any, of adding nutrients during full-scale application in the field. Further, the short duration of the field test (13 weeks) and subsurface heterogeneity make field assessment of nutrient addition impractical during the pilot study. In the field, enhancement by nutrient addition can only be demonstrated either by running two pilot tests in parallel (one with and one without nutrient addition) or by running a two-phase test with oxygen-only addition in the first phase followed by oxygen and nutrient addition in the second phase. The first alternative requires fairly uniform site conditions to select two similar pilot test cells, which is not practical on this site. The second alternative requires a pilot test of sufficient duration to achieve quantifiable results from both phases of testing. Both alternatives are expensive and are not likely to generate data which will conclude that the addition of nutrients are required during full-scale implementation. The laboratory testing alone will be sufficient to determine if addition of nutrients will significantly enhance remediation. If laboratory testing shows that a significant increase in biodegredation rates can be achieved by either moisture or nutrient addition, then these enhancements will be recommended for full-scale implementation.**

The bench-scale testing protocol includes microcosms constructed under four conditions simulating the natural unenhanced condition and three possible combinations of oxygen and/or nutrient addition to stimulate remediation (Work Plan Appendix B, Bench Scale Biodegradation Study). These conditions are:

- **Non-enhanced - no amendment with oxygen or inorganic nutrients (equivalent to natural unenhanced conditions);**
- **Oxygen-enhanced - amended with oxygen only (equivalent to bioventing only);**
- **Nutrient-enhanced - amended with inorganic nutrients only (equivalent to nutrient addition only under natural oxygen limited conditions); and**
- **Oxygen/nutrient enhanced - amended with oxygen and inorganic nutrients (equivalent to bioventing with nutrient addition).**

During this laboratory testing, oxygen and/or nutrients (when supplied) are supplied essentially in unlimited amounts in order to estimate the biodegradation potential under optimum conditions for each of the amendments. Comparison of the results between microcosm conditions will provide a relative measure of the impact on biodegradation rate and extent which can be achieved by each addition: oxygen; nutrients; or oxygen/nutrients. These results can then be combined with the results of the oxygen-only field biovent pilot test to estimate the amount of enhancement which can be achieved in the field by the addition of inorganic nutrients during bioventing.

Comment 3: *Utilization of 3 people during system startup is not cost effective.*

Also, please justify 3 new wells when 5 existing wells are located in the vicinity of the area to be evaluated.

The data to be accumulated to assess system performance during bioventing and sparging field tests appears more extensive than required to support the final configuration, especially if the only goal of the field testing is determination of radius of influence and respirometry testing. The proposed testing could be accomplished in the first week and the system left operational for the remaining performance period which follow-up testing every 2 to 3 weeks after startup.

Response: **A minimum of two people are needed to complete the tasks as outlined in the Work Plan for the start-up portion of the pilot test. A third person will be necessary to serve as the Health and Safety Officer (OSHA cross-trained person). This person will also provide support as needed during the week to become familiar with performing the pilot test tasks as this person will likely be responsible for operating the pilot test system and performing all specified tasks during the following 12 weeks of pilot test operation.**

The three new wells are required because none of the existing wells were suitable for data collection (this was not known until the appropriate information on the well construction was obtained and reviewed). Specifically, one well is needed to act as the biovent extraction well (no existing wells have sufficient screen above the water table to perform this function). The other two wells are needed to generate air flow data (vent and sparge air) in the unsaturated soils (no existing wells have sufficient well screen above the water table). These wells will be screened below the water table as well as to ensure sufficient data is collected from the biosparge testing.

The goals of the field testing are to determine the design parameters for a full-scale system (radius of influence, etc.) and to determine the feasibility of biosparging/

bioventing at the site. While the majority of the information required for design will be acquired within the first week of system operation, data collection to assess feasibility will occur throughout the first pilot test. The evaluation of feasibility involves collecting data on the rate and extent of biodegredation and the changes in these parameters over time. The system performance monitoring plan includes collecting four types of information: in situ respirometry testing, biovent effluent monitoring for oxygen, carbon dioxide and VOCs, well head monitoring for oxygen and carbon dioxide, and soil and groundwater sample analyses. In situ respirometry testing will be conducted at the start and completion of the pilot test and provide data on the rate of degradation at discrete locations throughout the test area initially and after 13 weeks of stimulation by aeration. Biovent effluent monitoring provides data on the overall performance of the system in terms of the average degradation rate and changes of this rate over time. This monitoring also allows estimation of the mass of hydrocarbons removed by volatilization as opposed to biodegradation. The largest changes are expected to be measured during the first four weeks of operation with smaller but still significant changes over the remainder of the test. The well head data provides on-going information on respiration at discrete location and, similarly to the biovent effluent data, the largest changes are expected during the first month of operation with smaller but still significant changes over the remainder of the test. The frequency of monitoring for these parameters will decrease after initial test operation, but must be maintained in order to assess changes in rates over time. These changes are expected to vary non-linearly over time and are likely to be different at different locations within the test zone due to subsurface heterogeneity and variations in contaminant loading.

Comment 4: *The pilot area to be observed is about 15 to 20 feet below grade, which is the location of the most heavily contaminated soils. No. 6 fuel oil resides from this depth to about 30 feet below grade. How does the contractor intend to use the information derived from the testing at 20 feet to confirm treatability and system performance requirements for the deeper contamination (i.e., will the results be representative of that expected through the site?)?*

Helium is injected on day 3 of the pilot test and measured in monitoring wells and at the system discharge point for the remainder of that day. To adequately conduct a respirometry study and determine air transport capacity, the helium tracer should be measured for 4 to 5 days after injection.

Response: **Based on soil conditions and the vertical extent of the contamination surrounding Tank 50, and our experience at similar sites, the air flow and respirometry information generated during the pilot test will be considered representative of the entire area of remediation.**

The helium injection into the sparge well is planned to be injected at one time (15-20 minutes in duration) simulating a slug of helium. This helium will then be transported through the soil matrix simulating the air (oxygen) flow. The monitoring duration will depend on the rate of air sparge flow and the distance to the surrounding monitoring wells. Our experience shows that helium will be measurable in surrounding wells for 0 to 4 hours after injection. However, helium monitoring will

continue as long as measurable concentrations of helium are present in the monitoring wells.

Comment 5: *Provide well construction details, manufacturer's sheets for equipment, details for the electrical trench, pole mounted materials and a system electrical schematic. Sparging/venting equipment capacities and the basis for equipment sizing should be included in the manufacturer's literature. The electrical data should be approved by NETC Public Works office prior to procurement of any materials and (if feasible) prior to finalizing the Work Plan..*

Response: **The details listed above will be provided as Appendix E to the Final Work Plan. The electrical system has been reviewed and coordinated by the NETC Public Works office.**

Comment 6: *In Sections 4.0, 5.0 and 6.0, the Work Plan refers to the Tank Farm No. 4 planning documents for analytical, waste handling and QC requirements. The planning documents on Tank Farm No. 4 were incrementally prepared making the information difficult to review. We should not expect others to refer to Tank Farm No. 4 documents for work descriptions or requirements. In my opinion, deleting the reference would be sufficient for this minor pilot test and would eliminate the potential for confusion by other reviewers.*

Response: **The reference in Section 4.0 has been deleted. References in Section 5.0 to Tank Farm No. 4 refer to transport of wastes only and do not reference Tank Farm No. 4 planning documents. The references in Section 6.0 have been deleted. Applicable QC requirements are provided in Appendix D.**

Comment 7: *Section 9.0 alludes to CRMC requirements and advises that the Navy will perform a CRMC program evaluation. What is the nature of the evaluation and who in the Navy agreed to conduct the evaluation?*

Response: **A conversation was held with Mr. Ron Blanchard (NETC - Newport) to discuss the SOW for planned activities. Regarding CRMC consistency determinations, Mr. Blanchard stated that our activities would be covered under the Base's general program for maintenance related to utilities. No further action was deemed necessary for Foster Wheeler Environmental or the Navy related to the CRMC.**

Comment 8: *The submittal register should have NORTHDIV as approving activity (since this is a pilot vice (versus) permanent installation) for all items except the electrical system requirements.*

Response: **The submittal register has been revised.**

Comment 9: *The inspection reports, daily report, QC report and field change request are not required for this pilot, but can be submitted if they assist in keeping activity personnel informed.*

Response: **The QC forms will be utilized to assist in tracking work.**

1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (Foster Wheeler Environmental) has prepared this Work Plan in conjunction with our subcontractor Flour Daniel GTI, Inc. (Fluor Daniel GTI) as part of remedial activities at Tank 50 (the Site) in Tank Farm No. 5 at the Naval Education and Training Center (NETC) in Newport, Rhode Island. The Work Plan was completed under Delivery Order No. 0011, Modification 4 of the Northern Division of the Naval Facilities Engineering Command Remedial Action Contract No. N62472-94-D-0398.

The purpose of this Work Plan is to provide the strategy, work requirements and summary of activities for completing bioremediation bench scale and pilot scale testing. The primary work objectives are as follows:

- Conduct a pilot scale bioremediation test at the site for 13 weeks in parallel with a bench scale biodegradation study;
- Conduct pre-pilot study soil sampling with analysis for total petroleum hydrocarbons (TPH);
- Calculate the consumption rate of petroleum hydrocarbon at the Site;
- Determine the feasibility of biosparging/bioventing at the Site; and
- Determine the operational parameters of a biosparging/bioventing system and present a basis of design for a full scale system.

2.0 SITE DESCRIPTION

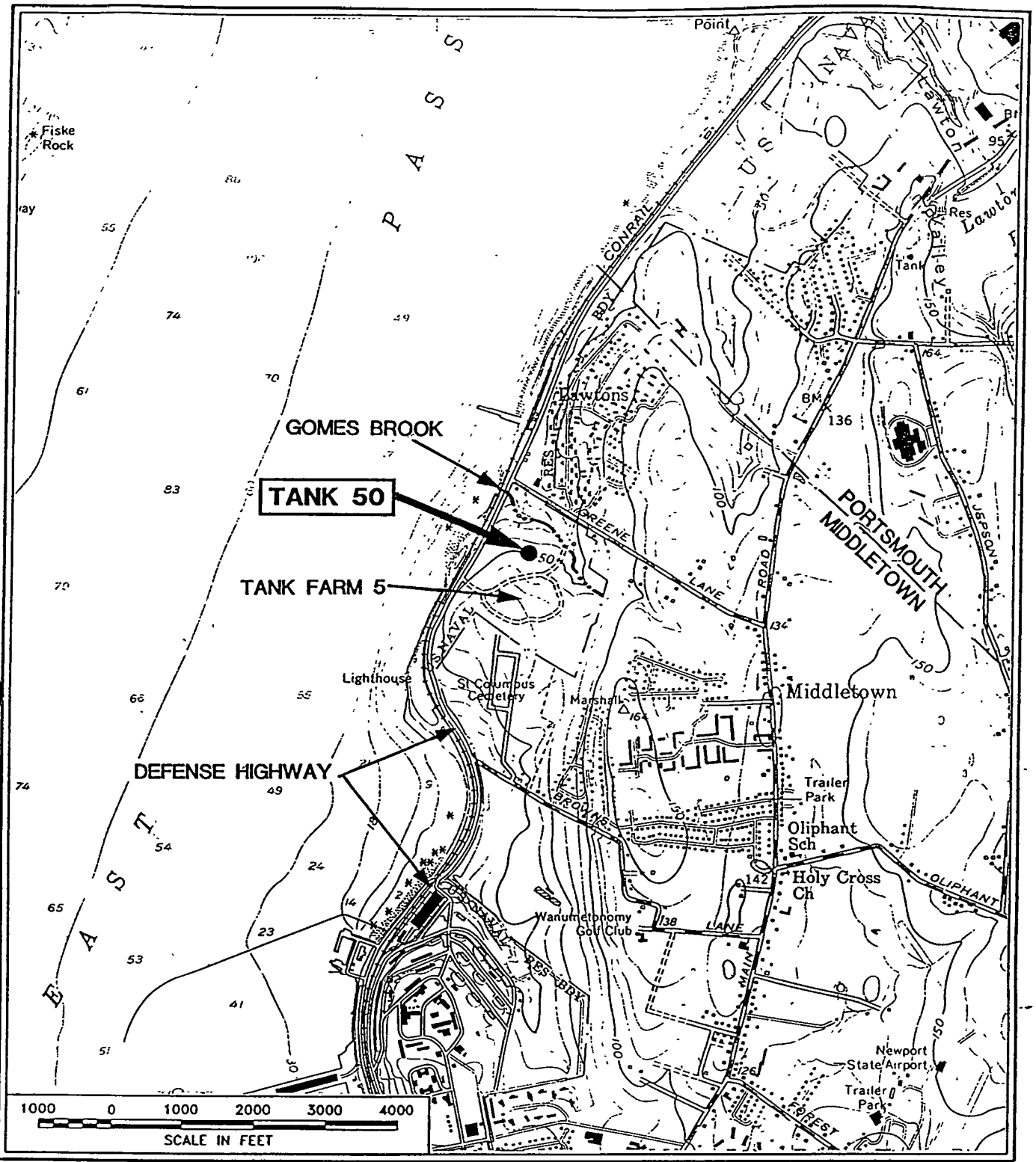
2.1 Site Location

NETC-Newport is located in the Towns of Newport, Middletown, and Portsmouth, Rhode Island, approximately 25 miles southeast of Providence. Tank Farm No. 5 is situated in the north-central portion of NETC-Newport in Middletown, RI. Tank 50 is the northernmost tank in Tank Farm No. 5 (Figure 2-1). Tank Farm No. 5 is bordered by the Defense Highway to the north/northwest; a cemetery to the southwest; woodlands and residential property to the southeast; and Greene's Lane to the north/northeast. Gomes Brook transects the northern portion of the tank farm. The brook flows westerly, to Narragansett Bay, and provides surface drainage for the northern portion of the facility.

Tank Farm No. 5 occupies approximately 85 acres and contains 11 former USTs, numbered from 49 through 59. A paved road leads into the farm, passing between the tanks in a loop. With the exception of Tank 53, there is no secured perimeter fence at the tank farm.. Tank 50 was used to store virgin heavy fuel oil but is not currently in use. Structures located at Tank 50 include the tank itself and the former pump house

2.2 Environmental Conditions Report

A site visit was conducted on May 22, 1996 by Foster Wheeler Environmental personnel. Photographs were taken as part of the site visit in order to document the existing conditions and are included in Appendix A



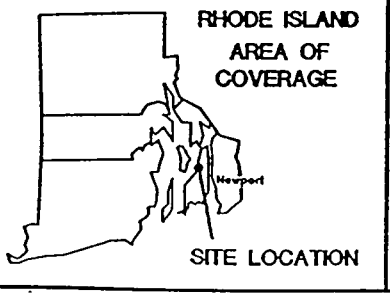


FIGURE 2-1

NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

BIOREMEDIATION PILOT TESTING - TANK 50 SITE LOCATION MAP

SCALE AS SHOWN

Source: USGS 7.5 min Quadrangle, Prudence Island, RI, 1955, photorevised 1970 and 1975.

3.0 SCOPE OF WORK

The Scope of Work for this delivery order includes the following activities:

- Site Mobilization and Equipment Setup;
- Bench Scale Biodegradation Study;
- Pilot Scale Operation;
- Demobilization/Site Restoration; and
- Post Pilot Test Report.

3.1 Mobilization

The mobilization effort for this task will take approximately three weeks and include the following:

- Collection of soil and groundwater for the bench scale biodegradation study;
- Installation of one (1) biovent well and two (2) monitoring wells;
- Collection of 18 pre-pilot scale study soil samples;
- Installation of utilities (electric); and
- Construction of the pilot scale system components.

The office facilities at the water treatment facility will be used to support the personnel for this work. Tank 50 will have a temporary decontamination area for personnel and equipment decontamination.

Soil Borings and Sample Collection

Soil borings will be completed at the Site to collect pre-pilot test soil samples and to enable the installation of one (1) biovent and two (2) monitoring wells. The boring locations are shown in Figure 3-1. Section 4.0 discusses the procedures for sampling and analysis.

The boring area and the Breathing Zone (BZ) of the workers will be screened for volatile organic compounds (VOCs), monitored for visual evidence of contamination. Soils excavated as a result of boring activities will be screened for VOCs and monitored for visual evidence of contamination and managed per Section 5.0, Waste Management Plan.

A drilling subcontractor to Foster Wheeler Environmental will be used to assist in the work. The crew for this work will consist of a two man drilling crew and one Foster Wheeler Environmental geologist.

Electricity

An underground line will be installed to supply power from the existing line power (Figure 3-1) to the blowers and other power equipment. A 45 KVA transformer will be installed on an existing concrete pad to reduce voltage necessary for site equipment (Figure 3-1) (Appendix E). A meter will be added to track usage.

A 2 foot deep trench will be excavated to connect the pad transformer to the proposed location of the site equipment at Tank 50. Soils excavated as a result of trenching will be screened for VOCs and monitored for visual evidence of contamination per Section 5.0, Waste Management Plan.

An electrical subcontractor to Foster Wheeler Environmental will install the electric service. It is expected that the crew for this work will consist of an excavator operator, two laborers, a licensed electrician and a Foster Wheeler Environmental engineer.

Equipment Setup

Equipment used during the pilot test will be specified as weather resistant, and suitable for use on a temporary (leased or rented) pilot scale operation basis. Equipment pads or enclosures will not be included.

Major equipment to be used include an air compressor and blower. Each of these will be skid mounted with the necessary fittings and valves (Appendix C). Other equipment to be used during monitoring include a flame ionization detector (FID), multi-gas meters and other hand held meters.

The crew for this work will consist of an electrician, a Foster Wheeler Environmental engineer and a technician.

3.2 Bench Scale Biodegradation Study

The Remediation Technology Testing Facility (RTTF) of Fluor Daniel GTI will perform the biodegradation study on TPH contaminated soil and groundwater which will be collected during mobilization activities.
Appendix B contains a summary of the work to be performed as part of this activity.

3.3 Bioremediation Pilot Study

The Bioremediation Pilot Study will be conducted at the Site and follow the procedures described in Appendix C. This section provides a summary of the activities described in Appendix C.

Pilot Test Startup

- Duration: 1 week
- Personnel: 1 Site Supervisor, 2 Testing Engineers
- Pre-Test Monitoring: Groundwater parameters (depth, DO, pH etc.); Vadose zone parameters (VOC, CO_2, vacuum etc.)
- Biovent Well: Establish air extraction rates
- Biosparge Well: Establish air injection rates

Pilot Test Operation

- Duration: 13 weeks
- Personnel: 1 Testing Engineer or Tank Farm 5 Treatment Plant Operator - twice per week
- Operation Monitoring: Groundwater parameters (depth, DO, pH etc.); Vadose zone parameters (VOC, CO_2, vacuum etc.)
- Biovent Well: Air extraction at rate determined during startup.
- Biosparge Well: Air injection at rate determined during startup.

Post Pilot Test Operation

- Duration: 10 weeks
- Personnel: 1 Water Treatment Plant Operator
- Monitoring: None
- Biovent Well: Air extraction at rate determined during operation

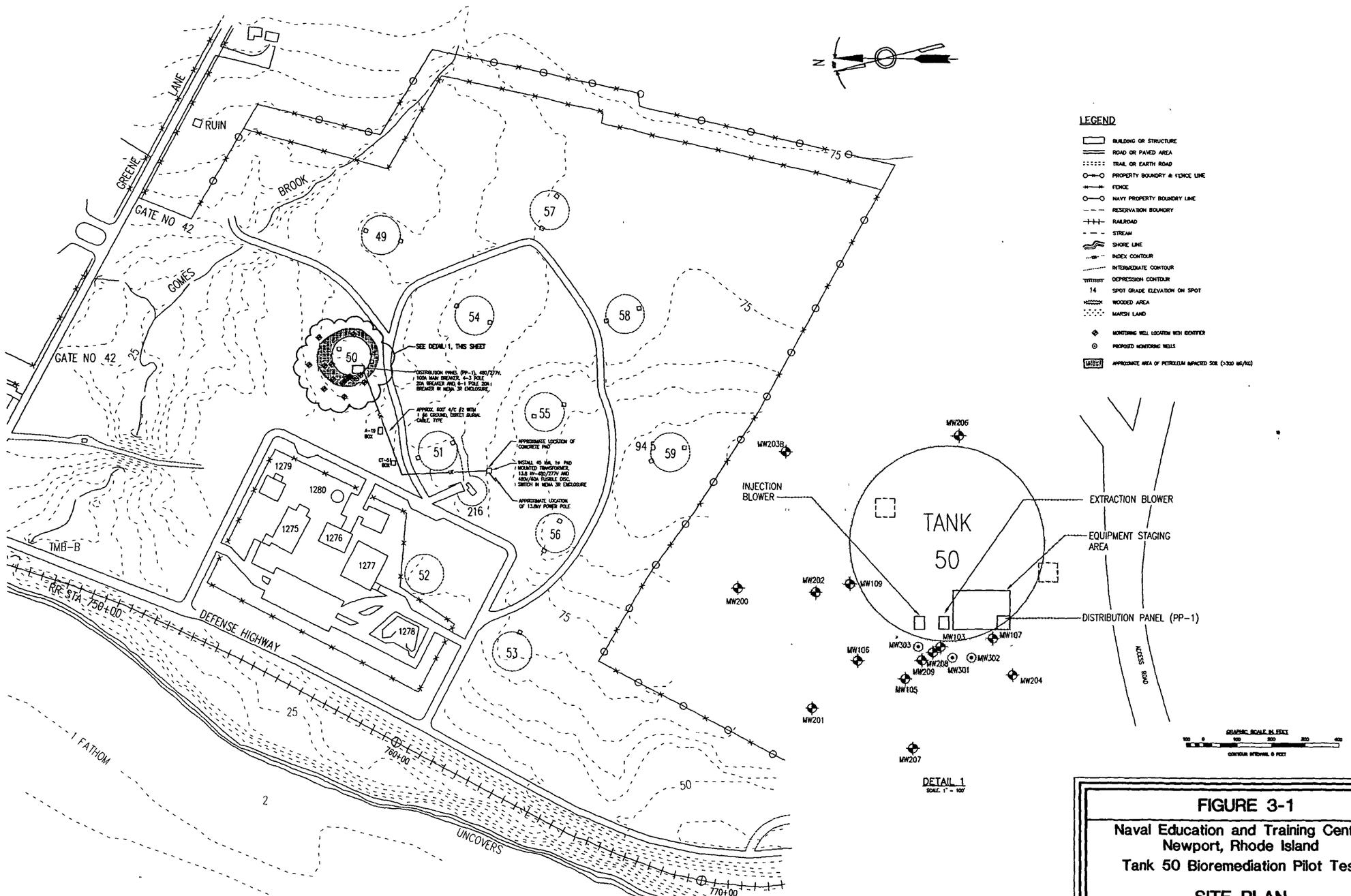


FIGURE 3-1

Naval Education and Training Center
Newport, Rhode Island
Tank 50 Bioremediation Pilot Test

SITE PLAN

SCALE: AS SHOWN	PROJ. NO. 1284.0011.0103

FIG3-1WP.DWG
7/2/95

- Biosparge Well: Air injection at rate determined during operation

3.4 Demobilization

Following the completion of pilot test activities, all equipment will be decontaminated on-site in the decontamination zone. All the power connections will be disconnected if necessary. Areas of the Site which have been disturbed will be graded, covered with topsoil and revegetated.

3.5 Post Pilot Test Report

The following are anticipated to be included in the Post Pilot Study Report

- Discussion of Bench Scale Biodegradation Study results with associated analytical results;
- Discussion of Pilot Scale Study results with associated analytical results and projected hydrocarbon degradation rates;
- Description of construction activities completed and red lined markups of permanent construction features;
- Site hydrologic conditions based on observations and monitoring well gauging data;
- Basis of Design for a full scale system which will include a site plan, P & ID drawing, a general arrangement drawing, and performance descriptions of biosparging/bioventing components and utility requirements; and
- Estimated duration of remediation based on contaminant distribution presented in previous site investigation reports.

It is assumed that there will be one meeting with the Navy to discuss the Post Pilot Study report and one revision of the report based on comments received from the Navy.

4.0 SAMPLING AND ANALYSIS PLAN

This section briefly discusses sampling and analysis activities that will be performed in support of remedial activities at Tank 50. Sampling and analysis activities are anticipated to include pre-pilot study TPH analysis, bioremediation treatability study sampling and analysis, and excavated soil segregation analysis. The sampling and analysis are detailed below:

- Eighteen pre-pilot study samples will be collected for TPH analysis by EPA Method 8015M utilizing split spoon samplers during well installation activities (Figure 3-1). Continuous sampling will be completed from the observed top of contamination and extend to the bottom of the boring. Specific depths will be determined in the field based on field observations. The samples will be collected from areas anticipated to contain TPH contamination based on previous site investigation data. A state of Rhode Island and EPA certified laboratory will be procured to complete these analyses.

- Bench Scale Biodegradation Study soil and water samples will be collected and analyzed by RTTF. Using the previously identified sampling procedure, 10 kilograms of soil will be collected during pre-pilot study sampling and well installation. Approximately 25 liters of groundwater will be collected from selected existing wells using disposable bailers. The soil and water will be composited, prepared and analyzed as outlined in Appendix B.

- Excavated soil will be segregated according to FID readings as identified in Section 5.0. Analysis will be performed in accordance with procedures outlined in the Tank Farm 4 Sampling and Analysis Plan.

5.0 WASTE MANAGEMENT PLAN

This section briefly discusses material and waste handling practices to be employed at the site during pilot test operations. There will be segregated waste streams for PPE, decontamination fluids, investigation derived waste (IDW) (liquids and cuttings) and potentially petroleum contaminated soils. It is assumed that all wastes will be RCRA non-hazardous.

- Foster Wheeler Environmental will transport the waste to Tank Farm No. 4 to be managed along with Delivery Order No. 0013 waste.
- Waste disposal for the bench scale test will be the responsibility of the RTTF and will be indicated in the lab statement of work (SOW).

Soils generated during the soil boring program will be placed in drums, staged at the Site and subsequently transferred to Tank Farm No. 4.

During excavation to install the electric service line to the Tank 50 area, soils will be screened and segregated, if necessary. The soils will be characterized based on FID readings, evidence of petroleum discoloration, or evidence of petroleum odors, and segregated as follows:

- Soils having a FID reading of less than 10 ppm, no evidence of discoloration and no evidence of petroleum odors will be staged next to the excavation and used as backfill.
- Stockpile 1: Samples having a FID reading of greater than 10 ppm and less than 100 ppm, and/or exhibiting the presence of discoloration, and/or exhibiting the presence of petroleum odors will be staged in stockpile 1 and subsequently transported to Tank Farm No. 4 for management.
- Stockpile 2: Samples having a FID reading of greater than 100 ppm will be staged in stockpile 2 and subsequently transported to Tank Farm No. 4 for management

6.0 QUALITY CONTROL PLAN

Work completed under this delivery order will utilize the applicable sections of the Quality Control Plan developed for Remedial Actions at Tank Farm No. 4 (Delivery Order No. 0013). Sections in the Quality Control Plan that are specific to this delivery order such as the Project Organization chart, inspection forms and a submittal register are contained in Appendix D.

7.0 ENVIRONMENTAL PROTECTION PLAN

Foster Wheeler Environmental is aware of the proximity of residential properties around the Site. Site operations will be conducted with this awareness in mind. The following procedures will be used to minimize noise and light pollution:

- Site construction will be conducted between the hours of 7:00 a.m and 7:00 p.m.;
- Equipment will be fitted with silencers or will be specified to minimize the noise output; and
- External lighting will be kept minimal and will be focused away from residential areas.

There are no soil erosion or sedimentation controls planned for the activities described above. The vegetation in the work areas (soil borings and installation of electric service) consists of dense grasses on

gently contoured slopes. Excavated areas will be restored. Photographs of these areas are shown in Appendix A.

A spill prevention control and countermeasure plan is not required for this project.

8.0 HEALTH AND SAFETY

A site specific health and safety plan (SHSP) will be developed and followed by all personnel working on this delivery order. The SHSP will be submitted separately.

At the commencement of each site activity and daily thereafter, a safety meeting will be conducted to instruct all personnel on the health and safety procedures to be followed including personnel air monitoring, if necessary, and air monitoring of the work area. Safety zones will be established that include an exclusion zone, a decontamination area, the staging area for the waste disposal containers and support zones,

9.0 REGULATORY COMPLIANCE

There are no environmental permits required to conduct these activities and all federal, state and local rules and regulations will be followed.

All non-hazardous solid waste will be handled in accordance with Rhode Island regulations as described in Section 5.0 and appropriate sections of the Waste Management Plan for Delivery Order No. 0013.

The Coastal Resources Management Council (CRMC) program evaluation will be performed by the Navy. Conversations have been held between the Navy and Foster Wheeler Environmental to discuss the scope of work for this project.

A wetland delineation is not expected to be performed. Tank 50 is approximately 450 feet from Gomes Brook. A site walkdown will be performed by a Foster Wheeler Environmental Scientist to ensure that no wetlands will be impacted by the work.

Foster Wheeler Environmental has performed a review of Rhode Island Pollution Control Regulations for air emissions and completed simplified calculations to identify emission quantities based on activities occurring at the Site. These estimates were determined to be below triggering levels. Documentation of these calculations and conclusions will be forwarded to RIDEM for registration notification.

10.0 PROJECT MANAGEMENT

Mr. David McCarron, P.E. is the Project Manager for this delivery order. He reports directly to Mr. Art Holcomb, P.E., the Program Manager. Mr. McCarron is the primary point of contact for this Delivery Order, and is responsible for project communications and management of project activities, planning and scheduling site activities and procurement of labor, materials and subcontracts.

Additional staff will consist of Mr. Robert Donati, P.E. as the Project Engineer, bioremediation technical support from Fluor Daniel GTI and site staff, as required.

Fluor Daniel GTI staff is under the supervision of Mr. Timothy Pac, CPG. Site staff will be under the supervision of Mr. Marc Dippre. Mr. Dippre is also health and safety cross trained and will ensure the implementation of the SHSP at the Site.

11.0 PROJECT SCHEDULE

The projected project schedule is shown in Figure 11-1. Bench scale and pilot scale studies are assumed to be 3 months (13 weeks) extending from 7/19/96 through 10/17/96.

EARLY START	EARLY FINISH	1996 APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
		PRECONSTRUCTION ACTIVITY								
09APR96	08APR96	△ SUBMIT PROPOSAL								
09APR96	15APR96	NAVY REVIEW								
18APR96	18APR96	NEGOTIATE DELIVERY ORDER								
02MAY96	01MAY96	△ CONTRACT AWARD								
02MAY96	31MAY96	DRAFT WORK PLAN								
20MAY96	04JUN96	PREPARE SSHP								
28MAY96	10JUN96	COMPLETE SOWs								
03JUN96	31MAY96	SUBMIT WORK PLAN△								
03JUN96	11JUN96	NAVY REVIEW								
05JUN96	04JUN96	SUBMIT SSHP△								
05JUN96	19JUN96	NAVY REVIEW								
12JUN96	17JUN96	FINAL WORK PLAN								
20JUN96	26JUN96	FINAL SSHP								
27JUN96	26JUN96	NOTICE TO PROCEED△								
		MOBILIZATION								
27JUN96	18JUL96	MOBILIZATION (INCLUDES PRE SAMPLING & SHAKEDOWN								
		PILOT OPERATIONS								
19JUL96	17OCT96	PILOT SCALE TEST OPERATIONS								
19JUL96	17OCT96	BENCH SCALE BIODEGREDATION STUDY								
18OCT96	17OCT96	COMPLETE PILOT OPERATIONS△								
		DEMOBILIZATION								
18OCT96	24OCT96	DEMOBILIZATION								
25OCT96	10DEC96	COMPLETE POST PILOT STUDY REPORT								
11DEC96	10DEC96	SUBMIT REPORT△								
		POST OPERATION								
18OCT96	26DEC96	POST PILOT SCALE OPERATION								

DESC
△ MILESTONE
CRITICAL
PROGRESS

FOSTEP WHEELER ENVIRONMENTAL COPRORATION

PPOGRAM MANAGER A HOLCOMB

DOM D Mc CARRON

RUN DATE	24MAY96
START DATE	09APR96
DATA DATE	09APR96
FINISH DATE	26DEC96

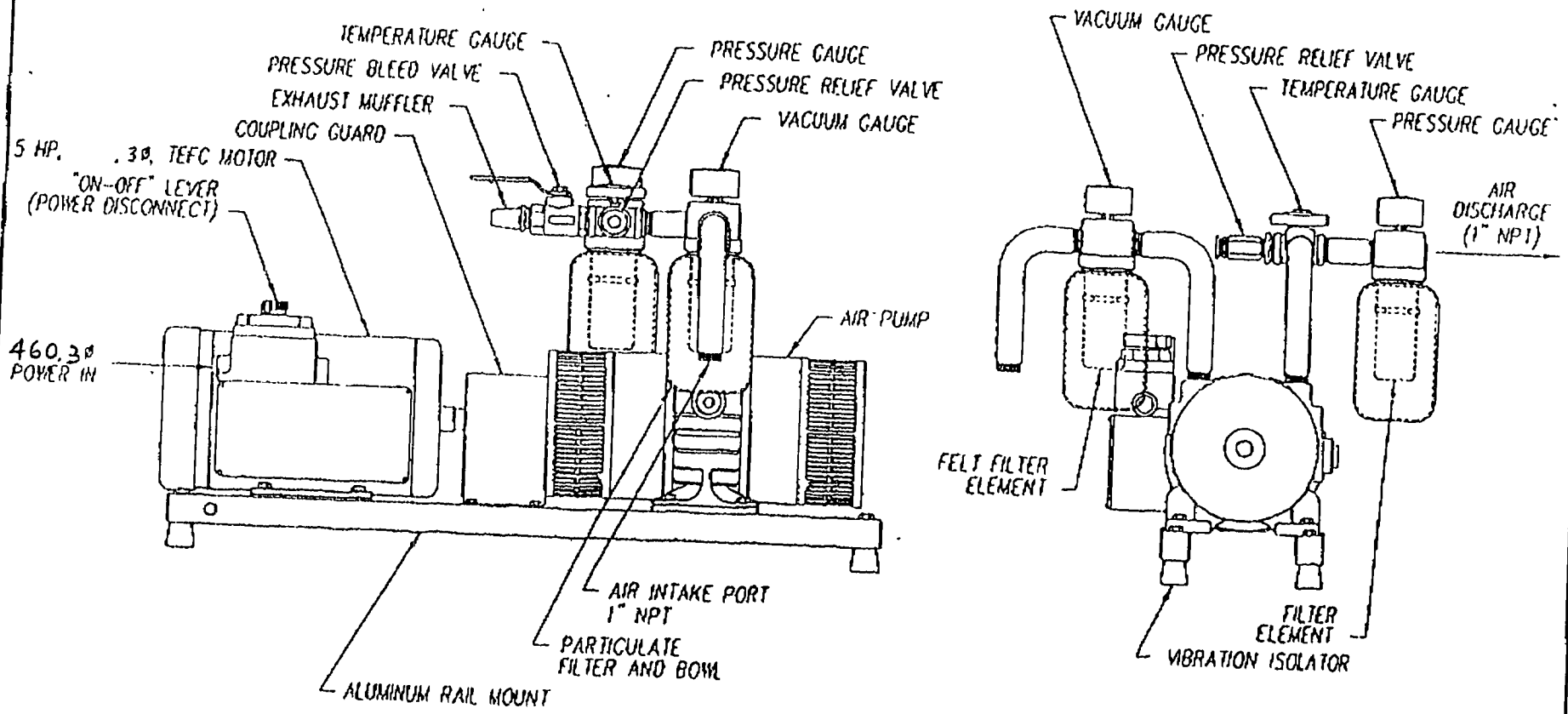
SURETRAK

BIO-REMEDIATION PILOT STUDY

TANK 50

D 0 0011

BIO-REMEDIATION TANK 50



A.R.T.
ADVANCED REMEDIATION TECHNOLOGIES

APPLETON BUSINESS CENTER
NEW IPSWICH, NEW HAMPSHIRE 03071
TEL: (603) 878-2624

SPARGING SYSTEM: 5 HP, TEFC.
460V3Ø

DWG. NO.: 1250670 | REV. 0

SPECIFICATIONS	
Meter Body, Bezel and Tube	Polycarbonate
Wetted Metal Parts	Stainless Steel (except for optional brass valves)
Seats	St. Steel, Blk. Glass, Alum., K Monel
Float Stops	Polycarbonate
Pipe Connections	Model RMA ⅛", Model RMB ¼", Model RMC ½" NPT
"O" Rings	Neoprene and Buna N
Fittings	Stainless Steel brazed to Stainless Steel backbone plate
Rivets	Stainless Steel, set into slots
Scale	Brushed Aluminum—Clear Epoxy Coated
Knobs	ABS Plastic
Pressure Rating	RMA 100 P.S.I., RMB 70 P.S.I., RMC 35 P.S.I. max.
Temperature Rating	To 130° F maximum
Accuracy	Model RMA 4%, Model RMB 3%, Model RMC 2% of full scale

OPTIONS AND ACCESSORIES	CODE
Metering Valve: Brass	BV
Metering Valve: Stainless Steel	SSV
Top Mounted Valve: Stainless Steel—available only on RMA for air (vacuum applications)	TMV
Pointer Flag: Polycarbonate	PF

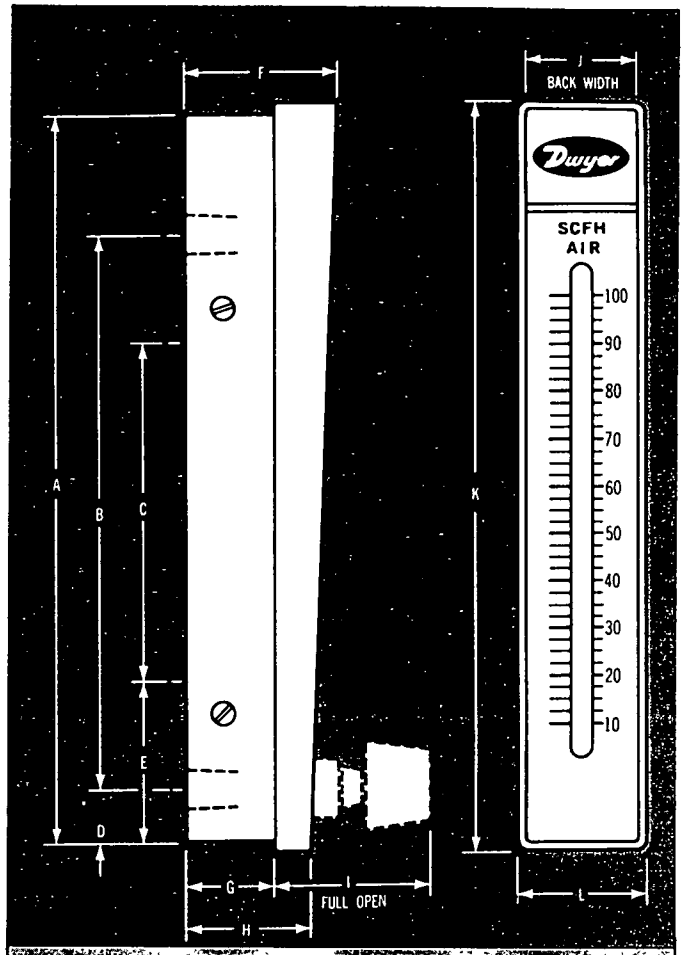
Series RM RATE-MASTER® Models and Ranges

Model RMA—2" Scale		Model RMB—5" Scale		Model RMC—10" Scale	
Range SCFH Air	Ordering No.	Range SCFH Air	Ordering No.	Range SCFH Air	Ordering No.
.05-.5	1	.5-5	49	5-50	101
.1-1	2	1-10	50	10-100	102
.2-2	3	2-20	51	20-200	103
.5-5	4	5-50	52	40-400	104
1-10	5	10-100	53	60-600	105
2-20	6	20-200	54	100-1000	106
5-50	7	40-400	55	120-1200	107
10-100	8	50-500	56	180-1800	108
15-150	9	60-600	57	SCFM Air	
20-200	10	Gal. Water per hour		1-10	121
CC Air/min.				2-20	122
5-50	151	1-12	82	3-30	123
10-100	150	1-20	83	Gal. Water per hour	
30-240	11	4-40	84		
50-500	12	10-100	85	2-20	134
100-1000	13			8-90	135
200-2500	14			Gal. Water per min.	
LPM Air					
.5-5	26			1-10	141
1-10	21			2-22	142
2-25	22			3-36	143
5-50	23			8-75	144
5-70	24			12-110	145
10-100	25				
CC Water/min.					
5-50	32				
10-110	33				
20-300	34				
Gal. Water/hr.					
1-11	42				
2-24	43				
4-34	44				
5-50	45				

*Accuracy ±8%

CAUTION

Dwyer Rate-Master® flowmeters are designed to provide satisfactory long term service when used with air, water, or other compatible media. Refer to factory for information on questionable gases or liquids. Caustic solutions, anti-freeze (ethylene glycol) and aromatic solvents should definitely not be used

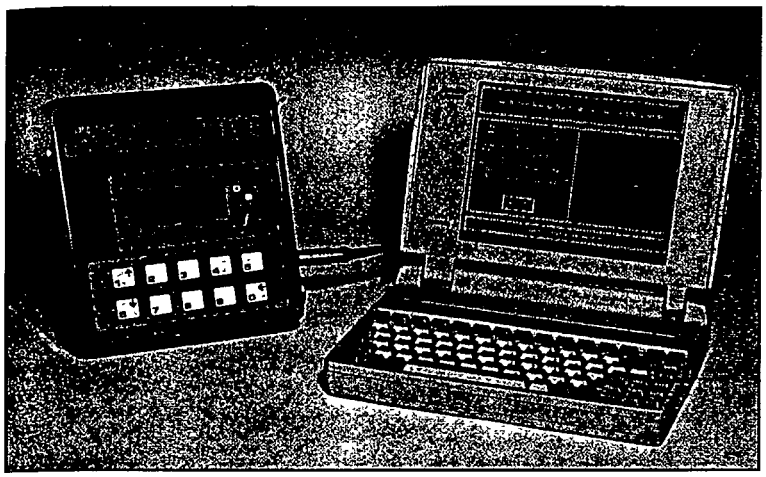


DIMENSIONS—IN INCHES			
	Model RMA	Model RMB	Model RMC
A	4 9/16	8½	15⅛
B	3 ⅛ NPT Conn.	6 7/16 ¼ NPT Conn.	12¼ ½ NPT Conn.
C	1⅝ 10-32 Thds.	3 5/16 ¼-20 Thds.	8¾ ⅜-24 Thds.
D	⅜	1⅝	1
E	1 1/16	1⅞	2¾
F	1 3/16	1¾	2¼
G	¾	1	1 7/16
H	1	1 7/16	1 31/32
I (OPEN)	1⅜	1 13/16 (BV or SSV MODELS ONLY)	2½
J	¾	1¼	2
K	4 13/16	8¾	15⅜
L	1	1½	2¼

How To Order

1. Select model desired by letter designation. RMA, RMB, or RMC.
2. Specify range desired by adding the order number after a dash following the letter designation. Example RMA-6.
3. If additional features are required, and available, add the option designation to the basic model code – e.g.: BV for Brass Valve, SSV for Stainless Steel Valve, and TMV for Top Mounted Valve. For example, RMA-6-SSV is the 2" scale flowmeter range No. 6 with a stainless steel valve.
4. Add accessories as desired.

New . . . Infrared Analyzers



The GA-90 hand-held Infrared Gas Analyzer is ideal for the manual collection of data at landfills or other potentially hazardous sites. It is a rugged unit which utilizes the principle of infrared absorption for quantitative analysis of Methane, Carbon Dioxide, Oxygen, barometric pressure and static pressure. Variable alarm levels can be entered through a series of menus on the user-friendly display.

This instrument has the ability to store up to 1,200 readings along with a well ID code, and automatically records time and date of any stored data. These readings can then be rapidly scanned on site at any time or downloaded to a computer or printer via an RS232C port. The data logging function allows readings to be obtained automatically at varying intervals in the absence of an operator.

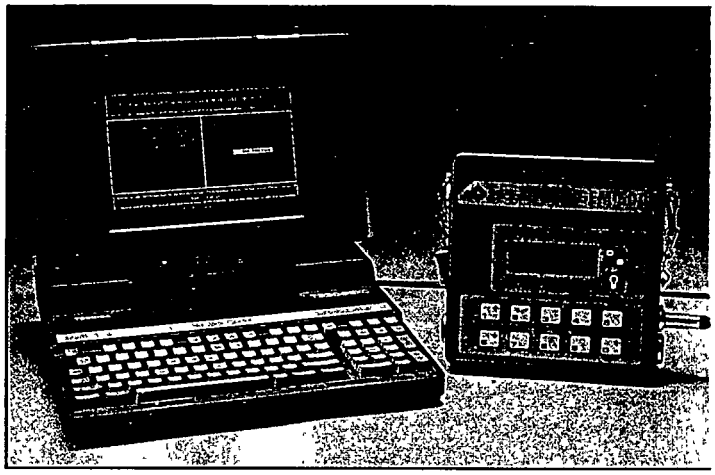
- **Accurate Methane readings even with CO2 present**
- **Internal pump will pull a sample up to 70 inches**
- **Monitor supplied with 3' tube with probe, charger, water trap and software.**

Specifications

Ranges:	**Carbon Dioxide**	0 to 50%
	Oxygen	0 to 21%
	Methane:	0 to 100%
	Static Pressure:	0 to 100" Water
Typical Accuracy:	**Carbon Dioxide**	0 to 50%, ±3 0%
	Oxygen:	0 to 21%, ±1 0%
Temperature Range:	32 to 104°F	
Power Source:	Rechargeable ni-cad battery	
Dimensions	8.5 x 8.9 x 2 inches	
Weight:	4.6 pounds	

Order No.	Description	Daily	Weekly
R-GA90N	GeoGroup GA-90 Analyzer	$105.00	$300.00
R-GA90	Landtec GA-90 Analyzer	105.00	300.00
R-PRINT1	Universal Printer (Serial/Parallel)	25.00	35.00

Purchased Support Accessories		Price
C-G01005	Inlet Port Filter	$10 80
C-G01006	In-Line Water Trap Element	40 50
A-R-15R	1.5 lpm Flow Regulator	98 00
B-R-TY	Tygon Tubing	1 95/ft
B-R-1L	1-Liter Tedlar Bag	23 10
B-R-5L	5-Liter Tedlar Bag	26.80



Landtec's portable GEM-500 was specially designed for use in landfills. The unit automatically displays and records Methane, Carbon Dioxide and Oxygen concentrations, as well as gas flow rate, Btu content, temperature, pressures and LEL. This all-weather, self-contained monitor uses a self-compensating infrared gas analyzer and an internal sample pump capable of drawing a gas sample at up to 70" vacuum. The user can recall prior data stored at up to 500 monitoring points and down load that data to a computer or printer. Sampling process takes less than a minute with easy to follow on-screen menu. Features user-adjustable alarms and auto-logging capabilities.

Specifications

Ranges:	**Methane:**	0 to 100%
	Carbon Dioxide:	0 to 100%
	Oxygen:	0 to 100%
	Temperature:	-10 to 100°C
	Differential Pressure:	0 to 10" W.C.
	Static Pressure:	0 to 100" W.C
Typical Accuracy:	**Methane:** 5%, ±0.3%; 15%, ±1.0%; 100%, ±1.9%	
	Carbon Dioxide: 100%, ±3.0%	
	Oxygen: 5%, ±0.25%	
Humidity Range:	0 to 100%	
Temp. Range:	14 to 104°F	
Power Source:	Rechargeable ni-cad battery	
Operating Time:	6 hours with continuous pump	
Dimensions:	8.5 x 8.5 x 2 inches	
Weight:	4 pounds	

Order No.	Description	Daily	Weekly
R-GEM500	GEM-500 Infrared Analyzer	$175.00	$525.00
R-PRINT1	Universal Printer (Serial/Parallel)	25.00	35 00

Purchased Support Accessories		Price
C-G01005	Inlet Port Filter	$10.80
C-G01006	In-Line Water Trap Element	40 50
B-R-TY	Tygon Tubing	1.95/ft
B-R-1L	1-Liter Tedlar Bag	23.10
B-R-5L	5-Liter Tedlar Bag	26.80

HAZCO

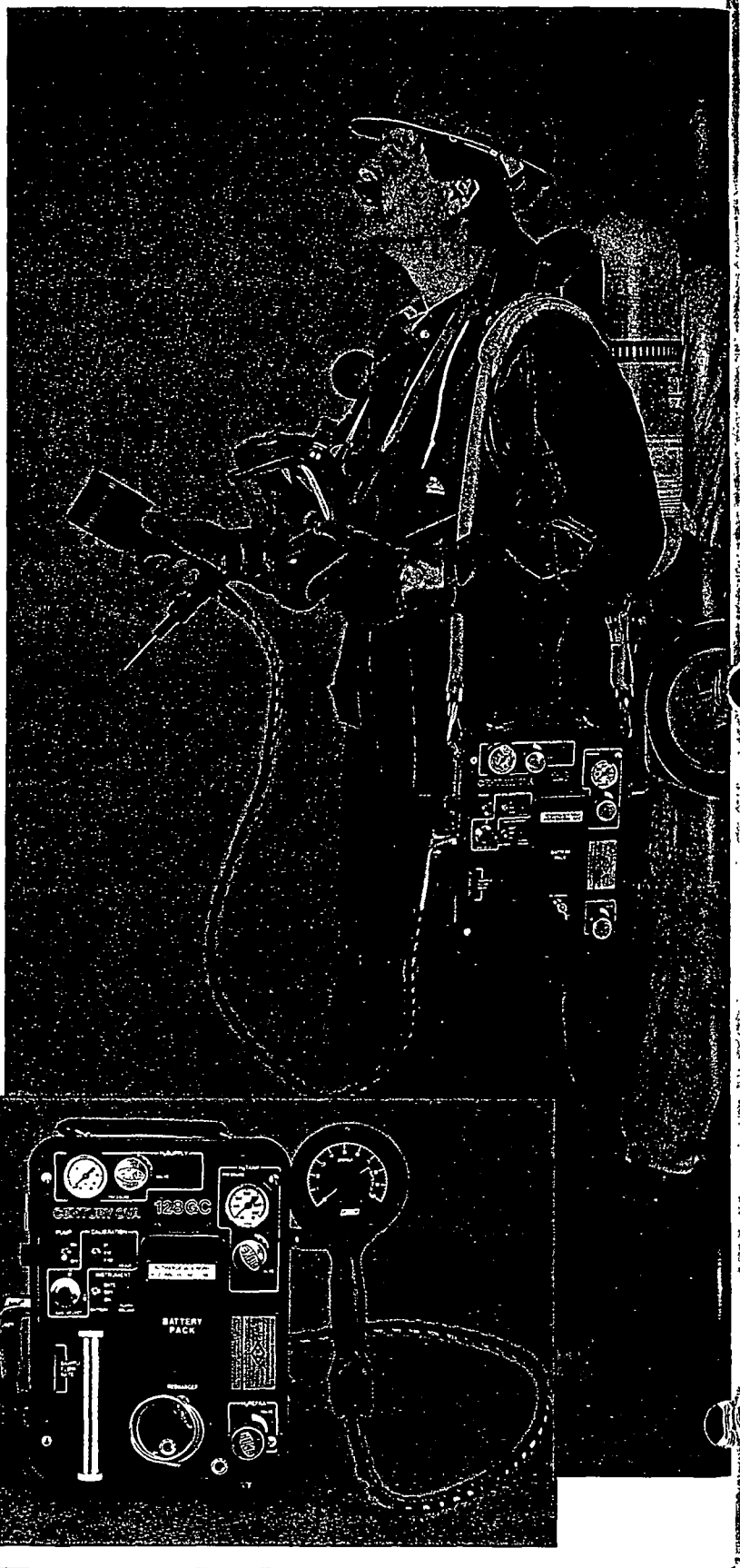
Foxboro OVA 128 & OVA 108 FID

Flame Ionization Detector For Rapid Analysis of High Vapor Concentration Areas

The Foxboro Organic Vapor Analyzer Models 108 and 128 are dual mode analyzers that detect and measure hundreds of organic gases and vapors. They provide continuous data on organic vapor concentrations for screening and surveying purposes as well as qualitative and quantitative analyses utilizing the chromatographic mode option on the Model 128GC.

The OVA incorporates an extremely sensitive flame ionization detector which monitors total organic vapors to parts per million (ppm) levels. In the chromatographic mode, a portable chart recorder is powered directly from the analyzer to record chromatograms for interpretation.

The OVA 128, more sensitive than the 108 in the lower ranges, has a linear scale available in three ranges: 0 to 10, 0 to 100 and 0 to 1,000.



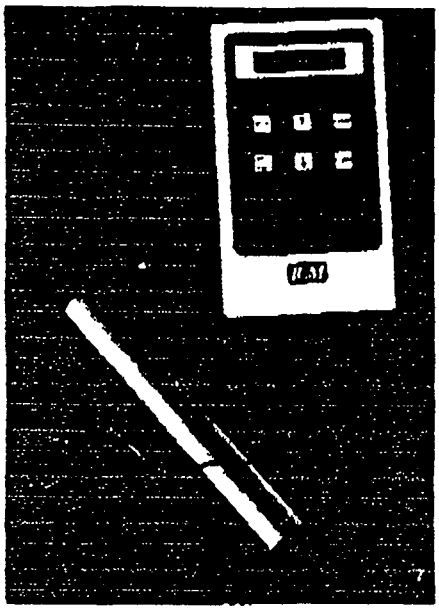
Specifications

	OVA 108: 0 to 10,000 ppm OVA 128: 0 to 1,000 ppm
Readout:	Directly on hand-held probe
Audible Alarms:	Automatic for flameout and pre-set concentration levels
Operating Time:	8 hours
Power Source:	Rechargeable lead acid batteries
Response Time:	2-second, 90% scale response
FM Approved:	Class I, Div. 1, Groups A, B, C and D BASEEFA Certified Instrinsically Safe
Dimensions:	12 x 9 x 5 inches
Weight:	12 pounds

Order No.	Description	Daily	Weekly	Recondition Service
R-OVA108	OVA 108	$85.00	$300.00	$150.00
R-108REC	OVA 108 Recorder	10.00	30.00	
R-OVA128	OVA 128	85.00	300.00	150.00
R-128GC	OVA 128 GC	115.00	350.00	150.00
R-128REC	OVA 128 Recorder	20 00	65.00	

Purchased Support Accessories		Price
B-R-DL	Diluter Kit for OVA 128	$750 00
A-R-SGCH	Certified Methane Span Gas	44.80
A-R-SGZA	Certified Zero Air Span Gas	44.80
B-C1059	Recorder Paper	31.60
B-C1077	Optional Methane Probe	167.65
B-R-TY	Tygon Tubing	1.95/ft
B-R-5L	5-Liter Tedlar Sample Bag	26 80
A-R-15R	1.5 lpm Flow Regulator	98.00

NEW! Aqua-Check™ Water Analyzer



The Aqua-Check analyzer provides accurate water quality readings for on-site analytical applications. This easy-to-use unit requires the push of only one button for readings, and the display guides the user through simple steps. An internal pressure transducer senses the Barometric Pressure, eliminating the need to manually read [illegible]enter compensation data. Up to 199 complete sets of [illegible]ngs, including calibration constants and set-up features can be logged and stored in its microprocessor memory. This information can then be recalled later for further analysis and downloading to a PC or printer via the RS232 port. Design features splash-proof membrane keypad, real-time clock, and automatic barometer data logging. Rental includes probe with 50' cable, AC adapter/charger and storage case.

- **Sample time can be set anywhere from one minute to one hour**
- **Readings compensated for effects of Salinity, Temperature and Barometric Pressure**

Specifications

Ranges:	**pH:**	1 to 13 pH
	Conductivity/TDC:	0 to 99,990 µS, 49,990 ppm
	DO:	0 to 50 ppm
	Temperature:	0 to 50°C
Response Time:	Within seconds at room temperature	
Power Source:	Rechargeable battery	
Dimensions:	**Meter:** 7.5 x 4.15 x 1.5 inches	
	Probe: 12 x 1.5 inches x 50'	
Weight:	10 pounds	

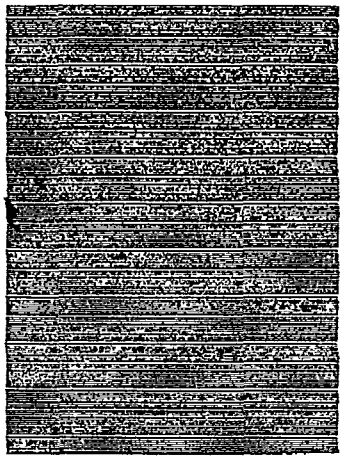
Order No.	Description	Daily	Weekly
R-51601	Aqua-Check Water Analyzer	$75.00	$190.00
[illegible]RINT	Universal Printer	$30.00	45.00

[illegible]hases Support Accessories		Price
C-PER1001	Calibration Kit*	$167.00

** Contains all solutions necessary for a complete calibration.*

NEW! Solomat — a NEOTRONICS company

520c Water Quality Meter



Solomat's hand-held 520c accurately measures water quality in a variety of applications including environmental impact studies and industrial spot checks. With a wide choice of interchangeable electrodes—Turbidity, Conductivity, pH, ORP, Ammonia, Dissolved Oxygen, Temperature and Flow Rate—the 520c can be tailored to meet the specific needs of any application, reducing the number of instruments needed for analysis. At switch on, the unit performs a self test to make sure it is working properly. Usage and calibration is simple and reliable with single key operation and preset calibration constants. Stores up to 50 data points plus temperature and numeric site code. Quickly measures parameters and displays them on the LCD screen in a wide range of engineering units. The LCD also displays battery status, calibration points and minimum, maximum and average readings. Rental includes unit with batteries and RS232 cable. The unit accepts up to three sensors simultaneously, rented separately.

Specifications

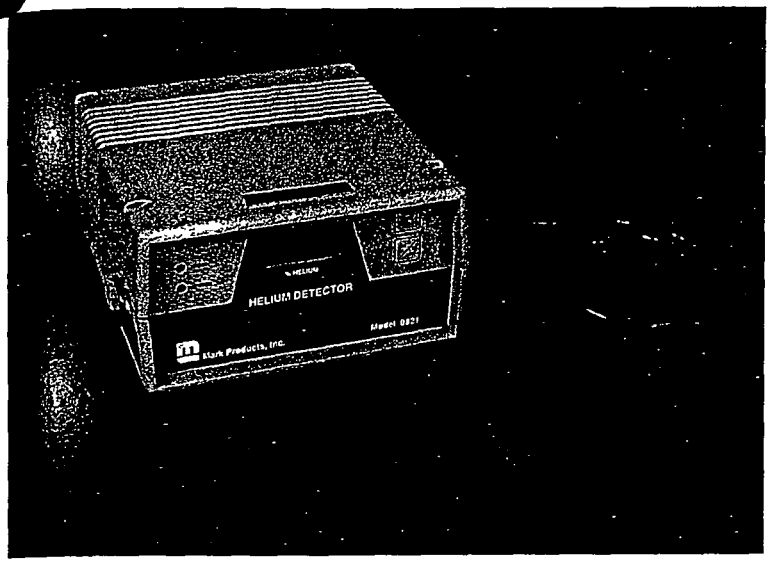
Range/Accuracy:	**pH:**	.00 to 14.00 pH/.01 pH
	mV:	±800.00 mV/.25 mV to .05% rdg
	Cond.:	1.0 to 2000µS per cm/ 1% rdg ±0.5µS (low range) 0.50 to 100mS per cm/ 1% rdg ±0.05mS (high range)
	DO:	0 to 20 ppm/0.2 ppm
	NH3:	.01 to 2000 ppm/±10% reading
	Turb.:	0.2 to 100 NTU/±3% rdg ±2 NTU (low) 50 to 4000 NTU/±3% rdg ±20 NTU (high)
	Flow:	4 to 1500 ft per min/±3% reading
	Temp.:	-110 to 1100°F/±0.25°F
Power Source:	Alkaline batteries	
Operating Time:	150 hours	
Dimensions:	8 x 10 x 7 inches	
Weight:	1.1 pounds	

Order No.	Description	Daily	Weekly
R-520C	520c Water Quality Meter	$60.00	$115.00
Channel One, Choice of One:			
R-520C-T	Turbidity Electrode	55.00	75.00
R-520C-C	Conductivity Electrode	20.00	35.00
Channel Two, Choice of One:			

Post-It® Fax Note 7671	Date 7-2-96	# of pages ▶ 1
To MARK DEAKE	From PETER G	
Co./Dept. [illegible]	Co. HAZCO SVC	
Phone # 617-457-8288	Phone #	
Fax # 617-457-8466	Fax #	

[illegible] Conductivity Solution, 10,000 µmhos, 1 Pint 12.85
B-YSI1000 ... Conductivity Solution, 100,000 µmhos, 1 Pint 12.85
C-ES1005 ..... Formazine Solution, 50 ml 13.65
C-DRT1002 .. Turbidity-Free Water, 1 Gallon 10.30
B-SOLO1001 Sodium Sulfate Calibration Powder 3.35

Mark 9821 Helium Detector



The Mark 9821 Helium Detector represents a break-through in portable leak pinpointing equipment. The enhanced sensitivity of the instrument will accurately pinpoint both small and large leaks from .01 to 100 percent. Easy-to-operate, the instrument draws a single sample, analyzes it and displays the percentage of Helium found on the LCD display. The automatic sampling sequence requires only 15 seconds to display the results. A rugged case surrounds the instrument, making it ideal for field applications.

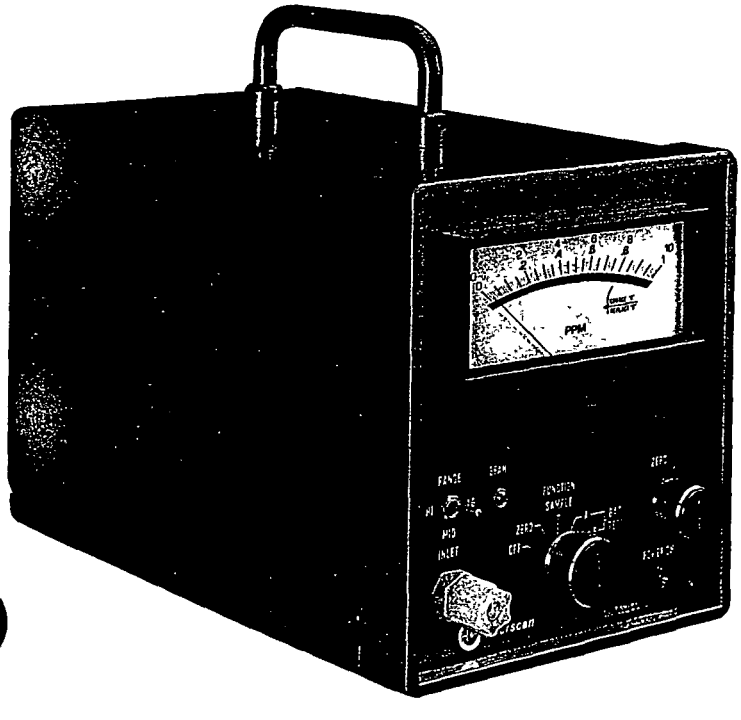
- **Monitor supplied with charger (110-volt), sampling hose, three 1' extension tubes, probe tip, collection boot and carrying case.**

Specifications

Range:	0.01 to 100%
Power Source:	Rechargeable batteries
Battery Life:	8 hours continuous
Weight:	7 pounds

Order No.	Description	Daily	Weekly
R-HE9821	Mark 9821 Helium Detector	$95.00	$340 00

New . . . Interscan Hydrazine Analyzer



The Model 1181A is a portable analyzer designed to monitor Hydrazine in the range of 0-1/0-5 ppm making it ideal for area survey work or walk-around monitoring. Operating off integral rechargeable batteries, it can also be used for occasional longer-term studies. The portable unit weighs just 8 pounds and features an analog display, audible and visual alarms, internal pump, and analog input of 0 to 100 mV full scale. The instrument also has an aluminum, 90° folding handle with spring detent for ease of carrying.

Unit is shipped complete with carrying case, scrubber, syringe, batteries and charging adapter.

- **Analog output**
- **Audible and visual alarms**

Order No.	Description	Daily	Weekly
R-1181A	Interscan Hydrazine Analyzer	$95.00	$225.00

Purchased Support Accessories		Price
A-R-SGZA	Lab Grade Zero Air	$ 44.80
A-R-SGN	Nitrogen, Pure, 99.9%	44 80
B-R-1L	1-Liter Tedlar Sample Bag	23.10
A-R-05R	ISC .5 lpm Flow Regulator	150.00
B-R-TYC	Tygon Tubing	1.50/ft

7900 SERIES

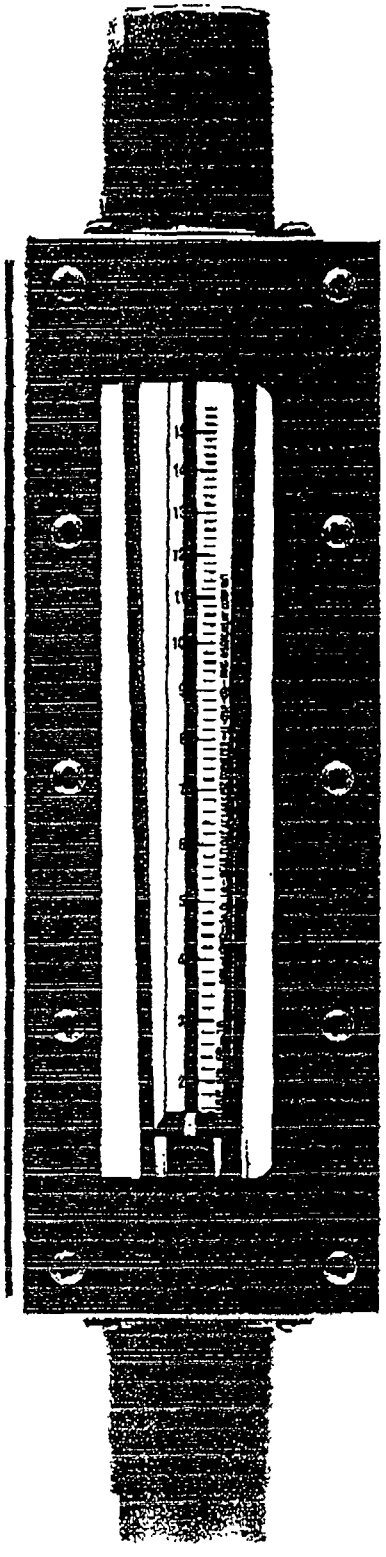
7910 STAINLESS CASE ENCLOSURE

SCALE LENGTH
250 mm (10")

ACCURACY—REPEATABILITY
± 2% F.S. Standard — ± ½%
± 1% F.S. Calibrated — ± ½%

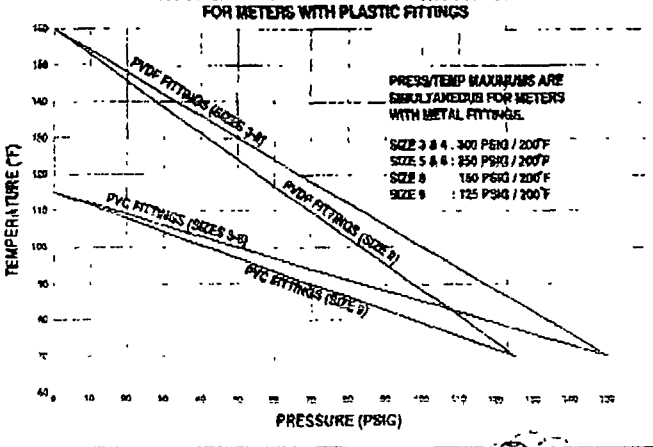
CAPACITIES
.1 to 150 GPM—Water
.4 to 247 SCFM—Air

METERING TUBE MATERIAL
Borocilicate Glass



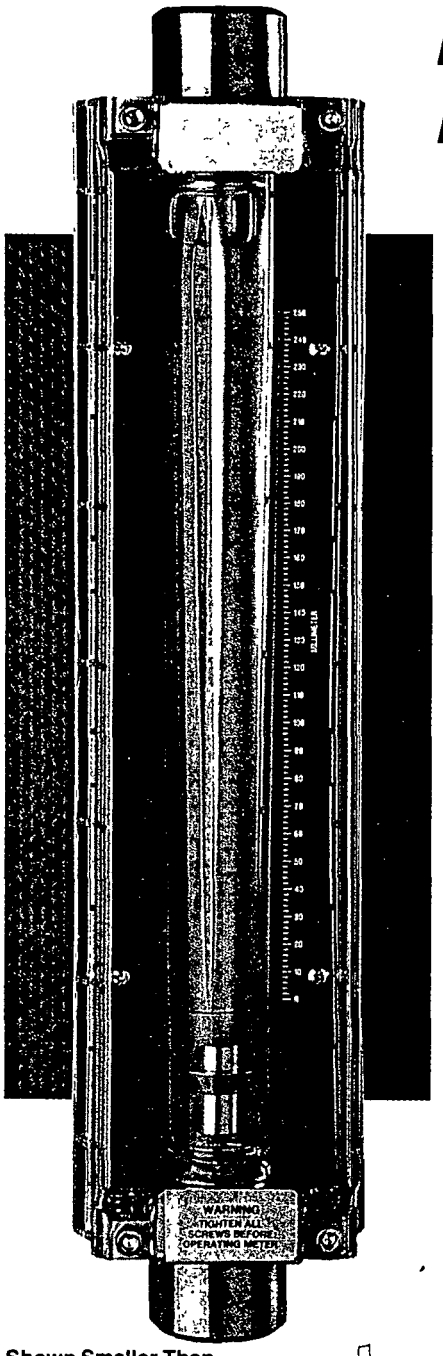
- Metering tubes are precision formed and annealed borocilicate glass.
- Tubes are fluted or plain taper. (Plain taper tubes us rod guided floats.)
- Classic design, premium quality, heavy duty 304 Stainless Steel case and covers.
- Floats are ISA style, low pressure loss and high capacity type.
- 316 Stainless Steel rotatable fittings feature dual ports (vertical and horizontal) for maximum installation versatility.
- Unique float stop design allows internals to be removed and replaced without disturbing either the tube or shield. So cleaning is easier, and with this design the possibility of damaging the tube during maintenance is dramatically reduced.
- Full 3/16" thick Polycarbonate safety shields (front and rear) are mounted inside stainless covers.
- Direct reading scales (GPM—Water or SCFM—Air) are standard. Special Scales are available in any format.
- Detachable, clear polycarbonate scale plate mounts directly on front of metering tube.
- Uniform white reading background is designed so that light can enter the tube from the back as well as the front.
- PVC fittings and Hastelloy® C-276 floats are stocked options for many flow ranges.
- Six meter sizes (9 tubes) 80 flow ranges.
- Factory certified calibration is available.

7900 SERIES : PRESSURE / TEMPERATURE CURVES
FOR METERS WITH PLASTIC FITTINGS

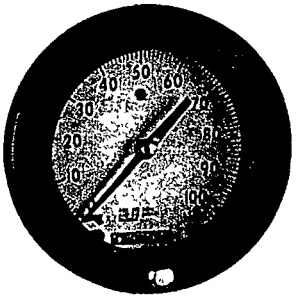


ECONOMICAL INDUSTRIAL ROTAMETERS

ΩMEGA



Shown Smaller Than Actual Size



Model PGJ-45B-100

Model PGJ-45B-100 shown. See Section M for a full selection of pressure gages.

- ±2% Full Scale Accuracy
- ±½% Full Scale Repeatability
- 10 to 100% of Flow Scale
- Correlation Equations Permit Use with Many Fluids
- Shielded for Use in Pressurized Systems
- Horizontal Ports for Panel Mounting

From

$448

1 YEAR WARRANTY

MADE IN USA

The FL1650 series rotameters provide high accuracy in a rugged, industrial housing. Standard construction has brass end fittings for mounting. Supplied with arbitrary 10-100% scale, with multiplication factors for air and water.

To Order (Specify Model Number)

HIGHLIGHTED MODELS STOCKED FOR FAST DELIVERY!

Model No.	Price	GPM	SCFM	Delta P. in. W.C	Max. press. (PSIG)	Max. viscosity (centistokes)
FL1651	$448	0.17	0.93	2	312	1.0
FL1652	448	0.37	1.64	4	312	1.0
FL1653	448	0.78	3.17	3	262	2.0
FL1654	448	1.09	4.45	5	262	3.7
FL1655	448	1.83	7.56	11	262	1.9
FL1656	448	2.06	8.32	17	262	7.0
FL1657	480	3.92	16.25	16	210	17.0
FL1658	480	5.12	21.20	19	210	3.5
FL1659	524	8.84	36.10	26	177	23.0
FL1660	524	10.93	45.90	35	177	5.5
FL1661	524	23.10	105.70	135	177	1.0

For 316SS end fittings, add suffix "-SS". Consult sales for pricing and delivery.

VENT

SPECIFICATIONS

Scale: arbitrary 10 to 100%, 250 mm length
Accuracy: ±2% full scale
Repeatability: ±0.5% full scale
Temp. Rating: 200°F for liquid, 250°F for gas
End Fittings: Brass std; 316 SS Opt.
Glass Tubes: Borosilicate glass
Float Stops: 316 stainless steel spring wire
Floats: Glass for FL1651, 316 SS all others
O-Rings: Viton std; Buna N Opt.
Housing: Die cast aluminum alloy 380, not wetted
Tube Retainer: ABS, not wetted
Threaded Fasteners: 18-8 stainless steel, not wetted
Shi ld: Polycarbonate, not wetted
C nnecti n: ¾" FNPT, Horizontal
Weight: 8.0 lbs; 3.63 kg
Dimensi ns: 4.25" W, 3.5" D, 19" H, 17.5" centerline port-to-port

N05

F Performance Specifications:

	N05ANI (AC)	N05ANI (DC)
Maximum Free Flow	6.0 Lit/min / 0 21 SCFM*	5 5 Lit/min / 0 19 SCFM
Maximum Vacuum	190 Torr / 22.4 in Hg.	190 Torr / 22.4 in. Hg.
Maximum Continuous Pressure	43 PSIG	30 PSIG

Electrical Specifications:

Motor Voltage (Hz)	115 VAC	12 / 24 VDC
Full Load Motor Current	1.1 Amps	3.3 / 1.8 Amps
Motor Frequency	60 Hz	DC
Motor Type	Shaded Pole	Permanent Magnet Brush Type
Motor Protection	Thermal Reset	None

Environmental Specifications:

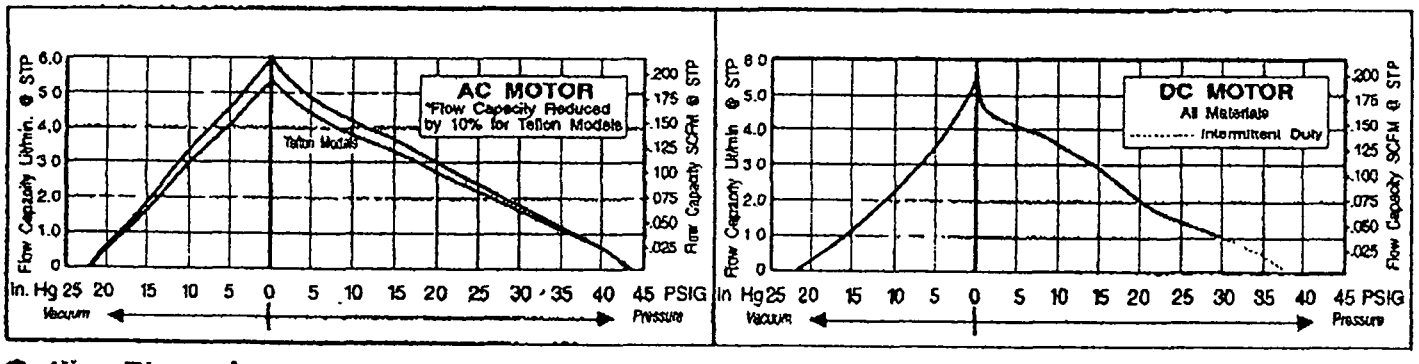
Maximum Ambient Temperature	105°F / 40°C	105°F / 40°C
Net Weight	2.43 lbs. / 1.10 Kg	2.37 lbs. / 1.07 Kg

Standard Materials of Construction:

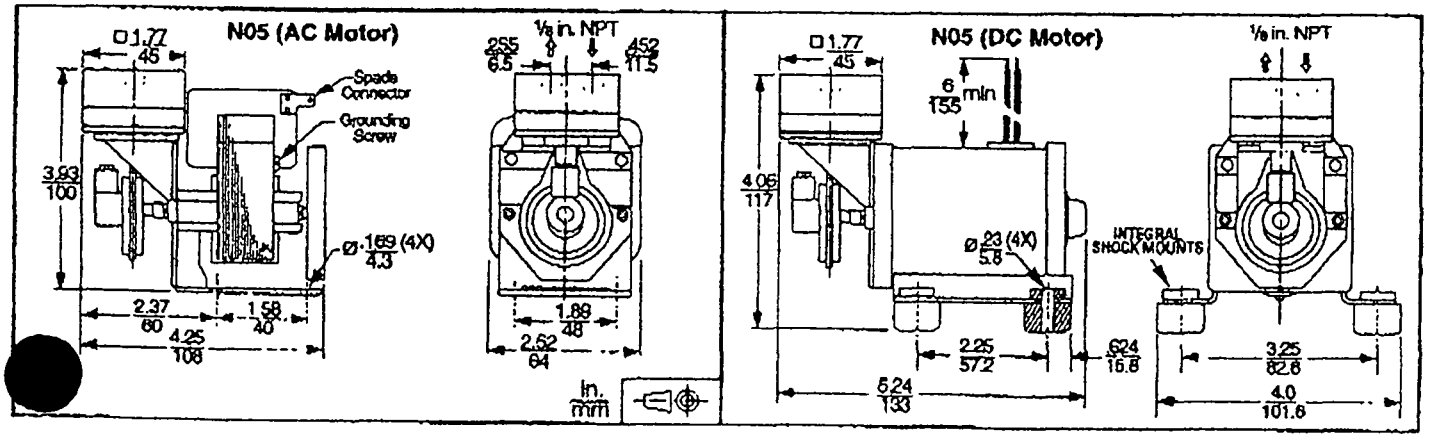
Standard Model Number	Head Material	Diaphragm Material
N05ANI	Aluminum	Neoprene
N05AVI	Aluminum	Viton®
N05ATI*	Aluminum	Teflon®-coated Neoprene
N05SNI	316 Stainless	Neoprene
N05SVI	316 Stainless	Viton®
N05STI*	316 Stainless	Teflon®-coated Neoprene

Notes: Standard continuous performance ratings at sea level with an ambient temperature of 70° F (21° C) and nominal electrical supply are listed above. *Flow capacity reduced by 10% for AC Teflon models. Higher performance models, cost efficient OEM modifications, a wide variety of options including brushless DC motors, other motor coil voltages/frequencies, and alternate materials of construction are available. Contact KNF applications department for details. Teflon® and Viton® are registered trademarks of E. I. DuPont. Specifications subject to change without notice

Performance Characteristics:

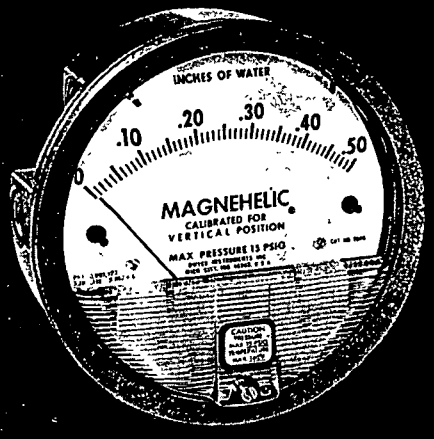


Outline Dimensions:

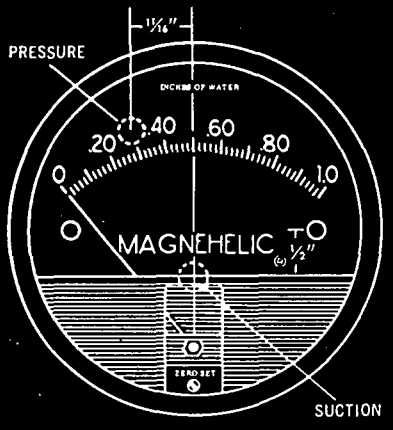


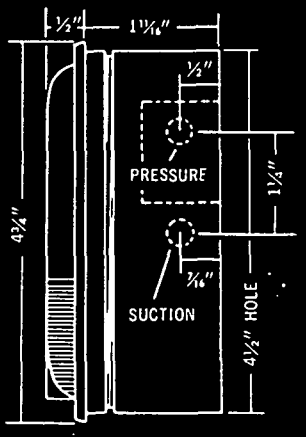
KNF NEUBERGER, INC.
Two Black Forest Road
Trenton, New Jersey 08691-9428
Fax: 609-890-8323 · Phone: 609-890-8600

SERIES 2000 Magnehelic® Differential Pressure Gages



Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.

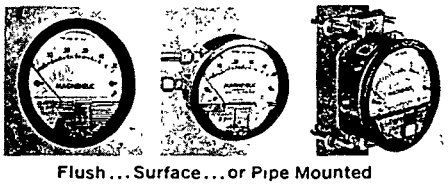




Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

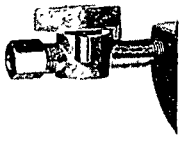
Select the Dwyer Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 ranges available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

Widely used to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.



Flush...Surface...or Pipe Mounted

Mounting. A single case size is used for most ranges of Magnehelic gages. They can be flush or surface mounted with standard hardware supplied With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼"-2" pipe. Although calibrated for vertical position, many ranges above 1 inch may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic gages ideal for both stationary and portable applications. A 4½" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.



Vent valves

In applications where pressure is continuous and the Magnehelic gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage Pressure can then be removed to check or re-zero the gage

HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4¾" hole is needed for flush mounting The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig Available in all ranges Because of larger case, will not fit in portable case Weight 1 lb , 10 oz (Installation of the A-321 safety relief valve on standard Magnehelic gages often provides adequate protection against infrequent overpressure, see Bulletin S-101)

PHYSICAL DATA

Ambient temperature range: 20° to 140°F.*

Rated total pressure: –20" Hg. to 15 psig †

Connections: ⅛" NPT high and low pressure taps, duplicated – one pair side and one pair on back.

Housing: Die cast aluminum. Case and aluminum parts Iridite-dipped to withstand 168 hour salt spray test. Exterior finish is baked dark gray hammerloid.

Standard ranges: See facing page.

Accuracy: Plus or minus 2% of full scale (3% on –0 and 4% on –00 ranges), throughout range at 70°F.

Standard accessories: Two ⅛" NPT plugs for duplicate pressure taps, two ⅛" pipe thread to rubber tubing adapters, and three flush mounting adapters with screws. (Mounting ring and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)

Weight: 1 lb. 2 oz.

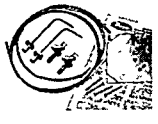
*Low temperature models available as special option
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left

OPTIONS AND ACCESSORIES

Transparent overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable signal flag
Integral with plastic gage cover; has external reset screw. Available for all ranges (not high pressure). Can be ordered with gage or separately.

Portable units
Combine carrying case with any Magnehelic gage of standard range (not high pressure). Includes 9 ft. of ¾" I.D. rubber tubing, stand-hang bracket, and terminal tube with holder.



Air filter gage accessory package
Adapts any standard Magnehelic for use as an air filter gage. Includes aluminum surface-mounting bracket with screws, two 5 ft. lengths of ¼" aluminum tubing, two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Kanapower® ALL WEATHER TANK TRUCK DROP HOSE AND VAPOR RECOVERY HOSE

NEW ENGLAND RUBBER INC.
55 COMMERCIAL CIRCLE
DEDHAM MA 02026

SPECIFICATIONS

Tank Truck Drop Hose

NOMINAL I.D. inch	O.D. inch	MIN. PITCH inch	MIN. BEND RADIUS inch	WORKING PRESSURE psi	BURSTING PRESSURE psi	WEIGHT lbs/ft	LENGTH per coil
2"	2.56	0.39	4	65	260	0.90	60' and 100'
3"	3.62	0.59	6	65	260	1.27	60' and 100'
4"	4.80	0.65	8	65	260	2.00	60' and 100'

Temperature range −30°F to 160°F.

Vapor Recovery Hose

2"	2.35	0.39	3.0	—	—	.56	60' and 100'
3"	3.48	0.59	2.5	—	—	0.83	60' and 100'
4"	4.60	0.65	5.0	—	—	1.60	60' and 100'

Temperature range: −40°F to 160°F

PLANTS:
750 W. Manville
Compton, CA 90220
(213) 637-1616

70 E. Messner
Wheeling, IL 60090
(312) 459-0390

WAREHOUSE:
7094 Peachtree Industrial Blvd.
Suite 108
Norcross, GA 30071
(404) 447-5184

SALES OFFICES:
13315 Watertown Plank Road
Elm Grove, WI 53122
(414) 784-6090

3121-C Merriam Lane
Kansas City, KS 66106
(913) 383-3003

5100-K Fox St.
Denver, CO 80216
(303) 573-5700

P.O. Box 477
Meadow Vista, CA 95722
(916) 878-1831

2158 Endovalley Drive
Cincinnati, Ohio 45244
(513) 474-2158

60 Norfolk Road
Holbrook, MA 02343
(617) 767-4090

NEW E ND RUBBER INC
55 COM CIAL CIRCLE
DEDHA 02026

Puma Petroleum

TUBE	Vinyl Nitr
REINFORCEMENT	Textile
	helical w spiral 2 ply
COVER	Vinyl Nitr
COLOR	Black, R
TEMPERATURE RANGE	- 40°F t
TYPE OF BRANDING	Printed Sl

WORKING PRESSURE	150 PSI
TYPE OF COUPLING	Cam and Groove or Combination Nipple. Clamps—Single Bolt, Double Bolt, or Band

⚠ WARNING
Consult with the coupling manufacturer to make sure you choose the correct coupling for the application and proper assembly. See coupling section, page 96, for further safety information.

SUCTION	Full vacuum

eatures

inyl nitrile cover

itrile tube

ont s printed brand
val longer lengths
an these listed below

Adv tages

- Abr
- Oil re
- Easy
- Econ waste

urial fit.
ffer

ation
less

Markets

Petrochemical/Petroleum Industry
Paper/Pulp Industry

Oil Exploration and Drilling
Ship Building

Tank Truck
Railroad Tank Car
Waste Hauling

Applications

Transfer of petroleum products

Transfer of crude oil, salt water, fresh (non-potable) water, and slurries.

Loading or unloading —pumping, suction, or gravity flow discharge

CODE	NOMINAL I.D. (IN.)	NOMINAL I.D. (MM)	REINF.	NO (IN.)	AL (MM)	APPROXIMATE WEIGHT POUNDS PER 100 FT.	MAXIMUM RECOMMENDED WORKING PRESS. (PSI)	MINIMUM RECOMMENDED BEND RADIUS (IN.)	MINIMUM RECOMMENDED BEND RADIUS (MM)	STANDARD TEST
0363-13	1	25.4	2 Br.	1		75	150	6	152.4	60
0363-14	1¼	31.8	2 Br.	1¾	44.5	85	150	6	152.4	60
0363-40	1½	38.1	4 Sp	2		[illegible]	150	5	127.0	100
0363-43	2	50.8	4 Sp	2¾	69.9	124	150	6	152.4	100
0363-25	2½	63.5	2 Ply	3		[illegible]	150	10	254.2	150
0363-43	3	76.2	4 Sp	3¾	95.5	195	150	12	304.8	100
0363-44	4	101.6	4 Sp	4		[illegible]	150	14	355.6	100
0363-60	6	152.4	2 Ply	6¾	171.9	447	150	[illegible]	[illegible]	25/100
0363-80	8	203.2	2 Ply	8		[illegible]	150	-	-	25/50

engths packaged in recyclable cardboar
ov ilable with a white stri

Bel chemic- through

⚠ WARNING
e are factors in this section consult the chart and safety section on pages 82

Appendix A

Environmental Conditions Photographs

PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398

Photographer: D. McCarron

Date/Time: 5-22-96

Frame No.: 5, 6

Site Location: Tank 50

Direction: Northwest

Activity: Env. Conditions Report

Comments: Looking @ monitoring wells MW-103, 208, 209 & 105 in foreground

Checklist Reference:

Photographer:

Date/Time:

Frame No.:

Site Location:

Direction:

Activity:

Comments:

Checklist Reference:

ND96-067
5/29/96

000720IB01Y

PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398

Photographer: D. Mc Carron

Date/Time: 5-22-96

Frame No.: 7,8

Site Location: Tank 50

Direction: Southwest

Activity: Env. Conditions Report

Comments: Looking at monitoring wells MW-103, 107 & 204

Checklist Reference:

Photographer:

Date/Time:

Frame No.:

Site Location:

Direction:

Activity:

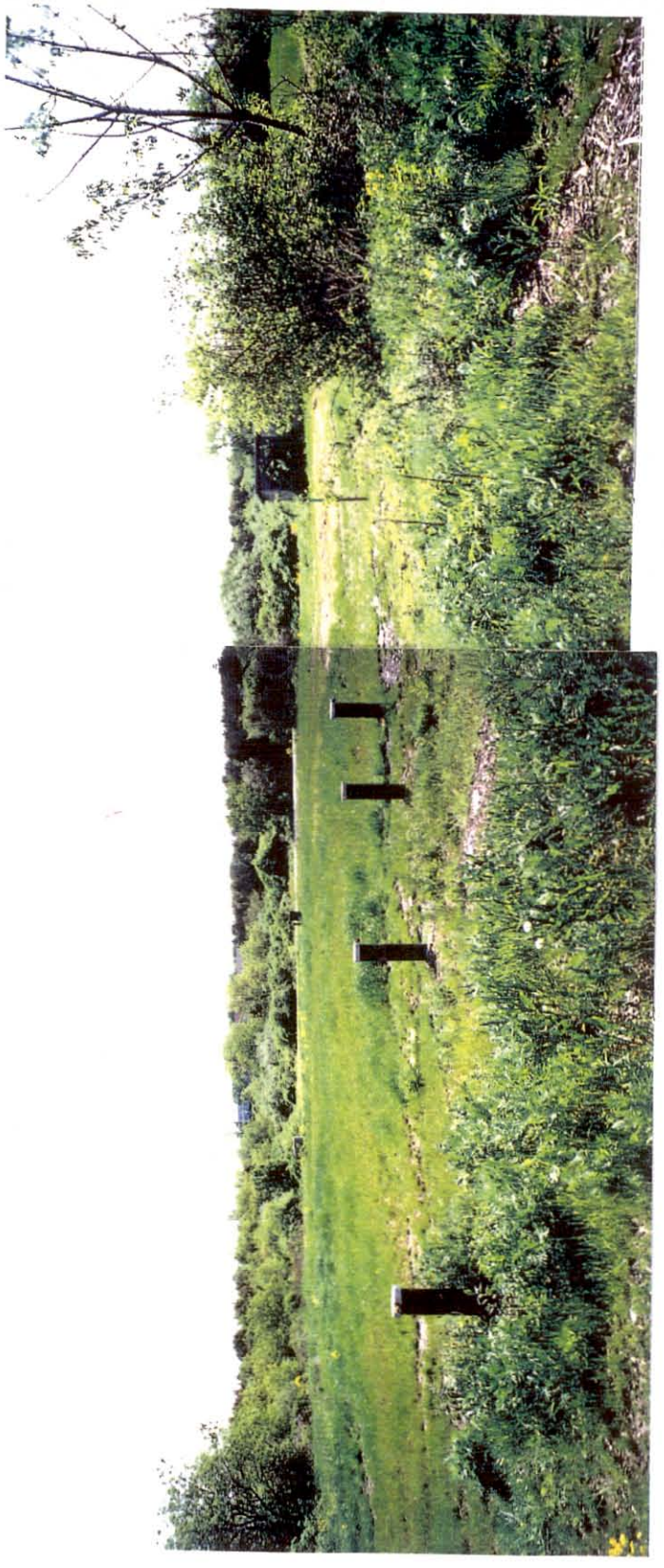
Comments:

Checklist Reference:

ND96-067
5/29/96

PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398



Photographer: D. McCarron

Date/Time: 5-22-96

Frame No.: 11,12

Site Location: Tank 50

Direction: East

Activity: Env. Conditions Report

Comments: Looking at monitoring wells MW-105, 209, 208 & 103

Checklist Reference:

Photographer:

Date/Time:

Frame No.:

Site Location:

Direction:

Activity:

Comments:

Checklist Reference:

ND96-067
5/29/96

PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398

Photographer: D. McCarron
Date/Time: 5-22-96
Frame No.: 16
Site Location: Near Tank 50
Direction: East
Activity: Env. Conditions Report
Comments: Electric service corridor
Checklist Reference:

Photographer: D. McCarron
Date/Time: 5-22-96
Frame No.: 19
Site Location: Tank Farm No. 5
Direction: South
Activity: Env. Conditions Report
Comments: Electric service corridor from existing power pole
Checklist Reference:

ND96-067
5/29/96

PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398

Photographer: D. McCarron
Date/Time: 5-22-96
Frame No.: 22
Site Location: Near Tank 51
Direction: North
Activity: Env. Conditions Report
Comments:

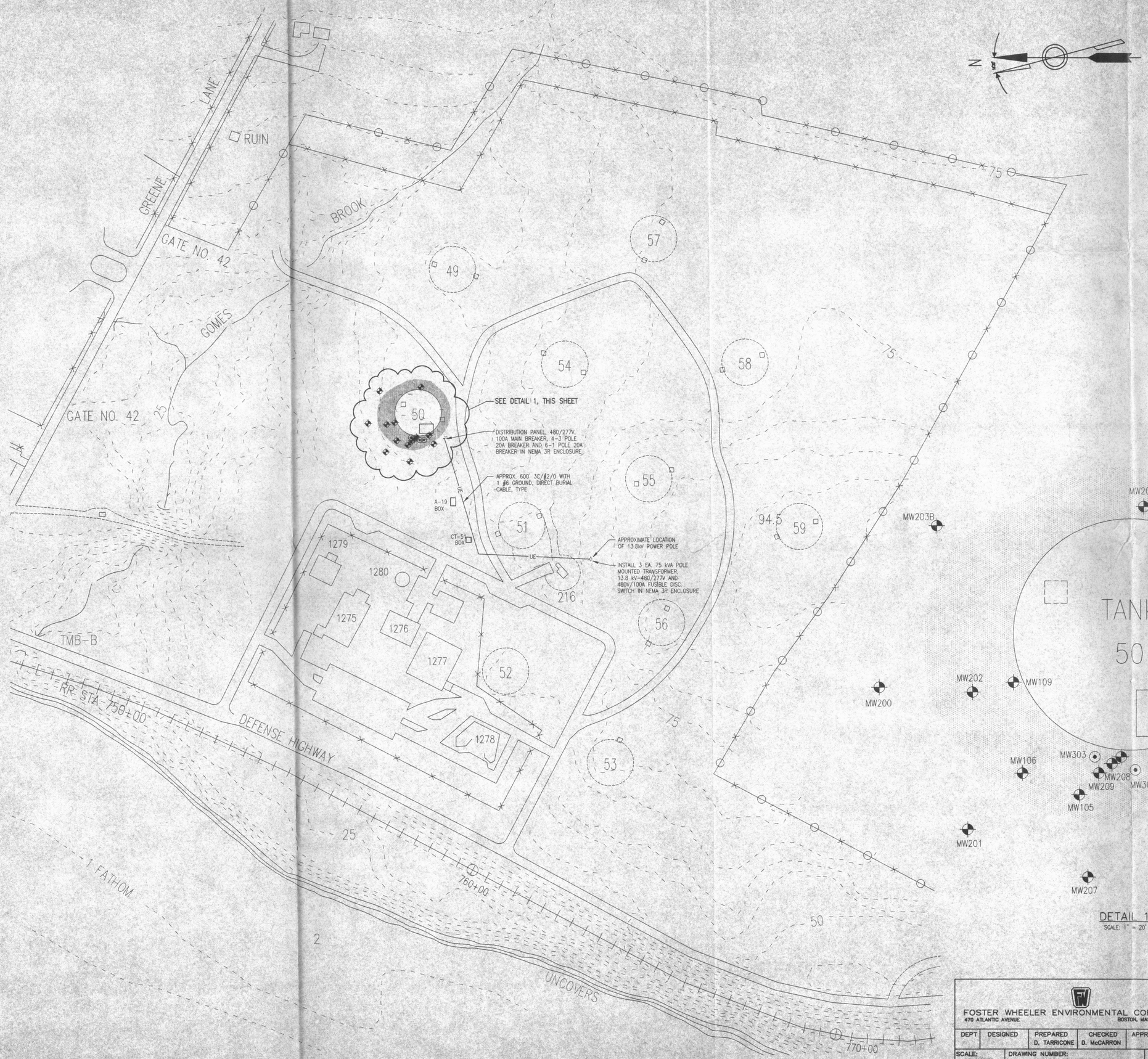
Checklist Reference:

Photographer: D. McCarron
Date/Time: 5-22-96
Frame No.: 24
Site Location: Tank Farm No. 5
Direction: West
Activity: Env. Conditions Report
Comments: Looking @ existing 13.8 KV Power Pole & transformer

Checklist Reference:

ND96-067
5/29/96

REVISION				
SYM	ZONE	DESCRIPTION	DATE	APPROVED



LEGEND

- BUILDING OR STRUCTURE
- ROAD OR PAVED AREA
- TRAIL OR EARTH ROAD
- PROPERTY BOUNDRY & FENCE LINE
- FENCE
- NAVY PROPERTY BOUNDRY LINE
- RESERVATION BOUNDRY
- RAILROAD
- STREAM
- SHORE LINE
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- DEPRESSION CONTOUR
- 14. SPOT GRADE ELEVATION ON SPOT
- WOODED AREA
- MARSH LAND
- MONITORING WELL LOCATION WITH IDENTIFIER
- PROPOSED MONITORING WELLS
- APPROXIMATE AREA OF PETROLEUM IMPACTED SOIL (>300 MG/KG)

DETAIL 1
SCALE: 1" = 20'

GRAPHIC SCALE IN FEET
100 0 100 200 300 400
CONTOUR INTERVAL 5 FEET

FOSTER WHEELER ENVIRONMENTAL CORPORATION
470 ATLANTIC AVENUE BOSTON, MASSACHUSETTS 02210

DEPT	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
		D. TARRICONE	D. McCARRON		5/29/96

SCALE: AS NOTED | DRAWING NUMBER: 1284.0011.FIG3-1.DWG | SH. OF | REV

NETC DWG. NO. XXXXXX
DSGN. XXXXX
DR. XXXX
BR.
DIR.
APPROVED DATE
SATISFACTORY TO
DATE

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

TANK 50 BIOREMEDIATION PILOT TESTING
NAVY REMEDIAL ACTION CONTRACT
DELIVERY ORDER NO.11
FIGURE 3-1

SIZE	CODE IDENT NO.	NAVFAC DRAWING NO.
F	80091	CONSTR. CONTR. NO. XXXXX
SCALE: XXXX		SPEC. XXXXX SHEET X OF X

Appendix B

Bench Scale Biodegradation Study

Bioremediation Laboratory Bench-Scale Treatability Study
Work Plan
Tank 50, NETC Newport
Delivery Order No. 0011 (Mod. 4)

1.0 Introduction

The bioremediation laboratory bench-scale treatability study will be performed by the Remediation Technology Testing Facility (RTTF) of Fluor Daniel GTI, Inc. as described in the following sections.

2.0 Sample Collection

Representative samples will be obtained from locations of known petroleum contamination at the Site taking care to exclude any separate phase product from the soil samples, should any be present. Samples will be collected using the following as guidance:

- Samples will be collected during the installation of soil borings directly from clean split barrel samplers. Brass or plastic liners may be used depending upon decontamination requirements;

- The presence of contaminants will be confirmed with field observations and field screening via a FID;

- Approximately 10 kilograms of soil will be collected for the study, packaged in sealed containers with some headspace;

- Groundwater samples will also be collected in areas of contamination and the presence of contaminants will be confirmed in the field based on field screening and observation information. Samples will be collected from either soil borings, or from existing wells in the area. Approximately 25 liters of groundwater will be collected for the study. The groundwater will be sent with some headspace and no preservation chemicals; and

- The soil and groundwater samples will be sent on ice for next day delivery to the RTTF including a chain of custody record specifying "biotreatability study." The address of the RTTF is:

  Fluor Daniel GTI, Inc.
  Remediation Technology Testing Facility
  4080 Pike Lane
  Suite B
  Concord, CA 94520
  ATTN.: Sample Log in

3.0 Initial Analysis

Laboratory personnel will prepare soil and groundwater composites from the individual samples received. The composites will be analyzed for the chemical, physical and microbiological parameters outlined in Table 1. These parameters will characterize the soil and groundwater composites for conditions that affect the bioremediation treatment and will be used to optimize the evaluation:

- The contaminant screening results will provide the baseline contaminant concentrations;
- The nutrient screening will be used to determine the amount of nutrient to amend to the soil for optimum conditions.
- The cation exchange capacity will provide a measure of the ability of the soil to retain cation;
- The pH measurement will allow for adjustment of the soil to the optimal pH range for biological activity, if necessary; and
- The microbial screening will assess the health of the bacterial population in the site soil. The total number of heterotrophic microorganisms will provide an indication of the viability of the site microorganism population. The ratio of total to specific contaminant-degraders will provide an indication of microbial adaptation to the contaminants as a food source.

4.0 Slurry Biodegradation Study

Following the initial characterization analyses, a soil slurry biodegradation study will be conducted to estimate the biodegradation potential under optimum conditions with respect to oxygen and mineral nutrient concentrations. A soil slurry test is the most cost-effective technique available to generate reproducible data regarding the rate and extent of biodegradation possible at the site. Results from this test can be used to predict the maximum extent of biodegradation that would be expected in a field system. Results can also be used to define nutrient and oxygen requirements.

The biodegradation evaluation will be performed in four experimental systems:

System 1 (non-enhanced). Soil and groundwater composites without amendments, to examine the extent of biodegradation occurring when no modifications are made to the soil and groundwater mixture.

System 2 (oxygen-enhanced). Soil and groundwater composites amended with oxygen, to examine the extent of biodegradation occurring when oxygen is in unlimited supply, and nutrients are not adjusted.

System 3 (nutrient-enhanced). Soil and groundwater composites amended with nutrients, to examine the extent of biodegradation occurring when nutrients are in unlimited supply, and oxygen is not amended.

System 4 (oxygen/nutrient-enhanced). Soil and groundwater composites amended with oxygen and nutrients, to estimate the extent of abiotic contaminant losses occurring in the test systems.

Each experimental system will consist of a series of sealed test reactors containing a slurry mixture of site soil and groundwater. Amendments will be added to the slurry mixtures according to the above test conditions.

The test reactors will be placed on a reciprocating shaker table and incubated at room temperature for 13 weeks. The systems will be monitored for TPH by gas chromatography with a flame ionization detector (GC/FID), contaminant-utilizing bacteria, and nutrients (ammonia-nitrogen [NH_3-N] and orthophosphate [oPO_4]). The monitoring will occur initially, after all of the sacrificial systems are set up, then at the end of each week, for a total of 14 monitoring points. Systems 2 and 4 will also be monitored for headspace gas concentrations, oxygen (O_2) and carbon dioxide (CO_2), by gas chromatography with a thermal conductivity detector (GC/TCD) initially and then every 3 weeks, for a total of 5 monitoring points. Supplemental oxygen will be provided as needed by direct addition of pure oxygen gas into the reactors of system 2 and system 4.

5.0 Reporting and Deliverables

An interim report will be generated fifteen days after the fifth week of the slurry biodegradation testing. This report will update the status of the treatability evaluation. Upon completion of the bioremediation evaluation, a final report will be prepared which outlines the experimental procedures, presents the results and discusses the conclusions. The final report will be generated within 15 days of completion of the analytical testing.

TABLE 1
Bioremediation Laboratory Treatability Study
Work Plan
Analytical Summary

Tank 50, NETC Newport
Delivery Order 11 (Mod. 4)

Analysis	Methodology	Matrix	Sample
Contaminant Screen			
Total Organic Carbon (TOC)	CFA S:18.0	S	single
Total Petroleum Hydrocarbon (TPH) by GC/FID(1)	EPA 8015 (modified)	W/S	duplicate
Background Nutrient Levels			
Ammonia-nitrogen	EPA 350.3	S	single
Orthophosphate	EPA 365.3	S	single
Other Chemical Properties			
pH	SM 4500-H^+	W/S	single
Cation Exchange Capacity	EPA 9080	S	single
Microbiological Screening			
Total Heterotrophic Bacteria (THB)	SM 9215 C (modified)	S	single
Contaminant-Utilizing Bacteria (CUB)	SM 9215 C (modified)	S	single
Headspace Gas Screening Analysis			
O_2/CO_2 by GC/TCD(2)	RTFF Internal Method	Slurry	single

NOTE: S - Soil; W/S - Water and Soil; EPA - Environmental Protection Agency; SM - Standard Methods; CFA - California Fertilizer Association.

(1) Gas chromatography with flame ionization detection.

(2) Gas chromatpgraphy with thermal conductivity detection.

APPENDIX C

PILOT SCALE BIOREMEDIATION TEST

Bioremediation Pilot Study
Tank 50, NETC Newport, RI
Delivery Order No. 0011 (Mod. 4)

1.0 Introduction

The objective of the Bioremediation Pilot Study is to generate the necessary information to design a full scale biosparge/biovent remediation system for the Tank 50 area. The information generated during the pilot test activities will include but not be limited to:

- radial zone of oxygenation;
- vacuum/pressure response; and
- measure biodegradation rates in the subsurface.

2.0 Pilot Test Location and Layout

Based upon review of the existing well locations, well construction and areas of known contamination, it is recommended that the pilot test activities be performed immediately west of Tank 50, in the area of wells MW103 and MW209. This area appears to provide the best existing well coverage and the best opportunity to reach the pilot test objectives. Below is a listing of the existing wells proposed to be used during the pilot test, their function and relative location:

- MW-103 biosparging test well (app. 10 ft., due west of Tank 50)
- MW-208 monitoring well (app. 10 ft, northwest of MW-103)
- MW-209 monitoring well (app. 15 ft., northwest of MW-103)
- MW-105 monitoring well (app. 25 ft., northwest of MW-103)
- MW-107 monitoring well (app. 30 ft., south of MW-103)

Since the measurement of and the actual performance of both sparging and venting technologies are directly dependent on the construction and condition of the test and monitoring wells, the actual well conditions and construction for wells listed above will be confirmed. If conditions are substantially different or the wells are found damaged, then modifications to using the above wells may be required.

In addition to the existing wells as described above, the following newly constructed wells are proposed for use during the pilot test activities:

- one(1) biovent extraction well, located app. 10. ft. southwest of MW-103
- two (2) combination monitoring wells;

  -one located approximately 10 ft. south of the proposed biovent extraction well, and
  -one located approximately 20 ft. north of the proposed biovent extraction well.

The above wells are necessary to ensure the that the information generated during the pilot test is of sufficient quality and volume such that the objectives of the pilot test can be met.

The additional test wells will be installed during mobilization as described in Section 3.1 and will be constructed as follows:

- biovent extraction well (1), 4-inch diameter, PVC, 20 ft. deep total depth, 10 ft. screened section,

- combination monitoring wells (2) (to be used to monitor both biosparging and bioventing activities), 2-inch diameter, PVC construction, 25 ft. total depth, 20 ft. screened section.

3.0 Equipment

The following equipment will be used to perform the pilot test. Figure C-1 contains the piping and instrument diagram for the test system.

System Equipment

1. air compressor
2. air hose and well head fittings for Biosparge/Biovent Wells
3. soil vapor extraction blower
4. associated valves and fittings

Monitoring

5. dissolved oxygen (DO) meter
6. FID, volatile hydrocarbon monitoring equipment
7. Multi-gas meter capable of measuring O_2, CO_2, and CH_4
8. down well interface probe
9. pressure/vacuum gauges (magnehelic type)
10. cylinder of helium gas and associated fittings
11. portable helium detector
12. Flow, temperature and pH meters

4.0 Pilot Test Operation and Monitoring

DAY 1

Test Preparation

- measure and document distance from the testing wells to all monitoring wells,
- measure and document static (pre-test) subsurface conditions, including:

- pressure/vacuum at monitoring wells;
- depth to groundwater in the monitoring wells;
- soil gas analysis in the well headspace of the monitoring wells (VOC, O_2, CO_2 and CH_4 concentrations);

- pH and dissolved oxygen (DO) in the groundwater at test monitoring wells; and
- presence or absence of floating product.

Initiate Biovent Test Activities

a. Start biovent extraction at approximately 30% of the maximum estimated site air flow rate. After steady state conditions are reached in the subsurface (15-30 minutes), measure the following parameters:

- vacuum at the extraction wellhead;
- air flow rate at the blower;
- induced vacuum at the monitoring well heads; and
- VOC, CO_2, O_2 and CH_4 concentrations in the biovent blower effluent.

b. Increase the extracted flow rate to approximately 60% of the maximum air flow rate. After steady state conditions are reached, repeat the measurements outlined above.

c. Increase the extracted flow rate to approximately 100% of the maximum air flow rate (corresponding to maximum vacuum). After steady state conditions are reached repeat the measurements outlined above.

d. Optimum vacuum level will be set prior to initiating air injection.

Initiate air injection at the biosparge well

a. start air compressor and open regulator valve to 75% of theoretical breakthrough pressure (breakthrough pressure is defined as the minimum pressure required to overcome the hydrostatic head of the groundwater above the sparge point).

b. slowly increase pressure until breakthrough is observed (indicated by measurable flow into biosparge well and/or physical observations at biosparge and monitor wells), record the breakthrough pressure and flow rate.

c. increase the air injection pressure to 115% of the breakthrough pressure, measure air flow rate once equilibrium is reached (target flow rate of 1-5 cfm). After 30 minutes measure: pressure/vacuum, depth to water and DO in surrounding monitoring wells. Repeat measurements every 30 minutes for two hours.

d. increase the air injection pressure to 130% of the breakout pressure, measure air flow rate once equilibrium is reached(target flow rate of 5-10 cfm). After 30 minutes measure: pressure/vacuum, depth to water and DO in surrounding monitoring wells. Repeat measurements every 30 minutes for two hours.

e. increase the sparge pressure to 160% of the breakout pressure, measure air flow rate once equilibrium is reached (target flow rate of 10-15 cfm). After 30 minutes measure: pressure/vacuum, depth to water and DO in surrounding monitoring wells. Repeat measurements every 30 minutes for two hours.

f. set the air injection and extraction rate and continue operating the biosparge and biovent systems overnight.

Note: Sparge and extraction air flow rates are presented as rough goals, actual air flow rates will be a function of the local geology and may vary considerably from the stated goals.

Day 2:

- Upon arrival at the site, measure the following system parameters:

- vacuum at the extraction wellhead;
- extraction air flow rate at the blower;
- sparge air flow rate;
- vacuum/pressure at the monitoring well heads;
- VOC, CO_2, O_2 and CH_4 concentrations in the biovent blower effluent;
- depth to groundwater in the monitoring wells; and
- groundwater pH and DO in the test monitoring wells.

- Continue operating the biosparge and biovent systems overnight at the most desirable flow rates.

DAY 3

- Upon arrival on-site, measure the system parameters listed in for Day 2 above.

- Initiate helium injection by bleeding in helium gas, at a predetermined rate, at the well head of the biosparge well. After steady state conditions are reached in the subsurface (15-30 minutes), measure helium and oxygen concentrations in the monitoring wells, and in the extraction blower effluent stream, every ½ hour for 4 hours.

- Stop operation of the biosparge and biovent pilot systems and initiate insitu respirometry test. Measure the following parameters immediately after turning off systems and, once per hour for the remainder of the day:

- vacuum at the extraction wellhead;
- vacuum/pressure at the monitoring well heads;
- VOC, CO_2, O_2, CH_4 and helium concentrations in the well head- space in all test wells;
- depth to groundwater in the monitoring wells;
- groundwater pH and DO in the monitoring wells; and
- helium and O_2 concentrations in all test wells.

DAY 4

-with the pilot system remaining off, measure the following parameters two times during the day:

- vacuum at the extraction wellhead;
- vacuum/pressure at the monitoring well heads;
- VOC, CO_2, O_2 and CH_4 concentrations in all test wells;
- depth to groundwater in the monitoring wells; and
- groundwater pH and DO in the test monitoring wells.

Day 5

- Upon arrival on-site, measure the following parameters one time:

- vacuum at the extraction wellhead;
- vacuum/pressure at the monitoring well heads;
- VOC, CO_2, O_2 and CH_4 concentrations in all test wells;
- depth to groundwater in the monitoring wells; and
- groundwater pH and DO in the test monitoring wells.

- Re-start the test with both the biosparge and biovent systems operating (at the most optimal flow conditions as determined from the results of day 1 and 2, respectively), measure the following parameters every two hours for the remainder of the day:

- vacuum at the extraction wellhead;
- air flow rate at the blower;
- vacuum or pressure at surrounding monitoring wells;
- VOC, CO_2, O_2 and CH_4 concentrations in the biovent blower effluent;
- depth to water; and
- groundwater pH and DO in the test monitoring wells.

- Leave the site with the biosparge and biovent systems operating. The systems may be set for intermittent operation (i.e., cycling on/off) during a portion of the test.

Week 2-12

- Inspect and document the operating condition of all testing equipment, perform maintenance as needed,

- Measure the following parameters twice per week:

- vacuum at the extraction wellhead;
- air flow rate at the blower;
- vacuum or pressure at surrounding monitoring wells;
- VOC, CO_2, O_2 and CH_4 concentrations in the biovent blower effluent;
- depth to water; and
- groundwater pH and DO in the test monitoring wells.

- Adjust system flow and operating conditions as needed to maximize system performance, re-measure the parameters listed above.

Week 13

- During the last week of the pilot test the biosparge and biovent systems should be de-activated and the following measurements and observations should be performed:

- In-Situ Respirometry Measurements (O_2, CO_2, CH_4 and VOC concentrations) in all test wells, 3-4 times per day for two days;
- measure depth to water, pH and DO in all test wells two times during the day of system deactivation; and

- Inspect and record all operating conditions of the test equipment, documenting any potential operation and or maintenance concerns.

Week 14-23

- At the end of week 13, the system will be restarted and operated without data collection for 10 weeks.

APPENDIX D

QUALITY CONTROL PLAN AMENDMENTS

Appendix D.1

Submittal Register

Transmittal No	Project Plan	SD No and Type of Submittal Material or Product (1)	Para No	Approval Required By (2)	Reviewers (2)	Planned Submittal Date	Contractor Action Action Code	Date of Action	Date Forward to Approved Authority Date Received From Contractor	Approving Authority Action Date Forwarded to Other Reviewer	Date Received from Other Reviewer	Action Code	Date of Action	Contractor Mailed to Contractor/ Received from Approved Authority	Remarks
		SD-08: Statements													
	Work Plan	Site Safety and Health Plan		G	A/E	6/4/96									
		SD-08: Statements													
	Work Plan	Work Plan includes QC Plan, Env Protection Plan, Sampling and Analysis Plan, Waste Management Plan		G	ROICC	6/3/96									
		SD-12: Field Test Reports													
		Interim Bench Scale Treatability Report		G	ROICC	9/30/96									
		SD-18: Records													
		Field notebooks			ROICC	12/15/96									
		Post Pilot Study Reports		G	ROICC	12/10/96									
		SD-01: Data													
		Tank photographs				12/15/96									

Navy Notes: Approved By:
G = Contracting Officer
Blank = COC Manager

NASA Notes: Approved By:
Blank = Contr. Officer

Army Notes: Classification:
GA = Government Approval
FIO = For Information Only

Action Codes:
NR = Not Reviewed
A= Approved
AN= Approved as Noted
RR= Disapproved; Revise and Resubmit
(Others may be prescribed by Transmittal Form)

Appendix D.2

Forms for Inspection Phases

INSPECTION NOTIFICATION FORM

Date: _____

Preparatory: _____ Initial: _____

Follow-Up: _____ Completion: _____

Planned Definable Feature of Work to be Inspected: _____

_____

_____

Date of Planned Inspection: _____

_____ _____
Originator Date

_____ _____
SQCM Signature Date

_____ _____
ROICC Acknowledgment Date

PREPARATORY INSPECTION CHECKLIST

CONTRACT NO.: N62472-94-D-0398 DATE: _____

TITLE: NETC NEWPORT TANK 50 SPEC SECTION: _____

MAJOR DEFINABLE FEATURE OF WORK: _____

A. PERSONNEL PRESENT:

	NAME	POSITION	COMPANY
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

B. TRANSMITTALS INVOLVED:

	NUMBER & ITEM	CODE	CONTRACTOR or Gov't APPROVAL
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

B-I. Have all items involved been approved? Yes _____ No _____

B-II. What items have not been approved?

	ITEM	STATUS
1.		
2.		
3.		
4.		
5.		
6.		
7.		

PREPARATORY INSPECTION CHECKLIST (cont.)

C. ARE ALL MATERIALS ON HAND? Yes _____ No _____

C-I. Are all materials on hand in accordance with approvals? Yes _____ No _____

C-II. Items not on hand or not in accordance with transmittals:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

D. TESTS REQUIRED IN ACCORDANCE WITH CONTRACT REQUIREMENTS:

	TEST	PARAGRAPH
1.		
2.		
3.		
4.		
5.		
6.		
7.		

D-I. COMPONENT INSTALLATION CHECKS:

	COMPONENT	ACCEPTABLE	UNACCEPTABLE
1.			
2.			
3.			
4.			
5			
6.			
7.			
8.			
9.			
10.			

PREPARATORY INSPECTION CHECKLIST (cont.)

E. ACCIDENT PREVENTION PREPLANNING - HAZARD CONTROL MEASURES:

E-I. Applicable Outlines (attach complete copies):

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

E-II. Operational Equipment Checklists:

ATTACHED FOR:

1. _____

2. _____

3. _____

F. ROICC Notified? Yes _____ No _____

_____
Site Quality Control Manager

INITIAL INSPECTION CHECKLIST

CONTRACT NO.: N62472-94-D-0398 DATE: _____

TITLE: NETC NEWPORT TANK 50

DESCRIPTION AND LOCATION WORK INSPECTED: _____

REFERENCE CONTRACT DRAWINGS: _____ SPEC SECTION: _____

A. PERSONNEL PRESENT:

	NAME	POSITION	COMPANY
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

B. MATERIALS BEING USED ARE IN STRICT COMPLIANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS: Yes ____ No ____

IF NOT, EXPLAIN: _____

C. PROCEDURES AND/OR WORK METHODS WITNESSED ARE IN STRICT COMPLIANCE WITH THE REQUIREMENTS OF THE CONTRACT SPECIFICATIONS: Yes ____ No ____

IF NOT, EXPLAIN. _____

INITIAL INSPECTION CHECKLIST (cont.)

C-I. COMPONENT INSTALLATION CHECKS:

	COMPONENT	ACCEPTABLE	UNACCEPTABLE
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

D. WORKMANSHIP IS ACCEPTABLE? Yes ____ No ____

STATE AREAS WHERE IMPROVEMENT IS NEEDED: _____

E. SAFETY VIOLATIONS AND CORRECTIVE ACTION TAKEN: _____

F. ROICC NOTIFIED? Yes ____ No ____

_____
Site Quality Control Manager

FOLLOW-UP INSPECTION CHECKLIST

CONTRACT NO.: N62472-94-D-0398 DATE: _____

TITLE: NETC NEWPORT TANK 50

DESCRIPTION AND LOCATION WORK INSPECTED: _____

REFERENCE CONTRACT DRAWINGS: _____ SPEC SECTION: _____

A. PERSONNEL PRESENT:

	NAME	POSITION	COMPANY
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

B. MATERIALS BEING USED ARE IN STRICT COMPLIANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS: Yes ____ No ____

IF NOT, EXPLAIN: _____

C. PROCEDURES AND/OR WORK METHODS WITNESSED ARE IN STRICT COMPLIANCE WITH THE REQUIREMENTS OF THE CONTRACT SPECIFICATIONS: Yes ____ No ____

IF NOT, EXPLAIN: _____

FOLLOW-UP INSPECTION CHECKLIST (cont.)

C-I. COMPONENT INSTALLATION CHECKS:

	COMPONENT	ACCEPTABLE	UNACCEPTABLE
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

D. WORKMANSHIP IS ACCEPTABLE? Yes ____ No ____

STATE AREAS WHERE IMPROVEMENT IS NEEDED: _____

E. SAFETY VIOLATIONS AND CORRECTIVE ACTION TAKEN: _____

F. ROICC NOTIFIED? Yes ____ No ____

_____
Site Quality Control Manager

COMPLETION INSPECTION CHECKLIST

CONTRACT NO.: N62472-94-D-0398 DATE: _____

TITLE: NETC NEWPORT TANK 50

MAJOR DEFINABLE FEATURE OF WORK: _____

LOCATION: _____ SPEC SECTION: _____
(Refer to Final Follow-Up Inspection Checklist)

A. OPEN PUNCHLIST ITEMS FROM FINAL FOLLOW-UP INSPECTION CHECKLIST:

	ITEM	DATE OF COMPLETION
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

B. NEW PUNCHLIST ITEMS NOTED:

	ITEM	DATE OF COMPLETION
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

C. ROICC NOTIFIED? Yes ____ No ____

On behalf of Foster Wheeler Environmental Corporation, I certify this activity is completely in accordance with the Contract Documents, based upon the information available to me.

_____
Site Quality Control Manager

NETC NEWPORT TANK 50 REMEDIAL ACTIONS
NAVY RAC CONTRACT NO: N62472-94-D-0398
DELIVERY ORDER NO. 011
FOSTER WHEELER ENVIRONMENTAL CORP.

DAILY QUALITY CONTROL REPORT

Daily Report No.: _____ Date: _____

Weather: _____ Precipitation: _____

In.: _____ Temp: Min: _____ Max: _____

1. Site Personnel, Equipment and Work Performed Today (see attached Daily Report to Inspector)

2. Job Safety (see attached Daily Safety Report)

3. Inspection Activities Performed (circle applicable inspections; inspections attached):

   Preparatory / Initial / Follow-Up / Completion Inspections

4. Material Received (if not covered on Inspection Checklist):

   _____
   _____
   _____
   _____
   _____

5. Submittals received/reviewed (if not covered on Inspection Checklist):

DESCRIPTION	SPEC/PLAN OTHER REF.	DESCRIPTION	SPEC/PLAN OTHER REF.

6 Verbal Instruction (USACE instructions received or given with action to be taken):

   _____
   _____
   _____
   _____
   _____
   _____

NETC NEWPORT TANK 50 REMEDIAL ACTIONS
NAVY RAC CONTRACT NO: N62472-94-D-0398
DELIVERY ORDER NO. 011
FOSTER WHEELER ENVIRONMENTAL CORP.

DAILY QUALITY CONTROL REPORT NO. _____ (cont.)

7. Remarks (Potential conflict(s)/compliance issues; delays encountered):

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

QC's Verification: On behalf of Foster Wheeler Environmental Corporation, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the Contract Documents to the best of my knowledge, except as may be noted above.

QC Manager: _____ Date: _____

Site Manager: _____ Date: _____

DAILY REPORT TO INSPECTOR

DATE

CONTRACT NO.	TITLE AND LOCATION	REPORT NO.
52472-93-D-0398	NETC NEWPORT - TANK 50	

CONTRACTOR *(Prime or Subcontractor)*	NAME OF SUPERINTENDENT OR FOREMAN

PRIME CONTRACTOR/SUBCONTRACTOR WORKFORCE *(If space provided below is inadequate, use additional sheets)*				LOCATION AND DESCRIPTION OF WORK PERFORMED
NUMBER	TRADE	HOURS	EMPLOYER	

TOTAL WORK HOURS ON JOB SITE THIS DATE		WERE THERE ANY LOST TIME ACCIDENTS THIS DATE?
CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT		☐ YES ☐ NO
TOTAL WORK HOURS FROM START OF CONSTRUCTION		IF "YES", A COPY OF THE COMPLETED OSHA REPORT IS REQUIRED

CONSTRUCTION AND PLANT EQUIPMENT LEFT ON JOB SITE UNTIL USE IS COMPLETED

DESCRIPTION	DATE FIRST ON JOB *(First time only)*	HOURS WORKED THIS DATE	HOURS IDLED	DATE OF FINAL REMOVAL FROM JOB SITE

SPEC. PARA. AND/OR DRAWING NO.	EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB *(Description, Sizes, Quantity)*	SUBMITTAL NO. OR CERTIFICATION	DATE APPROVED

REMARKS *(Include directions received from ROICC/AROICC, visitors, compliance notices received, errors and/or omission in P/S; pertinent information)*

CONTRACTOR/SUPERINTENDENT DATE

ND96-000
5/31/96

DAILY CREW REPORT

TASK PERFORMED: _____

JOB NUMBER: _____ **DATE:**

FOREMAN: _____

PERSONNEL:

TRADE	NAME	HOURS WORKED

EQUIPMENT:	HOURS WORKED

TASKS PERFORMED:

UNUSUAL CONDITIONS, DISCREPANCIES, ACTION TO BE TAKEN:

SIGNATURE: _____

NETC NEWPORT TANK 50 REMEDIAL ACTIONS
NAVY RAC CONTRACT NO: N62472-94-D-0398
DELIVERY ORDER NO. 011
FOSTER WHEELER ENVIRONMENTAL CORP.

DAILY SAFETY REPORT

Date: _____ **Report #** _____
Time Period: _____
Work Performed: _____

Level of Protection/Work Activity:
Respiratory/Dermal Activity

Air Monitoring Results:

Personnel in Exclusion Zone: See attached Entry/Egress EZ Log.

Daily Inspections:

Monitoring Equipment Utilized:

OVA S/N - _____
MICROTIP S/N - _____
MINIRAM S/N - _____
MSA CGI 261 S/N - _____
NOISE METER S/N - _____

Accidents or Breach of Procedures: _____

Weather Conditions: _____

Physical Conditions of Workers: _____

NETC NEWPORT TANK 50 REMEDIAL ACTIONS
NAVY RAC CONTRACT NO: N62472-94-D-0398
DELIVERY ORDER NO. 011
FOSTER WHEELER ENVIRONMENTAL CORP.

DAILY SAFETY REPORT (cont.)

Date: _____ **Report #** _____

Monitoring Equipment Checklist:

Contaminant	Number of Samples	Sampling Pump/Monitor

Comments: _____

Name: _____
Signature: _____

Foster Wheeler Environmental Corporation Page _____ of _____

Field Change Request

Section 1 thru 4 to be filled out by Construction. Section 5 to be filled out by Engineering

Project: **Navy RAC D.O. #11 - NETC Newport Tank 50 Remedial Actions**	OFS. No. **1284-0013**	FIELD CHANGE REQUEST: **FCR -** **Rev.**

To:_____ Dept: **Engineering** Location:_____ Date:_____

Re: ☐ Drawing No._____ Title._____
☐ Spec. No._____ Title:_____
☐ Other _____

1. DESCRIPTION (*Items involved, submit sketch if applicable*)_____

2. REASONS FOR CHANGE *(If from disposition of non-conformance report, list report number)*_____

3. RECOMMENDED DISPOSITION ☐ Minor Change ☐ Major Change (Contracting Officer Approval Req'd) ☐ Schedule Impact ☐ Budget Impact

Initiator (Signature):_____

4. Site Engineer *(Signature)*	Date	Site Manager Concurrence *(Signature)*	Date

5. Disposition

☐ Not Approved (give reason)

☐ Considered Minor Changes - Approved per Recommended Disposition - Design Documents will not be normally revised field to maintain as-built records

☐ Considered Major Changes - Action will be taken as described on DCN

Project Engineer *(Signature)*	Date	ROICC Approval *(Signature)*	Date
		ROICC Approval *(Signature)*	Date

Engineer signs and transmits to Resident Engineer with copies to:

Project Manager: David McCarron
Project Engineer: Robert Donati
Site Manager: Marc Dippre
Quality Control Systems Manager: Akrim Aziz

Others as required:_____

ND96-000
5/31/96

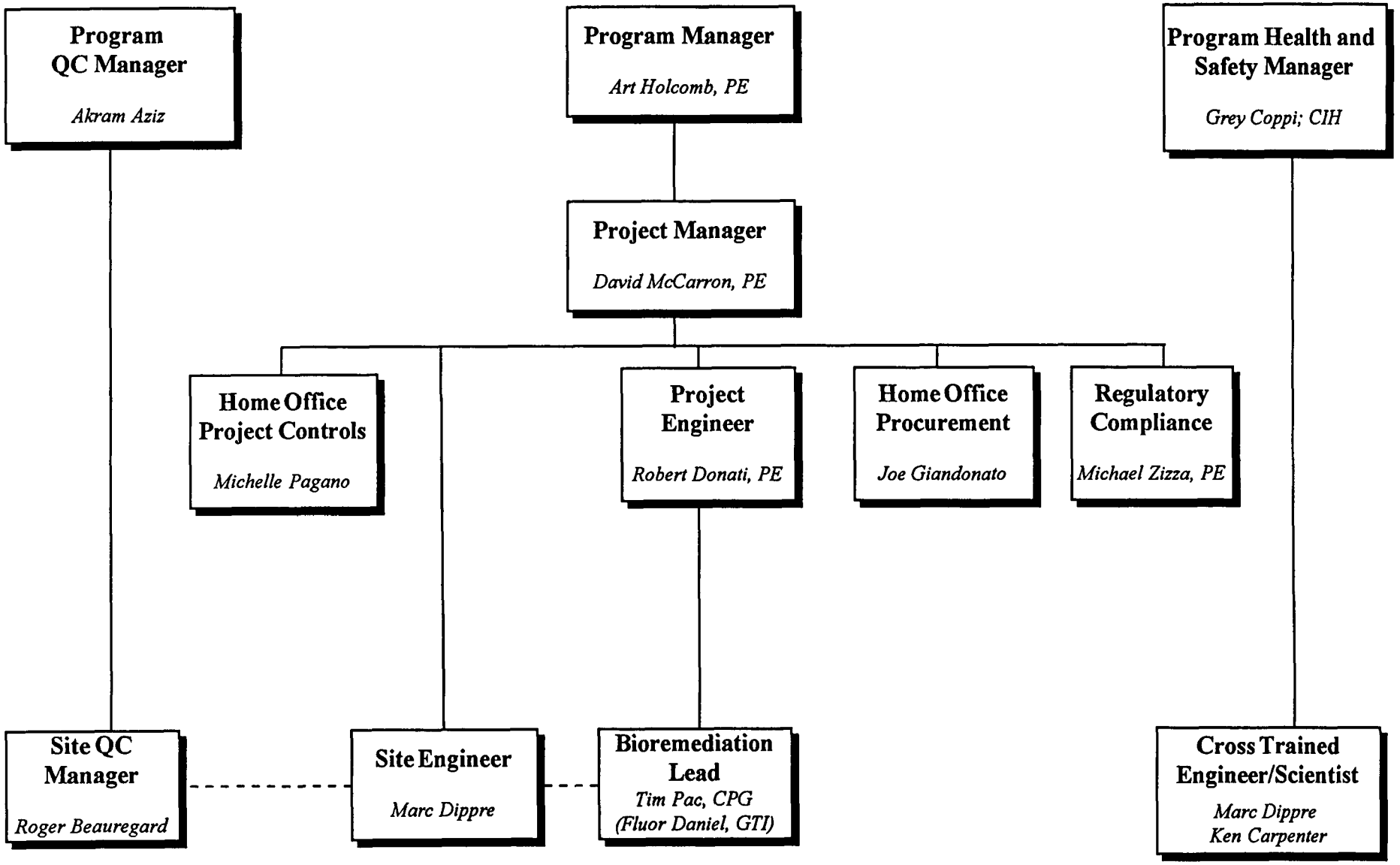
Appendix D.3

Project Organizational Chart

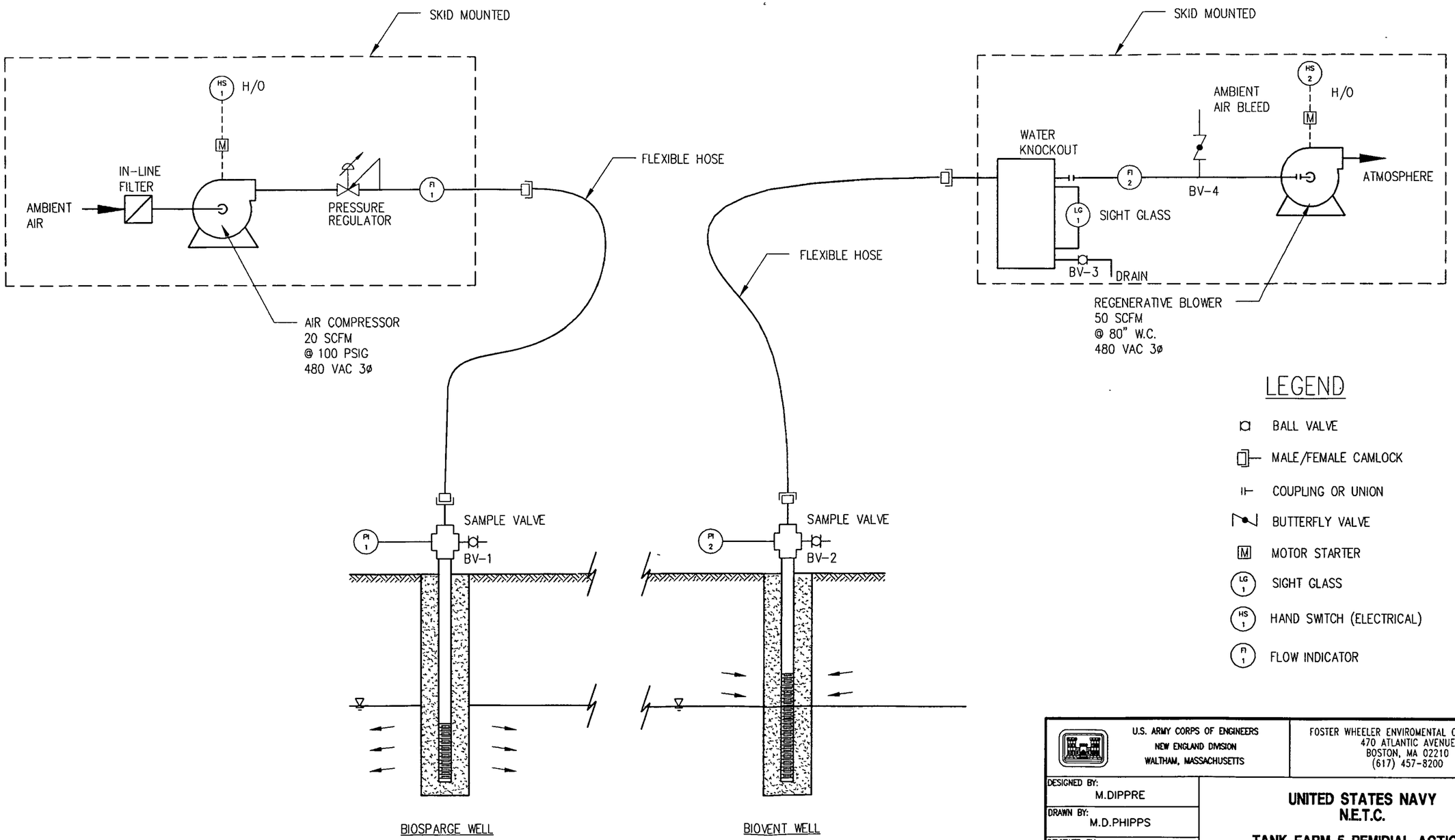
Figure D-1

Foster Wheeler Environmental Project Organizational Chart

Delivery Order #11, Modification 4



ppt043



LEGEND

- BALL VALVE
- MALE/FEMALE CAMLOCK
- COUPLING OR UNION
- BUTTERFLY VALVE
- M — MOTOR STARTER
- LG 1 — SIGHT GLASS
- HS 1 — HAND SWITCH (ELECTRICAL)
- FI 1 — FLOW INDICATOR

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION
WALTHAM, MASSACHUSETTS

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APPROVAL RECOMMENDED:*

(* As required by Engineering Circular No. 1110-1-76)

UNITED STATES NAVY
N.E.T.C.

TANK FARM 5 REMIDIAL ACTIONS
TANK 50

PIPING & INSTRUMENTATION DIAGRAM

SCALE: NONE
DATE: 05/09/96
CADD NO: 1284531

SOLICITATION NUMBER:
DRAWING CODE:

SHEET REFERENCE:
FIGURE C-1

U.S. NAVY NORTHERN DIVISION
REMEDIAL ACTION CONTRACT (RAC)
CONTRACT NO. N62472-94-D-0398
DELIVERY ORDER NO. 0011

POST PILOT STUDY REPORT

NETC TANK FARM NO. 5, TANK 50
NEWPORT, RHODE ISLAND

October 1997

Prepared by

Foster Wheeler Environmental Corporation
470 Atlantic Avenue
Boston, Massachusetts 02210

Revision	Date	Prepared By	Approved By	Pages Affected
2	10/3/97	B. Donati T. Pac (Fluor Daniel GTI)	D. McCarron	All

ND97-005
10/3/97

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1.0 INTRODUCTION

Foster Wheeler Environmental Corporation (Foster Wheeler) has prepared this Pilot Study Report in conjunction with our subcontractor, Fluor Daniel GTI, Inc. (Fluor Daniel GTI) as part of remedial activities at Tank 50 (the Site) in Tank Farm No. 5 at the Naval Education and Training Center (NETC) in Newport, Rhode Island. The work was completed under Delivery Order No. 0011, Modification 4 of the Northern Division of the Naval Facilities Engineering Command Remedial Action Contract No. N62472-94-D-0398, and in accordance with the Work Plan (Foster Wheeler, 1996).

This report describes the objectives, procedures, and results of the bioremediation bench and pilot scale studies. These results will be reviewed in conjunction with site remedial objectives to enable a focused approach to achieving the remedial objectives.

This section of the report provides a brief project background and history, as well as the intended objectives for these studies. Section 2.0 provides a description of the pilot system layout, design, and construction. Section 3.0 presents a description of the bench scale study. The operation, monitoring, and results of the pilot system are included in Section 4.0. Section 5.0 presents the conclusions of these studies. Section 6.0 provides recommendations relative to achieving remedial objectives.

1.1 Site Description

NETC-Newport is located in the Towns of Newport, Middletown, and Portsmouth, Rhode Island, approximately 25 miles southeast of Providence. Figure 1-1 shows the site location. Tank Farm No. 5 is situated in Middletown in the north-central portion of NETC-Newport. Tank 50 is the northernmost tank in Tank Farm No. 5, as shown in Figure 1-2. Tank Farm No. 5 is bordered by Defense Highway to the north/northwest; a cemetery to the southwest; woodlands and residential property to the southeast; and Greene Lane to the north/northeast. Gomes Brook transects the northern portion of the tank farm and flows westerly, to Narragansett Bay, providing surface drainage for the northern portion of Tank Farm No. 5.

Tank Farm No. 5 occupies approximately 85 acres and contains 11 formerly operational underground storage tanks (USTs), numbered 49 through 59. A paved road leads into the farm, passing between the tanks in a loop. With the exception of Tank 53, there is no secured perimeter fence at the tank farm. Tank 50 was used to store virgin heavy fuel oil but, again, is not currently in use.

1.2 Site History

The Navy began construction of the USTs at NETC-Newport in five separate tank farms in 1941. The USTs in Tank Farm No. 5, including Tank 50, were constructed between 1942 and 1943 and were used to store fuel oils and other petroleum products. In 1974, all of the USTs, except Tank 53 and 56, were taken out of service (Brown & Root, 1995b).

Tank 50 is a field-constructed reinforced concrete UST with a nominal storage capacity of 60,000 barrels (2.52 million gallons). The tank has 12-inch thick walls and roof and a 14- to 20-inch thick floor. The tank is 119 feet in diameter and 36 feet from the roof to the bottom of the tank. Tank 50 was constructed by blasting and excavating bedrock to create a 20- to 25-foot deep, steep-walled bedrock socket, with a diameter ranging from 20 feet larger than the tank diameter at the bedrock surface to only 5 feet larger at the tank bottom. The tank floors were poured directly on the surface of the bedrock at the bottom of the socket, followed by the construction of steel-reinforced, pre-stressed concrete walls and a concrete roof. Following tank construction, "locally derived materials" (fine to course sands and silts) were used to fill the annular space between the tank wall and bedrock socket, and soil was placed on the roof to bring the area

to existing grade. According to a summary of historical records in the *Site Investigation* (SI), backfill material consisted of shale placed in shallow, successive layers around the tank and compacted (tamped) between each layer, with larger pieces of shale at the bottom and smaller pieces at the top (Brown & Root, 1995b).

Several investigations have been conducted at Tank 50 to investigate soil and groundwater quality. An *Initial Assessment Study* (IAS) was conducted in 1982 and 1983 by Envirodyne Engineers, Inc. to evaluate the impact of disposal of tank bottom sludges at Tank Farm No. 5. A *Phase I Remedial Investigation* (RI) by TRC in 1990 did not report the presence of "significant" levels petroleum contamination at the tank farm. In a *Preliminary Closure Assessment* (PCA) investigation conducted by Brown & Root (as Haliburton NUS) in October 1994, soils saturated with residual petroleum were found below the water table. The petroleum composition consisted of a range of No. 6 through No. 2 fuel oil. During this investigation, five monitoring wells were installed near Tank 50 (MW-105 through MW-109). In a subsequent structural inspection of Tank 50, several cracks were noted on the tank floor.

In December 1995, Brown & Root completed the SI report on Tank 50. As part of the SI, an additional 17 borings and nine monitoring wells were installed around Tank 50. Seven of the monitoring wells were installed in the overburden soils (MW-200, MW-201, MW-202, MW-204, MW-206, MW-208, and MW-209) and two were set in bedrock (MW-203B and MW-207B). The results of the SI showed that petroleum impacted soils were primarily present in the tank socket (below the water table) with some petroleum observed approximately 40 to 50 feet downgradient (north) of the tank. Free phase product was also observed sporadically through the saturated zone soils. The highest total petroleum hydrocarbon (TPH) concentration detected in soil was 65,000 milligrams/kilogram (mg/kg) in MW-107 (with bunker oil TPH patterns) at a depth of between 12 and 14 feet below ground surface (bgs). Other TPH soil concentrations ranged form 310 to 13,000 mg/kg. During the SI, the TPH compounds detected included diesel fuel, bunker oils, and fuel oils ranging from No. 4 to No. 6. No floating product was detected in any of the wells; however, immiscible droplets of oil were observed in groundwater during well development. Appendix A contains copies of boring logs and monitoring well completion diagrams for monitoring wells installed by Brown & Root adjacent to Tank 50 which were used in the pilot scale study.

Following the SI, Brown & Root submitted a *Technology Screening Evaluation Report* in January 1996. In this report, evaluation of groundwater treatment technologies was determined to be unnecessary because of the low solubility of the heavier hydrocarbons. The evaluation recommended that in-situ bioremediation be chosen as the preferred technology for remediating the petroleum impacted soils, and that a treatability study be performed on site soils to evaluate the effectiveness of this technology.

1.3 Hydrogeologic Conditions

The NETC-Newport site is located within the Narragansett Basin, which is a lowland structural basin underlain by Pennsylvanian age non-marine sedimentary and metamorphic bedrock, including the Rhode Island Formation. Previous Brown & Root reports stated that bedrock beneath the site consisted of shale with phylite observed in boreholes in the vicinity of Tank 50 (Brown & Root, 1995a). The depth to bedrock across the site is highly variable; however, it is estimated not to exceed 45 feet bgs. In the vicinity of Tank 50 weathered bedrock is approximately 17 feet bgs, with more competent bedrock starting at approximately 24 feet bgs.

Undisturbed overburden deposits at the site consist of glacial outwash deposits. These deposits are highly variable, ranging from gravel to sand and silt, and extend to within 3 to 6 feet of the weathered bedrock surface where a medium dense discontinuous till layer overlies the bedrock.

Groundwater in the vicinity of Tank 50 is classified as "GA - Non-Attainment" (GA-NA). GA-NA groundwater is considered unsuitable for public water supply without treatment, but the goal of RIDEM is to remediate to GA. However, the location of the site and geologic condition make it unlikely that the site would be considered for use as a public water supply. Also, Tank 50 is not located within a groundwater reservoir or recharge area, nor are there any public or private wells located in the area (Brown & Root, 1995b). Based on past reports, groundwater flow is in a northerly direction toward Gomes Brook and Narragansett Bay.

1.4 Nature and Extent of Contamination

During previous investigations, three areas of petroleum contaminated soils were identified at Tank 50: surface soils near the pump chamber, subsurface soils adjacent to the tank, and subsurface soils downgradient (north and northwest) of the tank. Petroleum contaminants detected included TPH, several semivolatile organic compounds (SVOCs) including benza(a)anthracene and phenenthrene, and metals including cadmium and arsenic (Brown & Root, 1995b).

Surface soils were observed to have TPH concentrations ranging from 400 to 1,900 mg/kg. Subsurface TPH concentrations in the soils located within the socket were observed primarily below the water table and ranged from 310 to 13,000 mg/kg with the exception of one sample at MW-107 (65,000 mg/kg). TPH concentrations as high as 31,000 mg/kg (MW-105) were also detected in the soils collected from wells downgradient (north) of the tank socket.

1.5 Bench and Pilot Study Objectives

Based on the results of the SI and Technology Screening Evaluation Reports completed by Brown & Root, the remedial objectives include in-situ bioremediation as the preferred alternative for remediating petroleum contaminated soils in the vicinity of Tank 50. No remedial objective was deemed necessary for groundwater. The Rhode Island Department of Environmental Management (RIDEM) cleanup level for petroleum contaminated soils of 300 mg/kg was recognized as the TPH cleanup level for the site. However, based on recent conversations with the Navy, it is estimated that a cleanup level of 5,000 mg/kg is more representative of site-specific risks.

To support the remedial objectives, Foster Wheeler performed bench scale and pilot scale studies to determine the feasibility of using in-situ bioremediation, as recommended in the Technology Screening Evaluation Report, to remediate the fuel oils in the subsurface near Tank 50. While technology screening typically evaluates several remedial options, it is usually necessary to perform site-specific field and/or laboratory tests to evaluate the effectiveness of an alternative based on site-specific conditions. To implement these studies, intrusive activities performed at the site included soil sampling and installation of monitoring wells.

1.5.1 Technology Description

The in-situ bioremediation technology proposed in the Technology Screening Report for this site is bioventing/biosparging. This technology combines soil venting and air sparging processes. Bioventing and biosparging are processes where oxygen is delivered to the subsurface to stimulate the growth of microorganisms and enhance the degradation of petroleum contaminants. Unlike soil venting and air sparging, bioventing/biosparging typically employs lower air flow rates in order to provide enough oxygen for biodegradation without increasing volatilization of contaminants. The technologies can be implemented simultaneously by injecting air into the subsurface through a biosparge well and withdrawing air through a biovent well.

Prior to design and construction of a full scale system, bench scale and pilot scale treatability studies are generally performed to determine if in-situ bioremediation will be effective in degrading contaminants at a specific site. While a feasibility study may identify a technology as being potentially effective, site-specific parameters may limit the effectiveness. These studies are also used to evaluate operating conditions that will provide for optimal biodegradation during full scale operation.

1.5.2 Bench Scale Study

A 13-week bench scale study was conducted to investigate whether indigenous petroleum-degrading microorganisms were present and could successfully reduce the petroleum hydrocarbon concentrations in site soil and groundwater when amended with oxygen and/or inorganic nutrients. Testing was also designed to assist in evaluating the extent of degradation which can be achieved by full-scale bioremediation and to provide information on the amount of additional inorganic nutrients (oxygen, nitrogen as ammonia and phosphate), if any, required to enhance remediation.

1.5.3 Pilot Scale Study

The objective of the pilot scale study was to generate site-specific information in order to design a full scale biosparge/biovent remediation system for the Tank 50 area (Figure 1-3). The information generated during the pilot test activities included:

- Determination of the radius of influence (zone of aeration) for sparged air;
- Evaluation of vacuum/pressure response in the subsurface to various air flow rates; and
- Measurement of biodegradation indicator rates in the subsurface.

2.0 PILOT SYSTEM LAYOUT AND INSTALLATION

This section describes the design and installation of the pilot scale system. The pilot test configuration is shown on Figures 2-1 and 2-2. All investigation-derived waste (IDW) was managed according to Section 2.1.4.

2.1 Monitoring Well Installation

2.1.1 Soil Sampling

From July 22 to 24, 1996, Environmental Drilling, Inc. (EDI), under subcontract to Foster Wheeler, installed three monitoring wells in the vicinity of Tank 50 (MW-301, MW-302, and MW-303). One well (MW-301) was installed for use as the biovent well, and the remaining two wells were to be used as combination wells to monitor both biosparging and bioventing activities. Well MW-302 was installed approximately 10 feet south of MW-301. MW-303 was installed approximately 20 feet north of MW-301. The wells were installed in borings that were advanced using 8-inch (minimum) outside diameter hollow stem augers. Continuous split-spoon samples were collected from the surface to the bottom of the boring at MW-303, and from 5 and 8 feet bgs to the bottom of the borings at MW-301 and MW 302, respectively. The split-spoon sampler was driven using a 140-pound hammer falling 30 inches. Standard Penetration Tests (SPTs) were completed on each split-spoon where blow counts were recorded in 6-inch increments.

All lithological samples were collected in 8 oz. drillers jars. Soil samples were visually classified for lithology and were screened with a Foxboro 128 portable flame ionization detector (FID). Boring logs are included in Appendix B. Selected soil samples from each boring were also collected and submitted to Nytest Environmental Inc. (Nytest) for TPH analysis using EPA Method 8015. The results of these analyses and other observations are presented and discussed in Section 4.4.1.

Composite soil samples from each boring, and groundwater samples from existing monitoring wells, were also collected and submitted to the bench scale study laboratory for use in the bench scale study. A total of three soil samples (one from each boring) were composited from each split-spoon sample. Groundwater samples were collected from existing monitoring wells MW-103, MW-208, and MW-209.

2.1.2 Monitoring Wells

In each soil boring, a monitoring well was installed consisting of Schedule 40 PVC well screen (0.010-inch slot) and riser, and a five foot protective well casing. A 4-inch diameter, 25-foot monitoring well with 15 feet of well screen (at the bottom) was installed as MW-301. MW-302 and MW-303 were completed as 2-inch diameter monitoring wells with 20 foot well screens. Well completion diagrams are included in Appendix B.

Following installation, each well was developed by surging and bailing techniques using dedicated bailers to remove silt. Development continued until a minimum of three well volumes were removed from each well.

2.1.3 Equipment Decontamination

All downhole sampling equipment (split-spoons, bailers, etc.) was decontaminated between each use in accordance with the following procedure:

- Scrub with a brush using portable water and a nonphosphate detergent (Alconox);
- Rinse with potable water;
- Rinse with hexane; and
- Rinse with deionized (DI) water.

EDI mobilized sufficient drilling equipment (rods and auger flights) such that the equipment could be dedicated to each boring, and decontamination between sampling locations was not necessary. Upon completion of the drilling program, all drilling equipment, including the drill rig, were decontaminated by pressure washing on a temporary decontamination pad constructed with heavy gauge polyethylene sheeting.

2.1.4 Investigation-Derived Waste

During the sampling program, all IDW, including soil drill cuttings, well development water, decontamination fluids, and personal protective equipment (PPE) was segregated and contained in DOT-approved 55-gallon drums. A total of 8 drums of IDW were generated (4 drums with drill cuttings, 3 with development water and/or decontamination fluids, and 1 with PPE and the temporary decontamination pad).

The liquid IDW drums were transferred to the water treatment facility at Tank Farm No. 5. A pump was used to remove the liquids from each drum to the water treatment facility sump for treatment. The solid IDW drums (soil and PPE) were transported to Tank Farm No. 4 for management with Tank No. 4 waste streams.

2.2 Pilot System Location and Setup

The location of the pilot test area was west of Tank 50, in the area of wells MW-103 and MW-209 (Figure 2-1). This area was selected based upon review of the existing well locations, well construction details (depth of well and screened interval), and areas of known petroleum contamination, and appeared to provide the best opportunity to achieve the pilot test objectives (Foster Wheeler, 1996). Below is a list of wells that were used during the pilot test along with their function and location relative to the biosparge well (MW-103):

- MW-103: Biosparge well
- MW-302: Biovent well (30 ft. south of MW-103)
- MW-301: Monitoring well (10 ft. southwest of MW-103)
- MW-303: Monitoring well (14 ft. north of MW-103)
- MW-208: Monitoring well (5 ft. northwest of MW-103)
- MW-209: Monitoring well (10 ft. northwest of MW-103)
- MW-105: Monitoring well (25 ft. northwest of MW-103)
- MW-107: Monitoring well (30 ft. south of MW-103)

Monitoring well MW-301 was originally installed to be used as the biovent well (Foster Wheeler, 1996); however, it was determined during pilot test startup activities that this well could not perform in this function. Therefore, it was decided that well MW-302 would be the biovent well. Further discussion is contained in Section 4.4. Photographs taken during system construction are provided in Appendix C.

2.3 Pilot System Design and Construction

2.3.1 Utilities

Electrical service for the pilot system was installed by Rayco Electric, under subcontract to Foster Wheeler, from an existing 13.8 kV overhead power pole located approximately 500 feet southwest of Tank 50. A 75 kVA transformer, provided by the Navy, was set on an existing concrete pad located adjacent to the power pole. Direct burial electrical cable was installed from the transformer to a mini power center installed approximately 25 feet west of the pilot test study area. The cable was set in a 2-foot deep trench running approximately 250 feet north of the transformer across the access road, then 250 feet east to the power center (Figure 2-1). The power center consisted of a 277/480V distribution panel and a 7.5 kVA mini power zone set in a NEMA-4 enclosure, and pilot test equipment was direct wired to the power center.

2.3.2 Equipment

Major equipment components for the pilot test included a skid-mounted 3 horsepower (hp) oilless rotary vane blower (230/460 vac, 3 phase, 48 standard cubic feet per minute [scfm] at 15 psig) for the biosparge system and a skid-mounted 3 hp regenerative blower (230/460 vac, 3 phase, 80 scfm at 60 inches of water column [w.c.]) for the biovent system. Other system components included an air-to-air heat exchanger (Model 5Z760-9 Speedaire aftercooler) for the biosparge well, a helium cylinder for the tracer gas testing, and a water knockout tank for the biovent system. A pilot system piping and instrumentation diagram (P&ID) is provided as Figure 2-2.

2.3.3 Biosparging, Bioventing, and Monitoring Wells

Monitoring wells from those listed in Section 2.2, with 4-inch PVC stickups, were fitted with PVC to national pipe thread (NPT) adapters for the purposes of installing 2-inch galvanized steel wellheads. Monitoring wellhead features included a sampling port (3/4-inch bronze ball valve with 1/4-inch hose barb), 0 to 150 inches water magnehelic vacuum (or pressure) gauge, and a 2-inch NPT plug, allowing for access of monitoring probes (D.O., pH, and/or water depth) or collection of groundwater samples. During installation, dirt and oil from the tops of the 4-inch PVC wells were cleaned prior to solvent welding the PVC adapters.

The biosparge well (MW-103) was fitted with the same PVC to NPT adapter, sampling port, and 2-inch NPT plug as the monitoring wells, along with a 0 to 50 psi pressure gauge. A 1-inch female NPT polypropylene camlock fitting was provided for connection of the biosparge hose. The 1-inch biosparge hose was rated at 150 psig and fitted with male and female camlock ends. During helium injection, a standard high pressure cylinder of helium with a 0 to 150 psig low pressure regulator was strapped to the biosparge well. A 0 to 10 scfm rotameter was temporarily installed on the sampling valve to measure flow during helium injection. The pressure regulator was connected to a rotameter with a 1/4-inch steel braided hose. During the helium injection, the helium flow was regulated to one-half of the biosparge flow rate.

The biovent well (MW-302) consisted of the same wellhead components as the monitoring wells, plus a 2-inch male NPT polypropylene camlock fitting for connection of a 2-inch flexible hose for vapor extraction. The biovent hose was a petroleum vapor recovery hose with a spiral wrap, fitted with male and female camlock ends.

3.0 BENCH SCALE STUDY

In order to assist in the evaluation of site conditions in the subsurface and the potential of bioremediation applicability, a bench scale study was conducted. Soil samples were collected from the vicinity of Tank 50 and sent to Fluor Daniel GTI's Remediation Technology Testing Facility (RTTF) in Martinez, California.

This section summarizes the tasks conducted during performance of the bench scale testing, the descriptions of the methodologies used, and the results of the bench scale testing. The bench scale study report is included in Appendix D.

3.1 Soil and Groundwater Sample Collection

Three soil samples were collected (as described in Section 2.1.1) and supplied to the RTTF laboratory for analysis. The three soil samples were composited from split-spoon samples collected from MW-301, MW-302, and MW-303. These samples were collected during the drilling and installation of these monitoring wells. The samples collected were obtained for analysis based on observed elevated field headspace readings by FID and visual observation of contamination. A total of approximately 3 kg of contaminated soil was sent to the RTTF.

Three groundwater samples were collected from existing monitoring wells MW-103, MW-208, and MW-209.

The soil and groundwater samples were stored in coolers on ice and shipped to the RTTF. The samples were received at the RTTF on July 25, 1996 in two coolers under Chain of Custody numbers 39408 and 40791. Copies of the Chain of Custody Records are attached to the RTTF report in Appendix D.

3.2 Initial Composite Analyses

Soil and groundwater were initially composited at the RTTF and characterized for chemical, physical, and microbiological parameters that can impact biological processes. The results of these analyses were then used to assist in the final setup of the bench scale study. The initial analyses performed are summarized on Table 3-1.

3.3 Biodegradation Testing

The biodegradation test was conducted using a 3% (weight/volume) slurry of soil in groundwater from the site. The soil slurry test systems were designed to assess biodegradation potential under optimal biological conditions with respect to presence of oxygen, nutrients, and moisture. For this test, four experimental systems were used:

- **System 1 (Non-Enhanced).** Soil and groundwater composites were mixed without amendments to assess the extent of biodegradation occurring in the absence of modifications to the soil and groundwater mixture (i.e., a natural control sample);

- **System 2 (Oxygen-Enhanced).** Soil and groundwater composites were amended with oxygen to assess the extent of biodegradation occurring when oxygen is in unlimited supply and only endogenous inorganic nutrients are present;

- **System 3 (Nutrient-Enhanced).** Soil and groundwater composites were amended with inorganic nutrients to assess the extent of biodegradation occurring when nitrogen (in the form of ammonium chloride) and phosphate (in the form of potassium tripolyphosphate) are in unlimited supply; and

- **System 4 (Oxygen + Nutrients-Enhanced).** Soil and groundwater composites were amended with oxygen, phosphate, and nitrogen to assess the extent of biodegradation occurring when both oxygen and inorganic nutrients are in unlimited supply.

Each of the experimental systems consisted of a series of replicate sealed test reactors containing a slurry mixture of 1.5 grams (g) wet weight soil and 50 milliliters (ml) groundwater with approximately 110 ml gaseous headspace in a 160 ml serum bottle.

The slurries in bottles used for Systems 1 and 3 were purged with nitrogen gas to remove oxygen from the groundwater and produce anoxic test conditions. Although purging will reduce the amount of dissolved oxygen in the groundwater, it is not expected to create strictly anaerobic conditions. All bottles were sealed immediately after purging.

Additional oxygen was added to the bottles used for System 4 by injecting pure oxygen through each bottle's septum using a syringe. This additional oxygen was provided several times during the test to ensure that sufficient oxygen was available to support aerobic degradation during the initial phase of the test when oxygen depletion is often the most rapid.

All bottles were sealed with septa and crimped caps. The bottles were inverted and incubated at room temperature on a reciprocal shaker for the duration of the study. Shaking is required to maintain the slurry and to stimulate oxygen transfer from the headspace into the slurry phase.

During the 13-week duration of the study, several parameters were monitored periodically and adjusted as necessary in the test reactors to ensure that optimum conditions were maintained. These parameters included oxygen, carbon dioxide, ammonia-nitrogen, and ortho-phosphate. The number of specific-hydrocarbon utilizing bacteria was also monitored weekly in the test reactors in all four systems by sacrificing replicate test reactors for a total of 14 time points.

Initial TPH concentration in reactor bottles from each of the test conditions was determined during Week 0 of the test and weekly thereafter for a total of 14 time points. For each time point, two bottles from each of the four test conditions were sacrificed to provide duplicate analyses. The entire contents of the bottles were extracted with solvent at the RTTF and the extracts submitted to Sequoia Laboratory (Sequoia) for TPH analysis by EPA Method 8015. Diesel was selected as the reference standard since the GC/FID chromatograms from the initial TPH analysis performed by Sequoia indicated that the bulk of the hydrocarbons in the soil composite was diesel-range organics.

Initially, the extracts were not concentrated which resulted in detection limits that were higher than required for the test. Selected extracts were subsequently concentrated and reanalyzed to provide lower detection limits.

3.4 Bench Scale Study Results

This section summarizes the results of the bench scale study and highlights the important aspects of the study and the trends indicated.

3.4.1 Results of Initial/Baseline Chemical, Physical, and Biological Analyses

The results of the initial chemical, physical, and biological analyses for the soil and groundwater are presented on Table 3-2. The following is a summary and discussion of these results. Further discussion of the results is contained in the RTTF report in Appendix D.

The TPH concentration in the soil composite was 2,700 mg/kg based upon the average of triplicate analyses (2,500 mg/kg, 2,800 mg/kg, and 2,900 mg/kg). Review of the GC/FID chromatograms indicated that the majority of the hydrocarbon was present as diesel/No. 2 with some higher distillate fractions also observed, presumably the impact of the No. 6 oil in this area. The total organic carbon (TOC) in the soil was low at 0.8% with the TPH theoretically accounting for approximately one-third of the organic content. No TPH was detected above the detection limit of 13 mg/L in the composite groundwater sample (analyzed in duplicate).

Trace amounts of ortho-phosphate were detected in site soil, while ammonia-nitrogen was not detected above the detection limit of 1 mg/kg. While these concentrations are low, they do not necessarily preclude the field use of bioremediation either with or without nutrient enhancement. The cation exchange capacity (CEC) of the soil was low at 35 mg/g, and is consistent with both the type of material in the vicinity of Tank 50 and the low concentrations of inorganic nutrients detected in the soil.

The pH of the soil (6.4) was at the lower end of the neutral range, which is generally favorable to aerobic bacteria. The pH of the groundwater (7.9) was at the higher end of the neutral range and is also generally favorable to aerobic bacteria. The pH values indicate that the subsurface pH is generally favorable for bacterial activity and will not necessarily require adjustment.

The number of bacteria detected in both soil and groundwater was within the range of concentrations typically observed in non-toxic environments. The total heterotrophic bacterial population in soil was 2.3×10^7 colony-forming units per gram of soil (CFU/g), and represents the presence of a thriving bacterial population. The specific hydrocarbon-utilizing population numbers in soil were also high at 1.9×10^7 CFU/g, representing over 80% of the total heterotrophic population present. Ratios this high typically indicate that the native microbial population has already adapted to the presence of hydrocarbons as a food source, and are good candidates for further biological treatment.

3.4.2 Results of the Biodegradation Testing

The bench-scale study showed successful TPH degradation with nutrient, and oxygen and nutrient addition. By comparison, the system with no amendments also exhibited TPH biodegradation, but at a slower rate than the amended systems.

3.4.2.1 Oxygen Consumption and Carbon Dioxide Production

Oxygen and carbon dioxide concentrations were monitored in the headspace of test reactors in Systems 2 and 4. Table 3 of Appendix D presents the monitoring results.

The oxygen concentration in System 2 (amended with oxygen only) showed a slow but generally consistent trend in consumption of oxygen, from an initial concentration of 28% volume/volume (v/v) to 19.2% (v/v) by Week 12, with a corresponding gradual increase in the concentration of carbon dioxide.

The oxygen concentration in the oxygen + nutrient amended bottles (System 4) showed a rapid reduction in oxygen concentration from 21% on Day 2 to about 8% (v/v) by Week 2 with a parallel increase in

carbon dioxide concentration from 0.92% to 7.9% (v/v). Additional oxygen was added at this time to all of the test reactors in System 4 to maintain oxygen concentrations near 20% (v/v). A similar significant decrease in oxygen concentration was observed by Weeks 5 (down to 12%), 9 (down to 12%), and 12 (down to 11.4%). An additional 10 ml of oxygen was added to all System 4 reactors at these times.

Even though all bottles were sealed with a septum and crimp cap, it is likely that at least some loss in oxygen and carbon dioxide concentrations could be attributable to permeability losses across the septa used, especially in light of the long project duration time.

3.4.2.2 Bacterial Population

The number of specific hydrocarbon utilizing bacteria were measured by plate counts over the course of the biodegradation testing. Table 4 of Appendix D presents the contaminant utilizing bacteria results.

As anticipated, the lowest numbers of bacteria were generally detected in System 1, (unamended) with bacterial counts ranging from 1.4 to 15 x 10^5 CFU/ml (with the exception of one anomalous result of 27,000 x 10^5 reported on Week 5). The highest number of bacterial counts were generally detected in System 4, the system amended with both oxygen and inorganic nutrients, with bacterial counts ranging from 3.3 to 11,000 x 10^5 CFU/ml. The amended system also exhibited a trend of increasing bacterial counts occurring over several weeks.

The bacterial counts in Systems 2 (oxygen-amended) and System 3 (nutrient-amended) ranged from 0.94 to 10,000 x 10^5 CFU/ml and 6.1 to 5,500 x 10^5 CFU/ml, respectively. Systems 2 and 3 showed several weeks of elevated microbial numbers during the middle third of the project before exhibiting a reduction in their concentrations.

3.4.2.3 Nutrient Concentrations in Amended Systems 3 and 4

The results of the nutrient tests for ammonia, nitrogen, and phosphate are presented in Tables 5 and 6 of Appendix D.

The ammonia-nitrogen concentrations in the two nutrient-amended systems (Systems 3 and 4) were artificially elevated to 60 milligrams/liter (mg/l) in the test reactors at the beginning of the testing procedure. The concentrations of ammonia-nitrogen were observed to decrease over time in both systems, with more rapid depletion observed in System 4 (nutrient- and oxygen-amended) than System 3 (nutrient-amended). Because the depletion of ammonia-nitrogen generally represents reversible utilization as the result of oxidation and/or assimilation of nitrogen, as opposed to irreversible loss, it was not necessary to add additional ammonia-nitrogen to these systems.

The phosphate concentrations in the two nutrient-amended systems (Systems 3 and 4) were artificially elevated at 4 to 5 mg/l in the test reactors at the beginning of the testing procedure. The concentrations of ortho-phosphate increased slightly over time in both systems to about 10 to 12 mg/l. This result is likely due to the fact that phosphate was added in the form of tripolyphosphate which is not detected as efficiently as ortho-phosphate, but will be detected after hydrolysis. By Week 12, the ortho-phosphate concentration in both nutrient-amended systems had begun to decrease. No additional phosphate amendments to these microcosms were required.

3.4.2.4 TPH Concentrations

Two sets of samples were analyzed for TPH during the study. A discussion of the two sets of samples is contained in Appendix D.1. Table 7 presented in Appendix D shows the results obtained, along with their average concentrations and standard deviations. The average TPH concentrations and standard deviations are provided to assist in assessing analytical variability.

At each time point, duplicate test systems for each condition were extracted with dichloromethane and analyzed as described in Section 3.3. These analyses provided detection limits of approximately 700 mg/kg. At the completion of the initial tests, the dichloromethane extracts, stored refrigerated from Weeks 1, 2, 3, 11, and 14, were concentrated approximately 15 fold and reanalyzed, providing a revised detection limit of less than 75 mg/kg. The results of both sets of analyses, presented as averages of the duplicate analyses for each treatment process, are shown in Table 3-3.

Variability in TPH values for duplicate samples was expected due to the small soil sample volume used in each bottle (1.5 g wet weight). The distribution of contaminants in soils is typically heterogeneous, even after attempts at mixing and homogenization. The presence of small localized chemical hot spots, if selected as part of the 1.5 g sample, was expected to add variability to the final data.

TPH concentrations were reduced in all four systems. At the third week point, the most degradation (87%) appeared to be achieved by System 4 (oxygen and nutrients) with no apparent degradation occurring in System 2 (oxygen alone). TPH in System 2 actually increased at Week 3. System 3 (nutrients alone) had the next greatest degradation (66%), while the unamended System 1 exhibited a 22% reduction in TPH concentrations at Week 3.

Analyses were also available for the 11th and 14th weeks. The system with the greatest percent degradation in TPH at these two time intervals was System 3 (nutrients alone) at 93% reduction at week 14; while System 4 had a 86% reduction, System 2 had an 75% reduction, and System 1 had an 79% reduction in TPH at the end of Week 14.

The greatest short (3 week) and longer term reductions (11-14 weeks) in TPH concentrations were observed for Systems 3 and 4. System 2 (oxygen alone) did not show increased TPH reduction for the short term but did show slight enhancement in TPH reduction compared to the non-amended System 1 over the longer 11-14 week term.

3.5 Bench Study Conclusions

The results of the bench scale study show that biodegradation of the contaminant in the subsurface at the site is possible. The following conclusions can be drawn from the initial site characterization work and subsequent biodegradation testing:

- Site soils and groundwater contain levels of microorganisms consistent with non-toxic environments; the high proportion of hydrocarbon-degrading microorganisms to total microorganisms present is usually indicative of microbial populations already previously exposed and adapted to hydrocarbon biodegradation;

- Site soil and groundwater pH levels are within normally accepted favorable ranges for microbial survival and growth;

- Site soils contain low levels of two of the key inorganic nutrients required by microorganisms: ammonia-nitrogen and orthophosphate. While these nutrients are found at low levels, their effective concentrations are sufficient to maintain a microbial population in site soil and groundwater as evidenced by the heterotrophic and diesel-degrading plate count data obtained during the initial characterization work;

- Soil slurry microcosms receiving supplemental inorganic nutrients (Systems 3 and 4), especially ammonia, exhibited the most rapid and complete degradation of the hydrocarbons present; and

- Soils slurry microcosms that did not receive any supplemental nutrients (Systems 1 and 2) showed the lowest rate of hydrocarbon biodegradation and the highest residual TPH concentrations after the 14-week study.

The results of the bench scale study show that the addition of nutrients had the most significant impact on stimulating the rate and extent of TPH degradation. While aerobic decomposition of organics is usually much more rapid than anaerobic degradation, the bench scale study did not clearly indicate the benefits of adding oxygen. Although System 4 (nutrients & oxygen) achieved degradation rates and levels similar to System 3 (nutrients alone) there was no clearly discernible advantage. -For the short term (3 weeks) System 2 (oxygen added) appeared to possibly inhibit degradation. Over the longer term, System 2 achieved total TPH degradation rates only a little better than the unamended System 1.

Although it cannot be ascertained that System 1 was totally anaerobic, it would appear that significant degradation occurred without adding oxygen. It may be that the relatively low concentrations of dissolved oxygen are sufficient for degradation. It may even be possible that some of the petroleum degrading bacteria are anaerobic or facultative anaerobic micro-organisms (bacteria that could switch to degrading TPH under either condition). During this bench scale study, it should be emphasized that a significant portion of the indigenous population was identified as petroleum degraders (>80%). This suggests that in situ bacteria are utilizing the carbon source (petroleum) that is available, albeit at a slower rate. These bacteria may function under low oxygen or no oxygen as the water table falls or rises. The delay in TPH degradation under System 2 may have been the result of a delayed response for facultative bacteria to adapt to an oxygenated, low nutrient environment.

Nitrogen is a key nutrient for microbial growth that is often limited in the environment. Degradation of 100 grams of carbon (TPH) often requires approximately 10-15 grams of nitrogen and 1 gram of phosphorous. Since nitrogen was not detected in baseline soils above 1 mg/l and phosphate was detected at approximately 1 mg/l, there is a strong likelihood that adding nutrients as nitrogen was the key stimulus for accelerating degradation.

4.0 PILOT SCALE TEST

4.1 Introduction

The objective of the bioremediation field pilot test was to generate site-specific information in order to evaluate the effectiveness of using an in-situ bioremediation technology to remediate soils at Tank 50. To accomplish this objective, the pilot scale study was designed using a combination of existing and newly installed monitoring wells to provide the following information:

- Radial zone of aeration;
- Vacuum/pressure response in the subsurface;
- Measured biodegradation rates in the subsurface; and
- Site-specific engineering observations needed for a full scale design.

The pilot test activities were performed over a 13 week period beginning on August 12, 1996, and consisted of the following phases:

Baseline Monitoring

Subsurface parameters were measured before beginning pilot testing activities to obtain baseline data for the site. These data were compared against the pilot testing and post pilot testing measurements to evaluate the effect of the biosparging and bioventing activities on the subsurface conditions.

Startup Activities

Startup activities were performed over a ten day period and included a biovent system vacuum/flow response test, a biosparge system radius of influence test, and a helium injection/in-situ respirometry monitoring test. The helium injection/in situ respirometry was performed to evaluate the actual field biodegradation rates; while the helium dispersion rates were monitored and compared against oxygen degradation in the monitoring wells.

Pilot Test Monitoring

Following startup activities, the operation and monitoring of the pilot test biosparge and biovent systems continued for over ten weeks, with weekly monitoring of the subsurface conditions and system operational parameters to document the operational trends in subsurface conditions.

Post Pilot Test Monitoring

Upon completion of the long term pilot testing, a second (post pilot) in-situ respirometry monitoring test was performed over a six day period. These data were compared to the initial respirometry test results performed during startup activities to provide an indication of the extent of remediation that can be expected in subsurface soils.

4.2 Pilot Test Monitoring Procedures and Methodology

This section describes the monitoring procedures, equipment, and methodology used during the pilot test, which included system operational monitoring, well headspace monitoring, and saturated zone (in-situ) monitoring.

4.2.1 System Operational Monitoring

The following operating parameters for the biosparge and biovent systems were measured throughout the pilot test activities:

- Biosparge air flows and injection pressures;
- Biovent extracted soil vapor flows and vacuums;
- Volatile organic compound (VOC) concentrations in the biovent system off-gas; and
- Oxygen (O_2), carbon dioxide (CO_2), and methane (CH_4) concentrations in the biovent system off-gas.

Sparge Air Flows and Injection Pressures

The biosparge injection air flow rate was measured with an in-line, variable area rotameter (0 to 22 scfm, Omega model FL 1658) installed between the sparge blower and the injection well. The biosparge well injection pressure was measured with a pressure gauge (0 to 20 psi, Dwyer Instruments, model 4240) mounted at the injection well.

Extracted Biovent Vapor Flows and Vacuums

The extracted soil vapor flows were measured with an in-line, variable area rotameter (0 to 45 scfm, King model 761223-1-G-SP-01) installed on the suction line between the biovent well and the extraction blower. The biovent system applied vacuum was measured with vacuum gauges at the extraction well head (0 to 100 inches of w.c., Dwyer Instruments, model 2100) and biovent blower assembly, respectively.

VOC Concentrations in the Biovent System Off-Gas

The VOC concentrations in the biovent system off-gas were measured by drawing a volume of the extracted soil vapor in a sampling pump (SVP, 6 L/min., 22 inches Hg, KNF model NO5) into a 1-liter capacity tedlar bag. The tedlar bag was then connected to a portable FID (Foxboro 128 OVA) to measure total VOC concentrations in the off-gas.

O_2, CO_2, and CH_4 Concentrations in the Biovent System Off-Gas

The O_2, CO_2, and CH_4 concentrations in the biovent system off-gas were measured by drawing a volume of the extracted soil vapor into a 1-liter capacity tedlar bag with the KNF sampling pump. A multi-gas meter (Landtec GA-90) was connected to the tedlar bag to extract the sample volume and analyze for percentages of O_2, CO_2, and CH_4.

4.2.2 Well Headspace Monitoring

The following parameters were measured from the headspace of each monitoring well during the pilot test activities:

- O_2, CO_2, and CH_4 levels;
- VOC concentrations;
- Helium (He) concentrations; and
- Well head pressures and vacuums.

Helium Levels in Monitoring Well Headspace

The He concentrations in the subsurface were measured after He injection with a Mark helium detector (model 9821) connected to the monitoring well via flexible tubing and a barbed fitting at the well head assembly. A ball valve on the wellhead assembly was opened, allowing the internal pump in the He detector to draw the vapor in the well headspace. This was performed for approximately five minutes, or until readings stabilized, before the reading was recorded.

O_2, CO_2, and CH_4 in Monitoring Well Headspace

The O_2, CO_2, and CH_4 concentrations in the monitoring well headspaces were monitored using the Landtec gas meter connected at the well head via flexible tubing and barbed fitting. A ball valve on the wellhead assembly was opened, allowing the internal pump in the Landtec gas meter to draw the vapor from the well headspace. This was performed for approximately five minutes, or until readings stabilized, before the meter readings were recorded.

VOC Concentrations in Monitoring Well Headspace

The VOC concentrations in the monitoring well headspaces were monitored using the FID connected to the well head via flexible tubing and barbed fitting. The sampling port valve was opened allowing the FID pump to draw in well headspace gas. This continued for approximately five minutes, or until readings stabilized, before the FID readings were recorded.

Well Head Pressures and Vacuums

Well head pressures and vacuums were measured by connecting Dwyer magnehelic gauges (with ranges of 0 to 10 and 0 to 50 inches H_2O) to quick disconnects and flexible tubing at the monitoring well heads. Pressures were measured from the high pressure port and vacuums were measured from the low pressure port.

4.2.3 Saturated Zone Monitoring

The following saturated zone parameters were measured during the pilot test activities:

- Depth to groundwater;
- Presence and/or depth to free product; and
- Dissolved oxygen (D.O.).

Depth to Water/Petroleum Thickness

The depths to water and/or free petroleum product were measured with an Oil Recovery System (ORS) oil/water interface probe which was lowered down the monitoring wells and referenced to the top of the well casing.

D.O. Measurements

D.O. concentrations (in mg/l) and temperature (in °F) were measured in the groundwater using a direct digital-read downhole water quality meter (Aqua-check Water Quality Analyzer). The measurements were recorded at the same depth in each monitoring well (approximately 20 feet bgs).

4.2.4 Monitoring Equipment Maintenance and Calibration

All monitoring equipment were inspected for operation and calibration prior to each monitoring event. If warranted, calibration and/or maintenance was performed in accordance with the manufacturers recommendations prior to use. The equipment calibration/maintenance log is provided in Appendix E. When not in use, the monitoring equipment were stored (per manufacturers recommendations) in the groundwater treatment system building for Tank Farm No. 5.

All downhole monitoring equipment (the water quality meter and oil/water interface probe) were decontaminated between each well and after each monitoring event following procedures described in Section 2.1.3.

4.2.5 Data Collection and Quality Control

The pilot test operational and monitoring data were documented on monitoring forms during each monitoring event. In addition to the system data, the monitoring form was used to document weather conditions, specific problems, and/or general comments.

During monitoring activities, if the project engineer determined that the monitoring data was suspect for any reason, the following procedure was followed:

- The monitoring equipment was checked for proper operation and calibration;
- The monitoring activity was repeated, and the resulting measurement was compared with the original data point, until results were reproducible; and
- The monitoring data was re-recorded on the monitoring sheet.

4.3 Baseline Monitoring

4.3.1 Baseline Operations

Prior to initiating pilot testing activities, the following subsurface parameters were measured to document baseline conditions.

- TPH concentrations
- Depth to water;
- D.O.;
- Well head O_2, CO_2, and CH_4 concentrations; and
- Well head VOC concentration.

These data were used to evaluate the effect of the biosparge and biovent activities on the subsurface conditions. The baseline conditions are summarized in Table 4-1. In addition, observations during monitoring well installation are provided in Section 4.3.2.

4.3.2 Baseline Results

The soils encountered during the installation of monitoring wells MW-301, MW-302, and MW-303 (described in more detail in Section 2.1) appeared to be consistent with the description of the fill material used to backfill the tank socket. The upper 5 to 6 feet consisted predominantly of poorly graded silty fine to medium sands with small rock fragments and varying amounts of gravel. From approximately 6 to 8 feet bgs to the bottom of the borings (22 to 25 feet bgs), the soil/fill characteristics resembled

glacial till, consisting of fairly dense, poorly-graded, fine sand and silt with angular pieces of fine gravel. The fill was interbedded with poorly-graded gravels and various size pieces of shale. Groundwater was encountered at depths between 8 and 10 feet bgs. During the installation program, significant oil staining and pockets of residual petroleum product were observed throughout the saturated zone, particularly in the shale deposits and at the water table interface. The residual product, which coated the gravel and shale, was generally a viscous, dark-black product similar to heavier oil (No. 6). While a measurable thickness of floating product (LNAPL) was not observed in the new wells, petroleum residual coated both the water level tape and bailers during well development and monitoring.

Water levels in the vicinity of Tank 50 ranged from 9 feet bgs on August 26, 1996 to 6 feet bgs on November 4, 1996. The observed baseline water levels were 3 to 4 feet higher than the two water level events presented in the SI report (Brown & Root, 1995b).

The initial characterization of soils submitted for the bench scale study was performed for Fluor Daniel GTI by Sequoia. The soils submitted were a composite of samples taken from each well boring (each composite from a single boring). The laboratory indicated concentrations of TPH at 2,500 mg/kg, 2,800 mg/kg, and 2,900 mg/kg for the three samples. Sequoia indicated that the TPH fingerprint resembled diesel fuel and was quantified by comparison to a diesel fuel standard. Hydrocarbons which were not within the diesel fuel standards range were not quantified.

A portion of the split-spoon samples which were utilized to make up the composite samples sent to Sequoia for the bench scale study were also submitted for baseline TPH analysis. Eighteen discrete soil samples from MW-301, MW-302, and MW-303 were analyzed by Nytest (Table 4-14). Nytest indicated total TPH concentrations ranging between 488 mg/kg to 95,400 mg/kg. The averages of total TPH for each boring were 21,300 mg/kg, 39,900 mg/kg, and 30,300 mg/kg, respectively. Nytest indicated that the TPH fingerprint did not resemble any single hydrocarbon standard (Nytest utilized gasoline, No. 2 fuel oil, hydraulic oil, and 10w30 waste oil as standards). Nytest quantified the TPH by segmenting the sample into hydrocarbon ranges and comparing each range to the appropriate hydrocarbon range standard.

The difference in results obtained from the two laboratories is likely attributed to the method that each laboratory used to quantify the TPH values. Nytest quantified the different hydrocarbon ranges and then totaled for a single TPH value. Sequoia quantified only the hydrocarbons which were within the diesel range. Results from Nytest indicated that the diesel range (which most closely resembles the No. 2 fuel oil range) typically accounted for approximately 20 to 35 percent of the total hydrocarbons present. Additionally, results reported within the diesel/No. 2 fuel oil range differed due to the laboratories' quantifying the hydrocarbons against two different standards which exhibit two different responses that cover slightly different hydrocarbon ranges.

The baseline conditions measured in the pilot test study area were typical of soils and groundwater in the presence of organic contamination. In the groundwater, the low dissolved oxygen levels (value less than 1.00 mg/l) observed are indicative of oxygen deficient environments. In the monitoring well headspaces, the decreased oxygen observed in three out of six locations (locations with high TPH contamination) is also indicative of oxygen deficient environments. Oxygen levels in MW-208, MW-209, and MW-107 were only slightly oxygen deficient. In addition, the levels of methane, in particular MW-301, may indicate anaerobic conditions in the subsurface. Field screening measurements of VOCs using an FID indicate levels greater than 1,000 parts per million volume (ppmv) at five of seven monitoring wells.

4.4 Startup Activities

4.4.1 Startup Operations

4.4.1.1 Biovent Flow Response and Biosparge Radius of Influence Testing

During the first day of startup activities separate bioventing and biosparging tests were performed. Bioventing was performed by applying a vacuum to a monitoring well and inducing air flow in the subsurface. Initial biovent testing was performed at MW-301; however, no sustained soil vapor could be removed from the well. It was determined that due to low pneumatic conductivity in the vicinity of MW-301, water table upwelling may have occurred, whereby the well screen above the water table was covered. Based on water table measurements at MW-301, only 2 to 3 feet of open well screen was available to the unsaturated zone at the start of the test. Therefore, well MW-302 was selected as the biovent well. The biovent wellhead extraction assembly was attached to MW-302 and the bioventing test was performed. Soil vapor was extracted at flow rates of 5, 8, and 12 scfm at applied vacuums of 25, 40, and 60 inches of w.c., respectively. Test parameters, resulting measurements, and distances from the biovent well (MW-302) are summarized in Table 4-2.

The biosparge test was performed using MW-103 as the biosparge well. During the test, monitoring wells MW-301, MW-208, MW-303, MW-209, and MW-107 were used to measure the subsurface vacuum/pressure response, dissolved oxygen, depth to water, and wellhead VOC concentrations. Biosparge air injection rates of approximately 4 scfm and 12 scfm at injection pressures 7.5 and 8 psi were used. Test parameters, resulting measurements, and distances from the biosparge well (MW-103) are summarized in Table 4-3.

Upon completion of the initial biovent and biosparge testing activities, the systems were allowed to continue operating overnight in order to maximize the extent of aeration in the subsurface prior to in-situ respirometry testing. The following operational parameters were used: biosparge injection flow of 12 scfm at 8 psi injection pressure and extraction flow rate of 12 scfm at a wellhead vacuum of 37 inches of w.c.

4.4.1.2 Helium and In-Situ Respirometry Testing

On days 2 through 8 of the startup test (August 13 to 18, 1996), in-situ respirometry and helium injection tests were performed. A cylinder of compressed helium (219 cu. ft. capacity) was installed at the biosparge well and connected to the wellhead assembly via a pressure regulator, flexible air hose, and variable area flow meter (Figure 2-2). The helium was introduced into the biosparge injection well at a 50/50 helium/air ratio by volume and at a combined biosparge flow rate of 12 scfm. The helium was injected for approximately 10 minutes until the helium tank was empty. The biosparge and biovent system was then turned off and the respirometry and wellhead helium concentration monitoring was performed.

The well head respirometry and helium monitoring was performed during the first, second, third, and sixth days after helium injection. This data is summarized in Table 4-4.

4.4.2 Startup Results

Tables 4-2 through 4-4 summarize the monitoring data recorded during the startup activities performed from August 12, 1996 to August 23, 1996.

Biovent System Flow/Vacuum Response Test

Using MW-302 as the biovent well, flow rates of 5, 8, and 12 scfm were extracted from the soils above the water table at applied vacuums of 25, 40, and 60 scfm, respectively (Table 4-2). Induced vacuums were monitored in MW-301, MW-303, and MW-107, since these were the only wells with exposed well screen above the surface of the water table. Measurable vacuums were recorded in MW-301 and MW-107. No measurable vacuum was observed in MW-303.

Based on these initial data, the effective radius of influence was estimated between 10 and 30 feet. For planning and reporting purposes, an estimate of 20 feet was used. This radius of influence is lower than what might be typically expected in a disturbed fill, such as that in the socket surrounding Tank 50, and is likely attributable to heterogeneities with regard to graded soil and high water table in the Tank 50 area.

Biosparge System Radius of Influence Testing

Biosparge air injection rates of approximately 4 scfm and 12 scfm at injection pressures 7.5 and 8 psi were used. Test parameters, resulting measurements, and distances from the biosparge well (MW-103) are summarized in Table 4-3.

Dissolved oxygen exhibited an increase in three of the monitoring wells from baseline conditions, with MW-301 and MW-209 showing the most significant increases (from less than 1 ppm to over 10 ppm dissolved oxygen). Dissolved oxygen was not measured in MW-105 due to the presence of liquid phase petroleum.

Water table elevation in the monitoring wells measured consistently higher than baseline conditions, indicating an elevated water table surrounding the biosparge well MW-103. The largest increase in the water table elevation was observed in MW-301 which exhibited a 0.64 ft. increases. MW-107, which was the farthest monitoring well from the biosparge point (32 feet from MW-103), exhibited an increase of 0.08 feet.

Monitoring wells MW-301, MW-208, and MW-209 measured a positive pressure in the wellhead resulting from the biosparging activities, measuring 4, 1, and 6 inches of w.c. pressure, respectively, at a biosparge injection rate of 12 scfm.

These data indicate an approximate biosparge radius of influence of 20 to 30 feet. However, the data also indicate the potential for preferential flow paths. In particular, a preferential flow path was exhibited in the direction of the MW-301/MW-302 area. These flow data are compared with radius data generated from the pilot test operation in Section 4.5.

Respirometry Testing With Helium Injection

After introducing the helium into the biosparge injection well, the biosparge and biovent operations were stopped to allow for wellhead respirometry and helium monitoring. The monitoring schedule was as follows:

- Periodically during the first day;
- Twice during the following day; and
- Once per day during the third and sixth day of testing.

These data are summarized in Table 4-4 and discussed below:

- The monitoring wells with well screen above the water table (MW-301, MW-303, MW-107) exhibited a consistent decrease in oxygen concentrations and an increase in carbon dioxide concentrations over the course of the test, which is an indication of biological activity in the unsaturated zone soils;

- A comparison of the rates of decrease between oxygen and helium in wells MW-301 and MW-303 (two wells showing the significant helium levels) shows that oxygen concentrations decreased at a slightly faster rate than the helium concentrations. The difference in these rates can be directly attributed to biological processes in the unsaturated zone soils (as opposed to diffusion and/or dilution pathways); and

- MW-301 and MW-302 exhibited an increase in methane concentrations after approximately 6 hours into the testing period. This may be attributed to anaerobic biological activities generating methane as anoxic conditions are re-established in the subsurface.

Using the observed rates of oxidation depletion and carbon dioxide production, along with a method developed by Hinchee and Ong, an estimated rate of hydrocarbon degradation was calculated which provides an indication of the rate of biological degradation than can occur in the subsurface under aerobic conditions. Substituting in the rates from the field respirometry tests yields an estimated biodegradation rate of 1 mg/kg/day (mg of hydrocarbon/kg of soil/day of operation). The calculation, along with supporting assumptions and descriptive text, is included in Appendix E.

4.5 Pilot Test Monitoring

4.5.1 Pilot Test Operations

Continuous operation of the pilot test was initiated on August 26, 1996 by restarting the biosparge and biovent systems and continued for the next ten weeks. The objective of the pilot test operation was to document and evaluate the biosparge/biovent operational data and subsurface conditions over an extended period of operation. In addition, the system operation and maintenance information gathered over the course of the test can be used to generate site-specific information in order to design a full scale biosparge/biovent system.

Two operating modes were performed over the test period:

Weeks 3 to 9:	Biosparge injection flow rate of 12 scfm; Biovent extraction flow rate of 12 scfm;
Weeks 10 to 13:	Biosparge injection flow rate of 4-8 scfm; and Biovent extraction flow rate of 6-12 scfm.

During the pilot test operation, the following system parameters were measured at least once per week:

- Biosparge/biovent system operation and maintenance data;
- Dissolved oxygen;
- Depth to water;

- Well head oxygen, carbon dioxide, and methane concentrations; and
- Well head VOC concentration.

Operation data are summarized in Tables 4-5 through 4-12.

4.5.2 Pilot Test Results

The operation of the field testing activities was performed from August 26 to November 5, 1996, for a total of ten weeks of continuous operation. A compilation of the monitoring data is presented in Tables 4-5 through 4-12 and the major results are discussed below:

- All wells indicated a pressure reading at both the high and low biosparge injection rates, except for MW-107 which exhibited a vacuum of 4 inches of w.c. during the low biosparge injection rate (Table 4-5);

- Monitoring well MW-301 averaged 25 inches of w.c. pressure throughout the testing period, indicating strong influence from the adjacent biosparge well (Table 4-5); MW-209 exhibited a one-time pressure reading of 43 inches of w.c. during the last week of the test, indicating a change in the biosparge air preferential flow path;

- Monitoring well MW-208, which exhibited 3-6 inches w.c. pressure readings for the ring the first six weeks of operation, averaged less than 0.5 inches of w.c. over the last six weeks of testing (Table 4-5). This may indicate a possible change in the preferential flow path of the injected air;

- All the test monitoring wells, except MW-105, located outside of the tank socket, exhibited elevated levels of wellhead oxygen (19 to 20%) by the halfway point of the test, indicating an effective aeration of the testing area by the biosparge well (Table 4-8);

- MW-107 averaged less than 1% wellhead oxygen and 9% carbon dioxide until the third week of the test, at which time the oxygen concentrations increased to approximately 20% (Table 4-8) and carbon dioxide levels decreased to approximately 1% (Table 4-9), indicating a modification or change of the preferential flow paths in the subsurface soils;

- Methane concentrations were present in all the test wells during the first weeks of test activities and decreased to non-detectable concentrations after three weeks of pilot test operation with the exception of MW-105 (Table 4-10). This indicates that the anaerobic conditions and the resulting elevated methane levels were gradually flushed out of subsurface by the long term biosparging activities;

- VOC concentrations in the unsaturated zone monitoring wells varied from well to well (Table 4-11): MW-107 consistently measured over 1,000 ppmv; MW-301 averaged low VOC concentrations (10-20 ppmv), due to its location in between the biosparge and biovent wells (constant flushing of the soils with injected air from the biosparge well); and MW-105 consistently measured over 1,000 ppmv VOC in the well headspace, which can be attributed to the presence of liquid phase petroleum in that well;

- Petroleum thickness in MW-105, which was the only monitoring well with a measurable thickness of liquid petroleum, fluctuated between 0.01 and 0.1 ft. over the course of the test. This fluctuation appears to be a function of water table elevation, not biosparging activities; and

- The extraction flow rate from the biovent well (MW-302) averaged 10 scfm during the first six weeks of the field test, but dropped to 0-4 scfm during the last six weeks of the test (Table 4-12). This was mainly due to an elevated water table during the last six weeks of the field test which decreased the length of the well screen above the surface of the water table.

During the week of September 27, 1996, the Biovent system moisture separator tank filled with water (drawn in from the Biovent well), resulting in the alarm condition which shut down the system. The water was drained from the tank and placed in an on-site drum. Approximately 25-30 gallons of groundwater was removed from moisture separator throughout the test.

During the week of October 25, 1996, the biosparge injection rate decreased to close to zero, due an increase in the water table elevation of greater than two feet. This increased back pressure, and the fact that some water was pulled into the biosparge blower intake from the heavy rains, caused a decrease in the biosparge injection rate.

4.5.3 Operating Conditions and Maintenance Concerns

The elevation of the groundwater table in the soils surrounding Tank 50 was a contributing factor in the operational effectiveness of the biovent system. At various times during the pilot test, the effectiveness of the biovent system operation was significantly decreased and/or negated entirely due to an increase in the elevation of the groundwater table. This observation is confirmed by gaugings of the monitoring wells.

The depth to the groundwater surface during the pilot test ranged from a maximum of eleven feet bgs to a minimum of three feet bgs in the test area. The top of the well screen in the biovent well was located approximately five feet bgs. During high water periods, some or all of the screening interval was located below the water surface, effectively preventing air movement in the unsaturated soil above the water table. These high water periods corresponded with local rainfall events, indicating that surficial infiltration has a profound impact on the groundwater elevation in the Tank 50 area.

High water table periods resulted in the following operational problems in the biovent system:

- Groundwater being drawn into the biovent extraction system causing system shutdown due to a high water level alarm in the moisture separator tank;
- A reduction of the vacuum that could be applied to the biovent extraction well to minimize the potential to draw groundwater into the biovent system; and
- A decreasing of the overall effectiveness of the biovent well by limiting the amount of well screen exposed to the unsaturated soils above the water table.

4.6 Post Pilot Test Monitoring

4.6.1 Post Pilot Test Operations

Upon completion of the long term pilot test, a second in-situ respirometry test was performed over a six-day period and the results compared to those from the respirometry test performed during startup activities. A comparison of these two respirometry testing results is expected to provide an indication of the extent of remediation that can be expected in subsurface soils surrounding Tank 50 during the initial treatment time period. A summary of the post test respirometry data is presented in Table 4-13.

4.6.2 Post Pilot Test Results

Over a six-day period immediately following the completion of the long term field test operation, a second in-situ respirometry test was performed. Table 4-13 presents the monitoring data.

Over six days, no significant decrease in oxygen concentration, increase in carbon dioxide, or change in methane concentration was observed (except MW-105 which maintained constant methane levels throughout the test operation); therefore, no rate of biodegradation could be calculated from the data. An explanation for the pre/post test respirometry data could be attributed to the increased water table elevations at the end of the test, therefore, making the soil vapor drawn into the monitoring well less representative of the biological activity taking place in the soils.

4.7 Pilot Test Conclusions

This pilot study evaluated the potential effectiveness of bioventing/biosparging at the Tank 50 site for full scale implementation. Based upon data collected and observations made, the bioventing/biosparging technology may have limited effectiveness for reducing TPH concentrations at this site to the target cleanup levels within a reasonable period of time. This conclusion is based upon site soil permeabilities, heterogeneity, and a relatively low biodegradation rate. Heterogeneity and low soil permeabilities at the site would require the installation of a relatively large number of biovent/biosparge well pairs to provide adequate coverage. The low biodegradation rate may require prohibitively long remediation time to achieve TPH reduction to target levels. Both of these design variables would likely result in significant capital, operation, and maintenance costs.

Each radius of influence observed for the biovent and biosparge wells exhibited strong anisotropy and relatively limited zone of influence. Both of these are attributable to the nature of the compacted backfill material in the Tank 50 socket annulus. The following are examples that illustrate the soil heterogeneity and relatively poor soil permeability in the Tank 50 socket annulus:

- MW-301 was originally intended to be used as the biovent extraction well. However, upon startup, no vapor flow could be measured at this or nearby surrounding wells. The biovent extraction well was moved to MW-302 approximately 10 feet away where adequate vapor flow was achieved. During the startup biovent extraction test, significant vacuums were experienced at and recorded for only one well (MW-301) at a modest extraction flow rate (5 scfm). Only when the flow rate was increased to a higher flow rate (12 scfm) did a second well (MW-107) exhibit a response. The two wells influenced were approximately 10 feet from the extraction well, while a third non-affected well (MW-105) was 30 feet away (Table 4-2).

- A biosparge startup test run using MW-103 showed a discernible impact on three of five adjacent wells. The wells indicating a response (MW-208, MW-209, and MW-301) were all approximately 10 feet from MW-103 in a westward direction. The response observed in the three wells were at an elevated air injection rate of 11.5 scfm. At a lower air injection rate, only one well (MW-209) experienced a significant increase in well head pressure (Table 4-3).

- Upon injecting a helium/oxygen mixture into the biosparge well (MW-103) and then stopping the biosparge/biovent system operation, the nearest monitoring well (MW-208) only briefly recorded helium concentrations and at very low concentrations (0.15%). Monitoring wells MW-301 and 302, located south of the biosparge well, maintained higher concentrations of helium (approximately 15-40% He); while MW-209 and MW-303, located north of the biosparge well, recorded much lower concentrations (1-3% He).

- During pilot test operation, non uniform distribution of well head vacuum and dissolved oxygen were also observed. Only MW-301 showed a strong increase in well head pressure, four other monitoring wells showed varying low well head pressures. One well, MW-209 displayed a negligible response. Dissolved oxygen was consistently elevated in only three wells (MW-208, 301, and 303).

- The heterogeneity of the site makes interpretation of "radius of influence" data difficult. While the test results show that an effective distance up to 20-30 feet from a biovent/biosparge well pair may be achieved, the influence cannot be relied upon to be omni-directional, but, rather is preferentially uni-directional. This would make extrapolation of data to effective large scale system design difficult. Even with a uniform 20 foot radius, a large number of biovent/biosparge well pairs would be required. With uncertainty as to radial uniformity, additional pairs would be necessary to ensure overlap.

- The effectiveness of the biovent/biosparge system for TPH degradation also appears to be limited by the calculated degradation rate. A rate of 1 mg/kg/day was calculated based upon pilot study data. Assuming that all of the petroleum hydrocarbons were in a readily biodegradable form (No. 2 fuel oil), and the average TPH concentration- on-site was 30,000 mg/kg, then the remediation time to achieve a cleanup level of 5,000 mg/kg would be approximately 68.5 years (assuming this initial rate was maintained over the duration of the remedy). Similarly, approximately 82 years would be required to achieve a cleanup level of 300 mg/kg. Even assuming a lower concentration of 10,000 mg/kg would result in approximately 13.5 years to reach target level. Reported TPH concentrations at the site have been as high as 90,000 mg/kg. Since the measured degradation rate of 1 mg/kg/day is most likely representative of the degradation of the lighter, more readily degradable petroleum fraction, this rate would be predicted to decrease over time as the proportion of heavier fuel increased. In addition, a lower degradation rate could be expected for areas of the socket contaminated by No. 6 fuel oil.

5.0 CONCLUSIONS

The results from the laboratory and field pilot testing indicate that limited bioremediation using biovent/biosparge technology is feasible in the vicinity of Tank 50. The presence of high concentrations of heavy distillate fuel fractions, such as No. 6 fuel oil, make it unlikely that this technology alone could successfully reduce the hydrocarbon concentrations in all areas to below a cleanup level of 5,000 mg/kg. Additionally, the costs for a full-scale biovent/biosparge system would likely be capital intensive and require extended (several decades) operation and maintenance.

5.1 Biodegradation Occurring Under Natural Conditions

The concentrations of oxygen, methane, and carbon dioxide in the subsurface prior to initiating the pilot test indicate that biodegradation of the hydrocarbons is occurring naturally by both aerobic and anaerobic mechanisms at the site. Under these native conditions, hydrocarbons will be degraded faster under aerobic than anaerobic conditions. However, once oxygen has been depleted, continued aerobic metabolism is rate-limited by oxygen recharge, and anaerobic metabolism becomes the dominant process.

Gas-phase oxygen concentrations were depleted below ambient concentrations in all six monitoring locations and ranged from 20.3% to 8.5%, with the greatest depletion observed at locations exhibiting high concentrations of VOCs in the well headspace. This indicates that aerobic metabolism of hydrocarbons is occurring within the hydrocarbon impact zone near Tank 50. This conclusion is further supported by the observation that gas-phase concentrations of carbon dioxide, which are the metabolic end-product of aerobic degradation, were elevated over ambient concentrations (0.03% v/v) at all six monitoring well locations. As expected for biological production of carbon dioxide under aerobic conditions, the levels of carbon dioxide were generally highest in wells with the greatest depletion of oxygen. Aerobic decomposition may be facilitated by the seasonal fluctuating groundwater table allowing periodic oxygenation.

Methane was also detected at concentrations ranging from 0.1 to 18.0% in the headspace of five of the six monitoring wells prior to the test. The levels of methane observed in the wells, like carbon dioxide, were generally the highest in wells with the greatest depletion of oxygen. Methane is the end-product of strictly anaerobic metabolism (known as methanogenesis) and is produced from hydrocarbons only in the complete absence of oxygen. However, the fact that oxygen was also detected in these wells is not unusual in that well headspace measurements provide an indication of the average gas concentrations surrounding the wells, while methanogenesis may only be occurring in isolated anoxic pockets in the subsurface. The presence of methane in these wells indicates that, after oxygen had been depleted by aerobic degradation in these pockets, anaerobic metabolism became the pathway for degradation of the hydrocarbons. Anaerobic degradation may also be occurring in cycle with aerobic degradation as the groundwater table fluctuates.

5.2 Laboratory Feasibility Testing

The laboratory testing demonstrated that a healthy population of indigenous microorganisms is present in site soil and groundwater and is capable of degrading diesel-ranging organics when stimulated by the addition of oxygen or nutrients. However, the soil and groundwater composites used for the laboratory testing contained predominantly diesel-range organics and did not contain many hydrocarbons in the higher distillate range. Because of this distribution, the diesel-range organics were used to assess the feasibility of enhancing hydrocarbon degradation.

5.3 Field Pilot Testing

The results of the field pilot testing demonstrated that the introduction of oxygen into the subsurface stimulated the biological degradation of the hydrocarbons. The system testing showed that the biosparging radius of influence was approximately 20 to 30 feet and that the biovent radius of influence was approximately 20 feet in the vicinity of Tank 50. However, the test data indicated that preferential flow paths exist in the subsurface. This may limit the economical effectiveness of bioventing/biosparging at this site since a very conservative system would be required in many overlapping biovent/biosparge well pairs.

A biodegradation rate of approximately 1 mg/kg/day was measured by *in-situ* respirometry testing during the pilot testing. This rate is consistent with the range of rates observed by Fluor Daniel GTI and others at typical hydrocarbon-impacted sites. As discussed in Section 4.7, remediation time to achieve the cleanup goal of 5,000 mg/kg (No. 2 fuel oil/diesel) would be predicted to be up to 68.5 years (82 years for a 300 mg/kg cleanup goal).

5.4 Feasibility of Remediation Using Bioremediation

The biosparge/biovent technology can be implemented in the vicinity of Tank 50 to reduce hydrocarbons in the distillate range of diesel to TPH concentrations below 5,000 mg/kg. However, soil in the vicinity of Tank 50 is also impacted with higher distillate range organics, such as No. 6 fuel oil, for which reductions to less than 5,000 mg/kg may be impractical. Initial concentrations in this range are significantly higher than 10,000 - 15,000 mg/kg.

Diesel and No. 2 fuel oil range hydrocarbons contain predominantly aliphatic compounds with a chain lengths of 21 or fewer carbons and low to moderate molecular weight aromatic compounds including alkylbenzenes, naphthalenes, biphenyl/acenaphthenes, phenanthrenes, and fluorenes/acenaphthylenes. These moderately soluble compounds are all amenable to biological degradation. Concentration reductions in soil on the order of 90% or greater can generally be achieved.

No. 6 fuel oil contains a significant portion of both long-chain aliphatic compounds (greater than C-20) and high molecular weight PAHs which are resistant to biodegradation. These compounds are recalcitrant to biological degradation due to their extreme hydrophobicity and very low solubility in water. These properties limit their bioavailability to microorganisms. For the soil surrounding Tank 50, the residual mass will likely exceed the cleanup goal of 5,000 mg/kg, particularly in hot spot areas where degradation processes will likely proceed more slowly, if at all.

6.0 RECOMMENDATIONS

The Brown & Root Technology Screening Evaluation Report recommended the implementation of bioventing/biosparging at this site in order to achieve reduction in TPH concentrations to soil cleanup levels. Prior to implementing these technologies, Brown & Root recommended that bench scale and pilot scale studies be performed.

The results from the laboratory and field pilot testing performed by Foster Wheeler indicate that limited in-situ bioremediation using biovent/biosparge technology is feasible in the vicinity of Tank 50; however, due to high concentrations of heavy distillate fuel fractions, such as No. 6 fuel oil, this technology alone will not successfully reduce the hydrocarbon concentrations in all areas to below a closure goal of 300 or even 5,000 mg/kg within a reasonable period of time.

Because of the limited success of in-situ bioremediation achieved during the laboratory and field studies, a cursory review of alternative remedial options has been performed. The options reviewed included the technologies previously evaluated by Brown and Root and other options determined to be feasible by Foster Wheeler.

Because the soil contamination contains high concentrations of heavy distillate fuel fractions, such as No. 6 fuel oil, there are no economically feasible in-situ remedial options available to successfully reduce the hydrocarbon concentrations in all areas to below cleanup levels in a reasonable period of time. This is due to the high initial TPH levels that exist in the subsurface along with site constraints observed during pilot testing and other technical and economic limitations. Except for the excavation and disposal option, the remedial options discussed in the following pages are those that can "perform contaminant mass removal" but will be unlikely to achieve cleanup levels.

In addition, a focused risk assessment should be performed to establish the level which causes "no significant risk". The establishment of this site-specific cleanup level for TPH in soils at Tank 50 will enable Foster Wheeler and the Navy to better justify the selection of a remedial option. The development of a site-specific TPH cleanup level would involve:

1) Preparation of a work plan per RIDEM regulations to present the proposed approach, along with response to comments and meetings.

2) Additional sampling and analysis using the Massachusetts Department of Environmental Protection (MADEP) Extractable Petroleum Hydrocarbon (EPH) Method to characterize the chemical fractions of petroleum hydrocarbons on-site. RIDEM regulations include nearly identical language and technical content to those in the MADEP initial regulations (circa 1995) such as the same "residential" and "industrial" TPH soil standards based on direct contact and leachability, and the establishment of an Upper Concentration Limit for TPH of 30,000 mg/kg. RIDEM regulations also include the use of Method 3 (essentially site-specific risk assessment) to develop site-specific TPH cleanup levels, as allowed by MADEP. Volatile Petroleum Hydrocarbons (VPH) analysis does not appear to be warranted based on the characterization previously completed indicating a lack of "light" petroleum materials on-site. Approximately a dozen samples would be necessary to provide adequate compositional information for use in the site-specific approach. EPH analyses typically cost less than $200 per soil sample (usually about $100/sample).

3) Additional characterization of PAHs on-site. Analysis of one sample demonstrated the presence of PAHs, some of which can be significant risk drivers in the establishment of cleanup levels.

The PAHs of concern (specifically the carcinogenic PAHs) do not appear to be present at risk driving levels. However, with only one sample result it is difficult to state this with any degree of certainty. The EPH Method automatically characterizes and quantifies the PAH constituents. Therefore, additional analyses specifically for PAHs will not be required.

4) It may also be necessary to use the EPH analyses to further characterize groundwater, if that is also a medium of concern. GA-NA groundwater is considered a source of volatiles to indoor air. This pathway may not be complete if the PAH analysis shows low levels of the volatile PAHs, naphthalene, and 2-methylnaphthalene. If necessary, this same approach can be used to identify a site-specific health-protective groundwater TPH level which would not require any remedial actions. The development of this site-specific TPH groundwater concentration may be necessary for ultimate site closure.

5) Completion of the risk assessment evaluation and letter report.

Remedial Options

The following sections describe some of the available remedial options. The discussion includes their anticipated effectiveness and an order-of-magnitude cost estimate.

For these discussions, cleanup of the areas contaminated with greater than 300 mg/kg is used as the "residential" scenario, while cleanup of the areas contaminated with greater than 5,000 mg/kg is used as the future use "industrial" scenario. Figure 6-1 shows the approximate extent of contamination for each of these scenarios.

Option 1 - Excavation and Off-Site Disposal

Description: Excavation of soils that exceed the site-specific cleanup levels would be performed similar to the excavation of soil near Tank 53. This would include the following:

- Dewater the area using the ring drain system,
- Transfer and treat the water using the Tank Farm No. 5 water treatment facility,
- Install shoring system and excavate soils using backhoes, clam-shell excavators and bulldozers,
- Backfill the area with clean fill, and
- Transport and treat/dispose of the contaminated soil

Approximately 17,000 cubic yards of contaminated soil would require excavation based on an aerial extent of 0.30 acres for soil contamination greater than 300 mg/kg, down to a depth of 37 feet as reported by Brown and Root (Figure 1-3).

Using TPH soil sampling results reported by Brown and Root and Foster Wheeler for the cleanup level of 5,000 mg/kg, the aerial extent would only be 0.10 acres or approximately 5,000 cubic yards. This volume could be even lower if a site-specific cleanup level based on a future use "industrial" scenario was determined for Tank 50.

Effectiveness: Excavation and removal eliminates future exposure risks at the site because impacted soils can be physically relocated. Excavation will also allow for direct access to soils and, therefore, will provide more effective treatment than in situ methods and is expected to achieve the soil cleanup levels at the site.

Potential impacts to human health and the environment will primarily occur during excavation. Risks will not continue after the excavation is completed. Worker safety can be maintained through proper construction and safety techniques such as shoring and the use of trench boxes.

Implementability: Excavation could be performed similar to the excavation in the vicinity of Tank 53. The use of the water treatment plant at Tank Farm No. 5 for dewatering would need to be reviewed.

Cost: The total estimated present-worth cost of this alternative is $2,400,000 (>300 mg/kg area) or $900,000 (>5,000 mg/kg area). This cost represents only capital cost as the estimated 30-year present-worth O & M cost is $0. This cost is expected to be within the +50% to -30% accuracy.

Option 2A - Institutional Controls

Description: Institutional controls include options such as deed restrictions, access restrictions/fencing, posting of warning signs, and monitoring. Deed restrictions, land use restrictions, or other policies or rules prevent the present and future exposure of workers and nearby residents to the subsurface contaminants. These controls may limit future placement of drinking water wells, and construction or demolition activities in the area of Tank 50. Monitoring consists of sampling and laboratory analyses of groundwater to detect contaminant migration and groundwater movement.

Effectiveness: Institutional controls and groundwater monitoring may be effective at preventing exposure to impacted media present in the Tank 50 area. Controls would prevent the installation of water supply wells, eliminating potential exposure resulting from the use of groundwater.

Groundwater sampling can be used to monitor the migration of impacted groundwater which could result in possible impacts to ecological receptors such as Gomes Brook or Narragansett Bay. This option will not achieve site-specific cleanup levels in a reasonable period of time.

Cost: The total estimated present-worth cost of this alternative is $200,000. This cost represents an estimated capital cost of $15,000 (deed restrictions) and estimated 30-year present-worth O & M cost of $185,000.

Option 2B - Institutional Controls with Natural Attenuation Monitoring

Description: Institutional controls would be similar to Option 2A. While no engineered treatment processes are proposed, natural attenuation will result in some reduction of petroleum concentrations presently in soils near Tank 50. Natural attenuation would be monitored by performing additional groundwater sampling along with soil sampling and laboratory analysis.

Effectiveness: Institutional controls and groundwater monitoring may be effective at preventing exposure to impacted media present in the Tank 50 area. Controls would prevent the installation of water supply wells, eliminating potential exposure resulting from the use of groundwater.

Groundwater sampling can be used to monitor the migration of impacted groundwater which could result in possible impacts to ecological receptors such as Gomes Brook or Narragansett Bay. Monitoring would also be used to track concentrations in soils to evaluate effects of natural attenuation. This option is not expected to achieve site-specific cleanup levels in a reasonable period of time.

Cost: The total estimated present-worth cost of this alternative is $275,000. This cost represents an estimated capital cost of $15,000 (deed restrictions) and estimated 30-year present-worth O & M cost of $260,000.

Option 2C - Institutional Controls with Passive Nutrient Addition and Natural Attenuation Monitoring

Description: Institutional controls would be similar to Option 2A. To enhance subsurface biological processes, ammonia-nitrogen could be injected into existing wells and/or applied to the ground surface around the Tank 50 socket. Reduction in TPH from natural attenuation and enhanced biological processes would be monitored by performing groundwater and soil sampling and analysis.

Effectiveness: Institutional controls and groundwater monitoring may be effective at preventing exposure to impacted media present in the Tank 50 area. Controls would prevent the installation of water supply wells, eliminating potential exposure resulting from the use of groundwater.

Groundwater sampling can be used to monitor the migration of impacted groundwater which could result in possible impacts to ecological receptors such as Gomes Brook or Narragansett Bay. Monitoring would also be used to track concentrations in soils to evaluate effects of natural attenuation. This option is not expected to achieve site-specific cleanup levels in a reasonable period of time.

Cost: The total estimated present-worth cost of this alternative is $305,000. This cost represents an estimated capital cost of $15,000 (deed restrictions) and estimated 30-year present-worth O & M cost of $290,000.

Option 3 - In-Situ Bioremediation

The bench scale study indicates that a well established population of petroleum degrading bacteria already exist in-situ at the Tank 50 site. The ability of these micro-organisms to degrade petroleum has been shown by the bench scale study to be enhanced by addition of nitrogen and phosphate as nutrients. The bench scale study showed that overall, the aerobic conditions generally improved degradation rates. The following alternatives utilize in-situ bioremediation to reduce the contaminant mass at Tank 50.

Option 3A - Biosparge/Biovent with High Density of Points

Description: This alternative would implement biosparging/bioventing to the maximum extent possible. The pilot test determined a radius of influence of 20 to 30 feet however, preferential pathways were observed. Therefore, a 15 foot radius of influence is estimated to provide an aggressive coverage of all areas. Based on this radius, approximately 24 and 7 biosparge/biovent well pairs would be installed to cover the greater than 300 and 5,000 mg/kg areas, respectively. The remaining system would consist of a manifold system, a blower and a vacuum pump. No air emission control system is expected.

Effectiveness: Refer to the Post Pilot Study Report and the discussion provided above. This option is not expected to achieve site-specific cleanup levels in a reasonable period of time.

Implementability: This alternative uses standard monitoring wells to inject and extract air from the subsurface. Aboveground equipment would need to be housed in a building for use during winter months.

Cost: The total estimated present-worth cost of this alternative is $900,000 for the >300 mg/kg area and $600,000 for the >5,000 mg/kg area. This cost is comprised of approximately 50% capital cost and 50% 30-year present-worth O & M cost.

Option 3B - Biosparge/Biovent with Low Density of Points

Description: An alternative approach would be to install biovent/biosparge points at a density determined based upon the radial influence measured during the pilot test. Therefore, a 30 foot radius of influence is estimated to provide an aggressive coverage of all areas. Based on this radius, approximately 12 and 3 biosparge/biovent well pairs would be installed to cover the greater than 300 and 5,000 mg/kg target areas, respectively. The remaining system would consist of a manifold system, a blower and a vacuum pump. No air emission control system is expected.

Effectiveness: Preferential flow due to subsurface anisotropy would likely result in lack of aeration to some zones of the subsurface. However, at least partial oxygenation of these zones could be achieved by 1) passive diffusion of oxygen from aerated to unaerated zones and 2) pulsing (resulting in dynamic changes in flow paths and pressure gradients). The ultimate closure levels achievable would be the same as the high-point density options, except that additional residual hot spots could remain and the time for closure would increase. This option is not expected to achieve site-specific cleanup levels in a reasonable period of time.

Implementability: Implementability would be similar to Option 3A.

Cost: The total estimated present-worth cost of this alternative is $700,000 for the >300 mg/kg area and $500,000 for the >5,000 mg/kg area. This cost is comprised of approximately 40% capital cost and 60% 30-year present-worth O & M cost.

Option 4 - Intermittent Groundwater Extraction and Treatment

Description: This alternative would take advantage of the existing water treatment system at Tank Farm No. 5 and use data collected from the bench and pilot scale studies. The simplest approach would be to pump groundwater from the tank socket annulus on an intermittent basis to lower the groundwater table. Petroleum mass contained in groundwater would be removed immediately and sent to the treatment system. Lowering the groundwater table would allow establishment of aerobic conditions in the previously saturated zone, thereby stimulating biodegradation. As the groundwater table rose, additional contaminant would desorb onto the "cleaner" groundwater. After a short period of time the groundwater pumping could be reactivated to remove additional desorbed petroleum and reestablish aerobic conditions. This "intermittent" pumping would minimize pumping costs and volume of groundwater requiring treatment.

To accelerate degradation, ammonia-nitrogen could be injected into existing wells and applied to the ground surface around the tank socket. During precipitation events nutrient nitrogen would be provided to the micro-organisms. The periodic lowering of the groundwater table would allow oxygen to become available without expending significant capital, operation and maintenance costs.

Dewatering to impact the entire tank socket would utilize the ring drain system at Tank 50. This would be required if the area was greater than 300 mg/kg. In addition, one extraction well would be installed in the highest contamination area. Approximately 1,000 feet of underground piping would be installed to connect to the WTP.

Effectiveness: Although, the final TPH concentration achievable cannot be ascertained and site-specific cleanup levels are not expected to be met in a reasonable period of time, it is likely that this recommended alternative would remove a greater fraction of in-situ petroleum hydrocarbons than the biovent/biosparge system described in Option 3.

Implementability: This alternative uses the existing ring drain system or standard monitoring wells to extract groundwater from the subsurface. During tank cleaning activities at Tank 50, the flow rate from the ring drain ranged from 30 to 40 gpm during initial water removal to approximately 5 to 10 gpm for sustained dewatering. The existing water treatment facility system at Tank Farm No. 5 can handle flow rates ranging from 2 to 50 gpm. The influent water quality conditions from Tank 50 will need to be reviewed versus the design basis of the existing treatment system.

Cost: The total estimated present-worth cost of this alternative is $400,000. This cost represents an estimated capital cost of $100,000 and estimated 30-year present-worth O & M cost of $300,000.

Option 5 - Biosparge/Biovent with Low Density of Points
Combined with Intermittent Groundwater Pumping

Description: Intermittent groundwater pumping to lower the groundwater table (Option 4) can be combined with the low-point density approach (Option 3B).

Effectiveness: The low-point density biosparge/biovent approach will potentially leave pockets of subsurface soils unaerated due to anisotropy. Intermittent groundwater pumping will effect aeration of a wide zone and may enhance aeration of zones not impacted by the biosparge/biovent system. While the bulk of the remediation would be achieved in the same time period as that of the low-point density system alone, the addition of pumping would assist in achieving degradation in the remaining hot spots. This option is not expected to achieve cleanup levels in a reasonable period of time.

Implementability: Implementability would be similar to Option 3A.

Cost: The total estimated present-worth cost of this alternative is $800,000. This cost represents an estimated capital cost of $400,000 and estimated 30-year present-worth O & M cost of $400,000.

RECOMMENDATION SUMMARY

The development of a site-specific TPH cleanup level should be performed. This would include the following:

- Work Plan Preparation for RIDEM review,
- Sampling and Analysis,
- Risk Assessment Evaluation, and
- Letter Report

During the development of the site-specific TPH cleanup, the future use of the property would be established with the Navy. This in turn will provide the rationale for choosing a remedial option. The following is presented as an example:

- For the future use residential scenario (Transfer of property ownership) - It would be expected that the tanks will be demolished in place similar to Tank Farm No. 4. Therefore, excavation of

a limited amount of contaminated soil may be more acceptable than long term treatment or institutional controls. The site specific cleanup level will help limit the excavation volume.

- For the future use industrial scenario (Navy retains long-term ownership) - The use of institutional controls plus focused remediation to lower the hot spot contamination to below upper concentration levels may be more acceptable. For the focused remedial efforts, Option 4 is the preferred alternative.

7.0 REFERENCES

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Hinchee, 1992. A Rapid In Situ Respiration Test for Measuring Biodegradation Rates of Hydrocarbons in Soil, prepared by R.E. Hinchee and S.K. Ong; Journal of Air Waste Management Association p. 1305-1312, 1992.

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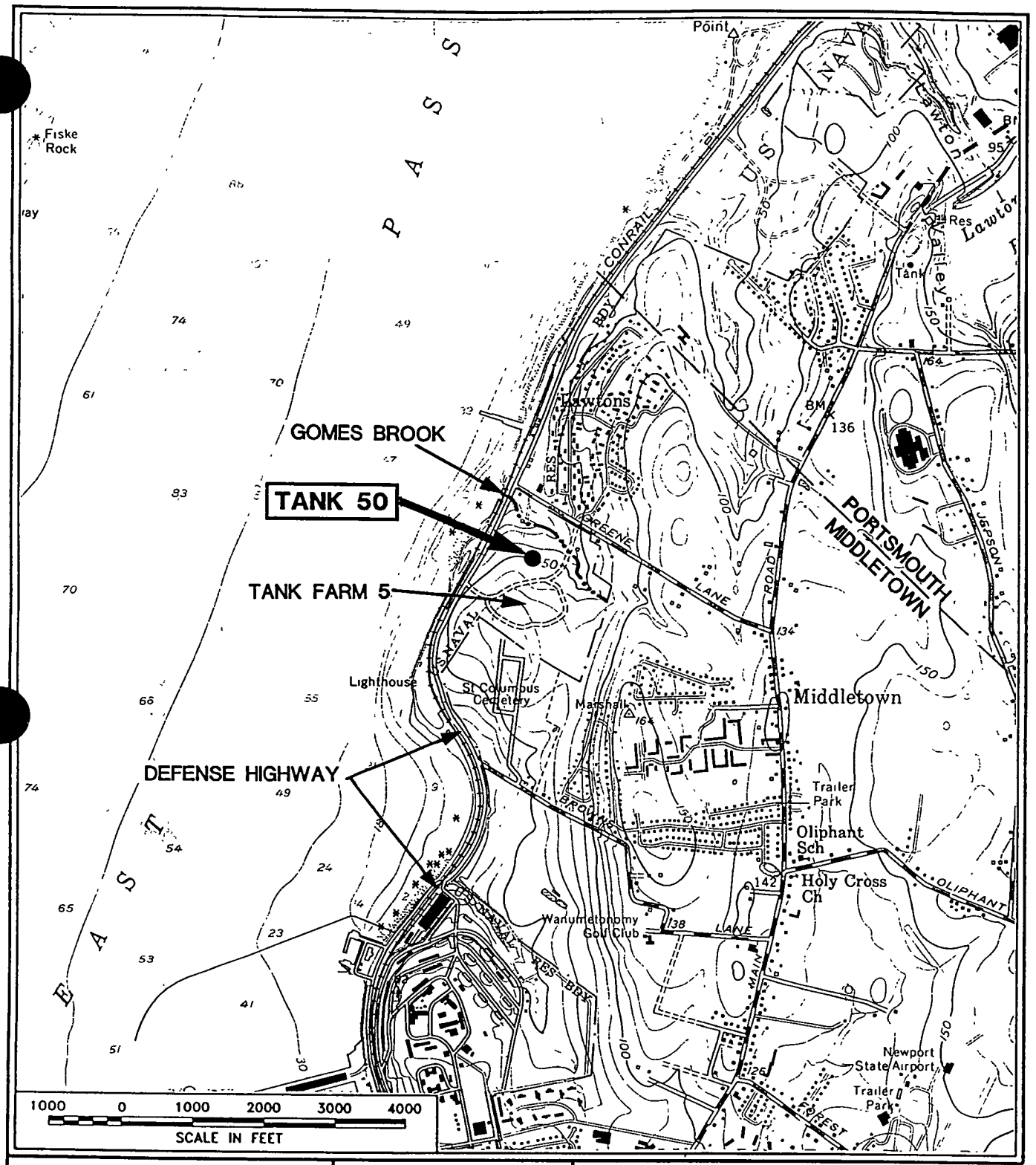
FIGURES



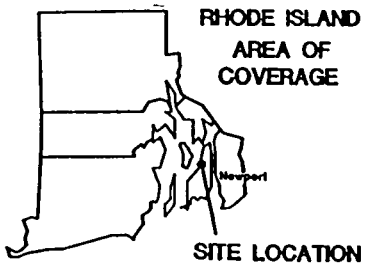


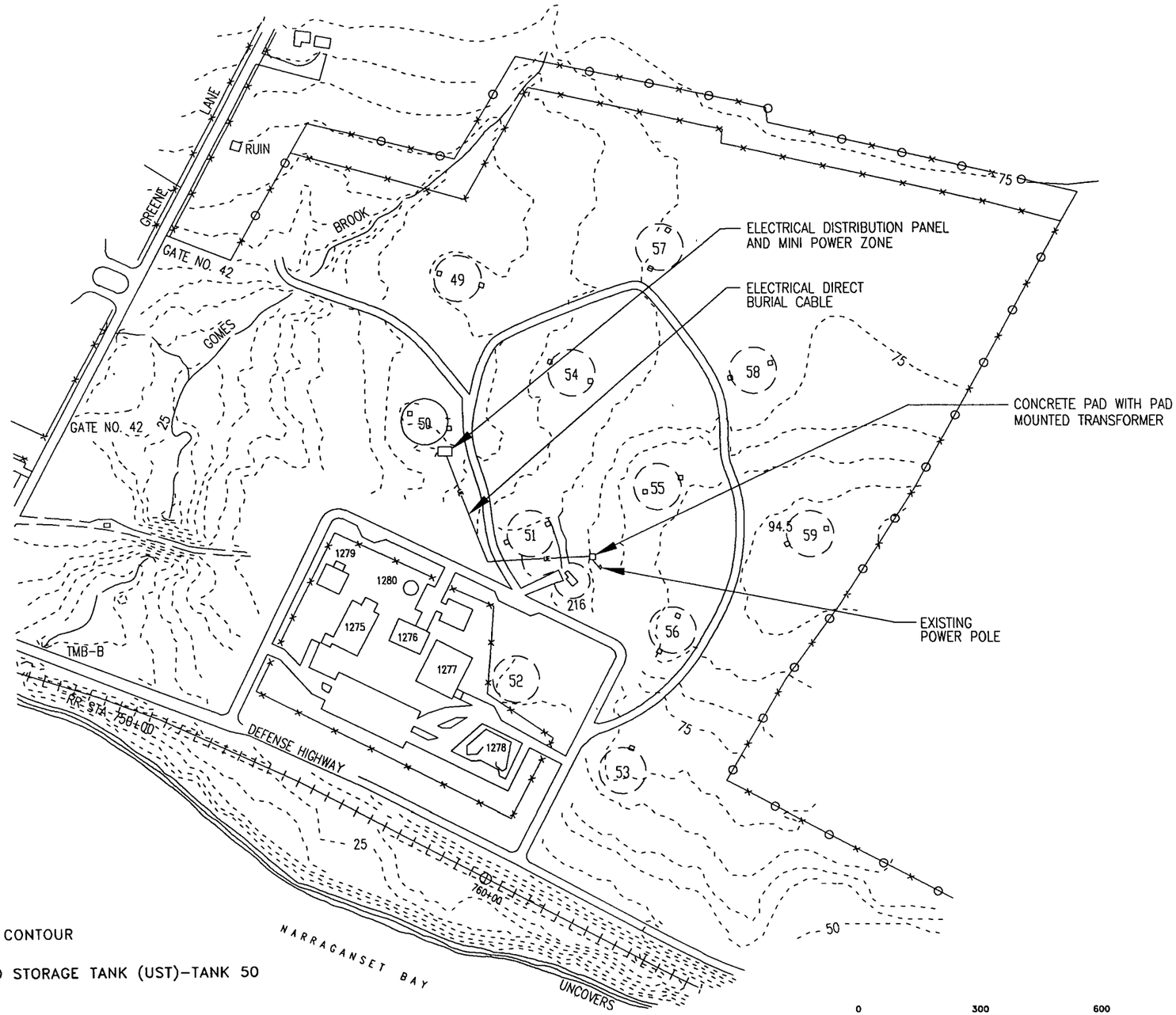
FIGURE 1-1

NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

BIOREMEDIATION PILOT TESTING - TANK 50 SITE LOCATION MAP

SCALE: AS SHOWN

Source: USGS 7.5 min Quadrangle, Prudence Island, RI, 1955, photorevised 1970 and 1975.



N

LEGEND:

- - -25- - - TOPOGRAPHIC CONTOUR

(50) UNDERGROUND STORAGE TANK (UST)–TANK 50

BROOK

—UE— ELECTRICAL CABLE

PREPARED BY:

FOSTER WHEELER ENVIRONMENTAL CORPORATION
470 ATLANTIC AVENUE, BOSTON, MA 02210
DECEMBER 6, 1996.

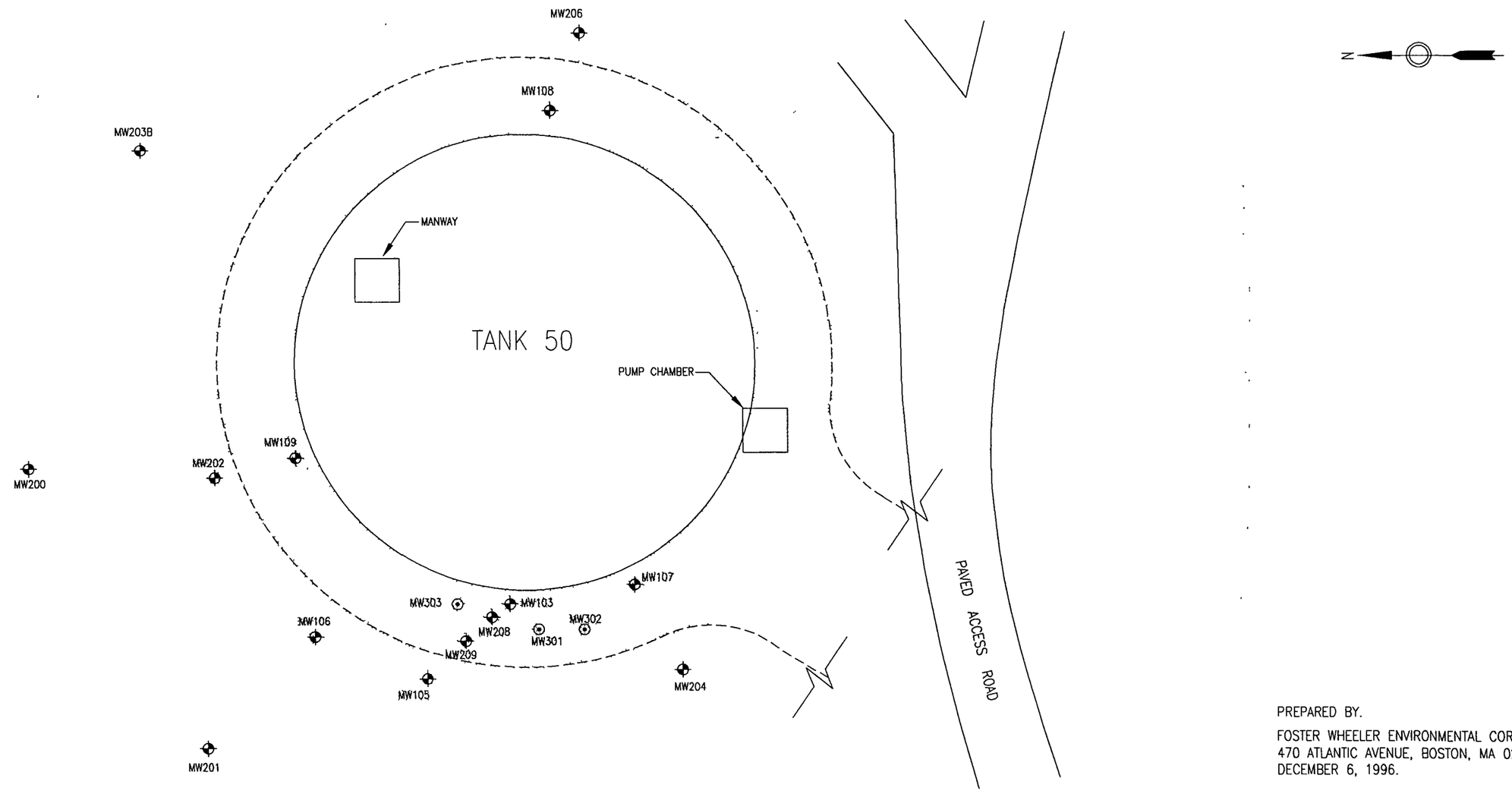
FIGURE 1-2

N.E.T.C. - Newport, Rhod Island
Tank Farm 5, Tank 50

SITE PLAN

SCALE: AS SHOWN

CADDFILE. 12841001.DWG



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FOSTER WHEELER ENVIRONMENTAL CORPORATION
470 ATLANTIC AVENUE, BOSTON, MA 02210
DECEMBER 6, 1996.

LEGEND

- - - - TANK SOCKET

APPROXIMATE EXTENT OF SOILS WITH TPH >300 mg/kg (AS DEFINED IN BROWN & ROOT SI)

MW201 EXISTING MONITORING WELLS

MW303 WELLS INSTALLED BY FOSTER WHEELER

0 30 60 90

SCALE IN FEET

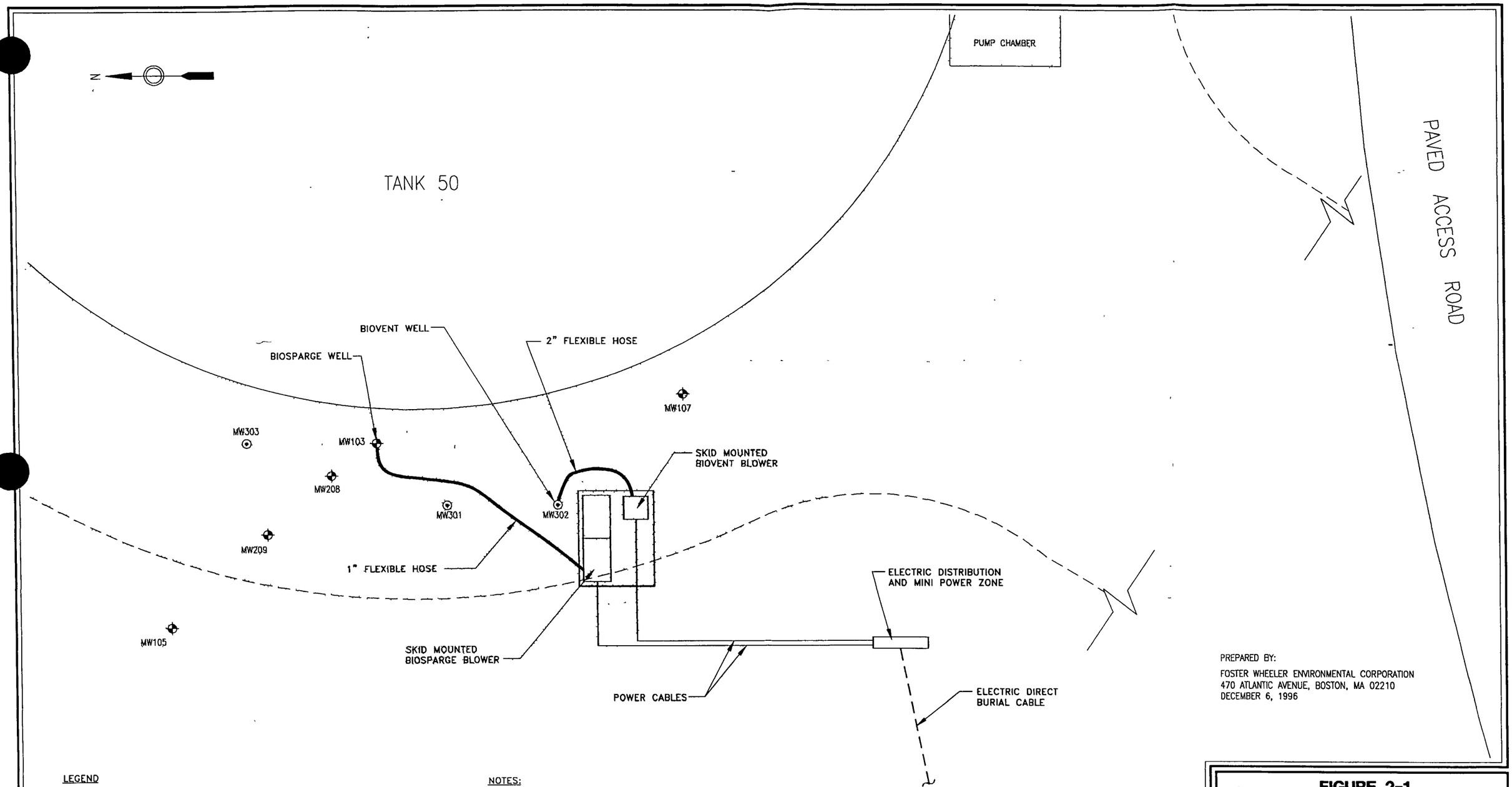
FIGURE 1-3

N.E.T.C. - N wport, Rhode Island
Tank Farm 5, Tank 50

PILOT TEST STUDY AREA

SCALE: AS SHOWN

CADDFILE. 12841002.DWG



PREPARED BY:

FOSTER WHEELER ENVIRONMENTAL CORPORATION
470 ATLANTIC AVENUE, BOSTON, MA 02210
DECEMBER 6, 1996

LEGEND

- TANK SOCKET
- APPROXIMATE EXTENT OF SOILS WITH TPH >300 mg/kg (AS DEFINED IN BROWN & ROOT SI)
- MW201 EXISTING MONITORING WELLS
- MW303 WELLS INSTALLED BY FOSTER WHEELER

NOTES:

BIOSPARGE WELL :	MW103
BIOVENT WELL :	MW302
MONITORING WELL :	MW301
MONITORING WELL :	MW303
MONITORING WELL :	MW208
MONITORING WELL :	MW209
MONITORING WELL :	MW105
MONITORING WELL :	MW107

0 10 20 30
SCALE IN FEET

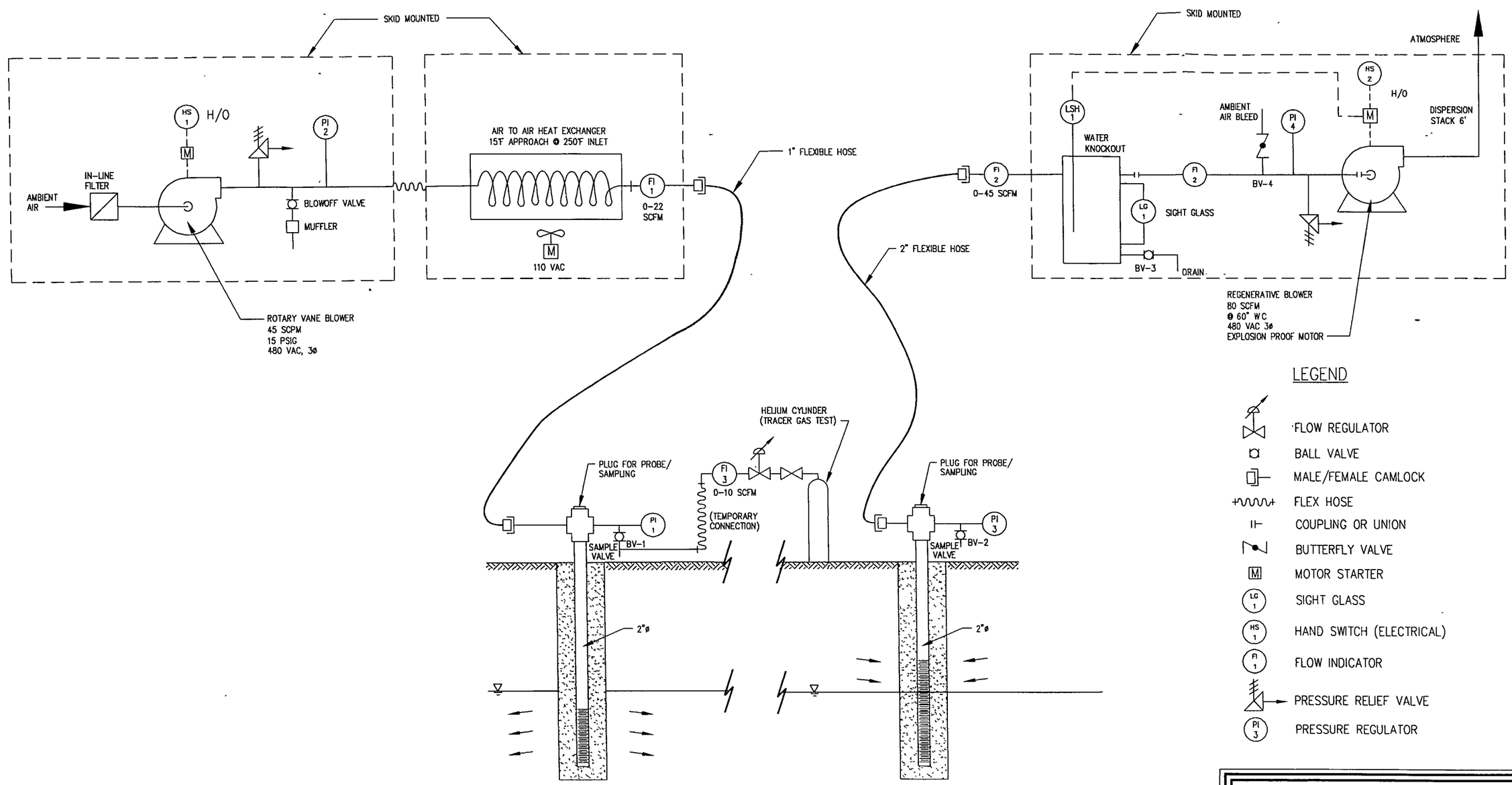
FIGURE 2-1

N.E.T.C. - Newport, Rhod Island
Tank Farm 5, Tank 50

PILOT TEST CONFIGURATION

SCALE: AS SHOWN

CADDFILE: 12841004.DWG



PREPARED BY

FOSTER WHEELER ENVIRONMENTAL CORPORATION
470 ATLANTIC AVENUE, BOSTON, MA 02210
DECEMBER 6, 1996

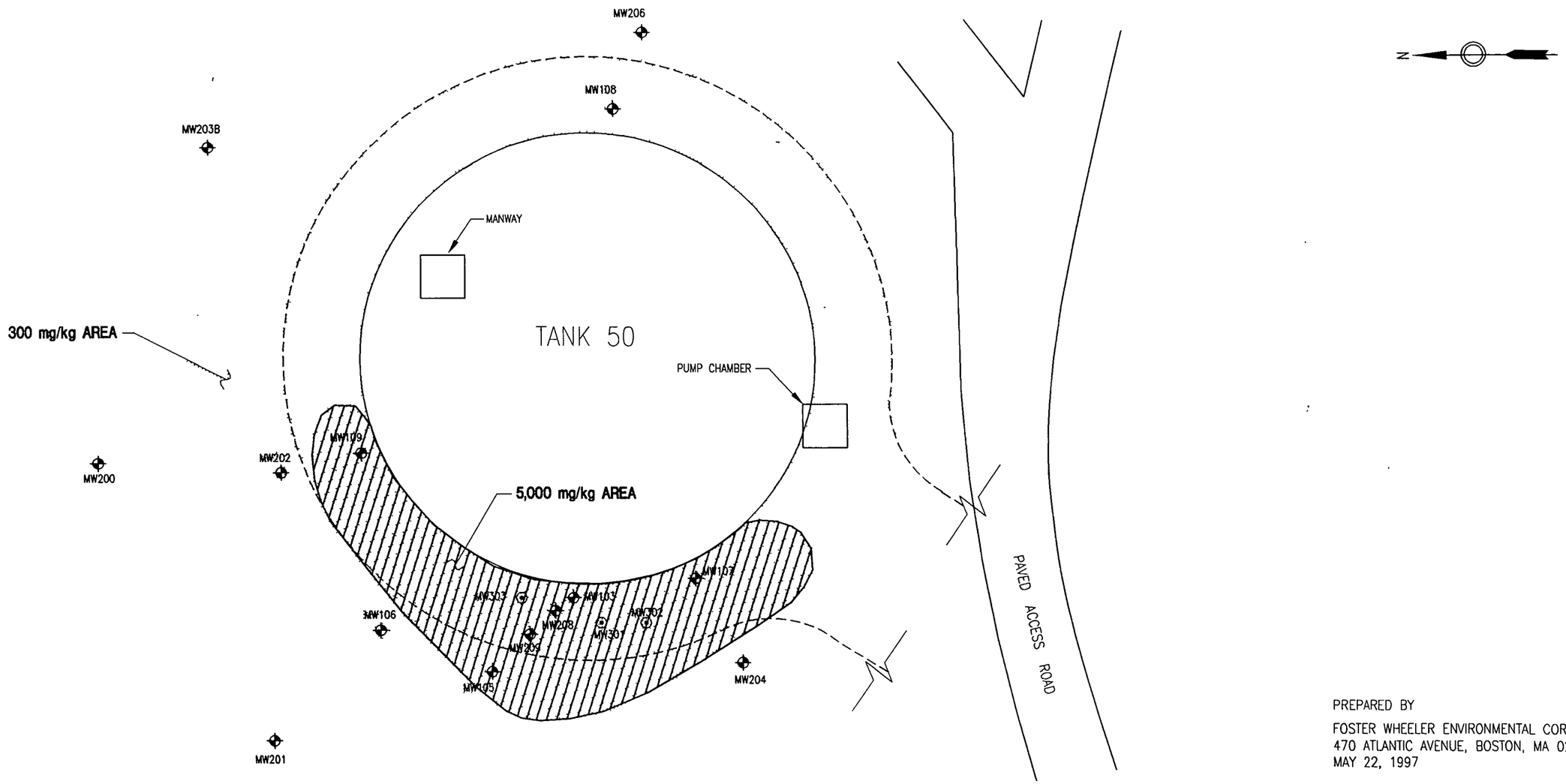
FIGURE 2-2

N.E.T.C. - Newport, Rhode Island
Tank Farm 5, Tank 50

PIPING & INSTRUMENTATION DIAGRAM FOR PILOT STUDY

SCALE: AS SHOWN

CADDFILE. 12841003.DWG



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MAY 22, 1997

LEGEND

- - - - TANK SOCKET

APPROXIMATE EXTENT OF SOILS WITH TPH >300 mg/kg (AS DEFINED IN BROWN & ROOT SI)

APPROXIMATE EXTENT OF SOILS WITH TPH >5,000 mg/kg (BASED ON SI SAMPLING RESULTS)

MW201 EXISTING MONITORING WELLS

MW303 WELLS INSTALLED BY FOSTER WHEELER

MW207

0 30 60 90

SCALE IN FEET

FIGURE 6-1

N.E.T.C. - Newport, Rhode Island
Tank Farm 5, Tank 50

APPROXIMATE REMEDIAL ACTION AREAS

SCALE: AS SHOWN

CADDFILE: 12841007.DWG

TABLES

Table 3-1

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Initial Soil and Groundwater Characterization Methodology

Analysis	Methodology
Contaminant Screening	
Total Organic Carbon (TOC)	CFA S:18.0
Total Petroleum Hydrocarbon (TPH) by GC/FID[a]	EPA 8015 (modified) with Soxhlet extraction
Background Nutrient Concentrations	
Ammonia-Nitrogen	EPA 350.3
Ortho-Phosphate	EPA 365.3
Other Chemical Properties	
pH	SM 4500-H^+
Cation Exchange Capacity (CEC)	EPA 9080
Microbiological Screening (CFU/g) for soil and (CFU/ml) for water[b]	
Total Heterotrophic Bacteria (THB)	SM 9215 C (modified)
Contaminant-Utilizing Bacteria (CUB) - Diesel	SM 9215 C (modified)

a. GC/FID: Gas chromatography by flame ionization detection.
b. CFU = colony forming units

Table 3-3

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Summary of TPH Data from Biodegradation Testing

Week	Average Concentration (mg/kg)[1, 2]			
	System 1 Unamended	System 2 Oxygen Only	System 3 Nutrients Only	System 4 Oxygen + Nutrients
0	1250	1000	1535	<700
1	1550 (1450)	1125 (1850)	805 (1300)	<700 (540)
2	1450 (2000)	1700 (2200)	1255 (1230)	700 (795)
3	700 (975)	725 (1600)	<710 (680)	<700 (88)
4	785	900	775	<755
5	850	<710	<640	<710
6	768	<735	<600	<570
7	925	<720	<745	<700
8	840	<700	<700	<700
9	1250	715	<700	<700
10	<700	745	<700	<700
11	<700 (690)	<700 (985)	<710 (168)	<700 (290)
12	1105	<860	<825	<815
14	<800 (515)	<800 (255)	<825 (113)	<790 (93)

1. Samples values reported below the reporting limit were included as equal to the reporting limit for calculation of averages.
2. Concentrations reported in parentheses are preliminary data from Sequoia with an approximate dilution factor correction.

Table 4-1

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Baseline Subsurface Conditions

Well ID	Distance From Biosparge Well (ft)	CH_4 (%)	CO_2 (%)	O_2 (%)	VOC (ppmv by FID)	Depth to Water (ft bgs)	Dissolved Oxygen (mg/l)
MW-208	5.5	0.1	0.1	20.3	>1000	8.24	0.7
MW-301	10	18.0	3.0	8.5	>1000	8.84	0 5
MW-209	10.5	0.7	0.5	19.8	>1000	8.29	0.7
MW-303	14	1.5	2.5	15.0	>1000	8.27	1 0
MW-105	28	0.5	1.0	15.0	>1000	12.51	--
MW-107	31	0.0	0.4	19.9	25-75	9.29	0.6

Notes:

Biosparge Well = MW-103
-- D.O. not monitored due to presence of liquid phase petroleum (floating product)

Table 4-2

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Startup - Biovent Flow/Vacuum Response Test

		Test 1	Test 2	Test 3
Biovent Extraction Flow Rate (scfm)		5	8	12
Biovent Wellhead Vacuum (inches of H_2O)		25	40	60
Well ID	Distance from Biovent Well (ft)	Observed Vacuum at Monitoring Wells (inches of H_2O)		
MW-107	10	0	1.5	1.6
MW-301	10	0.5	1.0	1.4
MW-303	30	0	0	0

Notes:

Biovent Well = MW-302

Table 4-3

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Startup-Biosparge Test Results

		Baseline	Test 1	Test 2	Baseline	Test 1	Test 2	Baseline	Test 1	Test 2
Air Injection Rate (scfm)		0	4 5	11.5	0	4.5	11.5	0	4.5	11.5
Injection Pressure		0	7.5	8.0	0	7.5	8.0	0	7.5	8.0
Well ID	Distance From Biosparge Well (ft)	Dissolved Oxygen (mg/l)			Depth to Water (ft bgs)			Well Head Pressure (inches of H_2O)		
MW-208	5.5	0.7	1.1	0.8	8.24	8.17	8.15	0	0.3	1.3
MW-301	10.0	0.5	1.3	10.4	8.24	8.2	8.6	0	0.6	4.0
MW-209	10.5	0.7	10.1	10.8	8.29	8.05	8.1	0	6.3	6.6
MW-303	14.0	1.0	0.6	0.4	8.27	8.15	8.16	0	0.0	0.1
MW-107	31.0	0.6	0.5	0.9	9.29	9.19	9.21	0	(2.4)	0.2

Notes:
Biosparge Well = MW-103
( ) = represents negative pressure of vacuum

Table 4-4

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Startup - Helium/Respirometry Monitoring

	Oxygen Levels (%)						
Hours After Completed Injection	MW-107	MW-302	MW-301	MW-208	MW-209	MW-303	MW-105
0.25	16.9	9.6	8.1	14.3	19.3	17.7	8.6
1	17.7	10.9	6.3	14.2	18.8	14.4	8.5
2	16.7	10.5	6.1	14.2	18.5	13.8	8.3
3.5	18.1	10.8	5.9	14.2	18.4	13.7	7.9
6	16.7	11.3	5.7	14.1	18.2	13.6	7.8
23	15.3	9.8	4.7	14.5	18.5	15.1	6.7
29	15.7	8.3	4.5	14.7	18.7	15.4	6.8
45	15.2	4.7	3.4	14.9	18.9	15.6	5.8
69	14.4	5.2	4.4	14	16.6	16.2	5.8
142	10.5	0.8	0	15.3	18.7	13.7	2.4
	CO_2 Levels (%)						
Hours After Completed Injection	MW-107	MW-302	MW-301	MW-208	MW-209	MW-303	MW-105
0.25	2.2	0.9	0.2	2.2	0.7	1	3.7
1	1.8	0.9	0.3	2.1	0.7	1.1	3.7
2	2.3	0.8	0.4	2.1	0.7	1.1	3.8
3.5	1.5	0.8	0.4	2.1	0.7	1.1	3.8
6	2.2	0.9	0.4	2.1	0.7	1.1	3.9
23	3	1.3	0.8	2	0.7	1.5	4.2
29	2.3	1.6	0.7	1.7	0.5	1.5	3.8
45	3.1	3	1.5	2	0.6	2.2	4.6
69	3.6	4.4	2.3	1.8	0.5	1.9	4.9
142	5.8	5.9	3.7	1.6	0.5	3.7	5.9

Table 4-4 (cont'd)

	CH_4 Levels (%)						
Hours After Completed Injection	MW-107	MW-302	MW-301	MW-208	MW-209	MW-303	MW-105
0.25	0.2	0.7	0.2	1.3	0.4	0.3	1.1
1	0.2	0.6	0.5	1.1	0.3	0 4	1.1
2	0.2	0.5	0.6	1	0.3	0.5	1.1
3.5	0.1	0.5	0.6	1	0.3	0.4	1.1
6	0.2	0.6	0.6	0.9	0.3	0.4	1.1
23	0.2	0.8	0.7	0.7	0.3	0.5	1.2
29	0.3	1.3	0.9	1	0.5	0.8	1.5
45	0.2	2	0.9	0.7	0.3	0.4	1
69	0.1	2.7	0.9	0.6	0.2	0.3	0.6
142	0.1	5.5	2.5	0.5	0.2	0.2	0.7
	Helium Levels (%) *						
Hours After Completed Injection	MW-107	MW-302	MW-301	MW-208	MW-209	MW-303	MW-105
0	0	--	55	0.15	0.08	3.1	0
31	0	15	33	0	0.72	3.3	0
46	0	15	38	0	0.6	1.4	0
70	0	14	35	0	0.67	0.53	0
142	0	10	28	0	0.5	0.24	0.09

Notes:
Helium introduced into biosparge injection well MW-103 @ 50/50 helium/air ratio (volume/volume) @ a combined biosparge late of 12 scfm.
Helium meter stopped working properly after T = 0 measurement. Therefore, readings from 1-23 hours are not included.
Replacement meter was used from hour 31 on.

Table 4-5

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Pilot Test Operation - Well Head Pressure/(Vacuum)
(inches of H_20)

Test Week *(1)	Date	MW-107	MW-302 **	MW-301	MW-208	MW-209	MW-303	MW-103 ***	MW-105
3	8/26/86	1	--	16	6	0.2	0.1	--	0.2
	8/30/96	1	--	17	5.9	0.2	0.2	--	0 2
4	9/3/96	0.8	--	15	3.4	0	0.2	--	0.2
	9/6/96	1 3	--	16	3	0	0.2	--	0 2
5	9/10/96	1 8	--	18	2.6	0	0.2	--	0 2
6	9/20/96	0 02	--	45	3.4	0	17	--	17
7 (2)	9/27/96	0	--	0	0	0	0	--	0
8	10/3/96	0	--	27	0.5	0	0.1	--	4 5
9	10/11/96	0	--	40	0 2	0	4.7	--	1 4
10	10/18/96	(0.1)	--	21	0	0	0.2	--	13
11	10/25/96	(0.1)	--	19	0.2	0	0.7	--	9
12	10/31/96	(1.0)	--	41	0 3	0	14	--	1
13	11/5/96	(1.2)	--	29	0.4	43	3.8	--	(5)

Notes:
* = Weeks 1 and 2 are designated as test start-up
** = Biovent Well
*** = Biosparge Well
(1) = Biosparge/Biovent Operating Conditions:
Weeks 3-9: Biosparge Injection Rate = 12 scfm, Biovent Extraction Rate = 12 scfm
Weeks 10-13: Biosparge Injection Rate = 4 scfm, Biovent Extraction Rate = 6-12 scfm
(2) = 9/27/96 data was measured with the Biovent/Biosparge systems off (due to high water alarm in Biovent System moisture separator)

Table 4-6

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Pilot Test Operation - Dissolved Oxygen
(mg/l)

Test Week *(1)	Date	MW-107	MW-302 **	MW-301	MW-208	MW-209	MW-303	MW-103 ***
3	8/26/96	0 3	--	9.9	9	0.6	8.1	--
	8/30/96	0.2	--	10	9	0.8	8	--
4	9/3/96	0.3	--	10.1	12.3	6.4	7.6	--
	9/6/96	0.7	--	10	11.3	4	7	--
5	9/10/96	1.5	--	10	10.6	2	7	--
6	9/20/96	2.7	--	9.4	9.5	8.1	9	--
7 (2)	9/27/96	1.5	--	2.5	6.5	0.5	1.5	--
8	10/3/96	1 1	--	9 9	9.8	1	5 9	--
9	10/11/96	0.9	--	11	10.6	0.7	2.8	--
10[2]	10/18/96	1.1	--	9.9	9.8	1	5 9	--
11[2]	10/25/96	1	--	0.5	3	0	0	--
12[2]	10/31/96	1.3	--	10.1	6.1	--	11.3	--
13[2]	11/5/96	1.5	--	11.2	10	12.3	7	--

Notes:
* = Weeks 1 and 2 are designated as test start-up
** = Biovent Well
*** = Biosparge Well
(1) = Biosparge/Biovent Operating Conditions
Weeks 3-9: Biosparge Injection Rate = 12 scfm, Biovent Extraction Rate = 12 scfm
Weeks 10-13: Biosparge Injection Rate = 4 scfm, Biovent Extraction Rate = 6-12 scfm
(2) = 9/27/96 data was measured with the Biovent/Biosparge systems off (due to high water alarm in Biovent System moisture separator)
(3) = MW-105 was not monitored for D O due to presence of liquid phase petroleum

Table 4-7

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Pilot Test Operation - Depth To Water
(ft bgs)

Test Week *	Date	MW-107	MW-302 **	MW-301	MW-208	MW-209	MW-303	MW-103 ***	MW-105
3	8/26/96	9.55	--	9.8	8.62	8 55	8.52	--	12.7
	8/30/96	9.50	--	9.8	8.6	8.6	8.5	--	12.7
4	9/3/96	9.70	--	9.72	8.81	8.74	8.68	--	12 85
	9/6/96	9.60	--	9.5	8.7	8.74	8.68	--	12.8
5 (3)	9/20/96	--	--	--	--	--	--	--	--
7	9/27/96	7.13	--	6.7	6.05	6.15	6.12	--	6 4
8	10/3/96	7.56	--	6.45	6.52	6.54	6.47	--	10 92
9	10/11/96	6.41	--	7.5	5.47	5.47	5.48	--	10.17
10 (3)	10/18/96	--	--	--	--	--	--	--	--
11 (1)	10/25/96	4.05	--	3.52	3.06	3 12	3.02	--	7 65
12 (1)	10/31/96	5.52	--	7.15	4.46	4.51	4.41	--	8.35
13 (1)	11/5/96	6.41	--	7.65	5.38	7.01	5.45	--	9.45

Notes:
* = Weeks 1 and 2 are designated as test start-up
** = Biovent Well
*** = Biosparge Well
(1) = Biosparge/Biovent Operating Conditions:
Weeks 3-9: Biosparge Injection Rate = 12 scfm, Biovent Extraction Rate = 12 scfm
Weeks 10-13: Biosparge Injection Rate = 4 scfm, Biovent Extraction Rate = 6-12 scfm
(2) = 9/27/96 data was measured with the Biovent/Biosparge systems off (due to high water alarm in Biovent System moisture separator)
(3) = Depth to water measurements were not measured on 9/20/96 and 10/18/96

Table 4-8

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Pilot Test Operation - % Oxygen

Test Week *(1)	Date	MW-107	MW-302 **	MW-301	MW-208	MW-209	MW-303	MW-103 ***	MW-105
3	8/26/96	0	--	20.6	19.1	17.9	19.7	--	8 7
	8/30/96	0	--	20.5	19.3	18	19.8	--	9
4	9/3/96	0	--	20.1	19.2	18 1	19.7	--	13 1
	9/6/96	0	--	20	19 2	19.2	18 6	--	12 3
5	9/10/96	0	--	19.9	19.2	19.7	18 6	--	11.8
6	9/20/96	19.7	--	19.9	19.3	19.4	19.6	--	9.2
7 (2)	9/27/96	20	--	17.6	19.7	19.7	19.7	--	8 7
8	10/3/96	19.6	--	21	19.3	19.4	19.8	--	7.6
9	10/11/96	19.4	--	19	19.7	19 6	19.7	--	7.2
10	10/18/96	19.5	--	19.9	19.7	19.5	19.7	--	9 6
11	10/25/96	19.2	--	18.3	19.3	18.4	18.9	--	9 6
12	10/31/96	20.5	--	20.9	20.8	18.9	20.8	--	8 2
13	11/5/96	18.5	--	19.6	19.6	19 5	19.2	--	10.2

Notes:
* = Weeks 1 and 2 are designated as test start-up
** = Biovent Well
*** = Biosparge Well
(1) = Biosparge/Biovent Operating Conditions:
Weeks 3-9: Biosparge Injection Rate = 12 scfm, Biovent Extraction Rate = 12 scfm
Weeks 10-13: Biosparge Injection Rate = 4 scfm, Biovent Extraction Rate = 6-12 scfm
(2) = 9/27/96 data was measured with the Biovent/Biosparge systems off (due to high water alarm in Biovent System moisture separator)

Table 4-9

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Pilot Test Operation - % Carbon Dioxide

Test Week *(1)	Date	MW-107	MW-302 **	MW-301	MW-208	MW-209	MW-303	MW-103 ***	MW-105
3	8/26/96	9.1	--	0	0.7	1 1	0.5	--	5
	8/30/96	8.9	--	0	7	1	0.5	--	5
4	9/3/96	8.6	--	0	0 6	0.8	0.3	--	3 2
	9/6/96	8.6	--	0	0.6	0.8	0.5	--	5
5	9/10/96	10	--	0	0 6	0 3	0 5	--	4 7
6	9/20/96	0	--	0	0.5	0.1	0.4	--	5 7
7 (2)	9/27/96	0.4	--	1	0 4	0.1	0.5	--	5 3
8	10/3/96	0.4	--	0	0.4	0.1	0.2	--	5
9	10/11/96	0.5	--	0	0.1	0.2	0.2	--	4 7
10	10/18/96	0.5	--	0	0.3	0.3	0.3	--	3 4
11	10/25/96	1.7	--	2.6	0.3	1	1.6	--	4.1
12	10/31/96	0.4	--	0	0	1.6	0.2	--	3 5
13	11/5/96	1.7	--	0	0	0	0.3	--	2.8

Notes:
* = Weeks 1 and 2 are designated as test start-up
** = Biovent Well
*** = Biosparge Well
(1) = Biosparge/Biovent Operating Conditions:
Weeks 3-9: Biosparge Injection Rate = 12 scfm, Biovent Extraction Rate = 12 scfm
Weeks 10-13: Biosparge Injection Rate = 4 scfm, Biovent Extraction Rate = 6-12 scfm
(2) = 9/27/96 data was measured with the Biovent/Biosparge systems off (due to high water alarm in Biovent System moisture separator)

Table 4-10

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Pilot Test Operation - % Methane

Test Week *(1)	Date	MW-107	MW-302 **	MW-301	MW-208	MW-209	MW-303	MW-103 ***	MW-105
3	8/26/96	3.3	--	0	0.1	0.6	0.2	--	0.3
	8/30/96	3.2	--	0	0.1	0 6	0 2	--	0 2
4	9/3/96	6.8	--	0.1	0.2	0.4	0.3	--	2
	9/6/96	3.4	--	0	0 1	0 2	0.2	--	0
5	9/10/96	3.6	--	0	0	0	0.1	--	0
6	9/20/96	0	--	0	0	0.1	0	--	0.9
7 (2)	9/27/96	0.1	--	0	0	0	0	--	1 6
8	10/3/96	0	--	0	0	0	0	--	2 5
9	10/11/96	0 2	--	0.1	0.1	0.1	0.1	--	1.4
10	10/18/96	0.1	--	0	0.1	0.1	0.1	--	3.4
11	10/25/96	0.2	--	0.1	0	0.2	0	--	4
12	10/31/96	0.1	--	0	0	0.4	0	--	4.4
13	11/5/96	0.1	--	0	0	0	0.1	--	3.7

Notes:
* = Weeks 1 and 2 are designated as test start-up
** = Biovent Well
*** = Biosparge Well
(1) = Biosparge/Biovent Operating Conditions.
Weeks 3-9 Biosparge Injection Rate = 12 scfm, Biovent Extraction Rate = 12 scfm
Weeks 10-13 Biosparge Injection Rate = 4 scfm, Biovent Extraction Rate = 6-12 scfm
(2) = 9/27/96 data was measured with the Biovent/Biosparge systems off (due to high water alarm in Biovent System moisture separator)

Table 4-11

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Pilot Test Operation - VOC Concentration (ppm by FID) (3)

Test Week *	Date	MW-107	MW-302 **	MW-301	MW-208	MW-209	MW-303	MW-103 ***	MW-105
3	8/26/96	>1000	--	40	500	0.1	600	--	>1000
	8/30/96	>1000	--	40	500	>1000	1	--	>1000
4	9/3/96	>1000	--	15	280	>1000	260	--	>1000
	9/6/96	>1000	--	15	200	>1000	210	--	>1000
5	9/10/96	>1000	--	10	120	>1000	160	--	>1000
6	9/20/96	--	--	--	--	--	--	--	--
7	9/27/96	350	--	>1000	30	300	50	--	>1000
8	10/3/96	600	--	10	10	250	50	--	>1000
9	10/11/96	>1000	--	10	15	85	30	--	>1000
10	10/18/96	750	--	10	10	500	50	--	>1000
11	10/25/96	>1000	--	20	10	>1000	300	--	>1000
12	10/31/96	190	--	10	0	>1000	31	--	>1000
13	11/5/96	>1000	--	5	0	50	35	--	>1000

Notes:
* = Weeks 1 and 2 are designated as test start-up
** = Biovent Well
*** = Biosparge Well
(1) = Biosparge/Biovent Operating Conditions
Weeks 3-9: Biosparge Injection Rate = 12 scfm, Biovent Extraction Rate = 12 scfm
Weeks 10-13: Biosparge Injection Rate = 4 scfm, Biovent Extraction Rate = 6-12 scfm
(2) = 9/27/96 data was measured with the Biovent/Biosparge systems off (due to high water alarm in Biovent System moisture separator)
(3) = FID meter only measures VOC concentration up to 1000 ppmv

Table 4-12

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Biosparge/Biovent System Operating Conditions

Date	Biosparge Flow Rate (scfm)	Injection Pressure (psi)	Biovent Flow Rate (scfm)	Vac. @ Blower (in of W.C.)	Vac. @ MW-302 (in of W.C.)	
08/26/96	12	8	10-20	50	40	
08/30/96	12	8	10-20	50	40	
09/03/96	12	8	10-20	50	40	
09/06/96	12	8	10-20	50	40	
09/10/96	12	8	10-20	51	42	Interface probe not available
09/20/96	12	8	10-20	50	40	
09/27/96	11	9	8	30	24	BS/BV systems down upon arrival due to high water
10/03/96	10.5	8.5	5-10	44	32	BV flow gauge not operational
10/11/96	10	9	2-4	30	4	Readjusted to BS 4 scfm and BV 2-4 scfm
10/18/96	4	8.5	0-4	48	28	Interface probe not available
10/25/96	0-1	10	0	34	32	No sparge flow upon arrival, heavy rains last 3 days, no BV flow due to high water
10/31/96	6 7	9.5	0	33	31	
11/05/96	8	8.5	0	34	32	BS/BV systems turned off upon leaving

Notes: BS = Biosparge System
BV = Biovent System

Table 4-13

NETC Tank Farm 5, Tank 50
Newport, Rhode Island

Post Test Monitoring - Respirometry Test

	Oxygen Levels (%)					
Hours After Test	MW-107	MW-301	MW-208	MW-209	MW-303	MW-105
1	18.5	19.6	19.6	19.5	19.2	10.2
42	18.9	19.8	18.5	19.7	19.6	10.9
64	18.9	19.7	18.5	19.7	19.6	10.8
141	19.1	20	19	20	19.5	10
	$C0_2$ LEVELS (%)					
Hours After Test	MW-107	MW-301	MW-208	MW-209	MW-303	MW-105
1	1.7	0	0	0	0.3	2.8
42	1.4	0.1	0.9	0	0.3	2.5
64	1.2	0.1	1	0	0.3	2.5
141	1.2	0	1	0	0.4	2.9
	CH_4 LEVELS (%)					
Hours After Test	MW-107	MW-301	MW-208	MW-209	MW-303	MW-105
1	0.1	0	0	0	0.1	3.7
42	0.1	0	0	0	0	2.1
64	0.1	0	0	0.1	0.1	3.3
141	0.1	0	0	0	0	4.3

Pre-Pi TPH Soil Data

Sample ID	Sample Depth (ft.bgs)	Sample Date	TPH as Gasoline	% Gasoline of Total TPH	TPH as #2 Fuel Oil	% #2 Fuel Oil of Total TPH	TPH as Hydraulic Oil	% Hydraulic Oil of Total TPH	TPH as 10W30 Waste Oil	% 10W30 of Total TPH	TPH Total
Monitoring Well Location MW-301											
301S1	6-8	7/23/96	670	1 6%	13,000	30 5%	17,000	39 8%	12,000	28 1%	42,670
301S2	8-10	7/23/96	260	1 6%	4,700	28.0%	6,300	37 6%	5,500	32 8%	16,760
301S3	10-12	7/23/96	580	1.1%	13,000	25.2%	22,000	42 7%	16,000	31 0%	51,580
301S4	12-14	7/23/96	200	0 6%	10,000	31.1%	10,000	31.1%	12,000	37.3%	32,200
301S5	14-16	7/23/96	250	1.7%	4,200	28 5%	4,900	33 2%	5,400	36 6%	14,750
301S6	16-18	7/23/96	130	1 1%	4,700	39.1%	3,000	24.9%	4,200	34 9%	12,030
301S7A	18-18 5	7/23/96	6 9	2.6%	260	97.4%	ND	ND	ND	ND	267
301S8	20-22	7/23/96	7 5	1 5%	480	98 4%	ND	ND	ND	ND	488
Monitoring Well Location MW-302											
302S4	12-14	7/23/96	160	0 5%	10,000	31.1%	10,000	31.1%	12,000	37 3%	32,160
302S6	16-18	7/23/96	390	1 3%	8,100	26 8%	12,000	39 7%	9,700	32.1%	30,190
302S16 (Dup of 302S6	16-18	7/23/96	400	0 4%	27,000	28 3%	37,000	38 8%	31,000	32 5%	95,400
302S8	20-22	7/23/96	8 2	0 5%	420	23 9%	680	38 7%	650	37 0%	1,758
Monitoring Well Location MW-303											
303S3	4-6	7/22/96	160	2 2%	1,500	20 4%	ND	ND	5,700	77 4%	7,360
303S4	6-8	7/22/96	120	0 4%	8,900	26 2%	12,000	35 3%	13,000	38 2%	34,020
303S5	8-10	7/22/96	240	0 7%	10,000	30 3%	13,000	39 3%	9,800	29 7%	33,040
303S6	10-12	7/22/96	280	1 3%	6,400	29.9%	7,900	37 0%	6,800	31 8%	21,380
303S7	12-14	7/22/96	160	0 4%	13,000	30 1%	14,000	32 4%	16,000	37 1%	43,160
303S8	14-16	7/22/96	160	0 5%	11,000	35 0%	9,300	29 6%	11,000	35 0%	31,460
303S11	20-22	7/22/96	6 5	0 02%	13,000	30 9%	17,000	40 5%	12,000	28 6%	42,006
Field Quality Control Samples											
302EB	-	7/23/96	ND	-	ND	-	ND	-	ND	-	ND
NETCFB	-	7/23/96	NA	-	ND	-	ND	-	ND	-	ND

The sample fingerprint did not resemble any single hydocarbon Data reported as Gasoline, #2 Fuel Oil, Hydraulic Oil, an 10W30 Waste Oil indicates concentrations of hydrocarbons in the respective hydrocarbon ranges

Notes.
Samples were analyzed by EPA Method 8015 Modified
All Results in mg/kg (ppm)
ND = not detected
NA = not analyzed
ft.bgs = feet below ground surface
EB = Equipment Blank
NETCFB = Field Blank

APPENDIX A

Data Collected During Previous Investigations

208 204
209
107

BORING LOG (KB) (BORING NO. TFS-B-50 - WELL NO TFS-MW-103) TFS-50 NUS CORPORATION

PROJECT: CTO-143 LOCATION: USI 50 DRILLED BY: A. CARON BORING NO.: 5-1 (103)

DATE STARTED: 10-26-94 INCLINATION: VERT. LOGGED BY: T. DORGAN (KS) GROUND ELEV.: 58.7 MSL N/MR

TE COMPLETED: 10-27-94 BEARING: N/M CHECKED BY: TOTAL DEPTH: 33'

ELEV. feet	DEPTH feet	SAMPLE TYPE-NO.	BLOWS PER 6"	PEN. in.	REC. in.	REMARKS ON ADVANCE OF BORING	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
	22	S-7	9 8 7 9	24	20	1605 OIL THROUGHOUT SAMPLE FREE PHASE		2224 7A 10" SIMILAR TO ABOVE. ROCK FRAG. + FEW SILT. HEAVY OIL STAINS + ODOR. 7B - 10" SILTY ~~SILT~~ (GRAVELLY ~~SILT~~) (GM) MOSTLY GRAVEL. W/ SOME SILT. BROWN. TRACE ROCK FRAGS.
	24	S-8	12,6 5,12	24	8	0858 1.5-2' FREE OIL STAIN ON ROD. OIL ~~FREE PHASE~~ THROUGHOUT SAMPLE		2426 (ML) MOSTLY SILT. LITTLE GRAVEL HEAVY STAINS + ODOR. GREY. POORLY GRADED - ROCK FRAGS = TRACE
	26	S-9	17,120/6" 10"	4		0905 16 LOWS. ROCK IN NOSE. HARD DRILLING CHUNCHY. OIL ~~FREE PHASE~~ THROUGHOUT SAMPLE		2628' (GP) POORLY GRADED GRAVEL + ROCK FRAGMENTS. GRAVEL INCLUDES QTZ. + IGN. ROCK TYPES (NON-COUNTRY ROCK) 2.5" IG. ROCK IN NOSE. VERY HEAVY OIL STAINING THROUGHOUT.
	28	S-10	23,27 14,17	24	12	0930 0.5 PPM PEAK 0.0 BZ OIL ~~FREE PHASE~~ THROUGHOUT SAMPLE		2830 10A - 3" (ML) SANDY SILT. MOSTLY SILT. FEW F. SAND. FEW GRAVEL. OIL BLOBS + STAINING. 10B - 9" ROCK FRAGMENTS + GRAVEL ANGULAR VERY HEAVY STAINS + ODOR

LEGEND:
TYPE-NO - Type of sample
C - Rock core sample
S - Split barrel sample
BLOWS PER 6" - 140 lb hammer falling 30" to drive a split barrel sampler; boring time per foot of rock
PEN - Penetration length of sampler
REC - Length of sample recovered
Z - Natural ground water table

NOTES.

DATE: PROJECT NO.:
PAGE OF BORING NO.:

(TANK 50 WELL NO. MW103 BORING TF5-B-50)

OVERBURDEN WELL CONSTRUCTION LOG

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

PROJECT: CTO-143 UST RI

PAGE: 1 OF 1

PROJECT LOCATION: NEWPORT RI - NETC - TANK FARM 4+5

CLIENT: U.S. NAVY

BORING NO.: MW-103

CONTRACTOR: EAW. DRILLING INC. DRILLER: A. CARON

BORING LOCATION: UST 50

LOGGED BY: T. DORGAN DATE: 10-27-94

PROJECT NO.: 0288

CHECKED BY: DATE:

ELEVATION TOP OF PROTECTIVE CASING

ELEVATION TOP OF RISER PIPE

GROUND ELEVATION N/M

General soil conditions (not to scale)

1-CENTRALIZER USED (CENTER OF SCREEN)

LENGTH OF PROTECTIVE CASING OR ROAD BOX ABOVE GROUND SURFACE	~2'
LENGTH OF RISER PIPE ABOVE GROUND SURFACE	1.90'
TYPE OF SURFACE SEAL	CEMENT
TYPE OF PROTECTIVE CASING	STEEL STICK-UP
I.D. OF PROTECTIVE CASING	6.25" ID / 6.75" OD
DEPTH BOTTOM OF SURFACE SEAL	2.5'
DEPTH BOTTOM OF CASING	3'
DEPTH BOTTOM OF SAND DRAIN	4'
TYPE OF RISER PIPE	SCHED. 40-PVC
I.D. AND O.D. OF RISER PIPE	4.0" ID - 4.25" OD
TYPE OF BACKFILL AROUND RISER PIPE	VERCLAY ~~[illegible]~~ / + SAND
DEPTH TOP OF SEAL	~~22~~ 22'
TYPE OF SEAL	BENT. CHIPS
DEPTH BOTTOM OF SEAL	~~25~~ 24'
DIAMETER OF BOREHOLE	10"
DEPTH TOP OF PERVIOUS SECTION	~~26~~ 26'
TYPE OF PERVIOUS SECTION	SCHED. 40 PVC ~~[illegible]~~
I.D AND O.D. OF PERVIOUS SECTION	4.0" ID - 4.25" OD
TYPE OF OPENINGS	.020 SLOTTED
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 SAND (SILICA)
DEPTH BOTTOM OF PERVIOUS SECTION	31'
DEPTH OF BACKFILL	~~24~~ 31'
TYPE OF BACKFILL	BENT. CHIPS + SAND
END OF BORING	~~[illegible]~~ 33.9'

BORING LOG (BORING NO TFS-B-59 = WELL NO TFS-MW-101) TFS-59 NUS CORPORATION

PROJECT: CTO-143 LOCATION: TANK 59 DRILLED BY: ASAY CARON BORING NO: (MW-101) ~~B-1~~

DATE STARTED: 10 25-94 INCLINATION: VERT. LOGGED BY: T. DORGAN GROUND ELEV.: ~~N/A~~ 43.4 MSL

TE COMPLETED: 10-25-94 BEARING: N/A CHECKED BY: TOTAL DEPTH: 40'

ELEV. feet	DEPTH feet	SAMPLE TYPE-NO.	BLOWS PER 6"	PEN. in.	REC. in.	REMARKS ON ADVANCE OF BORING	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
	36	SS-9	14,12 11,13	24	17	1600 GETTING BONEY HARDER DRIVING 3" SPOON		3638 9A-SIMILAR TO ABOVE ROCK: ~~FRAGS~~ WITH 7" TRACE M.-F. SAND. POORLY GRADED FINING UP MAND. 9B-10" ROCK FRAGS NEARLY 100% ROUND CORES, EASILY BROKEN IN HAND. DARK GRAY SHALE. NO ODOR.
	38	SS-10	17, 120 FOR 6"	6" 12	25"	1615 3" SPOON STIFF DRIVING		3840 25" ROCK IN NOSE, DARK SHALE. WEATHERED. ~10" ROCK FRAGS ~~NONE~~ *
								EOH @ ~~39'~~ 40' - AUG REF

LEGEND:
TYPE-NO - Type of sample
C - Rock core sample
S - Split barrel sample
BLOWS PER 6" - 140 lb hammer falling 30" to drive a split barrel sampler; boring time per foot of rock
PEN - Penetration length of sampler
REC - Length of sample recovered
Z - Natural ground water table

NOTES:
* ROCK FRAGS NOT BELIEVED TO BE RAIL. PROB.

10 SAMPLES 40' DRILLED
(5) 2" SPOONS
(5) 3" SPOONS

DATE: PROJECT NO.:
PAGE OF BORING NO.:

BORING LOG (BORING B-208 EQUIVALENT TO MW 208) NUS CORPORATION

PROJECT: CTO-143 LOCATION: 151 50 DRILLED BY: ASHY CARON BORING NO: TFS-B-208

DATE STARTED: 4-5-95 INCLINATION: VERT. LOGGED BY: TRACY DORGAN GROUND ELEV.: NM

DATE COMPLETED: 4-5-95 BEARING: CHECKED BY: TOTAL DEPTH: 20.5

ELEV. feet	DEPTH feet	SAMPLE TYPE-NO.	BLOWS PER 6"	PEN. in.	REC. in.	REMARKS ON ADVANCE OF BORING	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
						NO SAMPLES 0010		PETROLEUM ODOR IN ALL CUTTINGS
	10	S-1	10 10 / 10 10	24	14	1012 @ 1358		1012 SILTY GRAVELLY SAND. MOSTLY FINE SAND. LITTLE-SOME ANGULAR GRAVEL, LITTLE SILT, TRACE MOD. SAND. POORLY GRADED. GRAY. PETROLEUM ODOR ONLY
	12	S-2	12,14 / 17,15	24	11	1214 @ 1400 COMPOSITE SAMPLE 10-14 ENG. + TPH		1214 SIMILAR TO ABOVE. PETROLEUM IMPACTED AREAS IN VOID SPACES OF ROCK FRAGMENTS IN LAST 6" OF SPOON.
	14	S-3	7,7 / 7,7	24	11	1416 @ 1410		1416 SIMILAR TO ABOVE. TIGHTER. POSS. MORE SILT THAN PREVIOUS SPOONS. FREE-PHASE OIL ALONG FREE SPACES IN SOILS + GRAVEL. HIGHER AMOUNT OF OIL THAN IN PREVIOUS SPOONS.
	16	S-4	9 9 / 9, 9	24	13	1618 @ 1415		1618 SIMILAR TO ABOVE (1416) FREE PHASE OIL IN VOID SPACES.

KEY:
TYPE-NO - Type of sample
C - Rock core sample
S - Split barrel sample
BLOWS PER 6" - 140 lb. hammer falling 30" to drive a split barrel sampler; coring time per foot of rock
PEN - Penetration length of sampler
REC - Length of sample recovered
▽ - Natural ground water table

NOTES. 3EBAN BORING @ 1310.
3" SPLIT SPOONS

DATE: PROJECT NO.:
PAGE: OF BORING NO.:

BORING LOG (BORING B-209 EQUIVALENT TO MW 209) NUS CORPORATION

PROJECT: CTO-143	LOCATION: UST 50	DRILLED BY: HSAY CARON	BORING NO.: TFS-B-209
DATE STARTED: 4-6-95	INCLINATION: VERT.	LOGGED BY: TARLY DARGAN	GROUND ELEV.: NM
DATE COMPLETED: 4-6-95	BEARING:	CHECKED BY:	TOTAL DEPTH: 20.25

ELEV. feet	DEPTH feet	SAMPLE TYPE-NO.	BLOWS PER 6"	PEN. in.	REC. in.	REMARKS ON ADVANCE OF BORING	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
						NO SAMPLES 0010		0010 - N.S.T.
	10	S-1	11,12 37,58	24	12	1012 @ 0800		1012 SILTY GRAVELLY SAND. MOSTLY FINE SAND LITTLE SUB ANGULAR GRAVEL LITTLE SILT. TRACE MED. SAND. POORLY GRADED SAND. BROWN ~~GRAY~~ TRACE OIL BLEBS IN LOWER 1/2 OF SPOON. DRY
	12	S-2	21,15 17,18	24	11	1214 @ 0810 COMPOSIT 10-14 TPH, SPC, COD, BOD, NITRATES, TOC, PHOS., + G.S.		1214 SIMILAR TO ABOVE. LESS OIL BLEBS IN VOID SPACES. DRY-TO-MOIST
	14	S-3	7,8 11,12	24	9	1416 @ 0824		1416 GRAVELLY SILTY SAND. MOSTLY FINE SAND, LITTLE SILT, LITTLE TO FEW ANGULAR-TO SUBANGULAR GRAVEL UP TO 1" DIAM. POORLY GRADED. MOIST. BROWN TO GRAY. TIGHTER THAN ABOVE.
	16	S-4	12,8 12,12	24		1618 @ 0826		1616 SIMILAR TO ABOVE, (1416) GRAVELS UP TO 1.25" DIAM + ANGULAR (ROCK FRAGMENTS) 1 FINE 1.25" DIAM ANGULAR WHITE QTZ. FOUND IN NOSE.

LEGEND:
PE-NO - Type of sample
C - Rock core sample
S - Split barrel sample
BLOWS PER 6" - 140 lb. hammer falling 30" to drive a split barrel sampler; coring time per foot of rock
PEN - Penetration length of sampler
REC - Length of sample recovered
Z - Natural ground water table

NOTES. BEGIN BORING @ 0735.

3" SPLIT SPOONS

DATE _____ PROJECT NO.: _____
PAGE _____ OF _____ BORING NO.: _____

(TANK 50 WELL NO. MW209 BORING B-209)

OVERBURDEN WELL CONSTRUCTION LOG

HALLIBURTON NUS ENVIRONMENTAL CORPORATION

PROJECT: CTO 143 SITE INVESTIGATION

PAGE: 1 OF 1

PROJECT LOCATION: NETC NEWPORT - TANK FARM 5

CLIENT: U.S. NAVY

BORING NO.: MW-209

CONTRACTOR: ENV. DRILLING INC. DRILLER: ASHY CARON

BORING LOCATION: UST 50

LOGGED BY: TRACY DORGAN DATE: 4-6-95

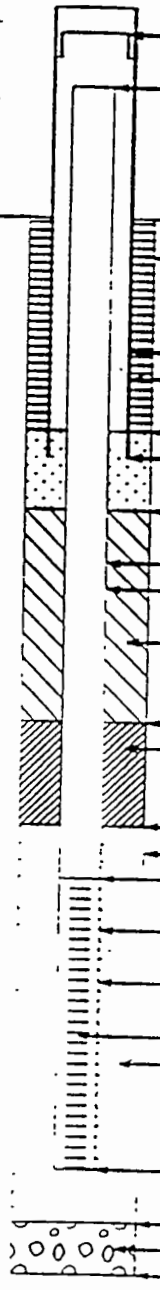
PROJECT NO.: 0288

CHECKED BY: DATE:

ELEVATION TOP OF PROTECTIVE CASING

ELEVATION TOP OF RISER PIPE

GROUND ELEVATION



General soil conditions (not to scale)

LENGTH OF PROTECTIVE CASING OR ROAD BOX ABOVE GROUND SURFACE	2.42
LENGTH OF RISER PIPE ABOVE GROUND SURFACE	1.98
TYPE OF SURFACE SEAL	CONCRETE
TYPE OF PROTECTIVE CASING	STEEL STICK-UP
I.D. OF PROTECTIVE CASING	6.25"
DEPTH BOTTOM OF SURFACE SEAL	2.0'
DEPTH BOTTOM OF CASING	2.5'
DEPTH BOTTOM OF SAND DRAIN	3'
TYPE OF RISER PIPE	SCHED. 40 PVC
I.D. AND O.D. OF RISER PIPE	4" ID - 4.5" OD
TYPE OF BACKFILL AROUND RISER PIPE	BENTONITE CHIPS + SILICA SAND
DEPTH TOP OF SEAL	11'
TYPE OF SEAL	BENTONITE CHIPS
DEPTH BOTTOM OF SEAL	13'
DIAMETER OF BOREHOLE	10"
DEPTH TOP OF PERVIOUS SECTION	15'
TYPE OF PERVIOUS SECTION	SCHED. 40 PVC
I.D AND O.D. OF PERVIOUS SECTION	4" ID - 4.25" OD
TYPE OF OPENINGS	FACTORY SLOTTED 0.020
TYPE OF BACKFILL AROUND PERVIOUS SECTION	SILICA SAND
DEPTH BOTTOM OF PERVIOUS SECTION	20'
DEPTH OF BACKFILL	20'
TYPE OF BACKFILL	SILICA SAND
END OF BORING	20.25

W5295083F

TABLE 4-1
WATER LEVEL DATA
TANK 50, TANK FARM 5
SITE INVESTIGATION REPORT
NETC - NEWPORT, RHODE ISLAND

Tank	Well/Boring	Date	Elev. of Prot. Casing	Elev. Top of PVC riser	Ground Elevation	Depth to Water from PVC (FT)	Stick Up (FT)	Depth to Water (FT BGS)	WT Elev.	Bedrock Depth (FT BGS)	Bedrock Elev.
49	MW111	11/10/94	63.39	62.99	61.2	11.03	1.79	9.24	51.96	NA	NA
50	MW103	11/9/94	60.84	60.52	58.7	12.90	1.82	11.08	47.62	NA	NA
50a	MW105	11/18/94	60.62	60.33	58.0	16.44	2.33	14.11	43.89	NA	NA
50b	MW106	11/8/94	59.33	59.08	57.5	15.36	1.58	13.78	43.72	NA	NA
50c	MW107	11/18/94	61.18	60.75	59.0	13.30	1.75	11.55	47.45	NA	NA
50d	MW108	11/18/94	60.63	60.36	58.3	13.00	2.06	10.94	47.36	NA	NA
50e	MW109	11/18/94	59.06	58.66	57.1	11.70	1.56	10.14	46.96	NA	NA
51	MW113	11/10/94	73.21	72.96	70.9	23.68	2.06	21.62	49.28	NA	NA
52	MW112	11/10/94	67.06	66.77	65.1	21.84	1.67	20.17	44.93	NA	NA
54	MW100	11/10/94	70.11	69.94	67.6	10.72	2.34	8.38	59.22	NA	NA
55	MW110	11/10/94	89.22	88.88	86.9	26.15	1.98	24.17	62.73	NA	NA
57	MW104	11/10/94	72.71	72.24	70.7	13.66	1.54	12.12	58.58	NA	NA
58	MW102	11/10/94	77.87	77.54	75.5	14.24	2.04	12.2	63.3	NA	NA
59	MW101	11/2/94	95.79	95 54	93.4	29.90	2.14	27.76	65.64	NA	NA
50	MW200	5/1/95	55.46	55.08	53.0	11.77	2.08	9.69	43.31	NA	NA
50	MW201	5/1/95	57.84	57.43	54.9	13.93	2.53	11.40	43.50	NA	NA
50	MW202	5/1/95	59.78	59.50	57.2	15.35	2.30	13.05	44.15	NA	NA
50	MW203B	5/1/95	57.48	57.05	55.2	13.40	1.85	11.55	43.65	16	39.2
50	MW204	5/1/95	62.99	62.45	60.5	17.40	1.95	15.45	45.05	NA	NA
50	B205	NA	NA	NA	58.4	NA	NA	NA	NA	NA	NA
50	MW206	5/1/95	61.14	60.75	58.9	14.86	1.85	13.01	45.89	NA	NA
50	MW207B	5/1/95	59.52	59.23	57.2	15.27	2.03	13.24	43.96	17	40.17
50	MW209	5/1/95	60.59	60.19	58.2	14.95	1.99	12.96	45.24	NA	NA
50	MW208	5/1/95	60.62	60.07	58.3	14.86	1.77	13.09	45.21	NA	NA
50	B210	NA	NA	NA	62.7	NA	NA	NA	NA	NA	NA
50	SB325	NA	NA	NA	58.6	NA	NA	NA	NA	NA	NA

TABLE 4-1
WATER LEVEL DATA
TANK 50, TANK FARM 5
SITE INVESTIGATION REPORT
NETC - NEWPORT, RHODE ISLAND
PAGE 2

Tank	Well/Boring	Date	Elev. of Prot. Casing	Elev. Top of PVC Riser	Ground Elevation	Depth to Water from PVC (FT)	Stick Up (FT)	Depth to Water (FT BGS)	WT Elev.	Bedrock Depth (FT BGS)	Bedrock Elev.
50	SB327	NA	NA	NA	61.5	NA	NA	NA	NA	NA	NA
50	SB328	NA	NA	NA	55.2	NA	NA	NA	NA	NA	NA
50	SB329	NA	NA	NA	52.7	NA	NA	NA	NA	NA	NA
50	SB337	NA	NA	NA	61.6	NA	NA	NA	NA	NA	NA
50	SB338	NA	NA	NA	60.8	NA	NA	NA	NA	NA	NA

Notes: Vertical Datum is based on local mean low water.
BGS = Below Ground Surface
Elev. = Elevation
WT = Water Table
NA = Not Applicable
Prot. = Protective

TEST BORING LOG

BORING NO. MW-301

SHEET NO 1 OF 1

JOB NO. 1284-C011-0209

ELEVATION

DATE STARTED 7/23/96

DATE FINISHED 7/23/96

DRILLER A. Caron

INSPECTOR B. Donati

Modified level D

PROJECT : NETC - Newport, Tank Farm 5, Tank 50

CLIENT : US Navy

BORING CONTRACTOR : EDI

GROUND WATER :

DATE	TIME	WATER EL.	SCREEN

	CAS.	SAMP.	CORE	TUBE
TYPE	HSA	SS		
DIA.	10"	3"		
WT.	140 lb			
FALL	30"			

WELL CONSTRUCTION: Bent 2.5'; Sand 4.5'; 6'; 21'; 4" ø SCH 40 PVC Screen: 0.010 slot.

DEPTH FEET	SAMPLE NO.	Rec ~~TYPE~~ (in)	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS (FID Readings - ppm)
0				No samples collected from 0-6'	
5				S-1: (SM-GM) Olive brown fine to very fine sand and silt, little coarse gravel, poorly graded, strong petroleum odor, dry	> 1000
	S-1	12"	5-8, 14-7		
	S-2	12"	7-10, 11-13	S-2: Same as S-1	480
10	S-3	8"	12-13, 14-12	S-3: Same as S-2, moist, large (2") pieces of fractured rock	675
	S-4	6"	14-11, 10-7	S-4: Same as S-3, saturated, heavy oil staining, visible sheen on water running from spoon.	800
15	S-5	6"	10-34, 14-10	S-5: Same as S-3	200
	S-6	4"	6-7, 10-13	S-6: Same as S 3	256
	S-7a	6"	7-9	S-7a: Same as S-3	340
20	S-7b	4"	9-8	S-7b: (SW) Light olive brown fine sand, trace to little (5-15%) silt, well to moderately well graded, saturated (18.5')	410
	S-8	10"	5-3, 5-2	S-8: Same as S-7b	100
25					
30					
35					
40					
45					

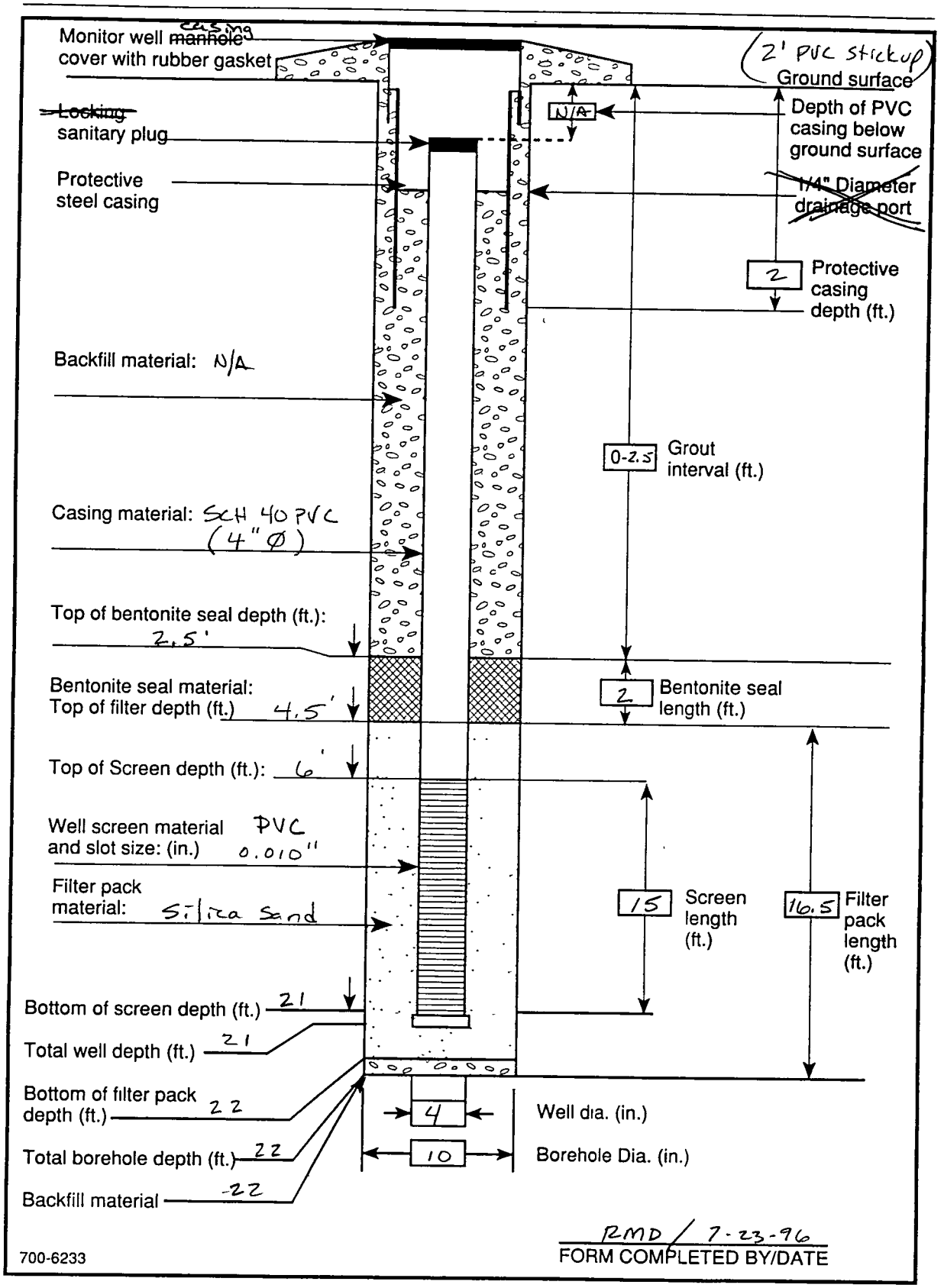
Terminated hole

Bottom of boring @ 22'

WELL DESIGNATION: MW - 301 INSTALLATION START DATE. 7/23/96

LOCATION: INSTALLATION COMPLETION DATE: 7/23/96

COMMENTS. NETC - Newport, Tank Farm 5, Tank 50



RMD / 7-23-96
FORM COMPLETED BY/DATE

700-6233

WELL COMPLETION INFORMATION

TEST BORING LOG

BORING NO. MW-302

SHEET NO 1 OF 1

JOB NO. 1284-C011-0209

ELEVATION

DATE STARTED 7/23/96

DATE FINISHED 7/23/96

DRILLER A Caron

INSPECTOR B. Donato

Modified level D

PROJECT: NETC - Newport, Tank Farm 5, Tank 50

CLIENT: US Navy

BORING CONTRACTOR: EDI

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN

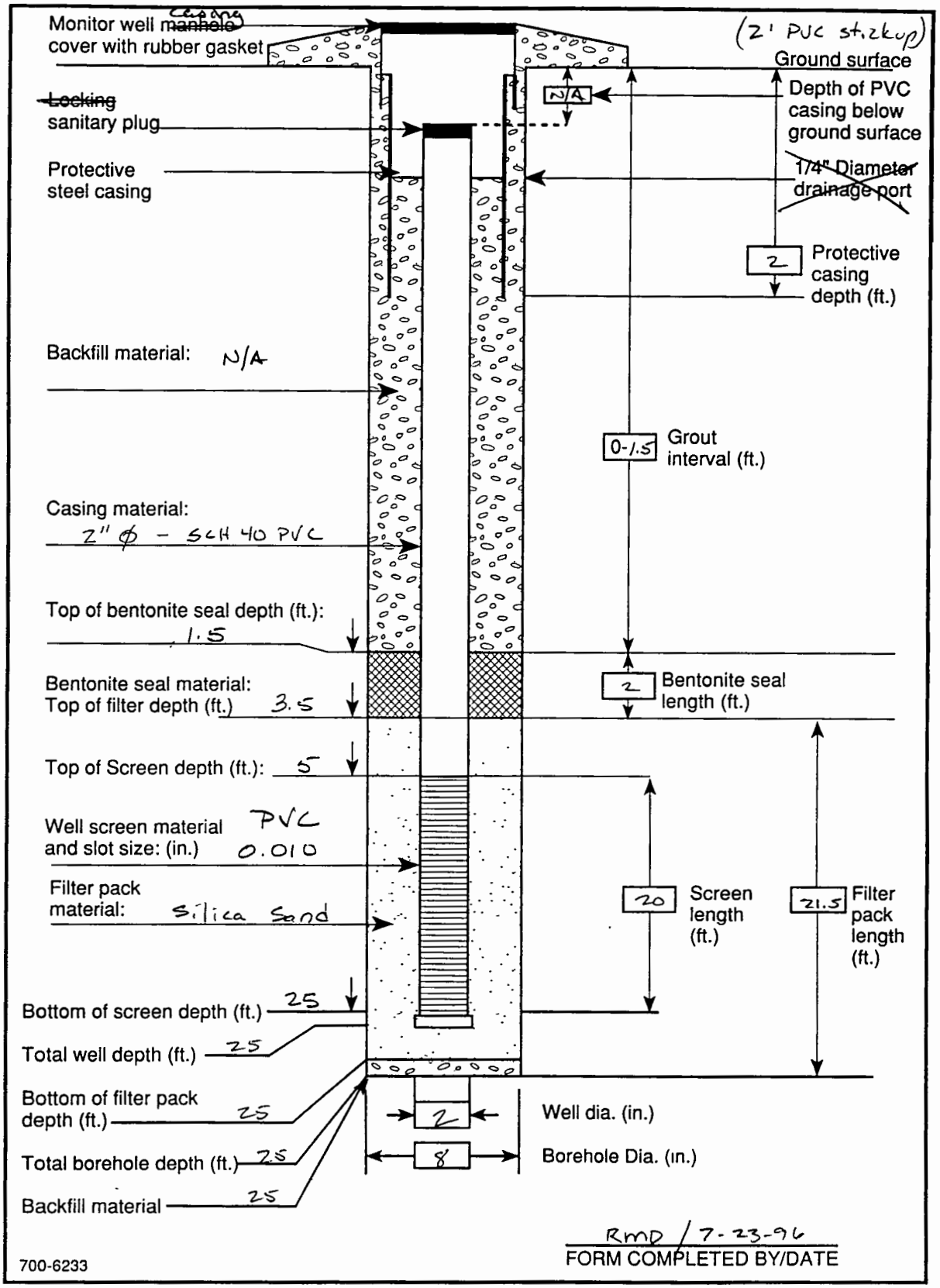
	CAS.	SAMP.	CORE	TUBE
TYPE	HSA	SS		
DIA.	8"	3"		
WT	140 lb			
FALL	30"			

WELL CONSTRUCTION	DEPTH FEET	SAMPLE NO.	Rec. ~~TAPE~~ (in)	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS (FID Readings - ppm)
Bent 1.5'	0				No samples collected from 0-6'	
Sand 3.5'						
5'	5				S-1a: (GP) Dk grayish brown fine to med sand and gravel, trace silt, poorly graded, dry, med. dense 7.0'	125
		S-1a	6"	8-10		
		S-1b	12"	13-8	S-1b: (SM-GM) Dk gray fine sand and silt, trace course gravel, angular pieces of fractured rock, damp, very strong petroleum odor	> 1000
		S-2	20"	8-13 / 38-14		
	10	S-3	6"	5-26 / 9-13		
		S-4	10"	12-14 / 18-12	S-2: Same as S-1b, moist	> 1000
					S-3: Brown, same as S-1b, saturated with pieces of oil-stained fractured shale, visible oil	> 1000
	15	S-5	7"	7-8 / 18-8		
		S-6	12"	5-8 / 21-17	S-4 Same as S-3 with visible oil staining and pockets of oil product	940
		S-7	6"	4-11 / 21-17		
	20				S-5: Same as S-3	560
		S-8	6"	8-14 / 22-27	S-6: Same as S-3	325
		S-9	15"	9-7 / 5-11	S-7 Same as S-3	560
					S-8: Same as S-3	95
25					S-9: Same as S-3	15
2" ϕ SCH 40 PVC Screen: 0.010 slot	25				Terminated hole Bottom of boring @ 25'	Note: Sample S-1b collected as duplicate of S-6
	30					
	35					
	40					
	45					

WELL DESIGNATION. MW-302 INSTALLATION START DATE: 7/23/96

LOCATION: INSTALLATION COMPLETION DATE: 7/23/96

COMMENTS: NETC - Newport, Tank Farm S, Tank 50



RMD / 7-23-96
FORM COMPLETED BY/DATE

700-6233

WELL COMPLETION INFORMATION

TEST BORING LOG

BORING NO. MW-303

SHEET NO 1 OF 1

JOB NO. 1284-C011-0209

ELEVATION

DATE STARTED 7/22/96

DATE FINISHED 7/23/96

DRILLER A. Caron

INSPECTOR B. Donatio

Mod. Level D

PROJECT: NETC - Newport, Tank Farm 5, Tank 50

CLIENT: US Navy

BORING CONTRACTOR: Environmental Drilling, Inc. (EDI)

GROUND WATER:

DATE	TIME	WATER EL.	SCREEN

	CAS.	SAMP.	CORE	TUBE
TYPE	HSA	SS		
DIA.	8"	3"		
WT	140lb			
FALL	30"			

WELL CONSTRUCTION: Bent 1.5; Sand 3.5; 5; 25

2" ϕ Sch 40 PVC Screen: 0.010 slot

DEPTH FEET	SAMPLE NO.	Rec. ~~TYPE~~ (in)	BLOWS PER 6 INCHES	CLASSIFICATION	REMARKS (FID Readings - ppm)
0	S-1	24"	16-21 / 47-52	S-1' (GM) Brown fine to med. sand & gravel, trace silt	-0-
	S-2	24"	61-58 / 72-31	S-2' (GM) Light brownish gray fine sand & silt, little (15-20%) course sand, poorly graded, dry	3
5	S-3	2"	20-11 / 30-15	S-3' (GM-SM) Dk grayish brown fine sand and silt, poorly graded dense, damp	16
	S-4	2"	18-15 / 15-15	S-4: Same as S-3 with angular pieces of fractured gravel, extensive oil staining	95
10	S-5	3"	12-13 / 18-20	S-5: Same as S-3, moist	165
	S-6	3"	10-13 / 11-12	S-6: (GM-SM) Dk olive gray fine to med. sand and silt, little coarse gravel, poorly graded, heavy oil staining, saturated	950
	S-7	12"	8-10 / 9-8	S-7: Same as S-6 with large pieces of fractured rock	100
15	S-8	8"	13-18 / 50-53	S-8. Same as S-7	170
	S-9	6"	8-12 / 12-10	S-9' Same as S-7	25
	S-10	12"	4-8 / 13-25	S-10' Same as S-7 with layered pieces of oil-stained shale.	370
20	S-11	6"	8-11 / 18-18	S-11: Same as S-10, with small pockets of oil product	505
	S-12	8"	8-14 / 11-12	S-12' Same as S-10	750
25, 30, 35, 40, 45					

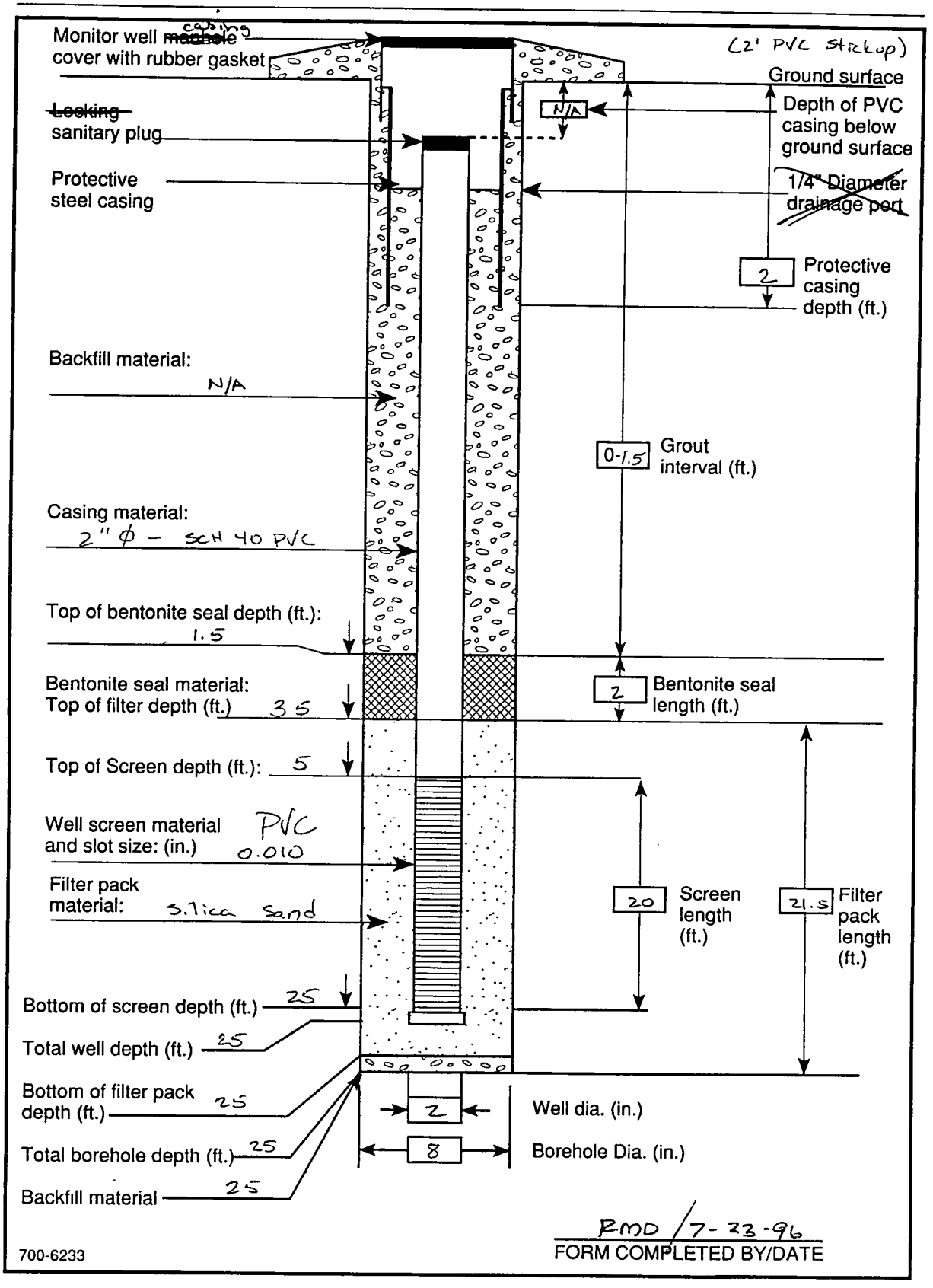
Terminated hole

Bottom of boring @ 25'

WELL DESIGNATION: MW-303 INSTALLATION START DATE 7/22/96

LOCATION: INSTALLATION COMPLETION DATE: 7/23/96

COMMENTS: NETC-Newport, Tank Farm 5, Tank 50



RMD / 7-23-96

FORM COMPLETED BY/DATE

700-6233

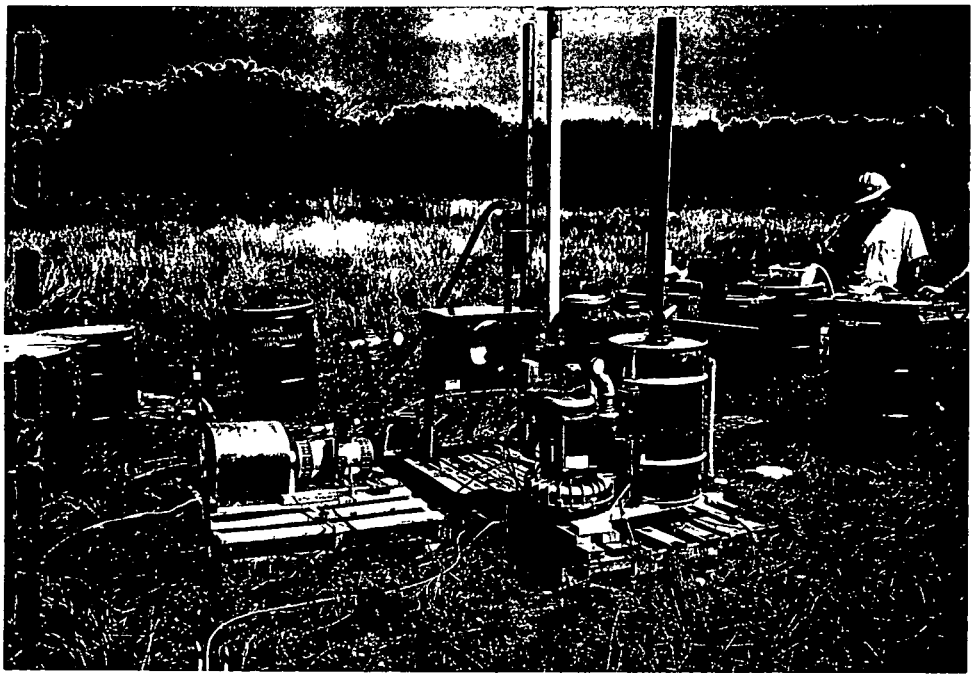
WELL COMPLETION INFORMATION

APPENDIX C

Photographs

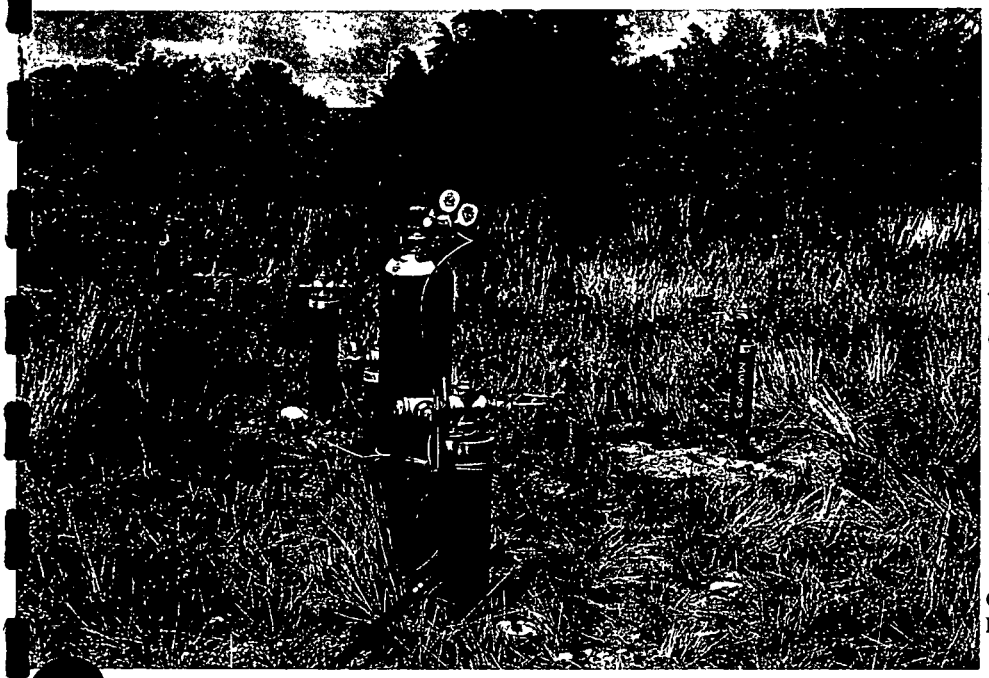
PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398



Photographer: D. McCarron
Date/Time: 8/12/96
Frame No.:
Site Location: TANK FARM 5 - TANK 50
Direction:
Activity: Bioremediation Pilot Scale Study
Comments: BIOSPARGE SYSTEM (ON LEFT)
BIOVENTING SYSTEM (ON RIGHT)

Checklist Reference:



Photographer: D. McCarron
Date/Time: 8/12/96
Frame No.:
Site Location: TANK FARM 5 - TANK 50
Direction:
Activity: Bioremediation Pilot Scale Study
Comments: Helium Testing

Checklist Reference:

ND96-067
5/29/96

PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398

Photographer: D McCarron

Date/Time: 8/12/96

Frame No.:

Site Location: TANK FARMS - TANK 50

Direction:

Activity: Bioremediation Pilot Scale study

Comments: BIOSPARGE AND BIOVENTING SYSTEM

Checklist Reference:

Photographer:

Date/Time:

Frame No.:

Site Location:

Direction:

Activity:

Comments:

Checklist Reference:

ND96-067
5/29/96

PHOTOGRAPHIC RECORD

DELIVERY ORDER NO. 11, MOD. 4
TANK 50 REMEDIAL ACTION
NETC - NEWPORT
MIDDLETOWN, RI
NAVY CONTRACT NO. N62472-94-D-0398

Photographer: J McCarron

Date/Time: 8/12/96

Frame No.:

Site Location: TANK FARM 5 - TANK 50

Direction:

Activity: Bioremediation Pilot Scale Study

Comments: OVERVIEW OF Pilot STUDY AREA

Checklist Reference:

Photographer:

Date/Time:

Frame No.:

Site Location:

Direction:

Activity:

Comments:

Checklist Reference:

ND96-067
5/29/96

APPENDIX D

Bench Scale Study Report

LABORATORY TREATABILITY REPORT - FINAL

TANK 50
NETC
NEWPORT, RHODE ISLAND

December 2, 1996

Prepared For:

Foster Wheeler Environmental Corporation
Boston, MA

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Written/Submitted by:

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Fluor Daniel GTI, Inc.
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Maureen C. Leahy, Ph.D.
Senior Technical Specialist

Fluor Daniel GTI, Inc.
Written/Submitted by:

George Skladany
Director, Remediation Technology Testing Facility

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Appendix B Chain of Custody and Initial TPH Reports
Appendix C Final TPH Reports
Appendix D Corrected Final TPH Reports

1.0 INTRODUCTION

Th Remediation Technology Testing Facility (RTTF) of Fluor Daniel GTI, Inc. (Fluor Daniel GTI) was contracted to provide a screening-level laboratory study to assess the feasibility of using bioremediation to treat soil and groundwater at the NETC site in Newport, Rhode Island in the vicinity of Tank 50. The study was conducted using soil and groundwater collected at the site.

1.1 Scope and Objectives of the Study

The purpose of the 13 week study was to investigate whether indigenous microorganisms could successfully reduce the petroleum hydrocarbon concentrations in site soil and groundwater when amended with oxygen and/or inorganic nutrients. The laboratory testing was designed to assist in evaluating the extent of degradation which can be achieved by full-scale bioremediation and to provide information on whether the addition of inorganic nutrients (oxygen, nitrogen as ammonia and phosphate) would enhance remediation.

The laboratory testing consisted of two tasks:

- **Initial Chemical and Biological Analyses** - to assess the concentration of petroleum hydrocarbons, microbial populations and available nutrients present in site soil and groundwater; and

- **Biodegradation Testing** - to assess the extent and relative rates of degradation which can be achieved using three different enhancements (oxygen addition alone, nutrient addition alone, and oxygen + nutrient addition).

1.2 Organization of the Report

Section 2.0 of this report presents the experimental methodologies used to carry out the feasibility testing. The feasibility results are presented in Section 3.0. The conclusions are presented in Section 4.0.

2.0 METHODOLOGY

2.1 Samples and Compositing

Soil and groundwater samples on ice were received at the Remediation Technology Testing Facility in Concord, California on July 25, 1996 in two coolers under Chain of Custody numbers 39408 and 40791. A copy of the Chain of Custody forms is included in Appendix A. The soil samples were labeled MW-301, MW-302 and MW-303. The groundwater samples were labeled MW-103, MW-208 and MW-209.

2.2 Initial Chemical Analyses of the Soil and Groundwater Composites

Upon receipt in the laboratory, all three soil samples were combined, manually mixed and homogenized to form a single soil composite for use in subsequent treatability testing. The three groundwater samples were also combined to form a single groundwater composite for testing and further use.

Prior to beginning the biodegradation study, the soil and groundwater composites were analyzed for physical, chemical and biological parameters which can impact biological degradation. The methods use for these analyses are summarized in Table 1.

For the soil composite, these analyses included:

- **Total Organic Carbon (TOC)** to assess the total amount of carbon in the soil available to microorganisms;
- **Total Petroleum Hydrocarbon (TPH)** performed in triplicate to assess the concentration of hydrocarbons present in the soil and also to provide an indication of contaminant concentration variability;
- **Nitrogen as Ammonia and Ortho-Phosphate** to assess the naturally occurring levels of critical inorganic nutrients present in site soils;
- **pH** to confirm that the pH of the soil was within the neutral range of 6 to 8 which is generally considered most favorable for aerobic hydrocarbon-degrading microorganisms; and
- **Cation Exchange Capacity (CEC)** to assess the capacity of the soil to bind the inorganic nutrients.

For the groundwater composite, these analysis included:

- **Total Petroleum Hydrocarbons (TPH)** performed in duplicate to assess the concentration of hydrocarbons present in the groundwater; and
- **pH** to confirm that the pH of the groundwater was within the neutral range of 6 to 8 which is generally considered most favorable for aerobic hydrocarbon-degrading microorganisms.

The soil and groundwater samples were extracted by Remediation Technology Testing Facility staff in Concord, California. Three 50 g (wet weight) samples were each Soxhlet extracted overnight with 125, 150 and 150 ml of dichloromethane, respectively. The extracts were then supplied to Sequoia Analytical (Walnut Creek, CA) for TPH analysis by GC/FID using EPA Method 8015 (modified). Two 500 ml composited groundwater samples were each Soxhlet extracted overnight with 130 ml of dichloromethane.

The extracts were then supplied to Sequoia Analytical (Walnut Creek, CA) for TPH analysis by GC/FID using EPA Method 8015 (modified).

2.3 Initial Microbial Enumerations

The number of total and specific hydrocarbon-degrading bacteria were enumerated in the soil and groundwater composites using standard plate counting procedures as defined by Standard Method 9215 C (modified). A 1.0 g portion of the soil composite was first extracted with 9.0 ml of sterile phosphate buffer and then the extract was serially diluted ten-fold in sterile phosphate buffer. A 1.0 ml sample of the groundwater composite was similarly serially diluted in sterile phosphate buffer. A 0.1 ml aliquot of each of the dilutions was then spread-plated in duplicate on appropriate agar nutrient plates.

For total heterotrophic bacteria, standard tryptic soy agar (TSA) plates were used. TSA plates provide a complete nutrient mixture with multiple carbon substrates and allows enumeration of most active colony-forming bacteria present in soil or groundwater. For specific hydrocarbon-degrading bacteria, standard minimal nutrient agar plates were used with diesel supplied as a vapor as the only source of carbon. Minimal nutrient agar contains only inorganic nutrients such as nitrogen and phosphate and only trace amounts of available carbon sources. These plates typically allow growth of only the active colony-forming bacteria capable of growth on the specific carbon substrates (e.g. diesel) made available to these plates.

All plates were incubated at room temperature (20-25°C) for up to 20 days prior to final counting of the number of colonies that formed on each dilution plate. Plates exhibiting between 30 and 300 distinct colonies were deemed to be acceptable, and were used in calculating the original minimal number of microorganisms present in the site groundwater or soils.

2.4 Biodegradation Testing

The biodegradation test was conducted using a 3% slurry of site soil in groundwater. Soil slurry test systems are designed to assess biodegradation potential under optimal conditions with respect to delivery of oxygen, nutrients and moisture.

The biodegradation evaluation was performed using four experimental systems:

- **System 1 (Non-Enhanced).** Soil and groundwater composites were mixed without amendments to assess the extent of biodegradation occurring in the absence of modifications to the soil and groundwater mixture;

- **System 2 (Oxygen-Enhanced).** Soil and groundwater composites were amended with oxygen to assess the extent of biodegradation occurring when oxygen is in unlimited supply and only endogenous inorganic nutrients are present;

- **System 3 (Nutrient-Enhanced).** Soil and groundwater composites were amended with inorganic nutrients to assess the extent of biodegradation occurring when nitrogen and phosphate are in excess; and

- **System 4 (Oxygen + Nutrients-Enhanced).** Soil and groundwater composites were amended with oxygen, phosphate (in the form of polyphosphate), and nitrogen (in the form of ammonium chloride) to assess the extent of biodegradation occurring when oxygen and major inorganic nutrients (N and P) are in excess.

2.4.1 Construction of Test Reactors

The experimental systems consisted of a series of sealed test reactors each containing a slurry mixtur of 1.5 grams (g) wet weight site soil and 50 milliliters (ml) site groundwater with approximately 110 ml gaseous headspace. The site soils previously mixed and composited for use in the initial characterization tests were used for the treatability experiment.

The amount of soil to add to the test reactors was selected to provide approximately 2 to 5 milligrams petroleum hydrocarbons per bottle. This range of hydrocarbons is standard for the size of the test reactors (160-milliliter glass serum bottles) and the oxygen available in the headspace of the test reactors to support aerobic degradation. Since the average TPH concentration of the groundwater was less than 13 mg/kg and the average soil composite concentration was 2,700 mg/kg, each test reactor initially contained approximately 4.1 mg TPH.

The slurries in bottles used for Systems 1 and 3 were purged with nitrogen gas to remove oxygen from the groundwater and produce anoxic test conditions. While purging will reduce the amount of dissolved oxygen in the groundwater, it is not expected to create strictly anaerobic conditions. All bottles were sealed immediately after purging.

The slurries in bottles used for Systems 3 and 4 were amended with inorganic nutrients including ammonium chloride to supply nitrogen and potassium tripolyphosphate to supply phosphate. Tripolyphosphate is used to supply phosphate since this form of phosphate is generally more soluble than ortho-phosphate, binds less to soils, and is more easily delivered to the subsurface. Sufficient nutrients were added to bring the ratio of carbon to nitrogen in the test reactors to greater than 10. The initial aqueous phase concentration in the amended reactors was 60 milligrams per liter ammonia-nitrogen and about 5 mg/L ortho-phosphate based upon analyses of centrifuged reactor fluid (as reported in Section 3.0). The supplemental nitrogen and polyphosphate nutrients were only added to appropriate test bottles at the beginning of the experiment.

Additional oxygen was added to the bottles used for Systems 2 and 4. Immediately after sealing the reactors, 10 ml of pure oxygen gas was injected through each bottle's septum using a syringe. This additional oxygen was provided to ensure that sufficient oxygen was available to support aerobic degradation during the initial phase of the test when oxygen depletion is often the most rapid.

All bottles were sealed with septa and crimped caps. The bottles were inverted and incubated at room temperature on a reciprocal shaker for the duration of the study (14 weeks). Shaking is required to maintain the slurry and to stimulate oxygen transfer from the headspace into the slurry phase (for Systems 2 and 4).

2.4.2 Monitoring and Maintenance of Test Reactors

During the 14-week duration of the study oxygen, carbon dioxide, ammonia-nitrogen and ortho-phosphate were monitored periodically. A more detailed description of these tests is provided below.

Oxygen and carbon dioxide concentrations in the headspace of the reactors were periodically monitored for the two oxygen-amended systems, Systems 2 and 4. The headspace gas of one designated bottle from ach system was sampled using a gas-tight syringe and analyzed using a gas chromatograph with thermal conductivity detector. The actual sampling dates selected were based on a review of the available THP data and previous experience with similar tests. Oxygen depletion can occur fairly quickly with actively growing cultures, and the first few sampling points (Day 2, Week 2 and Week 5) were thought to be reasonable time periods during which to see changes in oxygen and carbon dioxide concentrations. Once rapid biodegradation activity has been established, the consumption of oxygen tends to decrease if limited amounts of substrate are present, and monitoring frequency is typically decreased.

Since 10 ml of pure oxygen gas were added to System 2 and 4 bottles at start-up of the test, the volume of oxygen in the headspace was expected to be greater than the approximately 21% found in normal atmospheric gases. Since oxygen was to be maintained at excess in these systems, actual oxygen levels below 18% were considered "depleted", and additional oxygen was to be added to all suitable bottles if that condition was discovered. At Weeks 2, 5, 9 and 12 the oxygen levels in System 4 bottles (oxygen + nutrients) were found to be below 18%, and an additional 10 ml of pure oxygen gas was added to each of th remaining System 4 test reactors to replace the depleted oxygen.

Ammonia-nitrogen and ortho-phosphate concentrations in the aqueous phase of the slurries were monitored in all four systems once a week. At each time point, one bottle from each system was sacrificed. Th slurry was centrifuged and the supernatant removed for analysis. These screening-level analyses w r performed in duplicate using LaMotte test kits. Both the ammonia-nitrogen and ortho-phosphate test kits use a colorimetric test. The standard concentration range for the ammonia test kit is 1 to 8 milligrams per liter (mg/L) and for the phosphate test kit the standard concentration range is 0.5 to 10 mg/L. Samples with concentrations above these ranges were diluted prior to analysis.

2.4.3 Monitoring Bacterial Numbers in the Test Reactors

Th number of specific-hydrocarbon utilizing bacteria only in the test reactors was monitored weekly in all four systems for a total of 14 time points. A portion of the aqueous phase within one reactor from each system was serially diluted in sterile buffer and plated on mineral agar plates supplemented with diesel vapors as a sole hydrocarbon food source as previously described in Section 2.3. Each plate count numeration was performed in duplicate.

While total heterotrophic bacteria plate counts were also determined during the initial characterization of site soils and groundwater, these tests were not performed during the 14 week study period. Becaus the purpose of the study was to provide evidence that indigenous microorganisms could successfully treat the petroleum hydrocarbons already present, monitoring the changes in hydrocarbon-degrading microbial numbers was felt to provide the most useful indicator of desirable biological activity.

2.4.4 Monitoring TPH Concentrations in the Test Reactors

The TPH concentration in reactor bottles from each of the test conditions were determined during Week 0 of the test and weekly thereafter for a total of 14 time points. For each time point, two bottles from each of th four test conditions were sacrificed to provide duplicate analyses.

Each bottle was extracted three times with 10-ml portions of dichloromethane (DCM) to extract TPH from all three phases within the reactor (gas, liquid and soil). For each extraction, 10 ml DCM was injected into the bottle using a glass syringe and the bottle was then shaken for 20 minutes. The DCM was allowed to settle and was removed by syringe while inverting the bottle. The three extracts from each bottle were combined and dried by filtering through anhydrous sodium sulfate. A small volume of DCM was then used to wash the sodium sulfate. The exact pooled extract and rinse volume was recorded. Approximately one-half of the pooled extract volume was submitted to Sequoia Laboratories for analysis for TPH by GC/FID using EPA Method 8015 (modified) with diesel as a reference standard. These extracts were initially analyzed as provided without any further concentration or cleanup steps.

Diesel was selected as the reference standard since the GC/FID fingerprint indicated that the bulk of the hydrocarbons in the soil were diesel-range organics as discussed in Sections 3.1 and 3.3.4. Other hydrocarbons greater than C_{20} were present, but were not quantitated.

The analytical results, initially reported as nanograms TPH per microliter of extract (ng/uL), were then converted to the TPH concentration remaining in the test reactor based upon the dry weight of soil in the reactor according to the formula:

$$\frac{mg}{kg}\ soil = \frac{ng\ TPH}{ul\ extract} \times \frac{mg}{10^6\ ng} \times \frac{10^6\ ul}{L} \times \frac{1000\ g}{kg} \times \frac{Liters\ pooled\ extract}{1.5\ g\ soil \times 0.86}$$

where 0.86 is the dry weight fraction of soil. These initial analytical results provided a TPH detection level greater than that desired for some of the samples. To overcome this limitation, selected solvent extracts were later concentrated and reanalyzed in order to provide additional analytical information.

3.0 RESULTS

3.1 Results of Initial Chemical and Physical Analyses of Soil and Groundwater Composites

The results of the initial chemical, physical and biological analyses for the soil and groundwater are presented in Table 1.

The TPH in the soil composite was 2,700 mg/kg based upon the average of triplicate analyses (2,500 mg/kg, 2,800 mg/kg, and 2,900 mg/kg). Due to the relatively large volume of soil extracted (50 g), contaminant concentration variability was low. Review of the GC/FID chromatograms indicated that the majority of the hydrocarbon was present as diesel/#2 with some higher distillate fraction also observed. No TPH was detected above the detection limit of 13 ppm in the groundwater composite.

The TOC in the soil is low at 0.8% with the TPH theoretically accounting for approximately one-third of the organic content. While the non-hydrocarbon organic content of the soil will serve as a sink for oxygen, it is not expected to significantly impact full-scale design or remediation activities.

The concentrations of endogenous inorganic nutrients in the soil were very low. Trace amounts of ortho-phosphate was detected in site soil, while ammonia-nitrogen was not detected above the detection limit of 1 mg/kg. While these concentrations are low, they do not necessarily preclude the field use of bioremediation either with or without nutrient enhancement.

The pH of the soil (6.4) was at the lower end of the neutral range generally favorable to aerobic bacteria. The pH of the groundwater at 7.9 was at the higher end of the neutral range generally favorable to aerobic bacteria. The pH values indicate that the subsurface pH is generally favorable for bacterial activity and will not necessarily require adjustment.

The Cation Exchange Capacity of the soil was low at 35 mg/g, and is consistent with both the type of material in the vicinity of Tank 50 and the low concentrations of inorganic nutrients detected in site soils.

3.2 Results of Microbial Enumerations

The results of the initial microbial enumerations of the site soil and groundwater composites are presented in Table 1. The number of bacteria detected in both site soil and groundwater was within the range of concentrations typically observed in non-toxic environments. The total heterotrophic bacterial population in soil was 2.3×10^7 colony forming units per gram of soil (CFU/g), and represents the presence of a viable bacterial population. The specific hydrocarbon-utilizing population numbers in soil were also high at 1.9×10^7 CFU/g, representing over 80% of the total heterotrophic population present. Ratios this high typically indicate that the native microbial population has already adapted to the presence of hydrocarbons as a food source, and are good candidates for further biological treatment.

Total and specific hydrocarbon-utilizing bacterial populations present in site groundwater were present at concentrations typically expected for groundwater, and were well within the acceptable range of bacterial numbers generally observed at hydrocarbón-contaminated sites.

3.3 Results of the Biodegradation Test

A summary of the week by week sampling times for the biodegradation study is provided in Table 2. The specific results of the biodegradation test are presented in Tables 3 through 8 and are briefly discussed in the following sections.

3.3.1 Oxygen Consumption and Carbon Dioxide Production

Oxygen and carbon dioxide concentrations monitored in the headspace of test reactors in the two oxygen-amended Systems 2 and 4 are presented in Table 3. Significant biological activity is expected to reduce the oxygen concentration and increase the carbon dioxide concentration in the aerobic microcosms. Aerobic conditions in the slurry water would require dissolved oxygen concentrations of greater than 2 mg/kg. At headspace oxygen concentrations above 18%, the dissolved oxygen concentration in the water is expected to remain above 2 mg/kg.

The oxygen concentration in System 2 (amended with oxygen only) showed a slow but generally consistent trend in consumption of oxygen with a corresponding gradual increase in the concentration of carbon dioxide. The oxygen concentrations dropped from an initial concentration of 28% volume/volume (v/v) to 19.2% (v/v) by Week 12 (the initial concentration is elevated over atmospheric concentrations due to the injection of pure oxygen into the reactors at Day 0). Since the oxygen concentrations in this system remained relatively high (greater than 18%) throughout the monitoring period, no additional oxygen was added to these bottles.

The oxygen concentration in the oxygen + nutrient amended bottles (System 4) showed a rapid reduction in oxygen concentration from 21% on Day 2 to about 8% (v/v) by Week 2 with a parallel increase in carbon dioxide concentration from 0.92% to 7.9% (v/v). Additional oxygen was added at this time to all of the test reactors in System 4 to maintain oxygen concentrations near 20% (v/v). A similar significant decrease in oxygen concentration was observed by Weeks 5 (down to 12%), 9 (down to 12%) and 12 (down to 11.4%). An additional 10 ml of oxygen was added to all System 4 reactors at these times.

Even though all bottles were sealed with a septum and crimp cap, it is likely that at least some loss in oxygen and carbon dioxide concentrations could be attributable to permeability losses across the septa used, especially in light of the long project duration time.

3.3.2 Bacterial Numbers

The number of specific hydrocarbon utilizing bacteria detected in the test reactor systems by plate counts over the course of the biodegradation testing are presented in Table 4. Fluctuations in bacterial numbers are expected on a week to week basis, and concentration increases and decreases of 100 to 100,000 fold

are routinely observed as environmental growth conditions vary with time. Once these elevated numbers of microorganisms are achieved and the available limiting nutrient concentration decreases, microbial plate count numbers typically decrease. In genéral, plate count numbers increase as biological activity increases and as contaminant concentrations initially decrease. Once readily biodegradable food/nutrient supplies are depleted microbial numbers tend to decline.

The lowest numbers of bacteria were generally detected in System 1, the unamended system, with bacterial counts ranging from 1.4 to 15 x 10^5 cfu/ml (with the exception of one anomalous result of 27,000 x 10^5 reported on Week 5). The highest number of bacterial counts were generally detected in System 4, the system amended with both oxygen and inorganic nutrients, with bacterial counts ranging from 3.3 to 11,000 x 10^5 cfu/ml. In this amended system, there was a trend of increasing bacterial counts occurring over several weeks.

The bacterial counts in Systems 2 (oxygen-amended) and System 3 (nutrient-amended) ranged from 0.94 to 10,000 x 10^5 cfu/ml and 6.1 to 5,500 x 10^5 cfu/ml, respectively. Systems 2 and 3 showed several weeks of elevated microbial numbers during the middle third of the project before exhibiting a reduction in their concentrations.

3.3.3 Nutrient Concentrations

The results of the nutrient tests for ammonia-nitrogen and phosphate are presented in Tables 5 and 6, respectively.

Ammonia-nitrogen was not detected in Systems 1 and 2, which were not amended with additional inorganic nutrients. At the beginning of the study, the ammonia-nitrogen concentrations in the two nutrient-amended systems (Systems 3 and 4) were high at 60 mg/L in the test reactors. The concentrations of ammonia-nitrogen decreased over time in both systems, with more rapid depletion observed in System 4, the nutrient + oxygen-amended system. Because the depletion of ammonia-nitrogen generally represents reversible utilization as the result of oxidation and/or assimilation of nitrogen, as opposed to irreversible loss, it was not necessary to add additional ammonia-nitrogen to these systems.

Phosphate was also not detected in Systems 1 and 2. At the beginning of the study, the phosphate concentrations in the two nutrient-amended systems (Systems 3 and 4) were elevated at 4 to 5 mg/L in the test reactors. The concentrations of ortho-phosphate increased slightly over time in both systems to about 10 to 12 mg/L. This result is likely due to the fact that phosphate was added in the form of tripolyphosphate. Tripolyphosphate is not detected as efficiently as ortho-phosphate, but will be detected after hydrolysis. Some of the tripolyphosphate most likely hydrolyzed to ortho-phosphate during the autoclaving used to sterilize the stock solution prior to use. This orthophosphate was detected on Day 2. Additional tripolyphosphate is expected to hydrolyze over time due to bacterial action. By Week 12, the ortho-phosphate concentration in both nutrient-amended systems had begun to decrease. No additional phosphate amendments to these microcosms were required.

3.3.4 TPH Concentrations

Variability in TPH values for duplicate samples was expected due to the small soil sample mass used in each bottle (1.5 g wet weight). The distribution of contaminants in soils is typically heterogeneous, even after attempts at mixing and homogenization are made. The possibility of small localized chemical hot spots within the composited soil was expected to add significant variability to the final data.

Two sets of data dealing with TPH concentrations were obtained during the study. Table 7 shows the initial TPH results obtained, along with their average concentrations and standard deviations. The average TPH concentrations and standard deviations are provided to assist in assessing analytical variability. Laboratory data sheets and corresponding Chain of Custody forms for these samples are provided in Appendix B.

TPH concentrations were quickly reduced below detection levels (approximately 700-800 mg/kg) in both of the nutrient amended systems (Systems 3 and 4). System 4 showed the fastest TPH concentration decrease; this system was also amended with excess oxygen. System 2, amended with oxygen alone, and System 1, unamended, showed the next fastest reductions in TPH concentrations, respectively.

At the completion of the initial TPH analyses, the dichloromethane extracts stored refrigerated from Weeks 1, 2, 3, 11 and 14 were concentrated approximately 15 fold and reanalyzed, providing a revised detection limit of less than 55 mg/kg. Preliminary laboratory data sheets for these samples are provided in Appendix C. These results still had not received a final QA/QC check and revised concentration factor when they were received at Fluor Daniel GTI, thus they should be used only to provide a relative comparison of the effectiveness of the treatment methods at this time.

Final corrected laboratory data sheets were received from Sequoia Analytical late on Wednesday, November 27, 1996. These results are also incorporated into Table 7, allowing a comparison of the initial and final TPH determinations to be made for selected sampling dates. A final set of average TPH concentrations attained over time with the four different treatment processes is presented in Table 8. A plot graphically representing this data is provided as Figure 1.

The initial contaminant removal trends observed were confirmed with data from the TPH reanalysis. As shown in Figure 1, TPH reductions occurred most rapidly in the nutrient + oxygen amended (System 4) and nutrient amended (System 3) systems. With System 4, TPH concentrations fell significantly in the shortest period of time. TPH reductions, at a slower rate, were also observed in the unamended (System 1) and the nutrient only amended (System 2) systems. The transient increase in TPH concentrations observed over the first 20 days of the study may be attributed to the action of microbial surfactants which effectively solubilize TPH from the soil surfaces and make it more amenable to extraction. This pattern of transient TPH increases is frequently observed both in laboratory treatability experiments and in the field.

3.3.5 Data QA/QC

Three issues relating to overall project data QA/QC are discussed briefly below:

(1) Differences in target and actual sampling dates for TPH, nutrients, and bacterial counts (Table 2): This treatability study was designed to investigate the effectiveness of biological treatment under various test conditions over a thirteen week period. A total of 14 sets of analyses (Time zero plus 13 others) was planned and budgeted, and targeted sampling dates of once per week were scheduled. The actual time duration between each sampling point does not have to be equal in a study such as this in order to provide valid and useful data. In fact, in many studies a disproportionate number of analyses are performed early in th project schedule if rapid biological activity is expected. Since the different treatment processes used in the study were expected to produce different, if any, changes in biological activity, weekly sample points were scheduled for convenience knowing that developing trends would be easily observed.

Because of staffing constraints and the type and number of samples to be handled at each sampling point, monitoring activities were routinely spread out over a two or three day period around each targeted sampling date. In addition, while samples were originally scheduled to be taken for TPH and supporting analyses every week for thirteen weeks, an exception was made during Week 12. The Remediation Technology Testing Facility was relocated from Concord, California to Trenton, New Jersey during this period. Shipment of materials and samples from California as well as resumption of testing activities in an interim facility caused the Week 12 sampling date to be delayed until the end, rather than the beginning of the week. Rather than conducting the final sampling point early in Week 13, a decision was made to postpone this sampling point until Week 14.

(2) Final TPH reanalysis and reduced detection limits: The initial TPH determinations were made by direct GC-FID injection of the dichloromethane extracts supplied by the RTTF to Sequoia Analytical. As the study progressed, lower detection limits were needed to continue to track reductions in TPH levels with the various treatment conditions. By concentrating the original refrigerated dichlormethane extracts approximately 15 fold, the TPH lower detection limit was reduced from 700-800 mg/kg to less than 55 mg/kg, allowing data from throughout the entire 14 week study to be used.

Preliminary laboratory data sheets for these reanalyzed samples are provided in Appendix C. These results had yet to undergo a final QA/QC check and to incorporate a revised concentration factor, thus they should be used only to provide a relative comparison of the effectiveness of the treatment methods at this time.

Prior to submitting this final report, RTTF staff reviewed the final corrected TPH results submitted by Sequoia (Appendix D) and independently verified for selected samples that their calculations had taken into account the final concentration factor before reporting as mg/kg for soil.

(3) Holding times for dichloromethane extracts prior to reanalysis: With labile materials, solvent storage holding times are established to ensure that analysis takes place before degradation of the target analytes within the solvent can occur. Typical holding times for dichloromethane extracts is 40 days. The reanalysis

of original extracts from Weeks 1, 2, 3, 11 and 14 occurred November 23 and 24, 1996. Extracts from Weeks 11 and 13 complied with the 40 day holding time; extracts from Weeks 1, 2 and 3 were beyond the standard holding time. However, the results from the reanalyses were expected to remain valid due to the ability of moderate to heavy end petroleum products to remain stable in dichloromethane over extended periods of time providing that the samples are kept cold.

Table 7 allows a direct comparison to be made of TPH results obtained initially at the higher detection limit with those obtained during the reanalysis of the DCM extracts. While there is some variability associated with each analysis, the relatively close agreement between the pairs of numbers offers strong support that the TPH extracts remained stable and viable after greater than 40 days of refrigerated storage.

4.0 CONCLUSIONS

The following conclusions can be drawn from the initial site characterization work and subsequent laboratory treatability tests:

1. Site soils and groundwater contain levels of microorganisms consistent with non-toxic environments; the high proportion of hydrocarbon-degrading microorganisms to total microorganisms present is usually indicative of microbial populations already previously exposed and adapted to hydrocarbon biodegradation;

2. Site soil and groundwater pH levels are within normally accepted favorable ranges for microbial survival and growth;

3. Site soils contain very low levels of two of the key inorganic nutrients required by microorganisms: nitrogen and phosphorus. While these nutrients are found at low levels, their effective concentrations are sufficient to maintain a viable microbial population in site soil and groundwater as evidenced by the heterotrophic and diesel-degrading plate count data obtained during the initial characterization work;

4. Soil slurry microcosms receiving supplemental inorganic nutrients (Systems 3 and 4), especially ammonia-nitrogen and orthophosphate, exhibited the most rapid and complete degradation of the hydrocarbons present. Without additional work it is not possible to determine whether nitrogen, phosphate, or both nutrients are responsible for the observed increase in biological activity;

5. Soils slurry microcosms that did not receive any supplemental nutrients (System 1) showed the lowest rate of hydrocarbon biodegradation and the highest residual TPH concentrations after the 14 week study; and

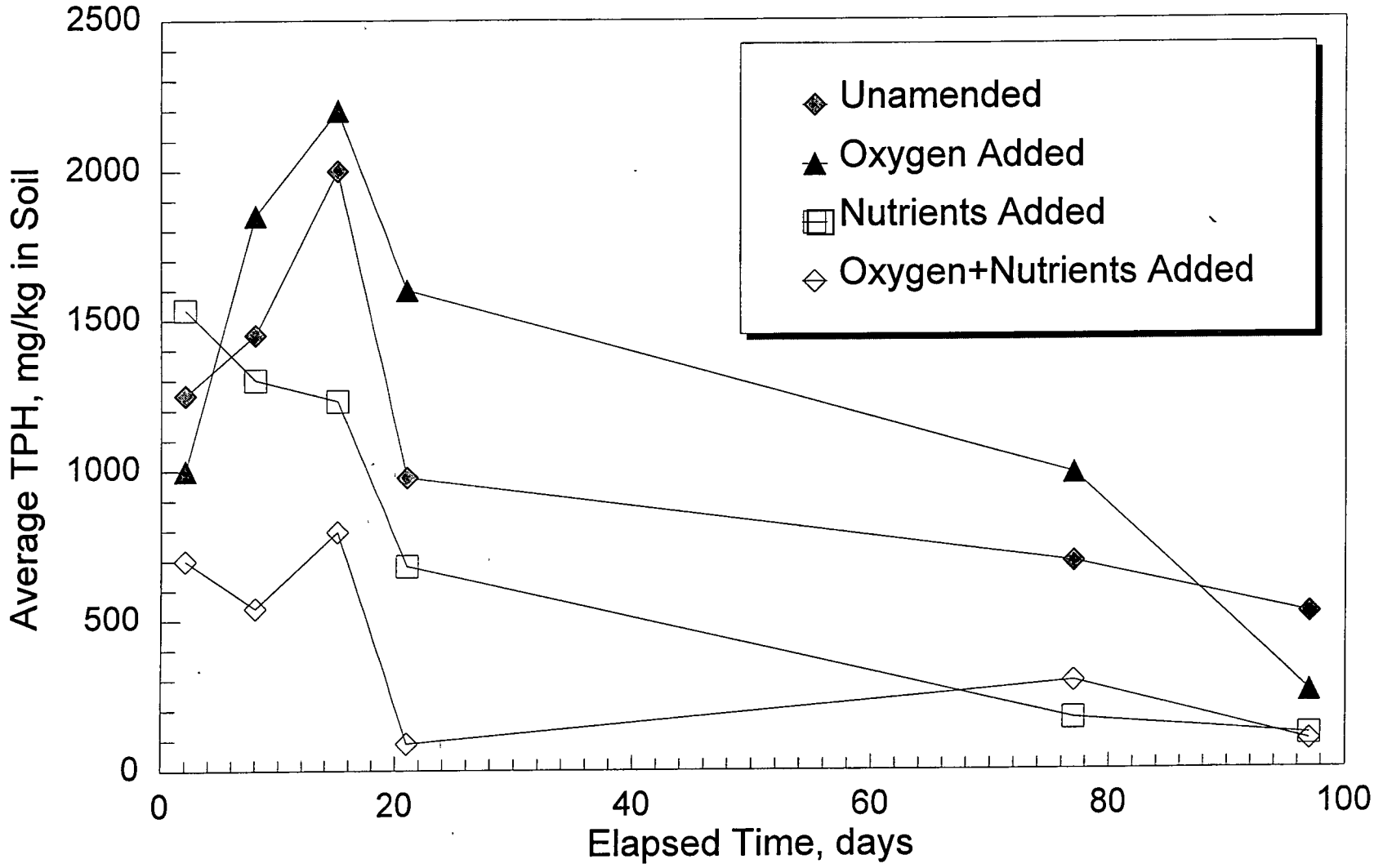
6. Soils slurry microcosms that received supplemental oxygen alone (System 2) showed TPH degradation rates greater than those observed with the unamended samples, but below those microcosms receiving additional nitrogen and phosphorus.

7. Caution should be exercised in extrapolating from these optimized laboratory treatability studies to full-scale bioimplementation programs. The treatment times obtained in the laboratory under idealized conditions will most likely not be attained under actual field conditions.

FIGURES

FIGURE 1

Graph of Average TPH Concentration vs. Elapsed Time



TABLES

TABLE 1
Initial Soil and Groundwater Characterization
Tank 50, NETC Newport
Delivery Order #11

Analysis	Methodology	Results	
		Soil	Groundwater
Contaminant Screening			
Total Organic Carbon (TOC)	CFA S:18.0	8,200 mg/kg	---
Total Petroleum Hydrocarbon (TPH) by GC/FID[a]	EPA 8015 modified with Soxhlet extraction	2,700 mg/kg [b]	<12.5 [c]
Background Nutrient Concentrations			
Ammonia-Nitrogen	EPA 350.3	<0.82 mg/kg	---
Ortho-Phosphate	EPA 365.3	1.8 mg/kg	---
Other Chemical Properties			
pH	SM 4500-H^+	6.4 pH units	7.9 pH units
Cation Exchange Capacity (CEC)	EPA 9080	35 mg/g	---
Microbiological Screening (CFU/g) for soil and (CFU/ml) for water[d]			
Total Heterotrophic Bacteria (THB)	SM 9215 C (modified)	2300×10^4	44×10^4
Contaminant-Utilizing Bacteria (CUB) - Diesel	SM 9215 C (modified)	1900×10^4	1.1×10^4

a. GC/FID: Gas chromatography by flame ionization detection.
b. This result is the average of triplicate soil analyses reported as 2,500, 2,800 and 2,900 mg/kg
c. Groundwater was analyzed in duplicate for this analyte.
d. CFU = colony forming units
NOTE: All soil results reported on a dry weight basis

TABLE 2
Tank 50 - NETC Newport
Project Schedule*

Week #	Target Sampling Date	Target Elapsed Time, Days	TPH, Actual Sampling Date	Nutrients, Actual Sampling Date	Bacteria Counts, Actual Sampling Date
0	06-Aug-96	0	08-Aug-96	07-Aug-96	07-Aug-96
1	13-Aug-96	7	14-Aug-96	13-Aug-96	13-Aug-96
2	20-Aug-96	14	21-Aug-96	20-Aug-96	20-Aug-96
3	27-Aug-96	21	27-Aug-96	28-Aug-96	28-Aug-96
4	03-Sep-96	28	03-Sep-96	03-Sep-96	04-Sep-96
5	10-Sep-96	35	12-Sep-96	10-Sep-96	10-Sep-96
6	17-Sep-96	42	17-Sep-96	19-Sep-96	18-Sep-96
7	24-Sep-96	49	25-Sep-96	25-Sep-96	25-Sep-96
8	01-Oct-96	56	03-Oct-96	02-Oct-96	01-Oct-96
9	08-Oct-96	63	10-Oct-96	08-Oct-96	08-Oct-96
10	15-Oct-96	70	16-Oct-96	16-Oct-96	15-Oct-96
11	22-Oct-96	77	22-Oct-96	22-Oct-96	22-Oct-96
12	29-Oct-96	84	01-Nov-96	01-Nov-96	01-Nov-96
13	05-Nov-96	91	Not Sampled	Not Sampled	Not Sampled
14	12-Nov-96	98	11-Nov-96	11-Nov-96	11-Nov-96

*Start date for the experiment was 06-Aug-96.

TABLE 3
Oxygen and Carbon Dioxide Concentrations (% v/v) in the Headspace of Test Reactors
Tank 50 - NETC Newport

		(Oxygen Added System 2)		(Oxygen + Nutrient Added System 4)		
	Date	Oxygen	Carbon Dioxide	Oxygen	Carbon Dioxide	Comments
WEEK 0	06-Aug-96	28.00	0.75	21.00	0.92	
WEEK 1						
WEEK 2	20-Aug-96	24.00	1.90	8.30	7.90	23-Aug-96 add 10 ml oxygen to System 4
WEEK 3						
WEEK 4						
WEEK 5	10-Sep-96	20.50	1.80	12.00	6.80	12-Sep-96 add 10 ml oxygen to System 4
WEEK 6						
WEEK 7						
WEEK 8						
WEEK 9	08-Oct-96	20.50	1.70	12.00	4.80	08-Oct-96 add 10 ml oxygen to System 4
WEEK 10						
WEEK 11						
WEEK 12	28-Oct-96	19.2	1.20	11.4	3.5	28-Oct-96 add 10 ml oxygen to System 4
WEEK 13						
WEEK 14						

Gas samples were removed with a syringe from the target bottles. The vapor sample was analyzed at the RTTF using gas chromatography with a Thermal Conductivity Detector.

TABLE 4
Contaminant Utilizing Bacteria (cfu X10^5/ml) in the Test Reactors
Tank 50 - NETC Newport

	Actual Sampling Date	No Amendments (System 1)	Oxygen Condition (System 2)	Nutrients Added (System 3)	Oxygen & Nutrients Added (System 4)
WEEK 0	07-Aug-96	1.4	0.94	4.5	3.3
WEEK 1	13-Aug-96	3.3	30	7.3	41
WEEK 2	20-Aug-96	4.4	5.5	32	390
WEEK 3	28-Aug-96	9.7	11	56	310
WEEK 4	04-Sep-96	4.8	4.2	6.1	40
WEEK 5	10-Sep-96	27,000	10,000	110	4,400
WEEK 6	18-Sep-96	7.8	39	340	3,800
WEEK 7	25-Sep-96	13	4,800	5,500	12
WEEK 8	01-Oct-96	5.6	3.5	15	11,000
WEEK 9	08-Oct-96	4.8	5.4	5	8,600
WEEK 10	15-Oct-96	15	8.6	11	140
WEEK 11	22-Oct-96	3.6	5.1	0.51	4 4
WEEK 12	01-Nov-96	0.0004	0.28	1.2	0.4
WEEK 13	Not Sampled				
WEEK 14	11-Nov-96	0.13	0.1	1.9	0.5

cfu = colony forming units per milliliter of water in the test reactor.

Analyzed at the RTTF using Standard Methods procedure 9215 C (modified)

Note: Results are the average of duplicate analyses.

TABLE 5
Ammonia - Nitrogen Concentrations (mg/L) in the Test Reactors *
Tank 50 - NETC Newport

Week #	Actual Date Sampled	No Amendments (System 1)	Oxygen Added (System 2)	Nutrients Added (System 3)	Oxygen & Nutrients Added (System 4)
WEEK 0	07-Aug-96	0.5	0.5	60	60
WEEK 1	13-Aug-96	<1	<1	50	37.5
WEEK 2	20-Aug-96	<1	<1	25	12.5
WEEK 3	28-Aug-96	<1	<1	30	10
WEEK 4	03-Sep-96	<1	<1	34	10
WEEK 5	10-Sep-96	<1	<1	34	10
WEEK 6	19-Sep-96	<1	<1	15	1.5
WEEK 7	25-Sep-96	<1	<1	31.5	4
WEEK 8	02-Oct-96	<1	<1	14	2
WEEK 9	08-Oct-96	<1	<1	19	1.25
WEEK 10	16-Oct-96	<1	<1	22	<1
WEEK 11	22-Oct-96	<1	<1	31	<1
WEEK 12	01-Nov-96	<1	<1	27.5	<1
WEEK 13	Not sampled				
WEEK 14	11-Nov-96	1.5	1.5	10	5

* NOTE: Results are the average of duplicate analyses. Analyzed at the RTTF using a colorimetric test kit following manufacturer's recommendations.

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TABLE 6
Ortho-Phosphate Concentrations (mg/l) in the Test Reactors*
Tank 50 - NETC Newport

Week#	Actual Date Sampled	No Amendments (System 1)	Oxygen Added (System 2)	Nutrients Added (System 3)	Oxygen & Nutrients Added (System 4)
WEEK 0	07-Aug-96	<0.5	<0.5	4	5
WEEK 1	13-Aug-96	<0.5	<0.5	6	6
WEEK 2	20-Aug-96	<0.5	<0.5	8	7
WEEK 3	28-Aug-96	<0.5	<0.5	8	6.5
WEEK 4	03-Sep-96	<0.5	<0.5	8	8
WEEK 5	10-Sep-96	<0.5	<0.5	12.5	10
WEEK 6	19-Sep-96	<0.5	<0.5	10	10
WEEK 7	25-Sep-96	<0.5	<0.5	10	10
WEEK 8	02-Oct-96	<0.5	<0.5	10	10
WEEK 9	08-Oct-96	<0.5	<0.5	13	9
WEEK 10	16-Oct-96	<0.5	<0.5	10	10
WEEK 11	22-Oct-96	<0.5	<0.5	7.5	10
WEEK 12	01-Nov-96	<0.5	<0.5	5	7.5
WEEK 13	Not Sampled				
WEEK 14	11-Nov-96	<0.5	<0.5	7.5	2.5

*Note: Results are average of duplicate analyses. Samples were analyzed by the RTTF using a colorimetric test kit according to the manufacturer's recommendations.

TABLE 7

Tank 50 - NETC Newport

Total Petroleum Hydrocarbons (GC/FID) in (mg/kg)

				NO AMENDMENTS (System 1)				OXYGEN ADDED (System 2)				NUTRIENTS ADDED (System 3)				OXYGEN / NUTRIENTS (System 4)			
	Sampling Date	Elapsed Time, days	Type of TPH Analyses (Note 1)	Sample 1	Sample 2	Ave	Std Dev	Sample 1	Sample 2	Ave	Std Dev	Sample 1	Sample 2	Ave	Std Dev	Sample 1	Sample 2	Ave	Std Dev
Starting Date	06-Aug-96	0	-																
WEEK 0	08-Aug-96	2	initial	1500	1000	1250	354	< 700	1300	1000	424	870	2200	1535	940	< 700	< 700	700	0
WEEK 1	14-Aug-96	8	initial	1600	1500	1550	71	950	1300	1125	247	870	740	805	92	< 700	< 700	700	0
			final	1300	1600	1450	212	1400	2300	1850	636	1600	1000	1300	424	550	530	540	14
WEEK 2	21-Aug-96	15	initial	1300	1600	1450	212	1300	2100	1700	566	1700	810	1255	629	700	< 700	700	0
			final	1500	2500	2000	707	2100	2300	2200	141	1500	960	1230	382	750	840	795	64
WEEK 3	27-Aug-96	21	initial	700	< 700	700	0	< 720	730	725	7	< 720	< 700	< 710	14	< 700	< 700	< 700	0
			final	1200	750	975	318	1300	1900	1600	424	950	410	680	382	120	< 55	88	46
WEEK 4	03-Sep-96	28	initial	740	830	785	64	< 700	1100	900	283	< 700	850	775	106	< 700	< 810	< 755	78
WEEK 5	12-Sep-96	37	initial	< 700	1000	850	212	< 700	< 720	< 710	14	< 700	< 580	< 640	85	< 700	< 720	< 710	14
WEEK 6	17-Sep-96	42	initial	836	< 700	768	96	< 730	< 740	< 735	7	< 570	< 630	< 600	42	< 550	< 590	< 570	28
WEEK 7	25-Sep-96	50	initial	< 750	1100	925	247	< 720	< 720	< 720	0	< 790	< 700	< 745	64	< 700	< 700	< 700	0
WEEK 8	03-Oct-96	58	initial	960	< 720	840	170	< 700	< 700	< 700	0	< 700	< 700	< 700	0	< 700	< 700	< 700	0
WEEK 9	10-Oct-96	65	initial	1800	< 700	1250	778	< 700	730	715	21	< 700	< 700	< 700	0	< 700	< 700	< 700	0
WEEK 10	16-Oct-96	71	initial	< 700	< 700	< 700	0	790	< 700	745	64	< 700	< 700	< 700	0	< 700	< 700	< 700	0
WEEK 11	22-Oct-96	77	initial	< 700	< 700	< 700	0	< 700	< 700	< 700	0	< 720	< 700	< 710	14	< 700	< 700	< 700	0
			final	650	730	690	57	870	1100	985	163	< 55	280	168	159	390	190	290	141
WEEK 12	01-Nov-96	87	initial	1400	< 810	1105	417	< 810	< 910	< 860	71	< 840	< 810	< 825	21	< 790	< 840	< 815	35
WEEK 13	NS		-	NS	NS			NS	NS			NS	NS			NS	NS		
WEEK 14	11-Nov-96	97	initial	< 790	< 810	< 800	14	< 810	< 790	< 800	14	< 810	< 840	< 825	21	< 790	< 790	< 790	0
			final	660	370	515	205	140	370	255	163	< 55	170	113	81	< 55	130	93	53

Note 1: "initial" analyses had a lower detection limit between 700-800 mg/kg of soil.

Note 2: "final" analyses had a lower detection limit of <55 mg/kg of soil.

NS - Not Sampled

FLUOR DANIEL TI

TABLE 8
Tank 50 - NETC Newport
Final TPH Analytical Results - Summary*

				Unamended (System 1)	Oxygen Only (System 2)	Nutrients Only (System 3)	Oxygen + Nutrients (System 4)
Week of Project	Actual Sampling Date	Actual Elapsed Time, Days	TPH Analysis	Average Concentration (mg/kg in soil)	Average Concentration (mg/kg in soil)	Average Concentration (mg/kg in soil)	Average Concentration (mg/kg in soil)
0	08-Aug-96	2	initial	1250	1000	1535	700
1	14-Aug-96	8	final	1450	1850	1300	540
2	21-Aug-96	15	final	2000	2200	1230	795
3	27-Aug-96	21	final	975	1600	680	88
11	22-Oct-96	77	final	690	985	168	290
14	11-Nov-96	97	final	515	255	113	93

*EPA 8015 (modified); average value of duplicate analyses.

APPENDIX D.1

Bench Scale Study Discussion

FLUOR DANIEL GTI

November 27, 1996

Refer: 872600

Mr. David McCarron, P.E.
Foster Wheeler Environmental Corporation
470 Atlantic Avenue
Third Floor
Boston, MA 02110

RE: Laboratory Treatability Report
Tank 50, NETC, Rhode Island

Dear Mr. McCarron:

Fluor Daniel GTI's Remediation Technology Testing Facility (RTTF) has prepared the enclosed draft Laboratory Treatability Study Report on the biodegradation testing performed on soil and groundwater from the vicinity of Tank 50. Due to a misinterpretation of the initial laboratory results, the results in this report as they pertain to the analytical detection limits are different from those reported in our interim report. The purpose of this letter is to describe this error and discuss the corrective measures implemented. In spite of these difficulties, the corrective actions taken have succeeded in obtaining the lower detection levels needed to draw valid conclusions throughout the 14 week period of study.

Detection Level

The detection limits for the biodegradation study were incorrectly reported as less than 1 mg/kg in the September 27, 1996 interim report. The true detection limits for the study, as originally analyzed, were in the range of 700 to 800 mg/kg. This mistake was discovered during review of the data for incorporation into the draft final report.

The problem arose from the fact that the analyses performed by Sequoia were not standard analyses since the solvent extracts were prepared by an RTTF staff member, and were then submitted to Sequoia for analysis. At each sampling event, the entire contents of each test bottle were extracted using dichoromethane (DCM). Approximately half the volume of each extract was sent to Sequoia Analytical for analysis using EPA 8015 (modified); the remaining extract volume was kept refrigerated at the RTTF.

Sequoia provided the results to the RTTF as both the concentration of TPH in the extract (in terms of ng/ul extract) and the concentration of TPH in the soil (in terms of mg/kg dry weight of soil used). For Week 0 samples, Sequoia reported an Extractable Hydrocarbons Reporting Limit of 1.0 mg/kg in soil, with a corresponding Report Limit Multiplication Factor of 1.0. The Multiplication Factor value was in error. The Multiplication Factor was actually 689 yielding a detection limit of 698 mg/kg. Sequoia also incorrectly reported an Extractable Hydrocarbons Reporting Limit of 1.0 mg/kg in soil with a corresponding Report Limit Multiplication Factor of 1.0 for the Week 1 samples. From Weeks 2 and on, Sequoia continued to report an Extractable Hydrocarbons Reporting Limit of 1.0 mg/kg in soil, but reported the correct Report Limit Multiplication Factor for each sample. These Report Limit Multiplication Factors ranged from 700 to

310 Horizon Center Drive / Trenton, NJ 08691 USA (609) 587-0300 FAX (609) 587-7908

800, meaning that the minimum detection limit of the analyses was really 700 to 800 mg/kg in soil Many of the DCM extracts remained stored and refrigerated at both Sequoia Analytical and the RTTF, a decision was made to submit a limited number of extracts for concentration and reanalysis over the weekend of November 23 and 24 with 8-hr turn around. Based on an average of 15 ml of extract being available for each sample, it was possible to concentrate the extracts from 10- to 30-fold. This concentration step lowered the detection limit from the range of 700 to 800 mg/kg to less than 70 mg/kg which would allow further conclusions to be from the study., not the 1 mg/kg previously reported.

The initial report mistakes from Weeks 0 and 1, and the corrected Report Limit Multiplication Factors, were not realized by the RTTF staff. When the interim laboratory progress report dated September 27, 1996 was issued, TPH concentrations reported by Sequoia as "ND" were incorrectly interpreted to mean "less than 1 mg/kg," rather than less than 700 to 800 mg/kg. This misunderstanding of the detection limit continued through the completion of the study.

Implementation of Corrective Measures

When this mistake was discovered during preparation of the draft final report, it became evident that a lower detection limit would be needed to track the actual TPH concentrations during Weeks 4 through 14 of the study. While trends in the data were apparent by the end of Weeks 3 and 4, no conclusions regarding differences in treatment effectiveness could be substantiated for Weeks 4 through 14 due to the high detection limit. In addition, without a lower detection limit, it would not be possible to assess the lowest TPH concentrations attainable using biological treatment under the four different test conditions except to say that biological processes are indeed effective in reducing TPH levels below 800 mg/kg.

Since the initial detection limits were too high to allow interpretation of the results from the latter part of the biodegradation study, a decision was made on November 22, 1996 to have a number of the samples re-analyzed before submission of the draft report. Many of the DCM extracts remained stored and refrigerated at both Sequoia Analytical and the RTTF, and were immediately available for reanalysis. Based on an average of 15 ml of extract being available for each sample, it was possible to concentrate the extracts from 10- to 30-fold. This concentration step would lower the detection limit from the range of 700 to 800 mg/kg to less than 70 mg/kg, allowing more complete conclusions to be drawn from the study.

Fluor Daniel GTI contracted with Sequoia to concentrate and reanalyze selected sample extracts at a lower detection limit on Friday, November 22. These samples were analyzed by Sequoia over the weekend of November 23 and 24 with an 8-hr turn around time for preliminary reports. These preliminary data were incorporated into Fluor Daniel GTI's draft report and have been submitted to Foster Wheeler in the attached report.

Extracts from Weeks 1, 2, 3, 11 and 14 were selected for concentration and reanalysis. These samples were chosen for the following reasons:

1. Major reductions in TPH concentrations appeared to occur during the first three weeks of the study based on the original analytical results. Since Sequoia could not locate their stored Week 0

extracts, only the extracts from the first three weeks of the project were reanalyzed in order to reconfirm the initial trends observed;

2. Since the extracts from Weeks 1 to 3 were outside of the 40-day holding time, reanalyzing these samples and comparing them to the initial results (analyzed within the 40-day holding period) would confirm that the integrity of the stored extracts was maintained; and

3. Weeks 11 and 14 were chosen to provide data at the completion of the study period. These extracts would also meet the standard 40-day holding time.

Reanalysis of these samples would provide the data needed to meet the two goals of the study: (1) evaluate differences in biological treatment effectiveness under four different environmental conditions, and (2) determine to what concentration TPH levels could be reduced.

These reanalyses are being completed at no additional cost to the project.

Reanalysis of Sample Extracts

During the reanalyses (completed over the weekend on November 23 and 24, 1996), a misunderstanding among Sequoia personnel led to the sample extracts being concentrated from the volume at hand to 1.0 ml each without the actual starting volume of each extract being recorded.

In order to determine the actual concentration factor attained by Sequoia, Fluor Daniel GTI has sent Sequoia their reserved portion of the extracts for volume measurements. Since the total volume of DCM extract per sample is known, and Sequoia used 1.0 ml of extract previously for analysis, the actual volume used for concentration can be obtained by difference. Sequoia Analytical will receive the unused portion of the extracts held by the RTTF on Wednesday, November 27, 1996. Then, Sequoia personnel will recalculate the final TPH concentrations determined in the reanalysis. The final data should be available Monday, December 2. The "final" TPH concentrations currently shown in Table 8 of the draft report will need to be adjusted based on the actual starting volumes of extract used, and these concentrations are expected to increase up to 100%.

Final Revisions to Laboratory Treatability Report

Once these data are received by Fluor Daniel GTI, the following revisions will be made to the laboratory report:

1. Final TPH data will be inserted into Table 7, allowing comparison between original analytical results obtained with the higher detection limits and the new data at the lower detection limits;

2. Table 8 will incorporate the new analytical results;

3. A figure will be added to present the results of Table 8 graphically;

4. A new Appendix D will be added containing the final data reports from Sequoia Analytical;

5. An addition will be made to Section 3.3.5 Data QA/QC, commenting on the integrity of the DCM extracts beyond the 40-day holding time; and

6. The Conclusions section of the report will be reviewed and modified as needed in light of the final results obtained.

Based on a review of the data available to date, the conclusions of the study are not expected to change. The presence of inorganic nutrients (with or without additional oxygen) had a strongly positive effect during the study, and resulted in the most complete destruction of TPH observed in the shortest period of time. Unamended microcosms as well as those microcosms receiving only supplemental oxygen also demonstrated biological activity and reduction in TPH concentrations, but at slower rates and not to the same extent observed with the nutrient amended systems.

The corrected and final versions of the report will be delivered to your attention in Boston by 5:00 p.m. Monday, December 2, 1996.

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

Sincerely,
Fluor Daniel GTI, Inc.

George Skladany
Director, Remediation Technology Testing Facility

Richard Brown, Ph.D.
Vice President, Remediation Technology

copy: T. Pac, Project Manager
N. Irish, Program Manager

APPENDIX E

Pilot Scale Study Field Information

FLUOR DANIEL GTI

ENGINEERING GRID

PROJECT NSTR / Whale Island
PROJECT NUMBER
SUBJECT Tank 50 - Pilot Test Equipment Log
BY MJD DATE 8/12/96
PAGE 1 OF 2
CHECKED BY
DATE

8/12/96 - WATER QUALITY METER CALIBRATED FOR D.O. AND pH
- GA-90 METER CHECKED FOR CALIBRATION, FACTORY CALIBRATION CONFIRMED

8/13/96 - Helium meter stopped working DUE to heavy rains, talked to HARCO they will send replacement for tomorrow
- FID stopped working due to heavy rains

8/14/96 - Helium meter recieved from HARCO, [He] measured @ ~1630

8/16/96 - GA-90 Meter RECALIBRATED AGAINST AMBIENT OXYGEN (20.5%)

~~9/1~~ 9/3/96 - D.O. READINGS NOT STABLE, CHANGED MEMBRANE on ~~Water~~ D.O. PROBE (WATER QUALITY Meter)

9/10/96 - I.P. not available - being used somewhere ~~else~~ @ the site (call Tank 4 area - can't locate)
- FID not lighting

9/27/96 - changed membrane on D.O. meter
- ~~cal~~ calibrated GA-90 METER w/ AMBIENT AIR

10/11/96 - RECALIBRATED GA-90 METER w/ AMBIENT AIR

FLU R DANIEL TI

ENGINEERING GRID

PROJECT
PROJECT NUMBER
SUBJECT EQUIPMENT LOG (CONT.)
BY
DATE 10/18/96
PAGE 2 OF 2
CHECKED BY
DATE

10/18/96 - IP PROBE COULD NOT BE LOCATED

10/31/96 - D.O. METER ⇒ CHANGED MEMBRANE

11/7/96 - GA-90 METER CALIBRATED AGAINST ATMOSPHERIC AIR

FLU R DANIEL GTI **ENGINEERING GRID**

PROJECT NETL / TANK 50 - Pilot Test PROJECT NUMBER

SUBJECT Biodegradation Rate Calc. BY MED DATE 12/5/96

PAGE 1 OF 2

CHECKED BY M.C. Leahy DATE 12-5-96

ESTIMATED RATE of Biodegradation from O_2 depletion:

$$24 \times (\%O_2/100) \times P/(RT) \times (\theta/\rho_b) \times MW_{HEX} \times 1000/9.5$$

where:

$P = 1$ atm

$R = 82.05 \times 10^{-6}$ (atm-m^3)/(g-mol °K)

$T = 20 + 273 = 293$ °K

$\theta = 0.3$

$\rho_b = 1440$ kg/m^3

$\%O_2 = 0.055$ = from Test Data

$$24 \times 0.055/100 \times 1/(82.05 \times 10^{-6})(293) \times 0.3/1440 \times 86 \times 1000/9.5$$

$$24 \times 0.00055 \times 41.6 \times 0.00021 \times 86 \times 105.3$$

$$= 1.05 \text{ mg-hex/kg of soil/day}$$

FLUOR DANIEL GTI **ENGINEERING GRID**

PROJECT NEPL/TANK 50 - Pilot Test PROJECT NUMBER

SUBJECT Biodegradation Rate Calc. BY MED DATE 12/5/96

PAGE OF

CHECKED BY M.C. Leahy DATE 12-5-96

Estimated Rate of Biodegradation from CO_2 production:

$$1.33 + 24 + \left(\%CO_2/100\right) + P/(RT) + \left(\theta/\rho_b\right) \times MW_{HEX} + 1000/6$$

where:

$P = 1$ atm

$R = 82.05 \times 10^{-6}$ (atm m^3)/(gmole °K)

$T = 20 + 273 = 293$ °K

$\theta = 0.3$

$\rho_b = 1440$ kg/m^3

$MW_{HEX} = 86$

$\%CO_2 = 0.03$ = From Test Data

$$1.33 + 24 + \left(0.03/100\right) + \left(1/(82.05\times10^{-6})(293)\right) + \frac{0.3}{1440} \times 86 \times 1000/6$$

$$1.33 + 24 + 0.0003 \times 41.6 \times 0.00021 \times 86 \times 166.7$$

$$= 1.2 \text{ mg. hex/kg of soil/day}$$

From O_2 depletion = 1.05 mg/kg/day

From CO_2 production = 1.2 mg/kg/day

ave = 1.1 ⇒ **1 mg hex/kg of soil/day**

200-796AC-170B

$\frac{1\%}{10} = .01$

the oxygen depletion and carbon dioxide production in terms of percent per hour (%/hr.) are calculated for each monitoring point using linear regression. The oxygen and carbon dioxide utilization curves are generally linear indicating a zero-order reaction rate.

Hydrocarbon degradation rates are then estimated from the oxygen depletion and carbon dioxide production rates. Hexane is assumed to be representative of petroleum products in terms of the oxygen utilization and carbon dioxide production per gram of hydrocarbon based on the following stoichiometric equation:

C_6H_{14}	+	$9.5\ O_2$	->	$6\ CO_2$	+	$7\ H_2O$
hexane		oxygen		carbon dioxide		water

The rate of oxygen depletion can then be converted to the estimated rate of biodegradation based on the equation:

Rate (mg-hexane/kg of soil/day) =
$24 \times (\%O_2/100) \times P/(RT) \times (\Theta/p_b) \times MW_{hexane} \times 1000/9.5$

P = pressure = 1 atmosphere
R = gas constant = 82.05×10^{-6} (atm·m³)/(g mole·K)
Θ = effective air porosity = 0.30
p_b = bulk density = 1440 kg/m³
MW_{hexane} = molecular weight of hexane = 86

Similarly, the rate of hydrocarbon degradation can be calculated from the rate of carbon dioxide production using Hinchee and Ong's assumption of a conversion efficiency of 75% hydrocarbon into carbon dioxide:

Rate (mg-hexane/kg of soil/day) =
$1.33 \times 24 \times (\%CO_2/100) \times P/(RT) \times (\Theta/p_b) \times MW_{hexane} \times 1000/6$

Hinchee and Ong (1992) and others have performed this testing at numerous sites. In general, biodegradation rates on the order of 2 to 20 mg/kg/day have been observed.

When the contaminant is other than a petroleum hydrocarbon, the molecular weight of the specific contaminant and its stoichiometric degradation equation should be substituted for those of hexane.

AVE. SLOPES FROM TEST DATA:

$\%O_2/hr$ RATE = -0.055

$\%CO_2/hr$ RATE = 0.030

THE ABOVE VALUES WERE USED TO CALCULATE THE AVERAGE RATE OF DEGRADATION

Hinchee, R.E. and S.K. Ong, 1992, "A RAPID IN SITU RESPIRATION TEST FOR MEASURING BIODEGRADATION RATES OF HYDROCARBONS IN SOIL." J. AIR WASTE MANAGE. ASSOC. 42(10): 1305-1312

NETC/Rhode Island
Calculation of Biodegrdation Rate From Aug96 Respirometry Test

Monitoring Point	O2 R^2	% O2/Hr	BioRate mg/kg*day
mw-301	0.8519	-0.04447	0.858271
mw-302	0.9023	-0.07393	1.426849
mw-107	0.938124	-0.04686	0.904398
ave.		-0.05509	1.063173

Monitoring Point	CO2 R^2	%CO2/Hr	BioRate mg/kg*day
mw-301	0.980739	0.024995	1.016047
mw-302	0.947163	0.039042	1.587057
mw-107	0.935089	0.026592	1.080965
ave.		0.03021	1.228023

SITE CLOSE OUT REPORT
FOR
GROUNDWATER REMEDIATION
OF
TANK FARM #5 - TANKS #53 & #56
AT THE
NAVAL EDUCATION AND TESTING CENTER
NEWPORT, RHODE ISLAND

Issued:

August 1997

Prepared for:

NORTHERN DIVISION
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, Pennsylvania 19047

Contract No. N62472-94-D-0398
Delivery Order No. 0011

CD97#12/97508

SITE CLOSE OUT REPORT FOR GROUNDWATER REMEDIATION OF TANK FARM #5 - TANKS #53 & #56 AT THE NAVAL EDUCATION AND TESTING CENTER NEWPORT, RHODE ISLAND

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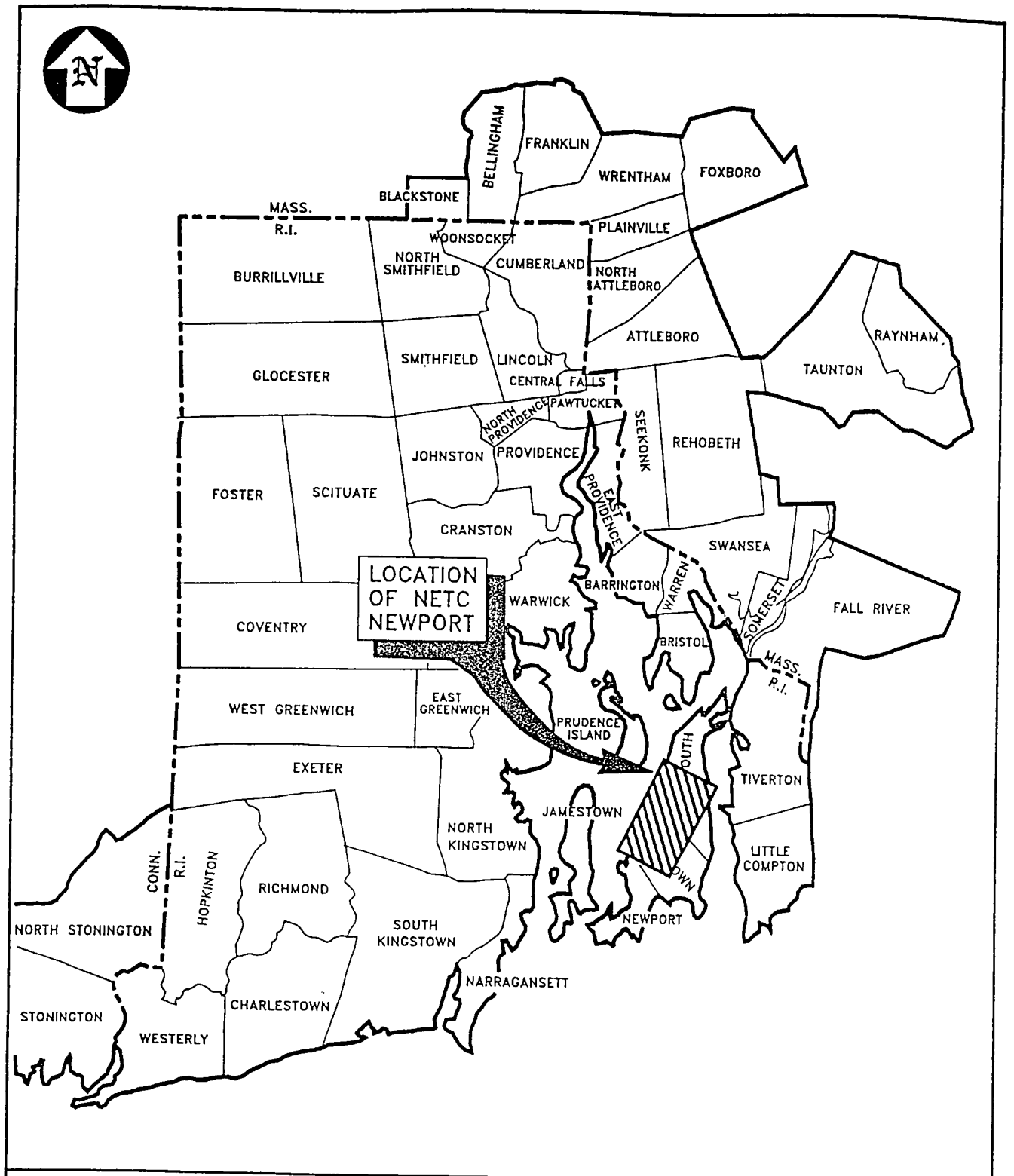
1.0 INTRODUCTION

Foster Wheeler Environmental Corporation, (Foster Wheeler Environmental) was contracted by the Northern Division Naval Facilities Engineering Command to provide operation and maintenance at the Tank Farm #5 Groundwater Treatment Facility Operable Unit at the Naval Education and Training Center (NETC), Newport, Rhode Island. This Site Close Out Report has been prepared for the United States Environmental Protection Agency (USEPA) to; provide documentation of the activities conducted; to establish that the Interim Remedy has met the objectives established as part of the Interim Record of Decision and to satisfy requirements of the Remedial Action Contract number N62472-94-D-0398, Delivery Order 0011.

2.0 SITE DESCRIPTION AND BACKGROUND

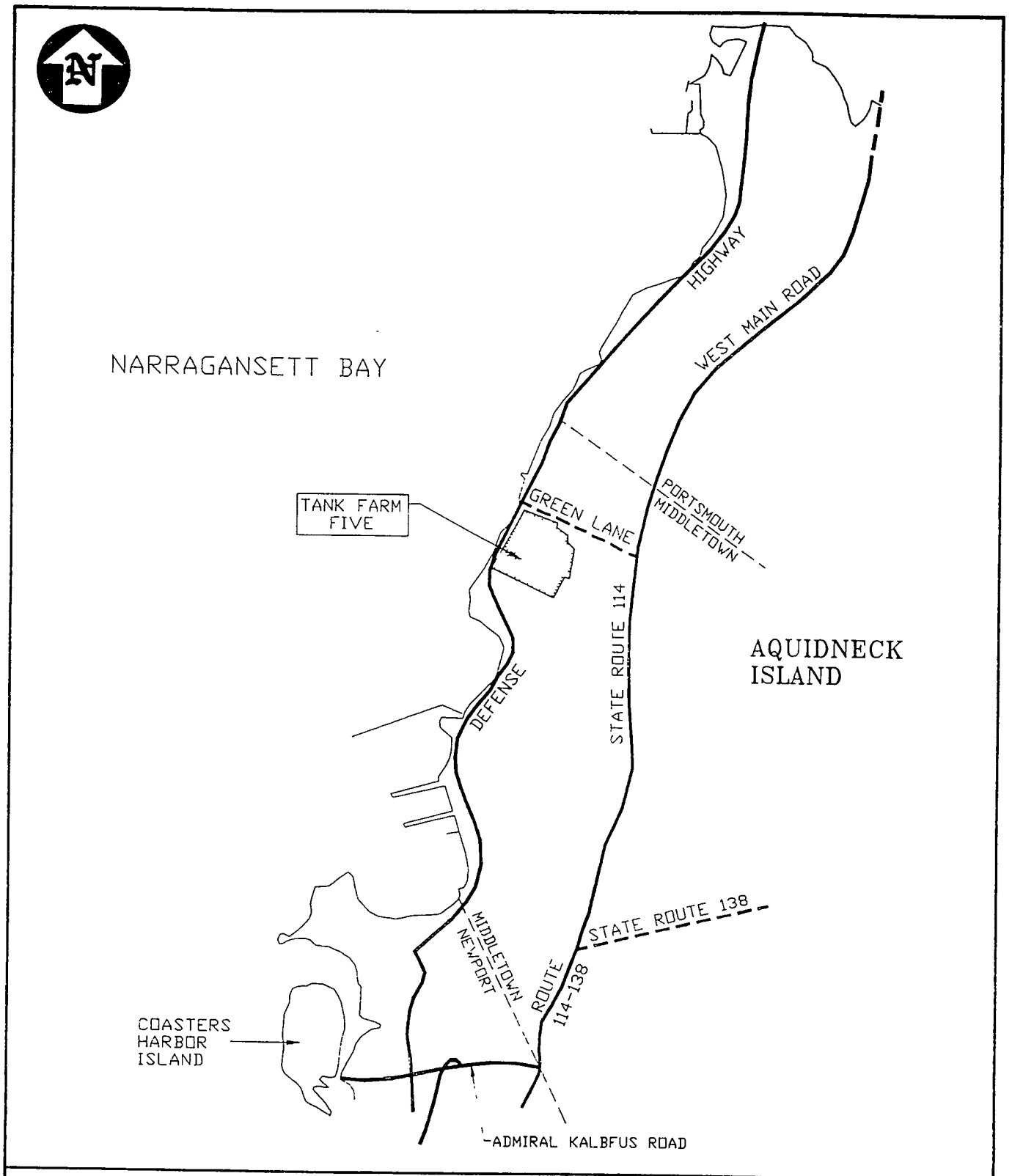
The Naval Education and Training Center (NETC) is a 1,063 acre parcel of land located in the Newport Naval Base, which is situated on approximately six miles of the western shore of Aquidneck Island, in Newport County, Rhode Island. The location of NETC is presented in Figure 2-1. Site 13, also known as Tank Farm #5, comprises 85 acres of the NETC and is located centrally within NETC, at the intersection of Green Lane and Defense Highway, in Middletown, Rhode Island. The Site location is presented in Figure 2-2 and the Site layout in Figure 2-3. The Site is bordered to the northeast by Green Lane, the northwest by Defense Highway, to the east by residences and the south by a cemetery.

Tank Farm Five is the site of eleven concrete underground storage tanks (numbered 49 through 59), each with a 2.52 million gallon capacity, which were used for fuel storage from World War II (1943) until 1974. Tank 53 is an underground storage tank (UST) located in the western portion of Tank Farm 5 that was constructed of reinforced concrete in a blasted bedrock socket. This was constructed to minimize potential contaminant migration. The Rhode Island Department of Environmental Management (RIDEM) adopted hazardous waste regulations in 1982 that were applicable to Tanks 53 and 56 which were used for storage of used oil from 1975 until 1980. Sampling conducted during an Initial Assessment Study (IAS Report, Envirodyne Engineers, March, 1983) of the contents of these two tanks determined that the oil and sludge phase in both tanks were hazardous due to lead and other inorganics. Water samples collected from both tanks contained detectable concentrations of chlorinated and aromatic hydrocarbons. In 1985, results of groundwater samples in the tank's ring drains as well as 150 feet downgradient of Tank 53 indicated the presence of organic compounds. RIDEM issued a Hazardous Waste Facility Permit to NETC in September, 1985, which stated that Tanks 53 and 56 were to be removed and closed in accordance with hazardous waste regulations. In November, 1989, NETC, Newport was placed on the USEPA's National Priorities List (NPL). An observed release occurred at Tank 53 in January 1990. RIDEM issued an Immediate Compliance Order which required NETC to remove the contents of Tank 53, remediate the contaminated groundwater and soils surrounding the tank and to

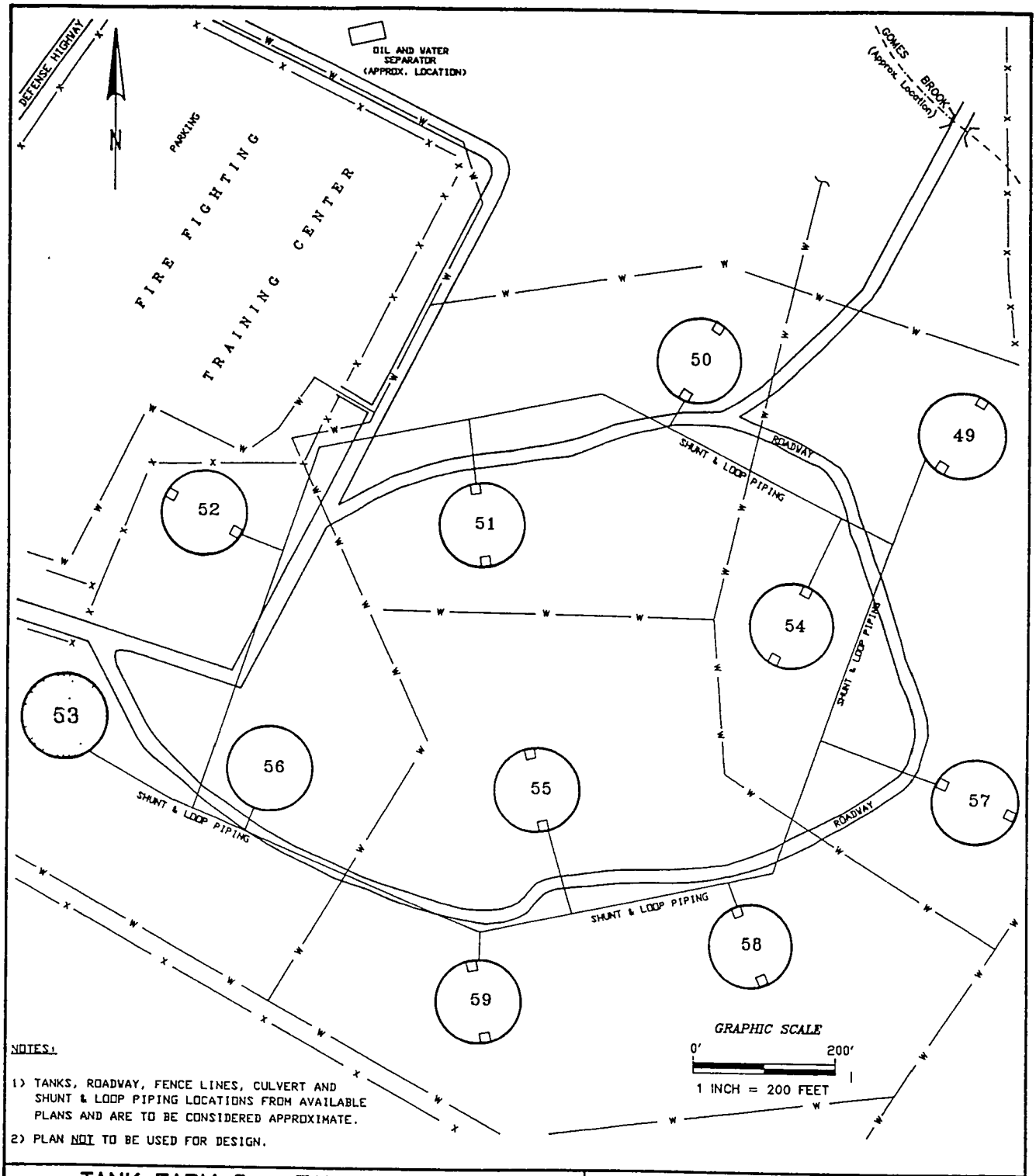


NETC LOCUS MAP			FIGURE 2-1
NETC – NEWPORT, RI			
TECHNICAL MEMORANDUM – SAMPLE ROUND 2			
DRAWN BY:	R.G. DEWSNAP	REV.:	0
CHECKED BY:	G.H. BULLARD	DATE:	JUNE 3, 1997
SCALE:		ACAD NAME:	DWG\NETC\TECHMEMO\ROUND_2\FIG2-1A

Brown & Root Environmental
A Division of Halliburton NUS Corporation
55 Jonspin Road Wilmington, MA 01887 (508)658-7899



SITE MAP		FIGURE 2–2
NETC – NEWPORT, RI		Brown & Root Environmental A Division of Halliburton NUS Corporation 55 Jonspin Road Wilmington, MA 01887 (508)658–7899
TECHNICAL MEMORANDUM – SAMPLE ROUND 1		
DRAWN BY: R.G. DEWSNAP	REV.: 0	
CHECKED BY: G.H. BULLARD	DATE: 18 MAR 97	
SCALE: APPROXIMATELY 1"=4800'	PROJECT NO: 7538 CTO #282	



NOTES:

1) TANKS, ROADWAY, FENCE LINES, CULVERT AND SHUNT & LOOP PIPING LOCATIONS FROM AVAILABLE PLANS AND ARE TO BE CONSIDERED APPROXIMATE.

2) PLAN NOT TO BE USED FOR DESIGN.

TANK FARM 5 – TANK 53 LOCATION			FIGURE 2–3
NETC – NEWPORT, RI			
TECHNICAL MEMORANDUM – SAMPLE ROUND 2			
DRAWN BY:	R.G. DEWSNAP	REV.:	0
CHECKED BY:	G.H. BULLARD	DATE:	JUNE 3, 1997
SCALE:	1" = 200'	ACAD NAME:	DWG\NETC\TECHMEMO\ROUND_2\FIG_2-3A

Brown & Root Environmental
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initiate an investigation to determine the extent of oil contamination in the area of Tanks 53 and 56. Studies to determine the extent of contamination (conducted in the Spring of 1990) determined the presence of petroleum hydrocarbons in both the soil and groundwater. Floating hydrocarbon product was observed in groundwater samples collected in the vicinity of Tank 53. Tank closure activities, including the removal of the contents of the tanks was completed in 1992.

Eighteen monitoring wells have been installed at the Tank Farm, six (6) in the vicinity of Tank 53 and two in the vicinity of Tank 56. Volatile Organic Compounds (VOCs), base neutral/acid extractable (BNA) compounds and inorganics were detected in the groundwater samples collected near Tanks 53 and 56. Petroleum-related VOCs were detected at levels exceeding Safe Drinking Water Act Maximum Contaminant Levels (MCLs) in the wells located near Tank 53 and petroleum product was observed in the two wells located in the ring drain. Semi-Volatile Organics (SVOCs) were detected in wells located near Tank 53, but MCLs were not exceeded. Inorganic concentrations exceeded MCLs in all wells, (including the background well), however, the highest concentrations were present in the samples collected in the central portion of the Site.

An Interim Record of Decision (ROD) was issued in September, 1992 which outlined the following components of the selected remedy for groundwater remediation;

- Groundwater extraction to contain contaminated ground water and prevent its migration and potential discharge to surface water bodies.

- Groundwater treatment using coagulation/filtration and UV oxidation to treat organic and inorganic contaminants.

- Discharge of treated groundwater to the local wastewater treatment facility (Newport Wastewater Treatment Facility).

- Continued groundwater monitoring to confirm the capture of contaminated ground water.

As part of the Interim Remedial Action the Navy elected to conduct a source removal action to address contaminated subsurface soils. Contaminated soils within the ring drain system were removed and disposed of off site from 1995 through 1996. The ring drain was re-constructed with clean stone and soils, the tank was ballasted with clean water and the pumping system was left out of operation.

3.0 CHRONOLOGY OF EVENTS

- The Interim ROD was issued in September, 1992.

- A Remedial Design Work Plan was submitted to the Northern Division Naval Facilities Engineering Command, Lester Pennsylvania, in January, 1993.
- Specifications for the Interim Remedial Action Tank Farm #5 and Tanks 53 & 56 were submitted January 25, 1993.
- An additional Site Investigation was conducted prior to the treatment facility construction to fill data gaps and to install additional observation wells.
- An Industrial Wastewater discharge Application was filed in April, 1993 with the City of Newport Pretreatment Program and approved in July, 1993.
- In July, 1993, the design for a groundwater extraction and treatment/containment system was completed, and all specifications were approved by the Navy.
- Construction of the system was completed in December, 1994.
- The system startup commenced on February 28, 1994.
- Source removal of soils around the ring drain was conducted from 1995-1996.
- Operation and Maintenance was performed by Zenone, Inc. Until December, 1996.
- In January, 1996, Foster Wheeler Environmental Corporation took over O/M at the Site.
- In December, 1996, the system was shutdown and currently remains out of operation.
- December 17-18, 1996 - Quarterly sampling of monitoring wells was conducted by Brown & Root Environmental.
- March 24-25, 1997 - Quarterly sampling of monitoring wells was conducted by Brown & Root Environmental.

4.0 PERFORMANCE STANDARDS

Performance standards (groundwater cleanup levels) established in the Interim ROD were developed from the results of the human health risk assessment conducted in 1991 for the Site.

CARCINOGENIC

Volatile Organics	Cleanup Level (ppb)	Basis
Benzene	5	MCL
Tetrachloroethene	5	MCL
Trichloroethene	5	MCL
Vinyl Chloride	2	MCL

Inorganics		
Arsenic	50	MCL
Beryllium	1	MCL
Lead	15	AL

MCL - Maximum Contaminant Level. National Primary Drinking Water Regulations, Final Rule Amendments to Safe Drinking Water Act (SDWA), U.S. EPA, Effective July, 1992.

AL - Action Level representative of drinking water quality at the tap. U.S. EPA, May 7, 1991.

NON-CARCINOGENIC

Volatile Organics	Cleanup Level (ppb)	Basis
cis-1,2-Dichloroethene	70	MCLG
trans-1,2-Dichloroethene	100	MCLG
1,1,1-Trichloroethane	200	MCLG
Inorganics		
Cadmium	5	MCLG
Chromium (Total)	100	MCLG
Manganese	3650	MCLG
Thallium	0.5	MCLG

MCLG - Maximum Contaminant Level Goal, based on health considerations only, Final Rule Amendments to SDWA, U.S. EPA, Effective July 1992.

The NPDES permit established the following Wastewater Discharge Limitations, applicable to the groundwater treatment system effluent;

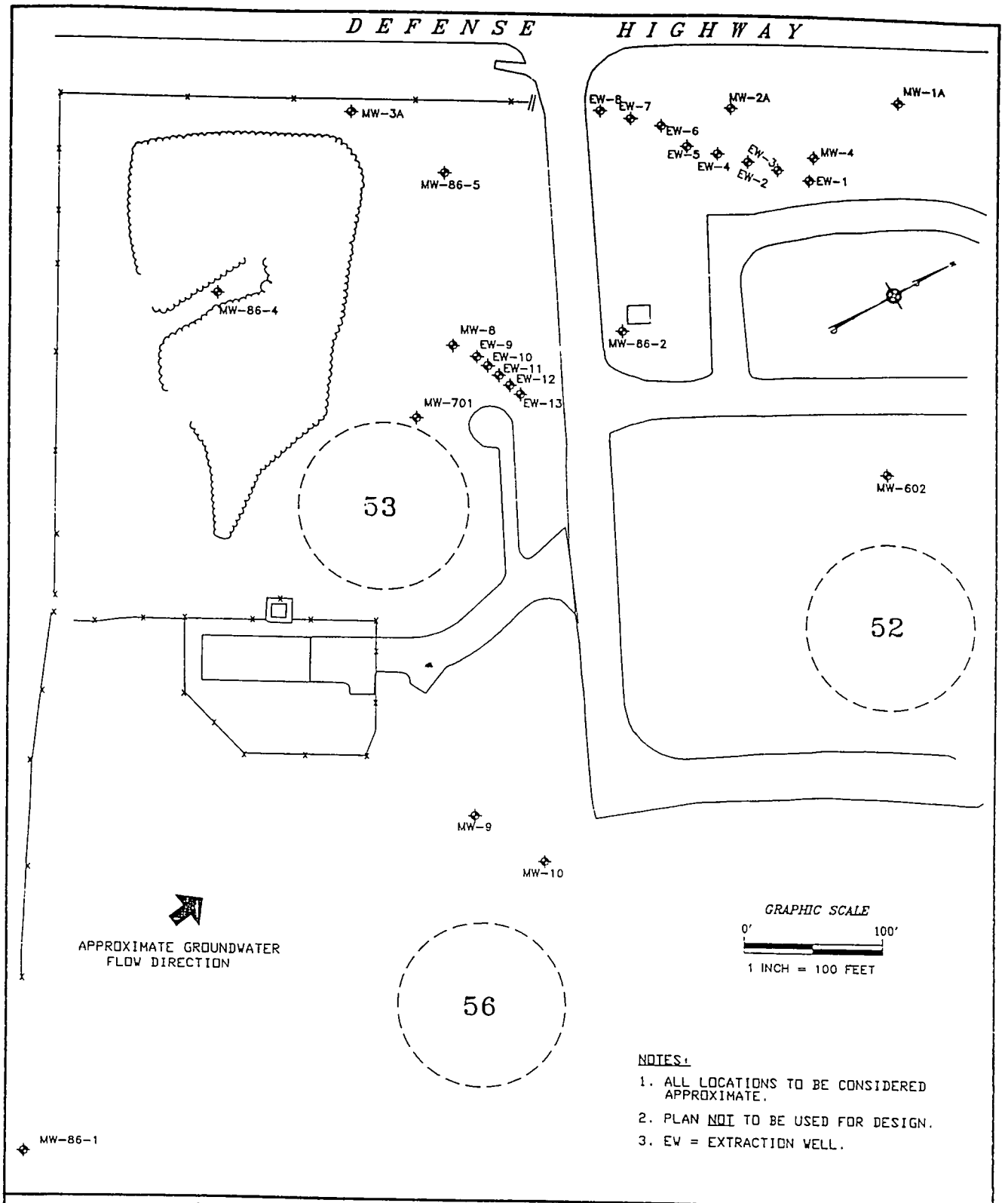
Constituent	Maximum Concentration in mg/L
Cadmium	0.8
Chromium (trivalent)	3.0
Chromium (hexavalent)	1.0
Copper	1.0
Lead	0.1
Nickel	3.0
Silver	3.0
Tin	0.0
Zinc	1.0
Cyanides	0.0
Sulfides (S-)	100.0
Sulfates (SO4-)	500.0
Floating oil	0.0
Mercury	0.5
Phenols (not to exceed)	1.0
Total Toxic Organics	2.0

The system operated in the following manner: groundwater from thirteen extraction wells (Figure 4-1) WAS pumped to the treatment building where the solids and dissolved metals are removed through pH adjustment, flocculation, clarification and filtration. The water is then treated via UV-Oxidation and Activated Carbon and discharged to the City of Newport Wastewater Treatment Facility. Sludge produced from the treatment chemicals can be treated via a filter press, however, the filter press was never used because not enough sludge was produced to warrant its operation.

Influent and effluent samples were collected each month and analyzed for Volatile Organic Compounds (VOCs) Method 624, Semi-Volatile Organic Compounds (SVOCs) Method 625, Pesticides / PCBs Method 508/608, Priority Pollutant Metals, Method 200 and general chemistry analyses including Biochemical Oxygen Demand (BOD), total phenols, Total Suspended Solids (TSS) and oil/ grease.

In addition, groundwater monitoring was conducted as part of the O/M of the system and included quarterly sampling of six monitoring wells for the chemical analyses of Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics and Total Petroleum Hydrocarbons (TPH). Analytical results of the influent, effluent and monitoring wells ranged from low concentrations (< 6 ppb) of organic contaminants, to non-detect in the first row of barrier extraction wells. No contaminants were detected in the perimeter barrier wells.

During the period of operation from January, 1995 through December, 1996, a total of seven rounds of quarterly sampling were conducted from selected monitoring wells. Results for the organic fractions in every round of sampling were below the established clean-up criteria with the exception of one result for benzene, which was detected at the 5 ug/L cleanup level once in monitoring well MW-7. This well was destroyed during the interim source removal action conducted in 1995 whereby the soils in the ring drain were removed. Consequently, further sampling from this data point could not be collected. Inorganics (lead and arsenic) exceeded the clean-up levels in some of the monitoring wells, however, the results reflect total inorganics as the samples were not filtered prior to analysis. In addition, the analytical results of influent water samples collected at the treatment facility were consistently below the cleanup levels for inorganics and organics. Results of the quarterly monitoring well samples and the monthly influent samples are presented in Table 4-1. The treatment system effluent was below the NPDES permit limits for every sample collected and were also below the cleanup levels established in the ROD. Monthly effluent data is presented in Table 4-2. Based on the analytical data generated during the operation of the treatment system and subsequent to the shutdown of the system, it appears that the removal action conducted by the Navy to remove the



WELL LOCATIONS			FIGURE -1
NETC - NEWPORT, RI			
TECHNICAL MEMORANDUM - SAMPLE ROUND 2			
DRAWN BY:	R.G. DEWSNAP	REV.:	0
CHECKED BY:	G. BULLARD	DATE:	JUNE 3, 1997
SCALE:	1" = 100'	ACAD NAME:	DWG\NETC\TECHMEMO\ROUND_2\FIG_3-1A

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TABLE 4-1
U. S. Navy Northern Division
RAC Contract - Delivery Order # 0009
NETC Tank Farm 5
Groundwater Treatment Facility
Analytical Results
Monitoring Well and Influent Samples

CARCINOGENIC	Cleanup Criteria ug/L	MW-2A 1/23/95 ug/L	MW-3A 1/23/95 ug/L	MW-4 1/23/95 ug/L	MW-1A 1/30/95 ug/L	MW-86-1 1/30/95 ug/L	MW-86-2 1/30/95 ug/L	MW-7 1/30/95 ug/L	INF 3/27/95 ug/L	INF 4/24/95 ug/L	INF 5/17/95 ug/L	INF 6/16/95 ug/L	MW-1A 7/7/95 ug/L	MW-2A 7/7/95 ug/L	MW-3A 7/7/95 ug/L	MW-86-1 7/7/95 ug/L	MW-86-2 7/7/95 ug/L	INF 7/12/95 ug/L	INF 8/2/95 ug/L
Volatile Organics																			
Benzene	5	< 1	< 1	< 1	< 1	< 1	< 1	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tetrachloroethene	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trichloroethene	5	2	< 1	3	< 1	< 1	3	2	3	2	2	< 1	< 1	2	< 1	< 1	2	2	2
Vinyl Chloride	2	< 1	< 1	< 1	< 1	< 1	< 1	3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Inorganics																			
Arsenic	50	47	30	280	7	71	59	56	< 4	< 4	< 4	< 4	< 4	< 4	8	17	5	< 4	< 4
Beryllium	1	2	1	2	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	1	2	1	1	1	1	< 1
Lead	15	59	74	122	5	13	60	72	1	1	2	2	3	26	89	15	23	1	< 1
NON CARCINOGENIC																			
Volatile Organics																			
1,1-Dichloroethane	----	< 1	< 1	< 1	< 1	< 1	5	17	8	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	4
cis-1,2-Dichloroethene	70	1	< 1	< 1	1	< 1	1 5	7	3.5	2	2.5	2.5	< 1	1	< 1	< 1	1	2	2
trans-1,2-Dichloroethene	100	1	< 1	< 1	1	< 1	1 5	7	3.5	2	2 5	2.5	< 1	1	< 1	< 1	1	2	2
1,1,1-Trichloroethane	200	< 1	< 1	< 1	1	< 1	2	3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Inorganics																			
Cadmium	5	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
Chromium (tot)	100	33	36	147	9	31	100	100	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9
Manganese	3650	1600	747	2580	903	2290	3280	5230	933	789	764	786	610	775	1950	762	847	907	949
Thallium	0.5	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2

NA - Not Analyzed < - Less than the quantitation limit.
Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year
The result for each isomer was reported at one-half the total value on this table
All samples were analyzed for full TCL Organics including Semi-Volatiles and Pesticides / PCB. Results for these analyses were consistently non-detect
Monitoring well samples collected in December, 1996 and March, 1997 were also analyzed for dissolved inorganics.
Analytical results for the dissolved inorganics were below the clean-up criteria.

TABLE 4-1
U. S Navy Northern Division
RAC Contract - Delivery Order # 0009
NETC Tank Farm 5
Groundwater Treatment Facility
Analytical Results
Monitoring Well and Influent Samples

CARCINOGENIC	Cleanup Criteria ug/L	INF 9/12/95 ug/L	MW-1A 10/10/95 ug/L	MW-2A 10/10/95 ug/L	MW-3A 10/910/95 ug/L	MW-4 10/10/95 ug/L	INF 11/20/95 ug/L	MW-1A 4/12/96 ug/L	MW-2A 4/12/96 ug/L	MW-3A 4/12/96 ug/L	MW-4 4/12/96 ug/L	MW-86-1 4/11/96 ug/L	MW-86-2 4/11/96 ug/L	INF 7/11/96 ug/L	MW-1A 7/10/96 ug/L	MW-2A 7/11/96 ug/L	MW-3A 7/10/96 ug/L	MW-4 7/10/96 ug/L
Volatile Organics																		
Benzene	5	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Tetrachloroethene	5	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Trichloroethene	5	< 1	< 1	2	< 1	3	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Vinyl Chloride	2	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Inorganics																		
Arsenic	50	< 4	< 4	< 4	< 4	NA	< 4	28	190	72	110	190	16	< 2	6 1	75	51	N/A
Beryllium	1	< 1	< 1	< 1	< 1	NA	NA	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	N/A
Lead	15	< 1	8	18	50	NA	2	14	110	85	14	43	11	4.5	7.1	55	86	N/A
NON CARCINOGENIC																		
Volatile Organics																		
1,1-Dichloroethane	----	3	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
cis-1,2-Dichloroethene	70	< 1	< 1	1	< 1	< 1	1.5	< 2.5	< 2.5	< 2.5	< 2 5	< 2.5	< 2.5	2 5	< 2 5	< 2.5	< 2 5	< 2.5
trans-1,2-Dichloroethene	100	< 1	< 1	1	< 1	< 1	1 5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2 5	2 5	< 2 5	< 2.5	< 2.5	< 2 5
1,1,1-Trichloroethane	200	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Inorganics																		
Cadmium	5	< 4	< 4	< 4	< 4	NA	< 4	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	9	6 8	N/A
Chromium (tot)	100	< 9	< 9	< 9	< 9	NA	< 9	26	20	71	42	52	< 10	< 10	< 10	43	41	N/A
Manganese	3650	901	886	312	1280	NA	596	98	1700	1500	260	1500	420	810	890	760	1600	N/A
Thallium	0.5	< 2	< 2	< 2	< 2	NA	< 2	< 10	< 10	< 10	< 10	< 10	< 10	< 2	< 2	< 2	< 2	N/A

NA - Not Analyzed < - Less than the quantitation limit
Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year
The result for each isomer was reported at one-half the total value on this table.
All samples were analyzed for full TCL Organics including Semi-Volatiles and Pesticides / PCB Results for these analyses were consistently non-detect
Monitoring well samples collected in December, 1996 and March, 1997 were also analyzed for dissolved inorganics.
Analytical results for the dissolved inorganics were below the clean-up criteria.

TABLE 4-1
U. S. Navy Northern Division
RAC Contract - Delivery Order # 0009
NETC Tank Farm 5
Groundwater Treatment Facility
Analytical Results
Monitoring Well and Influent Samples

CARCINOGENIC	Cleanup Criteria ug/L	MW-86-2 7/10/96 ug/L	INF 8/8/96 ug/L	INF 9/96 ug/L	INF 10/96 ug/L	MW-1A 10/4/96 ug/L	MW-2A 10/4/96 ug/L	MW-3A 10/4/96 ug/L	MW-4A 10/4/96 ug/L	MW-86-1 10/4/96 ug/L	MW-86-2 10/8/96 ug/L	INF 11/4/96 ug/L	GW-862 12/18/96 ug/L	EW-13 12/18/96 ug/L	EW-7 12/18/96 ug/L	MW-2A 12/18/96 ug/L	MW-8 12/18/96 ug/L	MW-861 12/18/96 ug/L	MW-864 12/18/96 ug/L
Volatile Organics																			
Benzene	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Tetrachloroethene	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Trichloroethene	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Vinyl Chloride	2	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Inorganics																			
Arsenic	50	29	2.6	4.3	4 4	14	90	35	250	26	170	6.7	18	11	< 4	18	< 4	28	14
Beryllium	1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Lead	15	14	< 2	4 3	< 2	7.4	64	44	63	10	42	2 9	9	< 5	< 5	8	< 5	1.5	11
NON CARCINOGENIC																			
Volatile Organics																			
1,1-Dichloroethane	---	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	8	< 5	< 5	< 5	< 5	< 5
cis-1,2-Dichloroethene	70	< 2 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	8	< 5	< 5	< 5	< 5	< 5
trans-1,2-Dichloroethene	100	< 2 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,1,1-Trichloroethane	200	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Inorganics																			
Cadmium	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Chromium (tot)	100	< 10	< 10	< 10	< 10	< 10	39	21	89	< 10	51	< 10	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Manganese	3650	1200	900	850	700	880	1100	920	2600	600	1800	540	140	1100	< 10	230	230	250	200
Thallium	0 5	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 5	< 5	< 5	< 5	< 5	< 5	< 5

NA - Not Analyzed < - Less than the quantitation limit.
Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year.
The result for each isomer was reported at one-half the total value on this table
All samples were analyzed for full TCL Organics including Semi-Volatiles and Pesticides / PCB. Results for these analyses were consistently non-detect.
Monitoring well samples collected in December, 1996 and March, 1997 were also analyzed for dissolved inorganics
Analytical results for the dissolved inorganics were below the clean-up criteria

TABLE 4-1
U. S Navy Northern Division
RAC Contract - Delivery Order # 0009
NETC Tank Farm 5
Groundwater Treatment Facility
Analytical Results
Monitoring Well and Influent Samples

	Cleanup Criteria ug/L	MW-3A 12/17/96 ug/L	MW-4 12/17/96 ug/L	MW-865 12/17/96 ug/L	MW-2A 3/24/97 ug/L	MW-4 3/24/97 ug/L	MW-701 3/24/97 ug/L	MW08 3/24/97 ug/L	MW865 3/24/97 ug/L	EW-13 3/25/97 ug/L	EW-7 3/25/97 ug/L	MW-3A 3/25/97 ug/L	MW861 3/25/97 ug/L	MW-862 3/25/97 ug/L	MW-864 3/25/97 ug/L
CARCINOGENIC															
Volatile Organics															
Benzene	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Tetrachloroethene	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Trichloroethene	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Vinyl Chloride	2	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Inorganics															
Arsenic	50	7	67	< 4	32	60	6	< 4	15	12	< 4	5	14	19	7
Beryllium	1	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Lead	15	8	13	< 5	17	9	< 5	< 5	10	< 5	< 5	< 5	< 5	7	< 5
NON CARCINOGENIC															
Volatile Organics															
1,1-Dichloroethane	---	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	6	< 5	< 5	< 5	< 5	< 5
cis-1,2-Dichloroethene	70	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	7	< 5	< 5	< 5	< 5	< 5
trans-1,2-Dichloroethene	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,1,1-Trichloroethane	200	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Inorganics															
Cadmium	5	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Chromium (tot)	100	< 20	< 20	< 20	50	20	< 20	< 20	< 20	< 20	90	< 20	< 20	< 20	< 20
Manganese	3650	9	160	100	270	180	2200	20	90	1000	40	80	190	860	110
Thallium	0.5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

NA - Not Analyzed < - Less than the quantitation limit
Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year
The result for each isomer was reported at one-half the total value on this table.
All samples were analyzed for full TCL Organics including Semi-Volatiles and Pesticides / PCB. Results for these analyses were consistently non-detect.
Monitoring well samples collected in December, 1996 and March, 1997 were also analyzed for dissolved inorganics.
Analytical results for the dissolved inorganics were below the clean-up criteria.

TABLE 4-2
U. S Navy Northern Division
RAC Contract - Delivery Order #0009
NETC Tank Farm 5
Groundwater Treatment Facility
Analytical Results
Monthly Effluent Samples

Analyte	NPDES Discharge Limit mg/L	EFF Jan. 19 1995 mg/L	EFF Feb 15 1995 mg/L	EFF Mar. 6 1995 mg/L	EFF Apr 24 1995 mg/L	EFF May 17 1995 mg/L	EFF Jun. 16 1995 mg/L	EFF Jul 12 1995 mg/L	EFF Aug. 2 1995 mg/L	EFF Sept 12 1995 mg/L	EFF Oct 17 1995 mg/L	EFF Nov. 20 1995 mg/L	EFF Jan 30 1996 mg/L	EFF Feb 23 1996 mg/L
Cadmium	0 8	<0 01	<0 01	<0.004	<0 004	<0.004	<0 004	<0 004	<0 004	<0.004	<0 004	<0.004	< 0 0050	< 0 0050
Cr +3	3 0	---	---	---	---	---	---	---	---	---	---	---	---	---
Cr +6	1 0	---	---	---	<0 005	<0 005	<0.005	< 0.005	< 0 005	< 0.005	< 0.005	< 0.005	< 0.015	0.01
Copper	1.0	<0 05	<0 05	0.004	<0 003	0 003	<0.003	<0 003	<0 003	<0 003	<0.003	<0 003	< 0 010	< 0.010
Lead	0 1	<0 04	<0 04	0 002	0 001	< 0 001	0 002	0 006	< 0 001	0 005	0 002	0 002	< 0.0020	0 002
Nickel	3.0	<0 02	<0.02	< 0 03	0 04	0 04	< 0 03	<0.03	<0 03	<0 03	<0 03	0 03	0 05	< 0.040
Silver	3.0	<0 02	<0.02	<0 004	<0 004	<0 004	<0.004	< 0.004	< 0 004	< 0 004	< 0.004	< 0.004	< 0 010	< 0.010
Tin	0 0	---	<0 01	< 0.03	<0 02	<0 02	<0.02	<0 02	<0 02	<0 02	<0.02	---	0.02	< 0 10
Zinc	1 0	<0 02	<0 02	0 043	0 025	0 027	0 011	0 016	0 015	0 008	0 009	0.018	0.037	0 034
Cyanide	0 0	<0 01	<0 01	<0 01	<0.01	<0 01	<0 01	<0.01	<0 01	<0 01	<0 01	<0.01	<0 010	<0.010
Sulfides	100 0	---	---	---	<0 01	0 03	0.01	< 0 01	0 13	< 0.01	< 0 01	0.02	< 1.0	< 1 0
Sulfates	500 0	---	---	---	36.9	37.4	42.0	45 6	45 6	42 1	---	360	42 8	40 8
Floating Oil	0 0	---	---	ND	ND	NA	ND	ND	ND	ND	ND	ND	---	ND
Mercury	0 5	<0 0005	<0 0005	<0.0002	<0 0002	<0 0002	<0 0002	<0 0002	<0 0002	<0 0002	<0.0002	<0.0002	< 0.00020	< 0 00020
Phenol	1.0	<0.01	0 015	0.02	<0 05	<0 05	<0 05	<0.05	<0 05	<0.05	<0.05	<0 05	< 0.010	< 0.010
TTO	2.0	0 001	0.003	< 0.001	< 0.001	0.001	< 0.001	< 0 001	< 0 001	0 002	0.002	0.002	ND	ND

Notes: < - Less than the quantitation limit. --- - Not Analyzed
TTO - Total Toxic Organics ND - Not Detected at the method detection limit,
Biochemical Oxygen Demand analyses were conducted on the effluent weekly. Results were consistenly below 5 mg/L
mg/L - Milligrams per Liter, or parts per million, ppm

TABLE 4-2
U S Navy Northern Division
RAC Contract - Delivery Order #0009
NETC Tank Farm 5
Groundwater Treatment Facility
Analytical Results
Monthly Effluent Samples

Analyte	EFF Mar. 12 1996 mg/L	EFF Apr 01 1996 mg/L	EFF Jun 12 1996 mg/L	EFF Jul. 11 1996 mg/L	EFF Aug. 8 1996 mg/L	EFF Sept. 5 1996 mg/L	EFF Oct 3 1996 mg/L	EFF Nov 4 1996 mg/L
Cadmium	< 0 0050	< 0 0050	< 0 0050	< 0 0050	< 0 0050	< 0.0050	< 0.0050	< 0.0050
Cr +3	---	---	---	---	---	---	---	
Cr +6	< 0 015	< 0 015	< 0.015	< 0 015	< 0 015	< 0.015	< 0 015	< 0 015
Copper	< 0 010	< 0 010	0 012	< 0.010	0.012	0 05	< 0 010	< 0 010
Lead	< 0 0020	< 0 0020	< 0 0020	< 0 0020	< 0 0020	0.0042	0 013	< 0 0020
Nickel	< 0 040	0 062	< 0 040	< 0 040	< 0.040	< 0 040	< 0 040	< 0 040
Silver	< 0.010	< 0.010	< 0 010	< 0.010	< 0.010	< 0.010	< 0.010	< 0 010
Tin	< 0 10	< 0 10	< 0 10	< 0 25	< 0.10	< 0 25	< 0 25	< 0 25
Zinc	0 035	0 045	0 039	< 0 020	0 056	< 0 020	0 025	< 0 020
Cyanide	<0.010	<0.010	<0 010	<0 010	<0 010	<0 010	<0 010	<0 010
Sulfides	< 1 0	< 1 0	< 1 0	< 1 0	---	< 1 0	< 1 0	< 1 0
Sulfates	66	8.4	32	37 5	37	36	34	30
Floating Oil	ND	ND	ND		---	---	---	
Mercury	< 0.00020	< 0.00020	< 0 00020	< 0 00020	< 0 00020	< 0.00020	< 0 00020	< 0 00020
Phenol	< 0 010	< 0 010	0.014	0 064	< 0 010	< 0.010	< 0 010	< 0.010
TTO	ND	ND	ND		ND	0 018	ND	ND

Notes < - Less than the quantitation limit --- - Not Analyzed
TTO - Total Toxic Organics ND - Not Detected at the method detection limit,
Biochemical Oxygen Demand analyses were conducted on the effluent weekly. Results were consistenly below 5 mg/L
mg/L - Milligrams per Liter, or parts per million, ppm.

contaminated soils in the ring drain has effectively removed the source of the contamination. Because the performance standards were being consistently met, the system was shutdown in December 1996. Analytical results of two rounds of quarterly sampling conducted subsequent to the system shutdown indicated no positive results exceeding clean-up criteria.

5.0 SYSTEM OPERATION QUALITY ASSURANCE / QUALITY CONTROL

The treatment system was designed to be primarily self-operating. The daily task requirements of the treatment system operator consisted of monitoring and maintenance procedures, typically taking three hours per day. These tasks are discussed below.

The following QA/ QC procedures are outlined in the O/M Manual for the system operation; The system operator maintained a log of activities, including the daily, weekly and monthly activities. Inspection Forms were maintained including the Daily System Inspection Form which recorded the on-site analysis of metals from the influent, clarifier effluent, pressure filter effluent and the GAC effluent. Total daily flow was recorded as well as the average flow rate in gallons per minute (gpm). A record of chemical usage, including sodium hydroxide, sulfuric acid, flocculant and coagulant was included in the Inspection Form and pressure readings from the compressor, filter press, UV Oxidation system were taken. Flow measurements from the thirteen extraction wells were additionally recorded. Equipment logs were maintained and checked for the scheduling of periodic maintenance to the compressor, filter press, air filter and UV lamp.

In addition to the QA/QC procedures for the operation of the groundwater treatment facility, QA/QC procedures were developed for sampling and routine monitoring. Groundwater sampling was conducted from seven monitoring wells selected by the contracting officer. Quarterly sampling was originally scheduled to commence three months after the system start-up, however, the sampling schedule was moved ahead three months (at the request of the Contraction Officer) to provide data prior to the system start-up. The volume of water in the well was determined prior to sampling. Three well volumes of groundwater was removed from each well before a sample was obtained. Groundwater samples were collected with the bailer used to purge the well and transferred into appropriate sample containers provided by the laboratory. Samples were immediately labeled with the location, date, time, sample method, name of sampler, and sample identification. Samples were preserved as required by the approved methods. Bailers and other sampling equipment was subjected to the following decontamination procedures; the bailers were scrubbed with a brush in soapy water, rinsed with clean water and then sprayed with methanol and finally rinsed with deionized water. Treatment System samples were collected from sample ports located in the treatment building and dispensed directly into the sample containers provided by the laboratory. The following QC samples were prepared for the quarterly groundwater sampling and the treatment system samples;

1. One trip blank
2. One Matrix Spike Duplicate (MSD)
3. One MSD blank
4. One sampling equipment blank (for groundwater sampling only)
5. Two duplicate samples

6.0 TREATMENT FACILITY ACTIVITIES

Construction of the Groundwater Treatment Facility at NETC was completed in December, 1994. The system began operation on February 28, 1995. Discharge to the City of Newport Wastewater Treatment Facility and sample collection began in April, 1995, approximately one month after system operation started. Approximately 6,208,500 gallons were treated in 1995 and approximately 5,157,700 gallons were treated in 1996. Average discharge flow rates ranged from 13 - 20 gpm (gallons per minute). Insufficient sludge was collected in the sludge thickener tank to ever warrant operation of the filter press. Effluent samples were analyzed for pH on a daily basis as required by a change order to the contract which was approved on January 18, 1995. These analyses were added, as well as weekly analysis for Biochemical Oxygen Demand (BOD), to satisfy the requirements of the City of Newport's sewer treatment plant. Results for these analyses consistently met the requirements established by the City of Newport Pretreatment Program.

Due to ongoing operations conducted by contractors, monitoring well MW-7, which had previously demonstrated trace levels of oil contamination, was destroyed. During one round of quarterly sampling, monitoring well MW-4 contained insufficient groundwater to sample. A shutdown occurred in May 1996 to remove iron fouling that was causing operational problems.

The following Agencies and contractors participated in the Remedial Action of the NETC Tank Farm #5 Site;

U.S. Navy

Naval Facilities Engineering Command
10 Industrial Highway
Mail Stop #82
Lester, PA 19113-2090
(215) 595-0567
Mr. James Briggs, P.E.., Design Manager
Mr. Francisco LaGreca, P.E., Engineer-In-Charge

Naval Education and Training Center
Building 1, Public works Department
Newport, RI 02841
(401) 841-3735

Ms. Rachel Marino, Environmental Coordinator

TRC-EC - Remedial Design

5 Waterside Crossing
Windsor, CT 06095
(203) 289-8631
Mr. Robert Smith, P.E., Program Manager
Mr. Carl Stopper, P.E., Project Manager
Mr. James Peronto, P.E., Technical Manager
Mr. Ronald Nault, P.E., Project Engineer

Zenone, Inc. - Groundwater Treatment Facility Construction and Operation
91 Providence Highway
Westwood, MA

Foster Wheeler Environmental Corp. - Operation and Maintenance
One Oxford Valley Suite 200
Langhorne, PA 19047
(215) 702-4000
Mr. Daniel Kopcow, P.E., Project Manager

Rhode Island DEM

291 Promenade Street
Providence, RI 02908
(401)277-2797
Mr. Jeffrey Crawford, Mr. Paul Kulpa
Ms. Cynthia Signore

U. S. EPA

Region I
Federal Facilities Section
90 Canal Street, 2nd Floor
Boston, MA 02203
(617) 573-5764
Mr. Carol Deating, Remedial Project Manager

7.0 FINAL INSPECTION

A final inspection prior to the shutdown of the system was not conducted since a review of the analytical data was the primary factor to determine that the performance standards were met. Two rounds of groundwater sampling have been conducted at the site since the December, 1996 shutdown. Analytical results of these samples indicated that all clean-up criteria has been met.

8.0 CERTIFICATION THAT REMEDY IS OPERATIONAL AND FUNCTIONAL

All work performed at the NETC Groundwater Treatment Facility was conducted within the design specifications. The system remained operational and functional throughout the period with the exception of a shutdown in May, 1996 during which iron removal was conducted because iron fouling was interfering with the system operation. Performance standards were achieved and can be documented via analytical results that are clearly below cleanup criteria and discharge limitations.

9.0 OPERATION AND MAINTENANCE

During the first six months of operation, a "Preliminary Operation and Maintenance Plan" was utilized for the operation of the system. Based on the experience gained during these first six months, the final Operation and Maintenance Manual was prepared in August, 1995. Daily, weekly, monthly, quarterly and annual tasks are outlined in the O/M Manual including on-site chemical analyses, data recording, physical inspection of the system, filter press operations, sampling schedules and procedures for laboratory analyses, flow data records, treatment chemicals maintenance and groundwater elevation measurements. Selections of the manual which were based on direct experience from the first six months of operations were underlined. A troubleshooting section was developed for potential operating problems.

10.0 SUMMARY OF PROJECT COSTS

The following table summarizes the estimated project costs;

TASK	*ACTUAL COST*	*ORIGINAL COST ESTIMATE*
Design	$ 280,000	
Construction	$ 1,450,780	
Post Constuction Award Services	$ 52,250	
O & M (2 years)	$ 406,150	

DO 11

FOSTER WHEELER ENVIRONMENTAL CORPORATION

One Oxford Valley, Suite 200
Langhorne, Pennsylvania 19047
(215) 702-4000 *FAX (215) 702-4045

Facsimile Transmittal

To: JOHN Mc GRAFTH	Date: JULY 30 1997
From: MEG WATSON	Recipient's Fax #: (610) 595-0554
Pages: 5 (includes cover sheet)	Charge # 1284.0011.9909

Message: * Urgent * For Your Review * Reply ASAP * Please Comment

RE: NETL DRAFT SITE CLOSE-OUT REPORT

PLEASE REPLACE TABLE 4-1 WITH THE FOLLOWING UPDATED TABLE. INCLUDED ARE MORE QUARTERLY SAMPLING RESULTS AS WELL AS THE 12/96 BROWN + ROOT DATA. 3/97 DATA HAS BEEN REQUESTED, IT WAS NOT AVAILABLE DURING THE FILE SEARCH. WHEN THIS DATA IS AVAILABLE, IT WILL BE INCLUDED AND FAXED.

ANY QUESTIONS PLEASE CALL ME AT 215 702 4039

We offer a full range of environmental services to complement our capabilities as a full-service contractor. These services include:

Hazardous Waste Services
- Risk-Based Management Services
- Remediation Services
- Remedial Design
- Assessments and Investigations
- Operations and Maintenance
- Waste Management

Consulting and Engineering Services
- Regulatory Compliance and Permitting
- Natural Resource Management
- Air, Water and Wastewater Engineering
- Ecological/Geoscience Services
- Economic, Social and Cultural Services
- Occupational Safety and Health

Our mission is to conduct a global business directed toward cleaning up and protecting the environment while facilitating economic growth, and to do so in a safe, compliant, cost-effective manner. Of paramount importance to us is providing Client Service Quality which translates to responsiveness and best value.

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CD97#4/97155

TABLE 4-1
NETC TANK FARM 5
GROUNDWATER TREATMENT FACILITY
ANALYTICAL RESULTS
MONITORING WELL AND INFLUENT SAMPLES

CARCINOGENIC	Cleanup Criteria ug/L	MW-2A 1/23/95 ug/L	MW-3A 1/23/95 ug/L	MW-4 1/23/95 ug/L	MW-1A 1/30/95 ug/L	MW-86-1 1/30/95 ug/L	MW-86-2 1/30/95 ug/L	MW-7 1/30/95 ug/L	INF 3/27/95 ug/L	INF 4/24/95 ug/L	INF 5/17/95 ug/L	INF 6/16/95 ug/L	MW-1A 7/7/95 ug/L	MW-2A 7/7/95 ug/L	MW-3A 7/7/95 ug/L	MW-86-1 7/7/95 ug/L	MW-86-2 7/7/95 ug/L	INF 7/12/95 ug/L
Volatile Organics																		
Benz ne	5	< 1	< 1	< 1	< 1	< 1	< 1	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tetrachloroeth ne	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	< 1	< 1	< 1	< 1	< 1	< 1
Trichloroethene	5	2	< 1	3	< 1	< 1	3	2	3	2	2	< 1	< 1	2	< 1	< 1	2	2
Vinyl Chlorid	2	< 1	< 1	< 1	< 1	< 1	< 1	3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Inorganics																		
Ars nic	50	47	30	280	7	71	59	58	< 4	< 4	< 4	< 4	< 4	< 4	8	17	5	< 4
Beryllium	1	2	1	2	< 1	< 1	< 1	1	< 1	< 1	< 1	< 1	1	2	1	1	1	1
Lead	15	59	74	122	5	13	60	72	1	1	2	2	3	26	89	15	23	1
NON CARCINOGENIC																		
Volatile Organics																		
1,1-Dichloroethane	---	< 1	< 1	< 1	< 1	< 1	5	17	8	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
cis-1,2-Dichloroethaene	70	1	< 1	< 1	1	< 1	1 5	7	3.5	2	2 5	2.5	< 1	1	< 1	< 1	1	2
trans-1,2-Dichloroethene	100	1	< 1	< 1	1	< 1	1.5	7	3.5	2	2.5	2.5	< 1	1	< 1	< 1	1	2
1,1,1-Trichloro thane	200	< 1	< 1	< 1	1	< 1	2	3	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Inorganics																		
Cadmium	5	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4
Chromium (tot)	100	33	36	147	9	31	100	100	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9	< 9
Manganese	3650	1600	747	2580	903	2290	3280	5230	933	789	764	786	610	775	1950	762	847	907
Thallium	0 5	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2

Notes:

Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year.
The result for each isomer was reported at one-half the total value on this table.
NA - Not Analyzed

TABLE 4-1
NETC TANK FARM 5
GROUNDWATER TREATMENT FACILITY
ANALYTICAL RESULTS
MONITORING WELL AND INFLUENT SAMPLES

CARCINOGENIC	Cleanup Criteria ug/L	INF 8/2/95 ug/L	INF 9/12/95 ug/L	MW-1A 10/10/95 ug/L	MW-2A 10/10/95 ug/L	MW-3A 10/910/95 ug/L	MW-4 10/10/95 ug/L	INF 11/20/95 ug/L	INF 3/12/96 ug/L	INF 6/12/96 ug/L	MW-1A 7/10/96 ug/L	MW-2A 7/11/96 ug/L	MW-3A 7/10/96 ug/L	MW-88-2 7/10/96 ug/L	MW-4 7/10/96 ug/L	INF 7/11/96 ug/L	INF 8/8/96 ug/L
Volatile Organics																	
Benzene	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Tetrachl roeth ne	5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Trichloroethene	5	2	< 1	< 1	2	< 1	3	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Vinyl Chloride	2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Inorganics																	
Arsenic	50	< 4	< 4	< 4	< 4	< 4	NA	< 4	< 10	< 2	6 1	75	51	29	NA	< 2	2 6
Beryllium	1	< 1	< 1	< 1	< 1	< 1	NA	NA	< 5	< 5	< 5	< 5	< 5	< 5	NA	< 5	< 5
Lead	15	< 1	< 1	8	18	50	NA	2	< 10	< 10	7.1	55	86	14	NA	4 5	< 2
NON CARCINOGENIC																	
Volatile Organics																	
1,1-Dichloroethane	—	4	3	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
cis-1,2-Dichloroethaene	70	2	< 1	< 1	1	< 1	< 1	1.5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	2.5	< 5
trans-1,2-Dichloroethene	100	2	< 1	< 1	1	< 1	< 1	1.5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	2.5	< 5
1,1,1-Trichloroethane	200	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Inorganics																	
Cadmium	5	< 4	< 4	< 4	< 4	< 4	NA	< 4	< 5	< 5	< 5	9	< 5	< 5	NA	< 5	< 5
Chromium (tot)	100	< 9	< 9	< 9	< 9	< 9	NA	< 9	< 10	< 10	< 10	43	41	< 10	NA	< 10	< 10
Manganes	3650	949	901	886	312	1280	NA	596	580	760	890	760	1600	1200	NA	810	900
Thallium	0.5	< 2	< 2	< 2	< 2	< 2	NA	< 2	< 10	< 10	< 2	< 2	< 2	< 2	NA	< 2	< 2

Notes:

Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year.
The result for each isomer was reported at one-half the total value on this table.
NA - Not Analyzed

TABLE 4-1
NETC TANK FARM 5
GROUNDWATER TREATMENT FACILITY
ANALYTICAL RESULTS
MONITORING WELL AND INFLUENT SAMPLES

CARCINOGENIC	Cleanup Criteria ug/L	INF 9/96 ug/L	INF 10/96 ug/L	MW-1A 10/4/96 ug/L	MW-2A 10/4/96 ug/L	MW-3A 10/4/96 ug/L	MW-4A 10/4/96 ug/L	MW-86-1 10/4/96 ug/L	MW-86-2 10/8/96 ug/L	INF 11/4/96 ug/L	MW-86-1 12/18/96 ug/L	MW-86-2 12/18/96 ug/L	MW-86-4 12/18/96 ug/L	MW-86-5 12/17/96 ug/L	MW-2A 12/18/96 ug/L	MW-3A 12/17//96 ug/L	MW-4 12/17//96 ug/L
Volatile Organics																	
Benz ne	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Tetrachloroethene	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Trichlor eth ne	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Vinyl Chlorid	2	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Inorganics																	
Ars nic	50	4.3	4.4	14	90	35	250	26	170	6.7	28	18	14	< 4	< 4	7	67
Beryllium	1	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	10	< 10	< 10	< 10	< 10	< 10
Lead	15	4 3	< 2	7.4	64	44	63	10	42	2.9	1 5	9	11	< 5	< 5	8	13
NON CARCINOGENIC																	
Volatil Organics																	
1,1-Dichloroethane	—	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
cis-1,2-Dichloroethaene	70	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
trans-1,2-Dichloroethene	100	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
1,1,1-Trichloro thane	200	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Inorganics																	
Cadmium	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Chromium (tot)	100	< 10	< 10	< 10	39	21	89	< 10	51	< 10	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Manganes	3650	850	700	880	1100	920	2600	600	1800	540	250	350	200	10	< 10	90	160
Thallium	0.5	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Notes: Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year.
The result for each isomer was reported at one-half the total value on this table.
NA - Not Analyzed

TABLE 4-1
NETC TANK FARM 5
GROUNDWATER TREATMENT FACILITY
ANALYTICAL RESULTS
MONITORING WELL AND INFLUENT SAMPLES

CARCINOGENIC	Cleanup Criteria ug/L	MW-8 12/18/96 ug/L	EW-7 12/19/96 ug/L	EW-13 12/19/96 ug/L
Volatile Organics				
Benzene	5	< 5	< 5	< 5
Tetrachloroethene	5	< 5	< 5	< 5
Trichloroethene	5	< 5	< 5	< 5
Vinyl Chlorid	2	< 10	< 10	< 10
Inorganics				
Arsenic	50	6	< 4	11
Beryllium	1	< 10	< 10	< 10
Lead	15	< 5	< 5	< 5
NON CARCINOGENIC				
Volatile Organics				
1,1-Dichloroethane	—	< 5	< 5	7
cis-1,2-Dichloroethaene	70	< 5	< 5	8
trans-1,2-Dichloroethene	100	< 5	< 5	< 5
1,1,1-Trichloroethane	200	< 5	< 5	< 5
Inorganics				
Cadmium	5	< 10	< 10	< 10
Chromium (tot)	100	< 20	< 20	< 20
Manganese	3650	230	< 10	1100
Thallium	0.5	< 5	< 5	< 5

Notes Results for cis-1,2-DCE and trans-1,2-DCE were reported together as total 1,2-DCE during the 1995 calendar year.
The result for each isomer was reported at one-half the total value on this table.
NA - Not Analyzed

FOSTER WHEELER ENVIRONMENTAL CORPORATION

June 24, 1996
File #: 1284-0011.96.0369

Commanding Officer, Naval Facilities
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, PA 19113
ATTN: Paul Briegel (Code 402A)

Subject: US NAVY CONTRACT NO. N62472-94-D-0398
NAVAL EDUCATION AND TRAINING CENTER (NETC)
NEWPORT, RHODE ISLAND
DELIVERY ORDER #0011 - DRAFT SITE HEALTH AND SAFETY PLAN
RESPONSE TO COMMENTS

Dear Mr. Briegel:

We have reviewed the Navy comments, provided by NEHC, regarding the draft Site Health and Safety Plan (SHSP) for the subject project. Their comments and our responses are presented below.

Specific Comments:

Page 1, Section 1.0, "Introduction":

1. COMMENT:

(a) The second and third sentence of Section 1.1, "Purpose," state, "This SHSP takes into account the specific hazards inherent to the NETC-Newport and presents procedures to be followed by Foster Wheeler Environment Corporation, its subcontractors, and all other on-site personnel..."

(b) The third bullet of Section 1.3, "Application," states, "This Addendum applies to all personnel in the above tasks who wish to gain access to active work areas, including but not limited to: Foster Wheeler Environmental employees and subcontractors."

Recommendation: We recommend that each subcontractor, as a minimum, provide their own "task-specific" hazard analysis.

RESPONSE: FWENC provides subcontractors with a copy of the SHSP to review and offer comments. Their insight is welcome and comments, if applicable, are included in the final SHSP.

Page 10, Section 4.3.2, "Noise":

2. COMMENT: The second sentence states, "Suspected high noise areas will be evaluated by the CTES to determine if wearing of protective devices is warranted." Information stating how sound pressure levels will be quantified is not provided.

Recommendation: Provide information stating how sound pressure levels will be determined.

NV/96-194

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TEL: 215-702-4000 FAX: 215-702-4045

RESPONSE: All FWENC employees receive an audiogram as part of their medical examination. Protective devices will be worn when working around any noise generating equipment. See section 4.3.2 for revision.

Page 13, Table 7-1, "Frequency and Location of Air Monitoring":

3. COMMENT: A requirement for pre-entry, perimeter, or dust monitoring is not provided.
Recommendation: Include these monitoring requirements or provide a rationale for not doing so in the final SHSP.

RESPONSE: See section 4.1 in the final SHSP.

Page 18, Section 8.2.2, "Heavy Equipment Decontamination":

4. COMMENT: Information stating what PPE personnel will use when performing heavy equipment decontamination is not provided. Additionally, a site-specific task hazard analysis for decontaminating heavy equipment is not provided.
Recommendation: Provide a task hazard analysis that provides site-specific guidance for those personnel performing equipment decontamination operations.

RESPONSE: Information relative to equipment decontamination was provided in the original SHSP submittal as part of the Activity Hazard Analysis - "Equipment Decontamination".

Page 24, Table 12-1, "Emergency Telephone Numbers":

5. COMMENT: The telephone number provided for the Newport Hospital is not "in-service" and a local poison control center is not listed.
Recommendation: Provide all appropriate emergency telephone numbers and verify them prior to starting site work.

RESPONSE: Phone numbers were corrected and verified in the final SHSP.

Page 25, Figure 12-1, "Hospital Location Map":

6. COMMENT: The Navy medical facility's location is not shown on the map.
Recommendation: Include directions to the Navy medical facility in the final SHSP.

RESPONSE: All medical emergency cases will be transported to Newport Hospital.

Page 30, Section 13.6, "First Aid and CPR":

7. COMMENTS: The first sentence states, "The CTES will identify those individuals requiring first-aid and CPR training in order to ensure that emergency medical treatment is available during field activities."
Recommendation: We recommend that a minimum of two personnel, trained and certified in adult first-aid/CPR and bloodborne pathogens be on-site during periods of operations.

RESPONSE: Due to the nature of this activity (intermittent staffing for pilot operation) and the proximity of other FWENC and non-FWENC personnel, one person will be trained in first aid/CPR.

Page 30, Section 14.3, "On-Site Log":

8. COMMENTS: The sentence states, "A log of personnel on-site each day will kept by the CTES."
Recommendation: Clearly state that all on-site workers will log-in to and log-out from the EZ/CRZ daily.

RESPONSE: Recommendation included in the final SHSP.

Appendix C, Activity Hazard Analysis, for "Subsurface Soil Sampling During Pilot Operations":

9. COMMENTS: In the third column, under "Protective Measures/Controls," Item No. 1 states that air monitoring will be performed with a PID. Earlier in the document monitoring by a FID was specified.
Recommendation: Clearly and consistently state what instrumentation will be utilized at this site in the final SHSP.

RESPONSE: The FID will be utilized for this project. The SHSP was revised to reflect this change.

If you have any questions regarding the above, please do not hesitate to call me at 215-702-4016.

Very truly yours,

Arthur Holcomb
Program Manager

ABH/eh

cc: A. Aziz, FWENC
J. Biswurm, FWENC
G. Coppi, FWENC
D. McCarron, Boston

U.S. NAVY NORTHERN DIVISION
REMEDIAL ACTION CONTRACT (RAC)
CONTRACT NO. N62472-94-D-0398
DELIVERY ORDER NO. 0011

SITE HEALTH AND SAFETY PLAN FOR PILOT-SCALE BIOREMEDIATION OF TANK 50

TANK FARM NO. 5 REMEDIAL ACTIONS
NAVAL EDUCATION AND TRAINING CENTER (NETC)
NEWPORT, RHODE ISLAND

June 1996

Prepared by

Foster Wheeler Environmental Corporation
470 Atlantic Avenue
Boston, Massachusetts 02210

Revision	Date	Prepared by	Approved by	Pages Affected
0	6/4/96	P. Sunkara/M Dippre	D. McCarron	All

ND96-070
6/4/96

SITE HEALTH AND SAFETY PLAN

Site:	**NAVAL EDUCATION AND TRAINING CENTER**
Location:	**NEWPORT, RHODE ISLAND**
Prepared By:	**FOSTER WHEELER ENVIRONMENTAL CORPORATION**
Date Prepared:	**June 4, 1996**
Revision:	**0**
Project Description:	**BENCH AND PILOT-SCALE BIOREMEDIATION OF Tank Farm No. 5**
Delivery Order #:	**11, Modification 4**
Waste types:	**Solids, Liquids**
Constituents	**Polynuclear Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH)**
Characteristics:	**Semi-Volatile**
Status:	**Abandoned Military Installation**
Overall Hazard:	**Low**

FOSTER WHEELER ENVIRONMENTAL CORPORATION (FOSTER WHEELER ENVIRONMENTAL), FOSTER WHEELER ENVIRONMENTAL SUBCONTRACTORS, AND FOSTER WHEELER ENVIRONMENTAL'S CLIENT DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

APPROVALS

By their signature, the undersigned hereby certify that this SHSP has been reviewed and approved for use at Tank 50 located in Tank Farm No. 5 at the Naval Education and Training Center, Newport, Rhode Island (NETC-Newport).

DAVID McCARRON PROJECT MANAGER/ENGINEER	DATE
GREY COPPI PROJECT HEALTH AND SAFETY MANAGER	DATE
MARC DIPPRE CROSS TRAINED ENGINEER/SCIENTIST	DATE

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1.0 INTRODUCTION

1.1 Purpose

This Site Health and Safety Plan (SHSP) addresses the health and safety practices that will be employed by all site workers participating in activities at Tank 50 located in Tank Farm No. 5 (the Site) at the Naval Education and Training Center in Newport, Rhode Island (NETC-Newport). The SHSP takes into account the specific hazards inherent to the NETC-Newport site and presents procedures to be followed by Foster Wheeler Environmental Corporation (Foster Wheeler Environmental), its subcontractors, and all other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. Activities performed under this SHSP will comply with applicable parts of USACOE Manual EM 385-1-1, OSHA Regulations 29 CFR Parts 1910 and 1926, and the Foster Wheeler Environmental Health and Safety Program Manual. Many programs from the manual are referenced in this SHSP but are not included. A copy of the manual will be maintained at the Site. Modifications to the SHSP may be made with the approval of the project health and safety manager (PHSM) using the Field Change Request Form found in Appendix A.

1.2 Scope

This SHSP has been developed to address health and safety concerns during the Pilot-Scale Bioremediation at Tank 50 (Figure 1-1). This section of the SHSP provides a summary of the activities performed as part of and associated with remedial activities. The activities are further detailed in the Tank 50, Tank Farm No. 5 Remedial Actions Work Plan (Work Plan). A copy of the Work Plan will be maintained on-site at the water treatment plant located at Tank Farm No. 5.

The SHSP addresses the following activities:

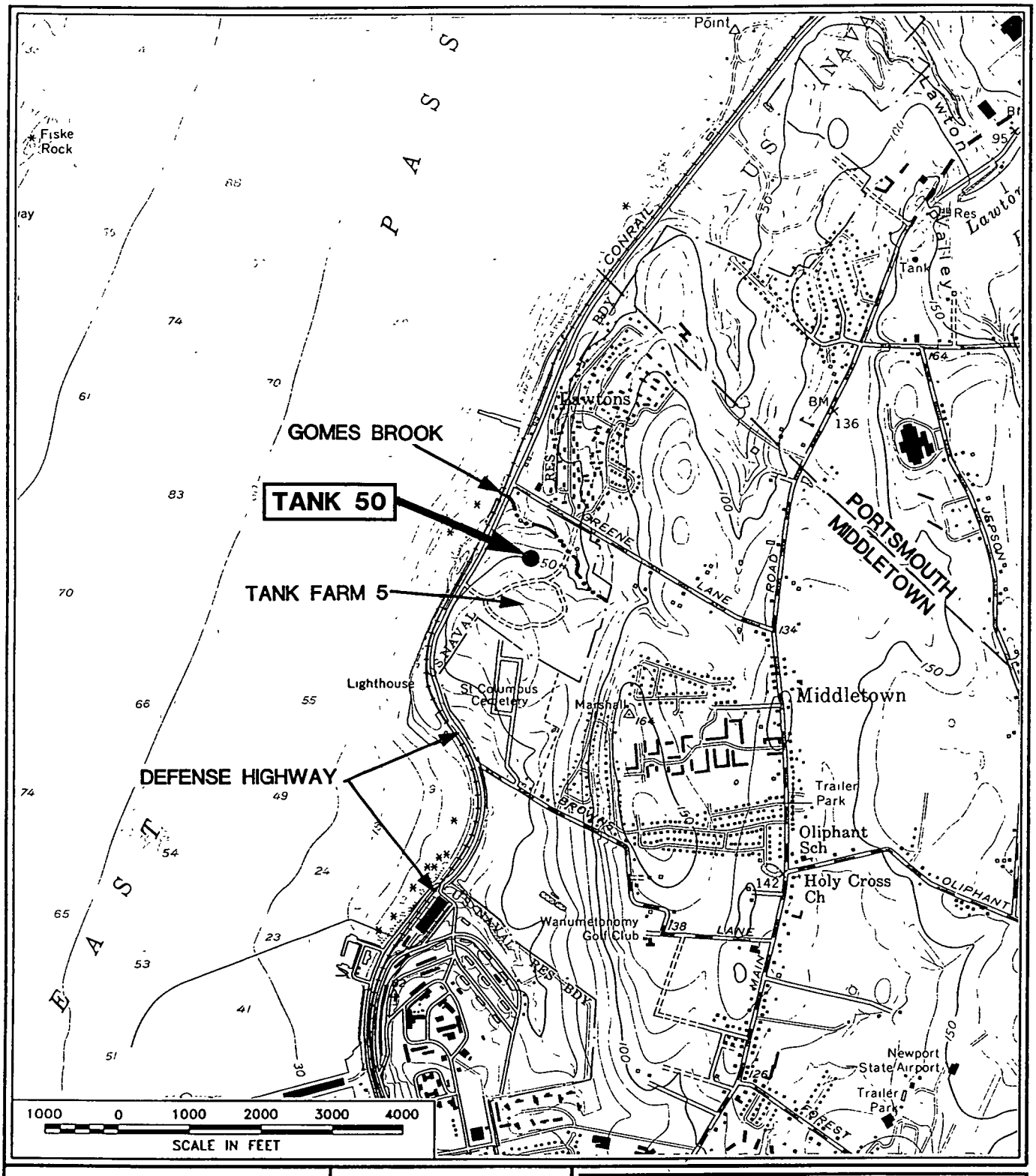
Site Mobilization and Preparation
Utility Trench Excavation
Utility Trench Connections
Soil Borings
Pilot Scale Operation
Demobilization/Site Restoration

1.2.1 Site Mobilization and Preparation

Equipment will be brought to the Site to support the following activities. Minimal site preparation activities are expected prior to performing these activities.

1.2.2 Utility Trench Excavation and Utility Line Connections

A 2 feet deep trench will be excavated to connect from the existing power pole on-site to the 480 VAC electrical wiring required for Tank 50 pilot testing. Soils excavated as a result of trenching will be screened for volatile organic compounds (VOCs) and monitored for visual contamination. Soil will be managed per procedures given in the Work Plan.



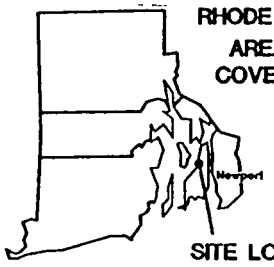


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FIGURE 1-1

NAVAL EDUCATION AND TRAINING CENTER
NEWPORT, RHODE ISLAND

BIOREMEDIATION
PILOT TESTING - TANK 50
SITE LOCATION MAP

SCALE: AS SHOWN

Source: USGS 7.5 min Quadrangle, Prudence Island, RI, 1955, photorevised 1970 and 1975.

1.2.3 Soil Borings

One boring well for bioventing and two additional monitoring wells are expected to be drilled. The boring area and the Breathing Zone (BZ) of the workers will be screened for VOCs and monitored for visual contamination. Soils excavated as a result of boring activities will be screened for VOCs and monitored for visual contamination. Soil will be managed per procedures contained in the Work Plan.

1.2.4 Pilot Scale Operation

A compressor and a blower will be installed for continuous bioventing and biosparging for 23 weeks during pilot scale testing. Subsurface soil samples will be collected and analyzed at an off-site laboratory. Subsurface soil samples will also be collected for bench scale bioremediation studies to be conducted at an off-site laboratory (by a sub-contractor).

1.2.5 Demobilization/Site Restoration

Following the completion of site activities, all equipment will be decontaminated on-site.

1.3 Application

The SHSP applies to all personnel who wish to gain access to the Site, including but not limited to:

- Client representatives
- Federal, state or local representatives
- Foster Wheeler Environmental employees and subcontractors

1.4 Summary of Major Risks

- Electrical shock
- Fuel oil vapor exposure to total petroleum hydrocarbons (TPH)
- Explosion/fire
- Physical injury

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section specifies the Foster Wheeler Environmental Project Organization.

2.1 Delivery Order Manager (DOM)

The Delivery Order Manager/Engineer is Mr. David McCarron. His duties and responsibilities include:

- Ensures implementation of this program through coordination with the responsible Project Health and Safety Manager (PHSM);
- Conducts periodic inspections;
- Participates in major incident investigations;
- Ensures the SHSP has all of the required approvals before any site work is conducted;

- Ensures that the PHSM or cross trained engineer/scientist (CTES) is informed of project changes which require modifications of the SHSP; and
- Has overall project responsibility for Project Health and Safety.

2.2 Project Health and Safety Manager (PHSM)

The PHSM is an individual certified by the American Board of Industrial Hygiene as a Certified Industrial Hygienist (CIH) and by the Board of Certified Safety Professionals as a Certified Safety Professional (CSP) with experience in hazardous waste site remediation activities. The PHSM is Mr. Grey Coppi, CIH, CSP. His duties and responsibilities include:

- Provides for the development and approval of the SHSP;
- Serves as the primary contact to review health and safety matters that may arise;
- Approves revised or new safety protocols for field operations;
- Approves individuals who are assigned HSO responsibilities;
- Approves HSOs to fulfill other project roles;
- Coordinates revisions of this SHSP with field personnel;
- Coordinates upgrading or downgrading of personal protective equipment with the CTES;
- Assists in the investigation of major accidents; and
- Conducts periodic audits of the site to determine compliance with the SHSP.

2.3 Cross Trained Engineer/Scientist (CTES)

One CTES will monitor compliance with the SHSP. The CTES will have specialized training on hazardous waste site operations. The CTES is Mr. Marc Dippre. His duties and responsibilities include:

- Assists in ensuring that proper PPE is utilized by field teams;
- Calibrates and utilizes monitoring instruments;
- Reports to the PHSM to provide information on field activities;
- Maintains health and safety log books; and
- Establish contact with Navy On-scene Commander and Local Emergency Planning Committee.

2.4 Site Personnel

- Report any unsafe or potentially hazardous conditions to the CTES;
- Maintain knowledge of the information, instructions and emergency response actions contained in the SHSP,
- Comply with rules, regulations and procedures as set forth in this SHSP and any revisions;
- Prevent admittance to work sites by unauthorized personnel; and
- Inspect all tools and equipment, including PPE, daily prior to use.

3.0 SITE HISTORY AND PROJECT DESCRIPTION

3.1 Location

NETC-Newport is located in the Towns of Newport, Middletown, and Portsmouth, Rhode Island, approximately 25 miles southeast of Providence. Tank Farm No. 5 is situated the north-central portion of NETC-Newport, Middletown, RI. Tank 50 is the northernmost tank in Tank Farm No. 5 (Figure 1-1). Tank Farm No. 5 is bordered by the Defense Highway to the north/northwest; a cemetery to the southwest; woodlands and residential property to the southeast; and Greene's Lane to the north/northeast. Gomes Brook transects the northern portion of the tank farm. The brook flows westerly, to Narragansett Bay, and provides surface drainage for the northern portion of the facility.

3.2 Background and Site Description

In 1941, the U.S. Navy began construction of five tank farms to store fuel oils and other petroleum products to resupply warships. The USTs at Tank Farm No. 5 were constructed between 1942 and 1943, and used for fuel storage from World War II to 1974. By 1974, the farm was abandoned except for Tanks 53 and 56. As a result of amendments to underground petroleum storage facility regulations enacted by the state of Rhode Island in 1992, all the tanks which previously stored virgin oils became subject to the closure requirements. Tank 50 closure activities began on August 15, 1994 and were completed in 1995.

Tank Farm No. 5 occupies approximately 85 acres and is the site of 11 USTs, numbered from 49 through 59 (Figure 3-1). Access to Tank Farm No. 5 is unrestricted and is gained via the Defense Highway. A paved road leads into the farm, passing between the tanks in a loop. With the exception from Tank 53, there is no secured perimeter fence on the farm.. Tank 50 has a capacity of 2.52 million gallons and was used to store virgin heavy fuel oil. The outside diameter of the tank is 119 feet, and at the side measures 36 feet from the bottom to the top of the roof.

Structures at Tank Farm No. 5 include a Fire Fighting Training Area, a water treatment facility used to treat groundwater at Tank 53, a temporary water treatment plant used to treat water pumped from USTs prior to cleaning, and an oil-water separator/sand filter system that was used to separate tank bottom sediments and water collected from sumps in the floor of each tank. Underground utilities reportedly consist of water, electricity, and telephone service. The exact location of the utility services could not be confirmed during the site investigation conducted by Halliburton NUS. Ground elevations at Tank Farm No. 5 range between 58 feet and 93 feet above mean low water (mlw). Topography generally slopes to the west and north from a high point near Tank No. 54 toward low areas at the perimeter of the farm. Vegetation , consisting of grass, dense brush, trees, and woodlands is found between the tanks and on the farm perimeter. Vegetation will be cleared as necessary at the time of pilot-scale bioremediation.

3.3 Site Characterization Data

Based on historical information provided by the Navy, it is known that Tank Farm No. 5 was used to store virgin heavy fuel oil. Data contained in site investigations at the Site indicate the presence of contamination in the soils and groundwater surrounding the tanks Based on July 1995 report by HNUS, TPH was the primary contaminant of concern. The highest concentration of TPH detected was 65,000 milligrams per kilogram (mg/kg). The Rhode Island Department of Environmental Management clean up level for TPH is 300 mg/kg.

Figure 3-1 Tank Farm No. 5 Layout (See pocket at back of report.)

Semi-volatile organic compounds (SVOCs) and some metals were also detected in the subsurface soil and groundwater samples. Soil sampling results included: naphthalene (up to 0.4 ppm), 2-methylnaphthalene (up to 1.3 ppm), dibenzofuran (up to 0.4 ppm), flourene (up to 1.3 ppm), phenanthrene (up to 3.8 ppm), anthracene (up to 0.6 ppm), flouranthene (up to 0.3 ppm), pyrene (up to 1.5 ppm), benzo(a)anthracene (up to 0.3 ppm), chrysene (up to 1.1 ppm), and benzo(a)pyrene (up to 0.3 ppm). All of the detected SVOCs with the exception of dibenzofuran are polynuclear aromatic hydrocarbons (PAHs). PAHs are typically derived from coal tar and the incomplete burning of fossil fuels. Dibenzofuran is also derived from coal tar, but is a heterocyclic compound. Low levels of arsenic (up to 15 ppm), cadmium (up to 2 ppm) chromium (up to 7 ppm), and lead (up to 5 ppm) were also detected in the subsurface soil samples. All groundwater results were detected at less than 0.1 ppm.

The results of site soil and groundwater samples collected during site investigations were evaluated during previous reports with respect to one or more of the following regulatory standards:

- Rhode Island Department of Health Lead Poisoning Prevention Standard (150 mg/kg) (RIDOH, 1992).
- U.S. EPA "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities" (400 ppm) (EPA, 1994a).
- U.S. EPA "Drinking Water Regulations and Health Advisories" (Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs)) (EPA, 1994b).
- RIDEM "Rules and Regulations for Groundwater Quality" (Groundwater Quality Standards and Preventative Action Limits) (RIDEM, 1993b).
- "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (RCRA Groundwater Protection Standard) (EPA, 1991).

Analytical results of samples collected and analyzed showed no positive detections for VOCs in soil and groundwater samples collected in the vicinity of Tank 50. Positive detections for SVOCs and inorganic analytes in these soil and groundwater samples did not exceed any of the State of Rhode Island or federal standards.

4.0 POTENTIAL HAZARDS OF THE SITE

This section presents an assessment of the chemical, biological and physical hazards that may be encountered during the tasks specified in Section 1.0. Additional information can be found in Appendix C-Activity Hazard Analysis.

4.1 Chemical Hazards

The most likely chemicals to be encountered during this work are petroleum hydrocarbons (TPH) and polyaromatic hydrocarbons (PAH). Table 4-1 contains a data summary of the chemical compounds of concern for this project.

Potential routes of entry include inhalation of contaminated dust particles, inhalation of VOCs and SVOCs, dermal absorption, skin contamination, or accidental ingestion of the contaminant. Inhalation of contaminated dust particles could occur during adverse weather conditions (high winds) or during operations which may generate airborne dust, such as soil boring and drilling. Considering the contaminant levels, contaminant exposure through dust inhalation is very unlikely. As a prudent practice, all reasonable means should be employed to keep visible dust emissions minimal.

Table 4-1

Chemical Data for Chemicals of Concern

Compounds	CAS #	ACGIH TLV	OSHA PEL	Routes of Exposure	Symptoms of Exposure	Target Organs
TPH	varies	None	None	inhalation, dermal	headache, dizziness, eye irritation, irritate respiratory system	eyes, lungs
PAHs (Coal Tar Pitch Volatiles)	65996-93-2	0.2 mg/m^3	0.1 mg/m^3	inhalation, ingestion, dermal	carcinogen, dermatitis, bronchitis	skin, respiratory system, bladder, kidneys

Note: mg/m^3 = milligrams per cubic meter of air

Inhalation of VOCs or SVOCs during this remedial activity is possible. However, since the contaminants represent weathered constituents of petroleum and oil-combustion by-products and exhibit low volatility, the likelihood is considered low.

In order to prevent dermal contact and inhalation of contaminants, personal protective equipment (PPE) will be worn as specified in Section 6.0.

4.2 Biological Hazards

During the course of the project, there is a potential for workers to come into contact with biological hazards such as animals, insects and plants.

4.2.1 Animals

During site operations, animals such as dogs, cats, raccoons, skunks, mice and snakes may be encountered. Workers shall use discretion and avoid all contact with animals. If these animals present a problem, efforts will be made to remove these animals from the site by contacting a licensed pest control technician.

4.2.2 Insects

Insects, such as mosquitoes, ticks, bees and wasps may be present during certain times of the year. Workers will be encouraged to wear repellents (DEET for Ticks) when working in areas where insects are expected to be present. If insects are prevalent, efforts will be made to remove them from the site by contacting a licensed pest control technician.

4.2.3 Lyme Disease

Since the site is located in the northeast, the potential for coming into contact with deer ticks exists. Lyme disease is caused by an infection from a deer tick which is about the size of the head of a pin. During the painless tick bite, a microorganism (spirochete) may be transmitted into the bloodstream which may lead to Lyme disease. The effects of the disease vary from person to person, which often makes it difficult to diagnose. Typically, the incubation period ranges from two days to two weeks. In most cases, the infected area will be resemble a red bulls' eye with concentric rings. Within the same period, flu-like symptoms may develop. If left untreated, the red ringed area will eventually fade and Lyme disease may further develop into an arthritis-like condition.

Control measures to prevent Lyme Disease include the following:

- Self/Buddy check of neck, hairline, groin and body after working in areas that may contain deer ticks.
- Wear light colored tyvek or clothing.
- If a tick is found, remove it by pulling gently at the head with tweezers

Report any of the above symptoms and all tick bites to the CTES for evaluation. Employees bitten by deer ticks during the course of employment will be given a medical examination.

4.2.4 Plants

Plants such as poison ivy and poison oak may be prevalent at the site during certain times of the year. Workers will be trained to recognize these plants and to minimize contact with them. PPE may be worn by

employees in order to reduce the potential for exposure. Pre-exposure topical lotions may be applied prophylactically.

4.3 Physical Hazards

Most safety hazards are discussed in the Activity Hazard Analysis (AHA) found in Appendix C for the various phases of the project. In addition to the AHAs, general work rules and other safety procedures are described in Section 10 of this SHSP.

4.3.1 Heat Stress

Heat stress is a potential hazard, which is greatly exacerbated with the use of PPE in hot environments Most of the project is carried out during summer. A heat stress prevention program will be implemented when ambient temperatures exceed 70° F for personnel wearing impermeable clothing and for other personnel when the WBGT index exceeds the ACGIH TLVs. The following are the main elements of the Foster Wheeler Environmental Corporate Health and Safety Program Manual (HS 4-6).

- Selection of PPE to reduce the risk of heat related illness
- Hydration
- Cool rest areas
- Engineering Controls (i.e. air conditioned cabs, drenching)
- Administrative Controls (work schedules, acclimatization, work/rest regimens)
- PPE (i.e. ice vests, vortex tubes)
- Monitoring (body core temperature, pulse rate)
- Identification of heat related illnesses (heat cramps, heat exhaustion, and heat stroke)
- Employee training

4.3.2 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps and generators. Suspected high noise operations will be evaluated by the CTES to determine if the wearing of protective devices are warranted. Pre-employment and annual audiograms are provided as part of the medical surveillance examination.

5.0 ACTIVITY HAZARD ANALYSIS

The AHA is a systematic way of identifying the potential health and safety hazards associated with major phases of work on the project and the methods to avoid, control and mitigate those hazards. The AHAs follow the guidance of the Foster Wheeler Environmental Corporate Program Manual HS 3-5. AHAs will be developed by the CTES and the Project Superintendent for activities not anticipated prior to start-up. The AHAs will be used to train workers in proper safety procedures during phase preparatory meetings.

AHAs addressing specific work package requirements shall be developed when necessary. Additional AHAs shall be developed and implemented for new tasks, additional work packages, or modified for existing tasks. The Navy will be copied upon AHA development.

AHAs are included in Appendix C of this SHSP. AHAs have been developed for the following phases of work:

- Site Mobilization and Preparation
- Utility Trench Excavation
- Utility Trench and Power Pole Connections
- Soil Borings
- Pilot Scale Operation
- Demobilization/Site Restoration

6.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) detailed below represents the hazard analysis and PPE selection required by 29 CFR 1910.132. For the purposes of PPE selection, the PHSM and CTES are considered competent persons. The signatures on the front of the SHSP constitutes certification of the hazard assessment. For activities not detailed below, the CTES will conduct the hazard assessment and select the PPE using the form provided in Appendix D and shall certify the assessment by signing the form. PPE selection will be made in consultation with the PHSM. The task-specific level of PPE required for each task is described in Appendix C. The following is a list of PPE required for each level of work.

Level D PPE includes the following:
- Work clothes (shirts and pants)
- Work gloves (as needed)
- Steel-toed boots
- Hard hat
- Hearing protection (as needed)
- Eye protection

Level D Modified PPE includes the following:
- Site dedicated coveralls or Tyvek
- Gloves (inner surgical type and outer nitrile gloves)
- Rubber steel-toed boots or booties
- Hard hat
- Hearing protection (as needed)
- Eye protection (safety glasses and face shield; face shield required during pressure washing activities)

Level C PPE includes the following:
- Tyvek
- Gloves (inner surgical type and outer nitrile gloves)
- Hard hat
- Rubber steel-toed boots or booties
- Hearing protection (as needed)
- Full face air-purifying respirator with combination organic vapor and high efficiency particulate air cartridge

7.0 AIR AND NOISE MONITORING

The following sections contain information describing the types, frequency and location of real time, integrated, and other air monitoring.

7.1 Real-Time Air Monitoring

This section addresses the real time air monitoring that will be conducted including instrumentation selection, air monitoring frequency and sampling location.

7.1.1 Work Area

Table 7.1 presents a breakdown of each main activity and provides the instrumentation, frequency and location of the real time air monitoring requirements for the site. Table 7.2 lists the Real Time Air Monitoring Action Levels to be used in all work areas.

The majority of the air monitoring will be conducted during trench excavation and boring to detect the TPH in the emanating vapors.

The following instruments will be used for work area monitoring:

- Flame-Ionization Detector, (FID)
- Combustible Gas Indicator (CGI) with Oxygen (O_2).

Table 7-1
Frequency and Location of Air Monitoring

Activity	Air Monitoring Instrument	Frequency and Location
Utility Trenching	FID	Every 30 to 60 minutes in the BZ
Boring	FID, CGI	During boring operation, in driller's BZ
Pilot Scale Operation	FID	During opening of wells/extraction blower discharge

Table 7-2
Real Time Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level	Site Action	Reason
FID	Breathing Zone (BZ)	<50.0 ppm above background	No respiratory protection	--
		>50 ppm	Level C	
		>250 ppm	Level B or stop work, evacuate area, continue to ventilate, notify CTES	
CGI	At the bore and boring equipment during boring operations	1% LEL <conc.<10% LEL	Use caution during procedures	Increasing potential for combustible atmosphere
		Conc.> 10% LEL	Stop work, evacuate work area, continue to ventilate area prior to continuing work, notify CTES	Potential for combustible atmosphere

7.2 Integrated Air Monitoring

The necessity to assess field personnel exposures to airborne contaminants through integrated air monitoring shall be evaluated by the PHSM upon mobilization and discussion with the CTES. Generally, those employees with the greatest risk of exposure will be monitored. Other areas or personnel may be monitored if the CTES suspects potential exposures above the capabilities of the PPE being worn.

7.3 Data Quality Assurance

7.3.1 Calibration

Instrument calibration shall be documented and included in a dedicated safety and health log book or on separate calibration pages. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

7.3.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on-site by the CTES for reference.

7.3.3 Data Review

The CTES will interpret all monitoring data based on Table 7-2 and his professional judgment. The CTES shall review the data with the PHSM to evaluate the potential for worker exposure, upgrades/downgrades in level of protection (LOP), comparison to direct reading instrumentation and changes in the integrated monitoring strategy. The CTES will immediately report all integrated sampling results above the PEL/TLV (one half of PEL/TLV where no respirators are worn) to the PHSM. Periodically, personnel exposure results will be tabulated and posted at the site. Monitoring and sampling data, along with all sample documentation will be periodically reviewed by the PHSM.

7.3.4. Laboratory

Chemical analysis of samples collected for assessment of employee exposures shall be performed only by an analytical laboratory accredited by the American Industrial Hygiene Association. The laboratory analysis will include field blanks, as required by the individual method or laboratory. Duplicate samples or splits with other laboratories may be used during the project. The laboratory shall also be successful participants in the PAT program for the category of material for which they are analyzing project samples.

7.4 Other Monitoring

Heat stress monitoring procedures can be found in the Corporate Health and Safety Program Manual, Section 4-6 and may be implemented when necessary.

8.0 ZONES, PROTECTION AND COMMUNICATION

8.1 Site Control

Site zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site when operations begin.

This project is a remediation project, and any person working in an area where the potential for exposure to site contaminants exists, will only be allowed access after providing the CTES with proper training and medical documentation. Foster Wheeler Environmental anticipates establishing multiple zones simultaneously at each active work area. Decontamination procedures shall be set up at each active work area to minimize or eliminate, to the extent possible, cross-contamination.

Support Zone - The SZ is an uncontaminated area (water treatment facility, equipment staging area during operation) that will be the field support area for most operations. The SZ provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides for an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone (EZ). This zone will be clearly delineated by cones, tapes or other means. The CTES may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the site CTES allowing adequate space for the activity to be completed, field members and emergency equipment Foster Wheeler Environmental will utilize a daily exclusion zone log.

8.2 Contamination Control

One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel

- Do not walk through areas of obvious or known contamination
- Do not handle or touch contaminated materials directly
- Make sure all personal protective equipment has no cut or tears prior to donning
- Particular care should be taken to protect any skin injuries
- Stay upwind of airborne contaminants
- Do not carry cigarettes, gum, etc , into contaminated areas

Sampling, Monitoring

- When required by the CTES, cover instruments with clear plastic, leaving openings for sampling ports
- Bag sample containers prior to emplacement of sample material

Heavy Equipment

- Limit the amount of contamination that comes in contact with heavy equipment
- If contaminated tools are to be placed on non-contaminated equipment for transport to the decontamination pad, use plastic to keep the equipment clean
- Keep excavated soils contained and out of the way of workers

8 2.1 Personnel Decontamination Station

Personnel exiting the Exclusion zone shall be decontaminated. Discarded protective clothing will be disposed in labeled 55-gallon drums and transferred to Tank Farm No. 4. Decontamination waste will be managed along with Tank Farm No. 4 waste until proper disposal off-site. Specific decontamination procedures will be utilized as appropriate, depending on the level of operation performed by the individual. Safety briefings shall explain these decontamination procedures for personnel and portable equipment for the various protection levels indicated in Section 6.0. Detailed waste disposal procedures are available in the Work Plan.

The following protocol shall be used for the decontamination stations according to the level of protection:

Level D	Level D+	Level C
1. Equipment drop	1. Equipment drop	1. Equipment drop
2. Hand/Face wash	2. Outer boot & glove wash	2. Outer boot & glove wash
	3. Outer boot & glove rinse	3. Outer boot & glove rinse
	4. Tape removal - boot & glove	4. Tape removal - boot & glove
	5 Outer boot & glove removal	5. Outer boot & glove removal
	6. Coverall removal/disposal	6. Coverall removal/ disposal
	7. Inner glove removal/ disposal	7. Respirator removal
	8. Hand/face wash	8. Inner glove removal/disposal
	9. Shower may be required	9. Inner clothing removal
		10. Hand/face wash
		11. Shower may be required
		12. Redress
		13. Respirator cleaning/ sanitizing

Note: Not all of the decontamination stations will be needed, this will depend upon the type of equipment worn.

Note: At a minimum, all personnel will thoroughly wash their arms, face and hands upon exiting the EZ or CRZ prior to eating, drinking, smoking, applying cosmetics, or any other actions that would increase the risk of hand to mouth transfer of chemicals.

The following decontamination equipment is required for level D+ and higher protection levels: Four small tubs (two sets of wash and rinse water), scrub brush, towels, contaminated clothing disposal bag or drum, and, respiratory cleaning solution.

Non-phosphate detergent and water should be sufficient for use as the decontamination solution. All receptacles for contaminated protective clothing will be equipped with lids that can be closed to prevent the release of contaminants and the collection of rainfall. The decontamination liquids and clothing will be contained and disposed according to federal, state and local regulations.

8.2.2 Heavy Equipment Decontamination

Heavy equipment will be decontaminated on a pad with a steam cleaner until no signs of visible contamination remain. Rinsate will be collected in 55 gallon drums and transported to Tank Farm No. 4 where it will be managed and disposed along with the Tank Farm No. 4 waste as per the Work Plan. Heavy equipment will not be permitted to leave the EZ unless it has been thoroughly decontaminated and visually inspected by the CTES or his designee. This inspection will be documented on the form found in Appendix G.

8.3 Communication

Mobilization/Demobilization (includes installation of electric service and soil borings)

- Hand-held two-way radios are utilized as appropriate by field teams for communication.
- Telephones - A telephone is located in the water treatment facility for communication with emergency support services/facilities.
- Air Horns - Air horns shall be carried by field teams or be strategically located within the EZ., and shall be maintained as the means for announcing emergency evacuation procedures and backup for other forms of communication.
- Hand Signals - Hand signals shall be used by field teams along with the buddy system. They shall be known by the entire field team before operations commence and their use covered during site-specific training. Typical hand signals are the following:

Signal	Meaning
Hand gripping throat	Out of air, can't breathe
Grip on a partner's wrist or placement of both hands around a partner's waist	Leave the area immediately, no debate
Hands on top of head	Need assistance
Thumbs up	Okay, I'm all right, I understand
Thumbs down	No, negative

Pilot Scale Operation

During the operation monitoring of the pilot scale test, only one worker will be on-site for the majority of the visits. During these visits the following communication procedures will be used:

- A hand held two-way radio will be obtained from Tank Farm No. 4 (D.O. #13) and contact between radios from the two Sites will confirm the radios functionality.
- The hand held two-way radio will be utilized at all times during monitoring.
- Telephone - the telephone located at Tank Farm No. 4 will be used for communication with emergency support services/facilities.

9.0 MEDICAL SURVEILLANCE PROCEDURES

All contractor and subcontractor personnel performing field work where potential exposure to contaminants exist at the site are required to have passed a medical surveillance examination in accordance with 29 CFR 1910.120(f). Medical monitoring will not be required for the following subcontractors:

- Fencing
- Clearing

The Foster Wheeler Environmental Corporate Medical Surveillance Program is described in detail in Section 4.5 of the Health and Safety Program Manual. The Corporate Medical Consultant is Greaney Medical Group in California. Dr. Peter Greaney is Board certified in occupational medicine.

9.1 Medical Surveillance Requirements

A physician's medical release for work will be confirmed by the CTES before an employee can work in the exclusion zone. The examination will be taken annually at a minimum and upon termination of hazardous waste site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the PHSM in consultation with the Corporate Medical Consultant and the CTES if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other site conditions warrant further medical surveillance

9.1.1 Medical Data Sheet

A medical data sheet is provided in Appendix G. This medical data sheet is voluntary and should be completed by all on-site personnel and will be maintained at the site. Where possible, this medical data sheet will accompany the personnel needing medical assistance The medical data sheet will be maintained in a secure location, treated as confidential, and used only on a need-to-know basis.

10.0 SAFETY CONSIDERATIONS

10.1 Health and Safety Work Rules

A list of work rules and safe work practices has been included in the Foster Wheeler Environmental Health and Safety Program Manual, Section 3-6. These rules have been incorporated into the SHSP as Appendix H. The work rules will be posted in a conspicuous location at the site.

10.2 Construction Hazards

The following is a list of applicable safety considerations for the major tasks. Further information is provided in the specific AHA and the Foster Wheeler Environmental Health and Safety Program Manual.

- Heavy Equipment
- Hand and Power Tool Usage
- Fire Hazards
- Motors and Pump Usage
- Electrical Equipment- the electrical subcontractor performing the utility pole connection shall observe standard industry practices such as the use of dielectric helmets, lifts, insulated gloves, use of grounds or jumpers, etc.
- Heat
- Punctures/Cuts
- Lifting/Materials Handling

10.3 High Loss Potential Hazards

- Excavation and Trenching FWENC HS 6-11
- Soil Boring FWENC HS 6-18
- Lockout/Tagout FWENC HS 6-5

Excavation and Trenching

Excavation will be conducted in accordance with the Excavation and Trenching Program, Section 6-4 of the Foster Wheeler Environmental Corporation Health and Safety Program Manual. Procedures in this document incorporate the requirements of 29 CFR 1926, Subpart P-Excavations. It provides for the designation of a "Competent Person" and general requirements for safe excavating practices. The program also incorporates company standards for the monitoring of potentially hazardous atmospheres; protection from water hazards; analyzing and maintaining the stability of adjacent structures; daily Competent Person inspections; soil classification; sloping and benching; protective systems; and training.

One of the designated Competent Persons will be Mr. Marc Dippre.

Lockout/Tagout

All activities requiring lockout/tagout procedures will be conducted in accordance with the Lockout/Tagout Program, Section 6-5 of the Foster Wheeler Environmental Corporation Health and Safety Manual; This program establishes the minimum requirements and procedures for performing lockout/tagout on machines and equipment in accordance with 29 CFR 1910.147, Control of Hazardous Energy. These procedures include but are not limited to, general requirements, testing/positioning group lockouts, tagout, shift changes, failure to clear locks and periodic inspections.

11.0 WASTE DISPOSAL PROCEDURES

The activities are not expected to produce any hazardous waste. All discarded materials, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination,

creating a sanitary hazard or causing litter to be left on site. All Investigation Derived Wastes (IDW) will be segregated and bagged or drummed as necessary, labeled, and segregated. Foster Wheeler Environmental will transfer the waste to Tank Farm No.4 to be managed along with DO #13 waste IDW sampling is therefore not necessary at Tank 50. Detailed waste disposal procedures, as well as overall waste management practices will be addressed as part of the Work Plan. Waste management practices will be implemented with continued support from the Foster Wheeler Environmental regulatory and waste management personnel as applicable.

12.0 EMERGENCY RESPONSE PLAN

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require immediate action; therefore, contingency planning and advanced training of staff are essential. Specific elements of emergency support procedures which are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on-site, record keeping, and emergency site evacuation procedures.

12.1 Responsibilities

12.1.1 Project Health and Safety Manager (PHSM)

The PHSM is Mr. Grey Coppi.

The PHSM oversees and approves the Emergency Response/Contingency Plan and performs audits to determine that the plan is in effect and that all pre-emergency requirements are met. The PHSM acts as a liaison to applicable regulatory agencies and notifies OSHA of reportable accidents

12.1.2 Cross Trained Engineer/Scientist (CTES)

The CTES is Mr. Marc Dippre.

The CTES is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The CTES is required to immediately notify the PHSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the PHSM can notify OSHA within the required time frame. The PHSM will be notified of all OSHA recordable injuries, fires, spills, releases or equipment damage in excess of $500 within 24 hours The CTES also serves as the Alternate Emergency Coordinator.

12.1.3 Emergency Coordinator

The Emergency Coordinator is Mr. Marc Dippre.

The Emergency Coordinator shall make contact with Local Emergency Response personnel prior to beginning work on site In these contacts the Emergency Coordinator will inform interested parties about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. The Emergency Coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on site. The emergency coordinator shall make necessary arrangements to be prepared for any emergencies that could occur

The Emergency Coordinator shall implement the Emergency Response/Contingency Plan whenever conditions at the site warrant such action.

12.1.4 Site Personnel

Site personnel are responsible for knowing the Emergency Response/Contingency Plan and the procedures contained herein. Appropriate training of all site personnel will be provided. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency.

12.2 Communication

A variety of communication systems may be utilized during emergency situations. These are discussed below.

12.2.1 Radio Communication

The primary form of communication during an emergency between field groups in the exclusion zone will be radio communications. Each field team within the exclusion zone shall have a radio. During an emergency situation, the lines will be kept clear so that instructions can be received by all field teams.

During pilot scale operational monitoring, a hand held two-way radio will be used by site personnel to maintain contact with D.O. #13 (Tank Farm No. 4) personnel. The hand held two-way radio will confirm contact with Tank Farm No. 4 during each Site visit.

12.2.2 Telephone Communication

During mobilization/demobilization activities, the telephone at the water treatment facility will be used for communication with emergency support services. During pilot scale operation, Tank Farm No. 4 telephones will be used for emergency communication to support services.

12.2.3 Air Horns

Air horns will be used to alert site personnel of emergencies. The following signals will be used:

- One continuous blast - site evacuation
- Two short blasts - shut down equipment, clear radio channels, await instructions
- Three short blasts - injured employee, first-aid providers respond

Air horns will be placed at each active work area.

The procedure to activate the air horns consists of depressing the air horn button or switch while pointing it in the direction of the area to be signaled. Air horns should be tested at least monthly to ensure that they are working properly.

12.2.4 Hand Signals

Hand signals will be employed by downrange field teams where necessary for communication during emergency situations Hand signals are found in Section 8.3.

12.3 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during remedial activities at the site, a table listing emergency telephone numbers (Table 12-1) will be posted prominently in the wastewater treatment facility and in all places where telephone service is available. A copy of the emergency telephone number may also be carried by the safety official in-charge at the site.

A route map from the site to the nearest hospital is referenced as Figure 12-1. Upon mobilization, this map will be posted adjacent to the above emergency telephone numbers in the field office and in all places where telephone service is available. It should also be placed in all on-site vehicles.

12.4 Pre-Emergency Planning

Foster Wheeler Environmental will communicate directly with administrative personnel from the emergency room at the hospital in order to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from exposure to any of the contaminants expected to be found on the site.

Before the field activities begin, the local emergency response personnel will be notified of the schedule for field activities and about the materials that are thought to exist on the site so that they will be able to respond quickly and effectively in the event of a fire, explosion, or other emergency.

12.5 Emergency Medical Treatment

The procedures and rules in this SHSP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it will be reported to the CTES immediately. First-aid equipment will be available on-site at the following locations:

First Aid Kit:	on-site near Tank 50, all active work areas
Emergency Eye Wash:	on-site near Tank 50, all active work areas

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Unless they are in immediate danger, severely injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

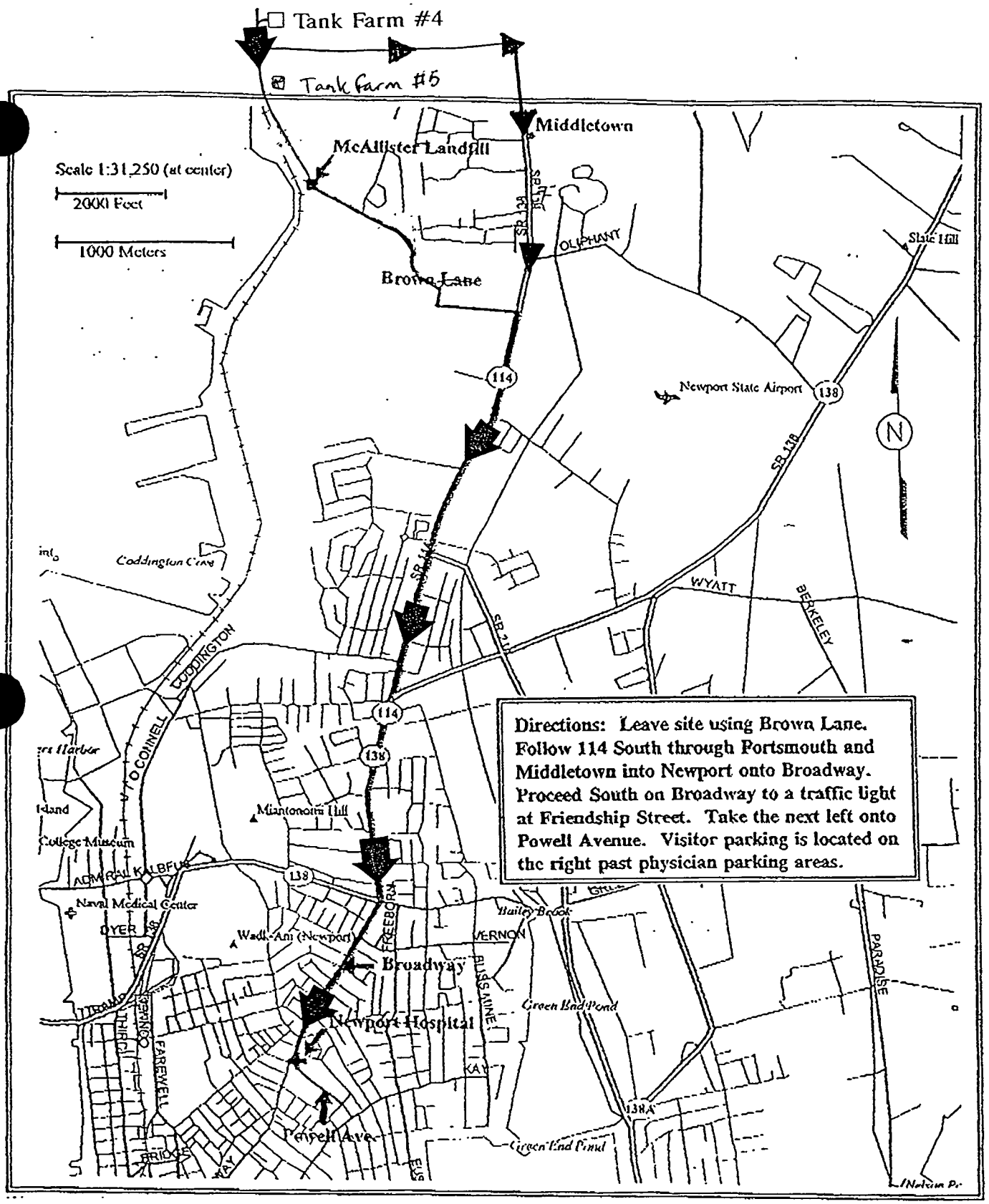
Only in **non-emergency** situations will an injured person be transported to the hospital by means other than an ambulance.

12.6 Emergency Site Evacuation Routes and Procedures

In order to mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear chain of authority will be established. The EC will take charge of all emergency response activities and dictate the procedures that will be followed for the duration of the emergency. The EC will report immediately to the scene of the emergency, assess the seriousness of the situation, and direct whatever efforts are necessary until the emergency response units arrive. At his discretion, the EC also may order the closure of the site for an indefinite period

Table 12-1
Emergency Telephone Numbers

Contact	Firm or Agency	Telephone Number
Police	Navy Local	401-841-3241/Base 401-846-1212/Off-Base
Fire	Navy	401-841-3333/ Base 401-846-2211/Off-Base
NTR Charles Peterson	Navy ROICC	401-841-1576
NOSC/NOS CDR	Navy - Deputy Fire Chief	401-841-3333
On-site Medical Clinic	Prompt Case	401-841-3111 Hours 10am to 8pm - 7 days a week
Newport Naval Base Ambulance		841-2222
Hospital	Newport Hospital	401-864-6400
PHSM Grey Coppi	Foster Wheeler Environmental	215-702-4079 (W) 908-757-8174 (H)
Regulatory Compliance Tom Teeling Mike Zizza	Foster Wheeler Environmental Langhorne Boston	 215-702-4078 (W) 617-457-8245 (W)
Dave McCarron	Foster Wheeler Environmental Delivery Order Manager	617-457-8244 (W) 617-267-7853 (H)
CTES Marc Dippre	Foster Wheeler Environmental	617-457-8295 (W) 617-776-8903 (H)
Chemtrec		800-424-9300
National Response Center		800-424-8802
LEPC Greg Marx		401-847-2695



U.S. Navy RAC
NETC - Newport, RI

Figure 12-1

Hospital Location Map

FOSTER WHEELER ENVIRONMENTAL CORPORATION

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, an air horn will be sounded on the site. The horn will sound continuously for one blast, signaling that immediate evacuation of all personnel is necessary due to an immediate or impending danger. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the primary evacuation point. This point will be determined by the field staff prior to start of work activities.

The EC will give directions for implementing whatever actions are necessary. Any project team member may be assigned to be in charge of emergency communications during and emergency. He will attend the site telephone specified by the EC from the time the alarm sounds until the emergency has ended.

After sounding the alarm and initiating emergency response procedures, the EC will check and verify that access roads are not obstructed. If traffic control is necessary, as in the event of a fire or explosion, a project team member, who has been trained in these procedures and designated at the site safety meeting, will take over these duties until local police and fire fighters arrive.

12.6.1 Evacuation Drills

Evacuation drills will be conducted to test the emergency system. The drills will simulate situations that may be likely to occur on-site. A critique of the drill according to Foster Wheeler Environmental Health and Safety Program Manual HS 2-1 will be conducted.

12.7 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site (air horn will sound for a single continuous blast), and notification of local fire and police departments. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

12.7.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials
- Storage of flammable liquids and gases away from oxidizers
- No smoking in the exclusion zone or any work area
- No hot work without a properly executed hot work permit
- Shutting off engines to refuel
- Grounding and bonding metal containers during transfer of flammable liquids
- Use of UL approved flammable liquid storage containers
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities
- Monthly inspections of all fire extinguishers
- Use of intrinsically safe radios, lighting, low voltage lighting

A map of all fire extinguisher locations will be developed by the site staff and will be posted in all trailers.

12.8 Overt Chemical Exposure

The following are standard procedures used to treat chemical exposures. Other specific procedures detailed on the Material Safety Data Sheet or recommended by the Corporate Medical Consultant will be followed, when necessary.

SKIN AND EYE CONTACT:	Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. Skin should also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs.
INHALATION:	Move to fresh air. Decontaminate and transport to hospital or local medical provider.
INGESTION:	Decontaminate and transport to emergency medical facility.
PUNCTURE WOUND OR LACERATION:	Decontaminate and transport to emergency medical facility.

12.9 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or postponed. The CTES or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed at the site. Protective clothing can be cut away at the site. If the outer contaminated garments cannot be safely removed on-site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the standard decontamination procedures will be followed.

12.10 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

- Project Health and Safety Manager, Grey Coppi
- Delivery Order Manager, Dave McCarron
- The employer of any injured worker who is <u>not</u> a Foster Wheeler Environmental employee
- Navy ROICC NTR

Written confirmation of verbal reports are to be submitted within 24 hours. The accident/incident report is found in the Foster Wheeler Environmental Corporate Health and Safety Program Manual Section HS 1-7

If the employee involved is not a Foster Wheeler Environmental employee, his employer shall receive a copy of the report.

12.11 Adverse Weather Conditions

In the event of adverse weather conditions, the CTES or designee will determine if work can continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries
- Potential for cold stress and cold-related injuries
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds)
- Limited visibility (fog)
- Potential for electrical storms
- Earthquakes and,
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The CTES will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

12.12 Spill Control and Response

A spill prevention control and countermeasure plan is not required for this work.

12.13 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on-site. A map showing the location of emergency equipment shall be developed by the CTES.

- Industrial first aid kit
- Portable eye washes (one per field team meeting ANSI Z358.1-1991)
- Air horns (one per field team)
- Fire extinguishers (one per trailer/vehicle, trailers and located at hot work stations)
- Fire Blanket
- Stretcher

12.14 Postings

The following information shall be posted at various, conspicuous locations throughout the site:

- Emergency telephone numbers
- Diagrams showing the location of fire extinguishers and emergency equipment and, (Diagram ??)
- Emergency exit, evacuation routes and staging area.

12.15 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers
- Refilling medical supplies
- Recharging eyewashes and/or showers
- Replenishing spill control supplies and,
- Replacing used air horns

13.0 TRAINING

13.1 General Health and Safety Training

In accordance with Foster Wheeler Environmental corporate policy, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

13.1.1 Three Day Supervised On-the-Job Training

In addition to the required initial hazardous waste operations training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

13.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for field work. The training will cover a review of 1910.120 requirements and related company programs and procedures.

13.3 Supervisor Training

The Foster Wheeler Environmental Site Superintendent has taken an eight-hour supervisor training class meeting the requirements of 1910 120(e).

13.4 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site and will highlight all provisions contained within this SHSP. This training will also allow field workers to clarify

anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

13.5 On-Site Safety Briefings

Project personnel and visitors will be given on-site health and safety briefings prior to the start of each work shift by the CTES to assist site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity for the CTES to periodically update the workers' air monitoring results. Prior to starting any new activity, a training session using the Activity Hazard Analysis will be held for workers involved in the activity.

13.6 First Aid And CPR

The CTES will identify those individuals requiring first aid and CPR training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association and include bloodborne pathogens training.

13.7 Hazard Communication

Hazard communication training will be provided in accordance with the requirements contained in the Foster Wheeler Environmental Health and Safety Program Manual, Section 4-2.

14.0 LOGS, REPORTS AND RECORDKEEPING

The following is a summary of required health and safety logs, reports and recordkeeping.

14.1 Field Change Request

To be completed for initiating a change to the SHSP. The PHSM and Project Manager or designee approval is required. The original will be kept in the project file. Approved changes will be reviewed with affected field personnel at a safety briefing. Copies will be distributed to the Client Representative.

14.2 Medical and Training Records

Copies of verification of training (40 hour, 8 hour refresher, supervisor, site specific training, respirator fit test, documentation of three day OJT) and medical clearance for hazardous waste site work and respirator use will be maintained on-site. Records for all subcontractor employees will also be kept on-site. All employee medical records will be maintained by the Corporate Medical Consultant - Greaney Medical Group in accordance with Foster Wheeler Environmental Corporation Health and Safety Program Manual, section HS 1-8.

14.3 On-Site Log

A log of personnel on-site each day will be kept by the CTES

14.4 Weekly Safety Reports

The CTES shall complete and submit weekly and monthly health and safety reports to the PHSM. The report is provided in Appendix H.

14.5 Exposure Records

All personal monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be maintained by the CTES during site work. At the end of the project they will be maintained according the 29 CFR 1910.20 and Foster Wheeler Environmental Corporation Health and Safety Program Manual, Section HS 1-8.

14.6 Accident/Incident Reports

The incident reporting and investigation during site work will follow Foster Wheeler Environmental Corporation Health and Safety Program Manual, section HS 1-7. Spill reporting and investigation may be recorded on this form.

14.7 OSHA Form 200

An OSHA Form 200 will be kept at the project site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to Regional Health and Safety Manager for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 200 form. The incident report form referenced in section 12.11 meets the requirements of the OSHA Form 101(supplemental record) and must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

14.8 Health and Safety Logbooks

The CTES will maintain logbooks during site work. The daily site conditions, personnel, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

14.9 Hazard Communication Program/MSDS

Material Safety Data Sheets (MSDS) will be obtained for applicable substances and included in the site hazard communication file. The hazard communication program will be maintained on-site in accordance with 29 CFR 1910.1200 and Foster Wheeler Environmental Corporation Health and Safety Program Manual Section HS 4-2.

14.10 Work Permits

All work permits, including hot work, lockout/tagout, and line breaking permits will be maintained in the project files.

15.0 FIELD PERSONNEL REVIEW

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the SHSP. It is maintained on-site by the CTES as a project record. Each field team member shall sign this section after site-specific training is completed and before being permitted to work on-site.

I have read, or have been informed of, the Site-Specific Health and Safety Plan for NETC, Tank Farm No. 5, Tank 50, and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	Date

16.0 REFERENCES

29 CFR 1910.120 Hazardous Waste Operations and Emergency Response. USDOL - OSHA.

Health and Safety Program Manual. Foster Wheeler Environmental Corporation. 1995.

Health and Safety Plan for Tank Contents Removal, Fuel Farm #5, NETC Newport, Rhode Island, OHM Remedial Services Corp., August 2, 1995.

Basis of estimate submitted by Foster Wheeler Environmental to NETC-Newport under the Remedial Action Contract, Delivery Order No. 0011, Tank 50, NETC-Newport, RI.

Proposal on Remedial Action Contract N62472-94-D-0398, DO #0011, Tank 50, NETC Newport, RI.

Tank 50 Closure Assessment Report, Tank Farm No. 5, NETC-Newport, Rhode Island, Halliburton NUS; July 1995 Preliminary Closure Assessment Report of Tank Farm No. 5 at Naval Education and Training Center, Newport, Rhode Island, Halliburton NUS, June 1995.

Work Plan for Tank 50, Tank Farm No. 5 Remedial Actions, Naval Education and Training Center, Newport, RI, prepared by Foster Wheeler Environmental, May 31, 1996.

APPENDIX C

Activity Hazard Analysis

ACTIVITY HAZARD ANALYSIS

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI

Activity: SITE PREPARATION AND MOBILIZATION OF EQUIPMENT

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1. Preparation of work area (Hazards 1-12 apply)	1. Back injuries	1. Site personnel will be instructed on proper lifting techniques; mechanical devices will be used to reduce manual handling of materials; team lifting will be used in lieu of mechanical devices.
2. Mobilization of equipment and delivery of materials (Hazards 1-5 and 10 apply)	2. Slips/Trips/Falls	2 Tripping and footing hazards will be identified and repaired before work begins on site; tripping and footing hazards will be clearly identified and repaired as they are discovered; Maintain work areas safe and orderly; Even terrain will be utilized as unloading areas; work areas will be maintained safe and orderly
3. Construction of decontamination pads (Hazards 1-8 apply)	3 Pinch/Cut/Smash	3 Cut -resistant work gloves will be worn when dealing with sharp objects; all hand and power tools will be maintained in safe condition; guards will be kept in place while using hand and power tools
	4. Vehicular Traffic	4. Spotter will be used when backing up trucks and moving equipment.
	5 Heavy Equipment (rollovers, overhead hazards, spills, struck by or against)	5. Equipment will have rollover protective structures and seat belts; operators shall wear belts when operating equipment; do not operate equipment in grades exceeding manufacturers recommendations; equipment will have guards, canopies or grills to protect from flying objects; ground personnel will stay clear of all suspended loads; all slings, chains, and ropes will be rated for the load in which it is expected to lift; spill absorbent materials will be readily available; drip pans, polyethylene sheeting or other means will be used for secondary containment; equipment will not be approached from blind sides; the equipment operator will be hand signaled before approaching ; avoid equipment swing areas; all equipment will be equipped with backup alarms.
	6 Noise	6. Hearing protection will be worn which has the noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); CTES will determine the need for hearing protection, all equipment will be equipped with manufacturer's recommended mufflers.
	7 Electrical shock	7 De-energize or disconnect all existing power lines before work commences Use double insulated or properly grounded power-operated tools. Ground fault circuit breakers will be used; cords will be inspected prior to use everyday; only approved submersible type cords will be used in wet areas; keep all plugs and receptacles out of water, follow Lockout-Tagout procedures in accordance with FWENC Health and Safety Procedures Manual; damaged electrical equipment will be tagged and taken out of service.
	8. Fire	8. Smoking will not be allowed in the work area; 10-12 lb ABC fire extinguishers shall be readily available and its location known to all personnel working on site
	9 Cuts, bites from ticks and insects	9 Use buddy system to check for ticks. Apply repellent
	10 Eye Injury	10 Safety glasses meeting ANSI standard Z87 will be worn
	11 Spills	11 Employees will be instructed on proper fueling operations Fuel cans will be secured after fueling operations Absorbent materials will be located at the work area.
	12. High/Low ambient temperature	12. All personnel working on site will be monitored for Heat/Cold stress according to FWENC's Health and Safety Procedures Manual.

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1. Hand and power tools	1. Initial inspections will be required prior to use of hand and power tools	1. Personnel shall read and comply with SHSP.
2. Level D PPE (steel toe boots, hard hats, safety glasses)	2. CTES shall verify that personnel have proper PPE	2. Personnel shall be given notice of proper PPE.
3. Fist aid kits	3. Weekly inspections will be performed on first aid kits	3. Radio contact will be available with personnel at Tank Farm No. 4 who will have current CPR and First Aid Training.
4. GFCIs and Extension cords	4. Extension cords will be inspected prior to each use; GFCIs will be inspected monthly	4. Personnel will be trained on proper use of ext. cords/GFCIs
5 Portable eye wash	5. Portable eye wash will be inspected monthly	5 Instruct personnel on proper use of eye wash
6. Fire extinguishers	6. Fire extinguishers will be inspected monthly	6. Instruct personnel on proper use of fire extinguishers

ACTIVITY HAZARD ANALYSIS
(cont'd)

Project. TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI
Activity: SITE PREPARATION AND MOBILIZATION OF EQUIPMENT

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
7. Heavy equipment	7. Heavy equipment will be inspected prior to use	7. Qualified operators only will use the heavy equipment. Heavy equipment will be operated within the manufacturer's recommended limits.
8. Chains, Slings, and Ropes	8 Inspections prior to each use will be conducted	8. Personnel will be trained on proper use of chains, slings, and ropes. Only qualified and competent persons will be permitted to perform.
9. Diesel Fuel/Oil and other potentially hazardous materials	9. Weekly safety inspection of storage and use areas will be conducted	9. Hazard Communication Training will be given.
10. Spill control materials	10. Weekly safety inspection of spill control materials will be conducted	10. Personnel will be given training on how to respond to spilled materials (in a defensive capacity).

ACTIVITY HAZARD ANALYSIS

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI

Activity: DRILL RIG SETUP AND BORING OPERATION

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1 Drill Rig setup	1 Underground hazards	1. All underground utilities will be identified prior to boring Dig Safe Number(s) will be called and documented.
2 Drill Rig operation	2 Rollovers	2. Equipment shall be set-up on stable ground and maintained level Cribbing will be used when necessary. Outriggers shall be extended as per manufacturer's specification.
	3. Back injuries	3. Site personnel will be instructed on proper lifting techniques; mechanical devices will be used to reduce menial handling of materials; team lifting will be used in lieu of mechanical devices.
	4. Overhead Hazards	4. (a) All personnel will wear hard hats. Ropes and other lifting equipment will be rated for the load that it is expected to lift. All ropes will be inspected at the beginning of each work shift. (b) All ground personnel will stay clear of all suspended loads. (c) All equipment will stay a minimum of 15 feet from energized electrical lines. This distance will increase as the voltage of the power lines increase.
	5 Slips/Trips/Falls	5 Tripping and footing hazards will be clearly identified and repaired as they are discovered; Maintain work areas safe and orderly, Even terrain will be utilized as unloading areas; work areas will be maintained safe and orderly.
	6 Dropped objects	6 Steel toe boots meeting ANSI standard Z41 will be worn.
	7. Eye injury	7. Safety glasses meeting ANSI standard Z87 will be worn.
	8 Struck by/against	8. No loose clothing, gauntlet-type gloves, rings, or watches will be worn by personnel operating drill rig equipment. Auger guides will be used on hard surfaces. Personnel will understand and review hand signals. Drill rigs and support equipment will be equipped with backup alarms. The drill rig operator will verbally alert employees and visually ensure employees are clear from dangerous parts of the equipment prior to starting or engaging equipment. All drill rig equipment will be equipped with automatic shut off devices Internal Combustion engines will be equipped with an ignition switch or grounding switch. Diesel engines will be equipped with quick closing valves which shut off air to intake ,manifold Electric switches will be equipped with suitable switch in motor circuits.
	9. Flying objects and debris	9. Splash shields and chemical goggles meeting ANSI standard Z87 shall be worn wherever applicable A portable eye wash station will be located around the work area
	10 Inhalation hazards	10 Initial work activities will be conducted in level D+. Air monitoring will be performed with a FID and the PPE will be upgraded to higher levels if necessary
	11. Noise	11. Hearing protection will be worn which has the noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); CTES will determine the need for hearing protection; all equipment will be equipped with manufacturer's recommended mufflers
	12 Fire	12. Smoking will not be allowed in the work area; 10-12 lb ABC fire extinguishers shall be readily available and its location known to all personnel working on site. Perform air monitoring for LEL.
	13. Sharp objects	13. Cut resistant work gloves will be worn. All hand and power tools will be maintained in safe condition. First aid kits will be available near the work area. Splash guards will be worn which can help protect against chips from striking the face.
	14. Struck by drill rods/augers	14. Worker shall stay clear of augers and drill rods. Tag lines shall be used on suspended loads when necessary.
	15. Caught in between rotating augers or parts	15. Workers shall remain at least 5 feet away from rotating augers. Cuttings will be removed only after augers have stopped turning.
	16. Heat Stress	16. All personnel working on site will be monitored for Heat/Cold stress according to Foster Wheeler Environmental's Health and Safety Procedures Manual. Drinking water will be available in Support Zone for hydration prior to work and for rehydration after work stops.

ACTIVITY HAZARD ANALYSIS
(cont'd)

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI
Activity: DRILL RIG SETUP AND BORING OPERATION

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
	17 Total Petroleum Hydrocarbon exposure	17. FID air monitoring will be conducted to detect any VOCs and appropriate PPE will be recommended. If BZ exceeds 50 ppm without detection of benzene or vinyl chloride, Level C respiratory protection shall be employed.
	18. Repetitive trauma injury during deconning spoons	18. Use lab-type squirt bottles, not trrigger sprayers, to decon spoons; rotate job assignments; lift work surfaces to 30-36 inches aboveground.

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1 Hand tools	1 Initial inspections will be required prior to use of hand tools	1. Personnel shall read and comply with SHSP.
2 Level D PPE (steel toe boots, hard hats, safety glasses)	2. CTES shall verify that personnel have proper PPE	2. Personnel shall be given notice of proper PPE.
3. Modified Level D PPE (coveralls, tyvek, booties, steel toe boots, hard hats, safety glasses, ear plugs or ear muffs, leather or kevlar gloves) (if required)	3. An initial inspection of each lot of PPE will be performed. The PPE should be visually inspected before each use.	3. Personnel will be given training on proper donning/doffing procedures.
4 Level C PPE (modified Level D plus full-face respirator with organic/HEPA cartridges) (if required)	4 Respirators shall be leak checked, cartridges shall be fresh.	4. Personnel shall have current 40-hour OSHA Health and Safety training and mase fit test.
5 First aid kits	5 Weekly inspections will be performed on first aid kits	5 Radio contact will be available with personnel at Tank Farm No. 4 who will have current CPR and Fist Aid Training.
6. Portable eye wash	6 Portable eye wash will be inspected monthly.	6 Instruct personnel on proper use of portable eye wash.
7. Fire extinguishers	7. Fire extinguishers will be inspected monthly.	7. Instruct personnel on proper use of fire extinguishers
8. Heavy equipment	8 Heavy equipment will be inspected prior to use	8. Qualified operators only will use the heavy equipment Heavy equipment will be operated within the manufacturer's recommended limits.
9. Chains, Slings, and Ropes	9 Inspections prior to each use will be conducted	9 Personnel will be trained on proper use of chains, slings, and ropes.
10 Diesel Fuel/Oil and other potentially hazardous materials	10 Weekly safety inspection of storage and use areas will be conducted	10. Hazard Communication Training will be given.
11. Spill control materials	11 Weekly safety inspection of spill control materials will be conducted	11. Personnel will be given training on how to respond to spilled materials.
12 Drill rig	12 Drill will be inspected prior to each use	12. Qualified operator will be used for drill rig operation.
13 Pressure washer	13 Pressure washer will be inspected prior to each use	13. Qualified operators will be used for pressure washers.

ACTIVITY HAZARD ANALYSIS

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI

Activity: SUBSURFACE SOIL SAMPLING DURING PILOT OPERATIONS

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1 Subsurface soil sampling during pilot operation (Hazards 1- 7 apply)	1. Inhalation hazards to VOCs	1. Initial work activities will be conducted in level D+. Air monitoring will be performed with a PID and the PPE will be upgraded to higher levels if necessary.
	2 Eye injury	2. Safety glasses meeting ANSI standard Z87 will be worn.
	3 Slips/Trips/Falls	3 Tripping and footing hazards will be clearly identified and removed out of the way. Maintain work areas safe and orderly.
	4 Dropped objects	4 Steel toe boots meeting ANSI standard Z41 will be worn.
	5 Sharp objects	5. Cut resistant work gloves will be worn. All hand and power tools will be maintained in safe condition Safety glasses meeting ANSI standard Z87 will be worn.

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1. Hand tools	1 Initial inspections will be required prior to use of hand and power tools	1. Personnel should read and comply with SHSP
2 Modified Level D PPE (coveralls, tyvek, booties, steel toe boots, hard hats, safety glasses, ear plugs or ear muffs, leather or kevlar gloves)	2 An initial inspection of each lot of PPE will be performed The PPE should be visually inspected before every use	2. Personnel will be given training on proper donning and doffing procedures.
3 First aid kits	3 Daily safety and weekly inspections will be performed on first aid kits	3. Radio contact will be available with personnel at Tank Farm No 4 who will have current CPR and Fist Aid Training.
4 Portable eye wash	4. Portable eye wash will be inspected monthly	4. Instruct personnel on proper use of portable eye wash
5 Fire extinguishers	5 Fire extinguishers will be inspected monthly	5 Instruct personnel on proper use of fire extinguishers
6 Spill control materials	6 Daily safety inspection of spill control materials will be conducted	6 Personnel will be given training on how to respond to spilled materials.

ACTIVITY HAZARD ANALYSIS

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI

Activity: EXCAVATION AND TRENCHING FOR UTILITIES

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1. Excavation for utility piping (Hazards 1- 13 apply)	1. Underground Utilities	1. Identify all underground utilities around the excavation site before work commences. Cease work immediately if any unknown utility markers are uncovered and report to the CTES.
2. Backfill and compaction after utility connections (Hazards 2-12 apply)	2 Vehicular Traffic	2. Spotter will be used when backing up trucks and moving equipment.
	3. Heavy Equipment (rollovers, overhead hazards, spills, struck by or against)	3. Equipment will have rollover protective structures and seat belts; operators shall wear belts when operating equipment; do not operate equipment in grades exceeding manufacturers recommendations; equipment will have guards, canopies or grills to protect from flying objects; ground personnel will stay clear of all suspended loads; all slings, chains, and ropes will be rated for the load in which it is expected to lift; spill absorbent materials will be readily available; drip pans, polyethylene sheeting or other means will be used for secondary containment; equipment will not be approached from blind sides, the equipment operator will be hand signaled before approaching ; avoid equipment swing areas, all equipment will be equipped with backup alarms.
	4 Noise	4 Hearing protection will be worn which has the noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); CTES will determine the need for hearing protection, all equipment will be equipped with manufacturer's recommended mufflers.
	5 Electrical shock	5 De-energize or disconnect all existing power lines before work commences. Use double insulated or properly grounded power-operated tools Grounded fault circuit breakers will be used, cords will be inspected prior to use everyday; only approved submersible type cords will be used in wet areas, keep all plugs and receptacles out of water, follow Lockout-Tagout procedures in accordance with FWENC's Health. and Safety Procedures Manual; damaged electrical equipment will be tagged and taken out of service
	6 Fire	6. Smoking will not be allowed in the work area; 10-12 lb ABC fire extinguishers shall be readily available and its location known to all personnel working on site
	7 Cuts, bits from thickets and insects	7 Wear white tyvek; use buddy system to check for ticks. Apply repellent
	8 Eye Injury	8. Safety glasses meeting ANSI standard Z87 will be worn
	9 . High/Low ambient temperature	9 All personnel working on site will be monitored for Heat/Cold stress according to Foster Wheeler Environmental's Health and Safety Procedures Manual.
	10 Total Petroleum Hydrocarbons exposure	10 FID air monitoring will be conducted to detect any VOCs and appropriate PPE will be worn per SSHP. If BZ exceeds 50 ppm without detection of benzene or vinyl chloride, Level C respiratory protection shall be employed

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1 Hand tools	1 Initial inspections will be required prior to use of hand tools	1 Personnel should read and comply with SHSP
2. Modified Level D PPE (coveralls, tyvek, booties, steel toe boots, hard hats, safety glasses, ear plugs or ear muffs, leather or kevlar gloves)	2. An initial inspection of each lot of PPE will be performed The PPE should be visually inspected before every use	2. Personnel will be given training on proper donning and doffing procedures

ACTIVITY HAZARD ANALYSIS
(cont'd)

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI
Activity: EXCAVATION AND TRENCHING FOR UTILITIES

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
3. Level C PPE (modified Level D plus full face respirator with organic/HEPA cartridges) (if required)	3. Respirators shall be leak checked, cartridges shall be fresh	3 Personnel shall have current 40-hour OSHA Health and Safety Training respirator fit test certificate, annual refresher training, if applicable, and medical clearance certificate.
4 First aid kits	4 Weekly inspections will be performed on first aid kits	4. Radio contact will be available with personnel at Tank Farm No. 4 who will have current CPR and Fist Aid Training.
5. Portable eye wash	5. Portable eye wash will be inspected monthly.	5 Instruct personnel on proper use of portable eye wash.
6 Fire extinguishers	6 Fire extinguishers will be inspected monthly	6 Instruct personnel on proper use of fire extinguishers.
7 Heavy equipment	7. Heavy equipment will be inspected prior to use	7. Qualified operators only will use the heavy equipment. Heavy equipment will be operated within the manufacturer's recommended limits
8. Diesel Fuel/Oil and other potentially hazardous materials	8 Weekly safety inspection of storage and use areas will be conducted	8. Hazard Communication Training will be given.
9. Spill control materials	9 Weekly safety inspection of spill control materials will be conducted.	9 Personnel will be given training on how to respond to spilled materials (in a defensive capacity)

ACTIVITY HAZARD ANALYSIS

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI

Activity: EQUIPMENT DECONTAMINATION

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1. Decontamination of Drill Rig and Equipment	1. Splash hazards due to pressurized water	1. Splash guards will be worn by employees along with safety glasses meeting ANSI standard Z87. A portable eye wash station will be located near the decontamination area.
	2 Slips/Trips/Falls	2. Tripping and footing hazards will be clearly identified and removed out of the way. Maintain work areas safe and orderly.
	3 Sharp objects	3. Cut resistant work gloves will be worn. All hand and power tools will be maintained in safe condition. First aid kit will be kept adjacent to work. Safety glasses meeting ANSI standard Z87 will be worn.
	4. Struck by water stream	4 Proper instruction on safe use of pressure washers will be conducted. Operators will not fix the hand trigger in the open position such that if the wand were left unattended, water would spray from the tip. All pressure washers will be equipped with a deadman switch Pressure washers will not be left running unattended. Pressure hoses will be inspected prior to use.
	5. Fire	5. Pressure washers shall not be started unless a steady flow of water is running to the machine (pressure washers shall not be run dry). A 10-lb ABC type fire extinguisher will be located adjacent to work area
	6. Dropped objects	6 All persons working in the decontamination area will wear steel toe boots meeting ANSI standard Z41.
	7. Overhead hazards	7 Personnel will be required to wear hard hats meeting ANSI Standard Z89.1.
	8. Total Petroleum Hydrocarbons exposure	8 FID air monitoring will be conducted to detect any VOCs and appropriate PPE will be worn per SSHP If BZ exceeds 50 pm without detection of benzene or vinyl chloride, Level C respiratory protection shall be employed

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1 Hand and power tools	1. Initial inspections will be required prior to use of hand and power tools	1. Personnel should read and comply with SHSP
2 Modified Level D PPE (coveralls, tyvek, booties, steel toe boots, hard hats, safety glasses, ear plugs or ear muffs, leather or kevlar gloves)	2. An initial inspection of each lot of PPE will be performed. The PPE should be visually inspected before every use.	2. Personnel will be given training on proper donning and doffing procedures.
3 First aid kits	3 Daily safety and weekly inspections will be performed on first aid kits	3. Radio contact will be available with personnel at Tank Farm No 4 who will have current CPR and Fist Aid Training
4. Portable eye wash	4 Portable eye wash will be inspected monthly.	4. Instruct personnel on proper use of portable eye wash.
5 Fire extinguishers	5. Fire extinguishers will be inspected monthly.	5 Instruct personnel on proper use of fire extinguishers.
6. Spill control materials	6 Weekly safety inspection of spill control materials will be conducted.	6. Personnel will be given training on how to respond to spilled materials (in a defensive capacity).

ACTIVITY HAZARD ANALYSIS

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI

Activity: PILOT OPERATIONS

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1 Operation of extraction blower (Hazards 1 through 8 apply)	1. Failure of mechanical equipment causing injury	1. All vendor supplied equipment shall be shop tested. Equipment selected for proper application. Interlocks provided in control system to shut down upon mech. overload.
2 Operation of biosparging compressor (Hazards 1 through 8 apply)	2 Failure of pressurized equipment causing injury	2. All vendor supplied equipment shall be shop tested. Equipment selected for proper application. Interlocks provided in control system to shut down upon overpressure via pressure relief valve
3 Operation of associated instruments (Hazards 1 through 8 apply)	3. Caught in rotating components	3. All vendor supplied equipment shall meets OSHA requirements for rotating hazard protection via belt guards, etc Label nippoints with cautionary sign.
4. Operation of sampling equipment (Hazards 6 and 8 apply)	4 Burns from hot surfaces	4. All surfaces of equipment which are hotter than 120°F shall be labeled per OSHA requirements
	5. Noise	5 Hearing protection will be worn which has the noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs), CTES will determine the need for hearing protection, all equipment will be equipped with manufacturer's recommended mufflers.
	6 Electrical shock	6. Installation of electrical system by licensed electrician. De-energize or disconnect all existing power lines before work commences. Use double insulated or properly grounded power-operated tools. Grounded fault circuit breakers will be used, cords will be inspected prior to use everyday, only approved submersible type cords will be used in wet areas, keep all plugs and receptacles out of water, follow Lockout-Tagout procedures in accordance with FWENC Health and Safety Procedures Manual; damaged electrical equipment will be tagged and taken out of service Receptacles shall be approved for wet area and be GFCI protected Label breaker.
	7 Fire	7 Smoking will not be allowed in the work area; 10-12 lb ABC fire extinguishers shall be readily available and its location known to all personnel working on site.
	8 Exposure to Total Petroleum Hydrocarbons	8. FID air monitoring will be conducted to detect any VOCs and appropriate PPE will be recommended. Monitor BZ; employ Level C respiratory protection if FID reading > 50 ppm without detection of benzene or vinyl chloride.

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1 Regenerative blower	1 Upon arrival at site and before operation	1 Operations personnel shall read manufacturer's literature
2 Air compressor	2 Upon arrival at site and before operation	2 Operations personnel shall read manufacturer's literature.
3 Instrumentation associated with blower and compressor	3 During operation of equipment	3. Operations personnel shall replace defective instrumentation.
4 Sampling equipment	4 Before each use	4 Operations personnel shall be familiar with sampling equipment.
5 First Aid Kits	5 Weekly inspection shall be performed	5. Radio contact will be available with personnel at Tank Farm No. 4 who will have current first aid and CPR training.
6 Fire extinguishers	6 Monthly inspections shall be performed	6 Personnel shall be familiar with fire extinguisher operation.
7 Hand and power tools	7 Prior to each use	7. Personnel shall be familiar with proper use of hand and power tools.
8 Level D PPE (steel toed boots, hard hats, safety glasses)	8 CTES shall verify that personnel have proper PPE	8. Personnel shall be given notice of proper PPE.
9 Level C PPE (if required) (coveralls, tyvek, booties, steel toed boots, hard hats, nitrile inner/outer gloves, full face respirator with HEPA/organic cartridges)	9 Respirators shall be leak checked, cartridges shall be fresh	9. Personnel shall have current 40-hr OSHA Health and Safety training, respirator fit test, and annual refresher training and medical clearance if necessary.

ACTIVITY HAZARD ANALYSIS

Project: TANK FARM NO. 5, TANK 50 REMEDIAL ACTIONS, NETC-NEWPORT Location: NEWPORT, RI

Activity: DEMOBILIZATION OF EQUIPMENT

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1 Disconnect power lines (Hazard 1 applies)	1. Electrical shock	1. Power supply will be cut off and locked out before disconnecting the power lines. Lock and Tag procedures shall be employed per FWENC H&S Manual.
2 Remove equipment (Hazards 2-6 apply)	2. Vehicular Traffic	2. Spotter will be used when backing up trucks and moving equipment.
	3 Slips/Trips/Falls	3 Tripping and footing hazards will be identified and reparired before work, tripping and footing hazards will be clearly identified and repaired as they are discovered, Maintain work areas safe and orderly.
	4 Noise	4 Hearing protection will be worn which has the noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); CTES will determine the need for hearing protection; all equipment will be equipped with manufacturer's recommended mufflers.
	5 Heavy Equipment (rollovers, overhead hazards, spills, struck by or against)	5. Equipment will have rollover protective structures and seat belts; operators shall wear belts when operating equipment; do not operate equipment in grades exceeding manufacturers recommendations, equipment will have guards, canopies or grills to protect from flying objects; ground personnel will stay clear of all suspended loads; all slings, chains, and ropes will be rated for the load in which it is expected to lift, spill absorbent materials will be readily available, drip pans, polyethylene sheeting or other means will be used for secondary containment, equipment will not be approached from blind sides; the equipment operator will be hand signalled before approaching ; avoid equipment swing areas, all equipment will be equipped with backup alarms
	6 High/Low ambient temparature	6 All personnel working on site will be monitored for Heat/Cold stress according to Foster Wheeler Environmental's Health and Safety Procedures Manual

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1 Hand and power tools	1. Initial inspections will be required prior to use of hand and power tools	1 Pearsonnel should read and comply with SHSP
2 Level D PPE (steel toe boots, hard hats, safety glasses)	2. CTES shall verify that personnel have proper PPE	2 Personnel shall be given notice of proper PPE
3 First aid kits	3 Daily safety and weekly inspections will be performed on first aid kits	3. Radio contact will be available with personnel at Tank Farm No. 4 who will have current CPR and Fist Aid Training.
4 Portable eye wash	4 Portable eye wash will be inspected monthly.	4 Instruct personnel on proper use of portable eye wash
5 Fire extinguishers	5 Fire extinguishers will be inspected monthly	5. Instruct personnel on proper use of fire extinguishers.
6. Heavy equipment	6 Heavy equipment will be inspected prior to use	6. Qualified operators only will use the heavy equipment. Heavy equipment will be operated within the manufacturer's recommended limits
7 Chains, Slings, and Ropes	7 Inspections prior to each use will be conducted	7. Personnel will be trained on proper use of chains, slings, and ropes

APPENDIX D

PPE Selection Form

Foster Wheeler Environmental Corporation

PERSONAL PROTECTIVE EQUIPMENT SELECTION

ACTIVITY:_____

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR

APPENDIX E

Medical Data Sheet

APPENDIX F

General Health and Safety Work Rules

FOSTER WHEELER ENVIRONMENTAL CORPORATION

GENERAL HEALTH AND SAFETY WORK RULES

1. All site personnel must attend each day's Health and Safety Briefing.

2. Any individual taking prescribed drugs shall inform the HSO of the type of medication. The HSO will review the matter with the Project Health and Safety Manager and the Corporate Medical Consultant (CMC), who will decide if the employee can safely work on-site while taking the medication.

3. The personal protective equipment specified by the HSO and the HASP shall be worn by all site personnel. This includes hard hats and safety glasses which must be worn at all times in active work areas.

4. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.

5. All personnel must sign the site log and the exclusion zone log when used at the site.

6. Personnel must follow proper decontamination procedures and shower at the end of the work shift.

7. Eating, drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the PHSM to allow fluid intake during heat stress conditions.)

8. All lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.

9. All signs and demarcations shall be followed. Such signs and demarcation shall not be removed except as authorized by the HSO.

10. No one shall enter a permit-required confined space without a permit. Confined space entry permits must be followed as issued.

11. All personnel must follow Hot Work Permits as issued.

12. All personnel must use the Buddy System in the Exclusion Zone.

13. All personnel must follow the work-rest regimens and other practices required by the heat stress program.

14. All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.

15, No person shall operate equipment unless trained and authorized.

16. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.

17. Ladders and scaffolds shall be solidly constructed, in good working condition and inspected prior to use. No one may use defective ladders or scaffolds.

18. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.

19. Safety belts, harnesses and lanyards must be selected by the Supervisor. The user must inspect the equipment prior to use. No defective personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.

20. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.

21. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out walkways and puddles unless protected and rated for the service.

22. Improper use, mishandling or tampering with health and safety equipment and samples is prohibited.

23. Horseplay of any kind is prohibited.

24. Possession or use of alcoholic beverages, controlled substances or firearms on any site is forbidden.

25. All accidents, no matter how minor must be reported immediately to the Supervisor.

26. All personnel shall be familiar with the Site Emergency Response Plan.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with all regulations set forth by OSHA, the FWENC Corporate H&S Manual, the HASP, the client, FWENC Supervisors and the HSO.

APPENDIX G

Equipment Decontamination Form

FOSTER WHEELER ENVIRONMENTAL CORPORATION
NAVY RAC DELIVERY ORDER #0011
NETC TANK FARM 5
DECONTAMINATION CERTIFICATE

EQUIPMENT ID: _____

_____

_____

To Navy ROICC:

The above referenced equipment was decontaminated on (Date: _____)

Very truly yours,

_____
FWENC Representative

Comments: _____

_____

_____

RE/96-247

APPENDIX H

Weekly Report

FOSTER WHEELER ENVIRONMENTAL CORPORATION
NORTHERN DIVISION - NAVY RAC
NETC - TANK FARM 5
WEEKLY HEALTH AND SAFETY REPORT

Project Name: _____

Location: _____

SITE INFORMATION	INJURIES AND ILLNESSES
Week Ending _____	Yes_____ No_____
Hours Worked _____	Describe and attach reports:
Level of Protection B ___ C ___ D __	_____

MAJOR ACTIVITIES CONDUCTED THIS WEEK:
(drum handling, sampling, excavation, abatement/T&D, etc.)

_____

SIGNIFICANT EVENTS THIS WEEK:
(regulatory visits, equipment malfunctions, process start-up or shutdown):

_____

FUTURE ISSUES:
(schedule, manpower allocation, monitoring equipment, other resources needed)

_____

SITE AUDIT/INSPECTIONS CONDUCTED Yes _____ No _____
(describe outstanding findings and attach results)

_____

RE/96-293-12A

AIR MONITORING:

Real Time

Major Activity	Location(s)	Worker Occupation	FID/PID Range	CGI/02 Range	PDM Range	Other

PERSONAL AIR MONITORING

Analyte	Activity Monitored	Occupation	Location	Result	Type of Sample

SUBCONTRACTORS ON SITE

Company Name	Task or Function	Return to Site Next Week (Y/N)

Health and Safety Officer - Signature

Date

Prepare in quintuplicate (original and 4 copies)

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

CONTROL NO. 1B

CONTRACT NO	DELIVERY ORDER #	ACTIVITY LOCATION
N62472-94-D-0398	0011 (Newport) / Job #1	Naval Education and Training Center - Newport, RI

PROJECT TITLE:
GWTS at Tank Farm #5 at Naval Education and Training Center (NETC), Newport, RI

FROM:	DATE
Foster Wheeler Environmental Corp. - Program QCM: Akram Aziz	May 21, 1996
TO: ROICC	DATE
LTJG. C. Peterson (2 copies)	May 21, 1996

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:

[X] COTR P. BRIEGEL (6COPIES) [ ] DESIGNER [ ] OTHER

Akram Aziz 5/21/96
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

ITEM NO.	SUBMITTAL DESCRIPTION	PREPARED/ SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
1B	SD-18, Records	A. Aziz			
	Final Incident Prevention Plan				
	to include response to Navy comments				

MISC\96-184.DOC

FOSTER WHEELER ENVIRONMENTAL CORPORATION

May 21, 1996
File #: 1284.0011.96.0290

Contracting Officer
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, PA 19113
ATTN: Code 402A (P. Briegel)

Subject: NAVY RAC - CONTRACT NO. N62472-94-D-0398
GROUNDWATER TREATMENT FACILITY -NETC RHODE ISLAND
DELIVERY ORDER #0011
RESPONSE TO NAVAL ENVIRONMENTAL HEALTH CENTER (NEHC) COMMENTS
DRAFT INCIDENT PREVENTION PLAN

Dear Mr. Briegel:

We have reviewed the Navy comments, provided by the NEHC, regarding the draft Incident Prevention Plan (IPP) for the subject project. The comments and our responses are presented below.

1. **COMMENT:** Page 2, Section 2.1, "Purpose":

a) The fourth sentence states, "This facility has been operating since March 1995 and , according to Navy personnel, the influent is considered clean." Information describing what is meant by "clean" is not provided and it is unclear what is to be accomplished at this site (i.e., remediation of contaminated groundwater). If remediation of chemically contaminated groundwater is performed, then guidance found in 29 CFR 1910.120 and 29 CFR 1926.65 must be adhered to.

b) The fifth sentence states, "all activities performed under this IPP will comply with applicable parts of the Foster Wheeler Environmental Corporation Health and Safety Program Manual." Information is not provided stating where this document is located on-site.

NEHC Recommended that FWENC:

a) Review anticipated site operations and clearly state what is required.
b) Clearly state where this program is to be maintained on-site.

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

RESPONSE:

a) This facility has been operating since March 1995 and the analytical results for the organic compounds in the groundwater influent are below limits of detection. Therefore, there are no contaminants of concern. This was stated in section 2.1 of the final IPP.

b) The manual will be maintained at the office located on-site.

2. **COMMENT:** Page 3, Section 2.3, "Application":

This section states, "The IPP applies to all personnel involved in remediation activities who wish to gain access to active work area, including but not limited to: Navy Representatives, Foster Wheeler Environmental and subcontractors."

NEHC Recommended: that each subcontractor, as a minimum, provide their own "task-specific" hazard analysis.

RESPONSE:

There will be no subcontractors as part of this work. The section will be changed to state, "The IPP applies to all personnel involved in remediation activities who wish to gain access to active work areas, including but not limited to: Navy Representatives and Foster Wheeler Environmental," in the final IPP.

3. **COMMENT:** Page 3, Section 3.0, "Project Organization and Responsibilities":

No company official has been assigned to establish communications with the NOSC/NOSCDR, the LEPC, and other potential emergency response organizations.

NEHC Recommended: that FWENC assign these coordination activities to an appropriate company official.

RESPONSE:

Mr. Todd Wert, the system operator, is the company official assigned to establish communications with the NOSC/NOSCDR, the LEPC, and other potential emergency response organizations.

4. **COMMENT:** Page 7, Section 7.1, "PPE Selection":

The stated levels of PPE are listed as Level D or Modified Level D. However, in Appendix B, first page of Activity Hazard Analysis," under "Control Measures" for the task titled , "General," it states, "Provide level C protection, if necessary." No information is provided stating how this determination is to be made.

NEHC Recommended: that FWENC review the PPE levels for these tasks and revise them as necessary to maintain consistency throughout the document.

RESPONSE:
Appendix B, first page of Activity Hazard Analysis," under "Control Measures" for the task titled , "General," will be corrected to state "Provide level D or modified level D protection".

5. **COMMENT:** Page 8, Section 8.0, "Air Monitoring Requirements":

The paragraph states, "... there will be no real-time air monitoring performed due to the absence of volatile contaminants in the groundwater, as indicated by Navy personnel." However, on page 3, Section 2.4, "Summary of Major Risks," the first bullet cites, "Exposure to volatile organic compounds and raw material during O & M activities." Again in Appendix B, first page of the "Activities Hazard Analysis," under "Potential Hazards" for the task titled, "General'" it cites "Chemical exposure to TPH via inhalation and skin." Due to the conflicting information, it is unclear what hazards exist at this site.

NEHC Recommended: that an appropriate air monitoring program be established, particularly initial entry monitoring prior to daily or periodic entry.

RESPONSE:
Since the organic contaminant levels in the influent have been below limits of detection, an air monitoring program will not be established. The inconsistency was addressed in the final IPP.

6. **COMMENT:** Page 8, Section 9, "Zones, Protection and Communications":

a) The last sentence of Section 9.1, "Site Zones," states, "As a result, during normal operations the entire GWTF is classified as a support zone (SZ)." The first sentence, Section 9.1.1, "Work Zone (WZ)," states, "The WZ is the suspected area of contamination or exposure and presents the greatest potential for worker exposure," and the first sentence of Section 9.1.3, "Support Zone (SZ)" states, "The SZ is an uncontaminated area (control room) that will be used for supporting O & M operation." EPA defines the WZ as an area of known potential for worker exposure to site contaminants.

b) The third bullet, Section 9.2, "General Rules" states, "Consumption of food and drink is permitted only at the operator's desk. Hands and face must be washed upon leaving the GWTF and before eating, drinking, chewing gum or tobacco, and smoking or other activities which may result in ingestion of contaminants."

NEHC Recommended:
a) That the GWTF be treated as a work zone and , if the control room is directly accessible from the outside of the building, it should be established as the SZ.
b) FWENC recommend that any activities that might result in ingestion of site contaminants be restricted to areas outside of the GWTF.

RESPONSE:
a) The recommendation will be included in the text, "GWTF normal operation...GWTF is classified as a work zone (WZ), but will only require level D protection...or process chemical is possible, a special work zone area will be established around that activity to control...contaminants. The remaining GWTF areas will be consider normal operations.

Personnel performing activities within an established special work zone will meet requirements of 29 CFR 1910.120 (e). If chemicals are detected in the influent, any personnel inside the GWTF will be notified of the establishment of a special WZ and be required to remain outside of these zones."

b) The office space inside the GWTF will act as a support zone (SZ), since it has a door and walls which separate it from the rest of the work area.

7. **COMMENT:** Page 10, Section 10.2, "Noise":

This paragraph states, "Noise is a potential hazard associated with the operation of the treatment system. Noise monitoring is not part of the IPP. Hearing protection devices will be worn if the operator has to shout to a co-worker to communicate at a distance of 3 feet." Information is not provided stating that a hearing conservation program has been developed and implemented.

NEHC Recommended: that, the final IPP, include an appropriate method to quantify sound pressure levels in accordance with 29 CFR 1910.95.

RESPONSE:
Section 10.2 will be changed in the final IPP to state that, "all FWENC employees receive an audiogram as part of their pre-employment medical examination, per FWENC HS 4-4. Based upon our operating experience with this type of facility, the sound pressure level is less than 70/dBA.

8. **COMMENT:** Page 11, Section 12.0, "Medical Surveillance":

Information is not provided stating that the medical surveillance program is performed by or under the direct supervision of a certified occupational health physician.

NEHC Recommended: that the final IPP, provide pertinent information as required by Navy/Marine Corps Installation Restoration Manual (February 1992).

RESPONSE:
The FWENC medical surveillance program in supervised by Dr. Peter Greaney, a Board Certified Physician. NEHC recommendation included in the final IPP.

9. **COMMENT:** Page 12, Section 13.0, "Emergency Response Plan":

a) Information is not provided for periodic exercising of emergency response plan or for critiquing the exercise or incident.

b) Section 13.5.1, "Emergency Telephone Numbers": The list is noted to be incomplete or inaccurate. For example, it does not include the telephone number for the NOSC/NOSCDR, LEPC or a civilian medical treatment facility. A 1-800 telephone number is provided for a poison control center. Information available to this office indicates that Rhode Island does not have an in-state 1-800 poison control center listing. Additionally, no map or written directions to the base or civilian medical facilities is provided.

NEHC Recommended that:
a) Include guidance for exercising and critiquing emergency response plan in the final IPP.
b) Revise the list to include all appropriate emergency response personnel. Telephone numbers should be verified prior to commencing on-site operations. We also recommend adding a map clearly depicting the route(s) to the medical facilities.

RESPONSE:
a) The treatment plant operator is aware of his role under section 13.0 and a revision to Section 13.0 was made in the final IPP.

b) A map was included in the final IPP. The list of emergency phone numbers was corrected and verified as to accuracy.

10. COMMENT: Page 16, Section 13.8, "Overt Chemical Exposure":

The second paragraph addressing "Eye Contact," states, "An emergency eyewash is located in the guard house.' It is unclear if this is in close proximity to the site of potential exposures. The American National Standards Institute (ANSI) states, "Emergency eyewash units shall be in accessible locations that require no more than 10 seconds to reach and should be within a travel distance no greater than 100 feet from the hazard." The maximum time required to reach the eyewash should be determined by the potential effect of the chemical. For a strong acid or caustic, the eyewash should be immediately adjacent to or within ten feet of the hazard.

NEHC Recommended: that information in the final IPP state that the emergency eyewash units are positioned to meet the criteria of ANSI Standard Z358.1-1990.

RESPONSE:
The eyewash is located in the GWTF and not the Guard House. The revision to Section 13.8 was made in the final IPP.

11. COMMENT: Page 17, Section 13.9, "Decontamination During Medical Emergencies":

The first sentence states, "If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted."

NEHC Recommended: that FWENC rephrase the sentence to indicate that decontamination may be deferred (not omitted.)

RESPONSE:
The revision to Section 13.9 was made in the final IPP.

12. COMMENT: Page 19, Section 14.0, "Training":

a) Section 14.1, "Site -Specific Training," contains no information that site workers have received OSHA mandated training for hazardous waste operations. Additionally, no information is provided regarding periodic "tail-gate' or "tool-box" safety meetings.

b) Section 14.2, "First Aid and CPR": This paragraph states, " It is expected (emphasis ours) that a minimum of one person at the NETC site will be trained in first aid and cardiopulmonary resuscitation (CPR) in order to render aid if needed."

NEHC Recommended that:
a) In the final IPP, clearly state the specific types of hazardous waste training site workers have received. Additionally, it is suggested that copies of employee training certificates be kept on-site for the duration of the project.

b) We recommend at least two trained employees certified in CPR and First Aid, be present on-site at all times work is being performed. These employees should also have received appropriate blood borne pathogens training as required by 29 CFR 1910.1030.

RESPONSE:
a) The treatment plant operator has not received OSHA 1910.120 training because the training requirements of 1910.120 do not apply as the GWTF is processing non-hazardous water. The operator was given instruction by the PHSM that included, but was not limited to the following:

1. IPP discussion on his duties and responsibilities.
2. Type of PPE to be worn and how to don/doff.
3. Hazard communication training, i.e., labels, msd's.
4. Process hazards review and analysis.

b) Only a single part-time operator will operate the system at all times. He has access to an on-site phone and emergency phone numbers and notification procedures.

If you have any questions or comments, please do not hesitate to call me at 215-702-4074.

Very truly yours,

Greg P. Coppi for

Arthur B. Holcomb, P.E., C.I.H.
Program Manager

ABH/eh
Attachment

cc: A. Aziz, FWENC
G. Coppi, FWENC
D. Kopcow, FWENC
File

FOSTER WHEELER

FOSTER WHEELER ENVIRONMENTAL CORPORATION

INCIDENT PREVENTION PLAN

Site:	**Naval Education and Training Center**
Location:	**Newport, Rhode Island**
Prepared By:	**Foster Wheeler Environmental Corporation**
Date Prepared:	**May 20, 1996**
Revision:	**0**
Delivery Order:	**0011**
Project Description:	**Operation and Maintenance of the Tank Farm #5 Groundwater Remediation Pump and Treat System**
Overall Hazard:	**Low**

Includes Navy Comments from April 11, 1996

FOSTER WHEELER ENVIRONMENTAL CORPORATION, FOSTER WHEELER SUBCONTRACTORS, AND THE DEPARTMENT OF THE NAVY DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

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APPENDIX B: Activity Hazard Analyses
APPENDIX C: PPE Form
APPENDIX D: Work Rules
APPENDIX E: Medical Data Sheet
APPENDIX F: Lockout/Tagout Procedures

1.0 PLAN IDENTIFICATION AND APPROVALS

APPROVALS

By their signatures, the undersigned hereby certify that this Incident Prevention Plan (IPP) for the operation and maintenance of the groundwater remediation pump and treat system has been reviewed and approved for the Naval Education and Training Center Site located in Newport, Rhode Island.

Project Manager	Date 5/21/96
Site Contact	Date
Project Health and Safety Manager	Date 5/21/96

2.0 INTRODUCTION

2.1 Purpose

This Incident Prevention Plan (IPP) addresses the health and safety practices that will be employed by all site workers participating in the groundwater remediation located at the Naval Education and Training Center (NETC) located in Newport, RI . The IPP takes into account the specific hazards inherent to the NETC site and presents the minimum procedures to be followed by Foster Wheeler Environmental Corporation, its subcontractors, and all other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. The format of an IPP was chosen instead of a HASP because of the low potential for employee exposure to groundwater contaminants. This facility has been operating since March 1995 and, the analysis of influent water indicated that, the organic compound levels are below limits of detection. All activities performed under this IPP will comply with applicable parts of the Foster Wheeler Environmental Corporation (FWENC) Health and Safety Program Manual. The manual will be stored at the office located on-site. Modifications to the IPP may be made with the approval of the PHSM using the Field Change Request form found in **Appendix A.**

2.2 Scope

2.2.1 Operation and Maintenance (O&M) of the Groundwater Remediation Pump and Treat System

This IPP has been developed to address health and safety concerns relative to the Operation and Maintenance of the groundwater remediation pump and treat system. The remedial action activities include the following tasks:

- Vessel charging
- Raw materials handling
- Influent/effluent sampling
- Waste disposal

The treatment system as designed and installed is nearly self operating. The treatment system operator needs approximately three hours per day to perform standard system monitoring and maintenance procedures. This includes replenishing treatment chemicals, reading and recording pH, pressure, and flow gages, and performing additional maintenance as may be required.

The groundwater treatment process consists of thirteen extraction wells and an associated treatment system. Groundwater removed from the extraction wells is pumped to the treatment building where the primary treatment is Ultraviolet Oxidation and Activated Carbon. Prior to chemical treatment, solids and dissolved metals are removed from the influent stream via chemical addition of flocculants, clarifiers and filtration from sand/gravel filters.

2.3 Application

The IPP applies to all personnel involved in the remediation activities who wish to gain access to the active work area, including but not limited to:

- Navy representatives
- Foster Wheeler Environmental employees

2.4 Summary of Major Risks

The IPP has been developed to address the following major risks during the groundwater remediation actions at the Naval Education and Training Center (NETC) site located on Newport Naval Base.

- Exposure to raw materials during O&M activities; and
- Safety hazards that may arise during O&M activities.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section specifies the Foster Wheeler Environmental Project Organization. Foster Wheeler Environmental will manage the project.

3.1 Project Manager (PM) - Dan Kopcow

- Has the overall responsibility for the health and safety of site personnel
- Ensures that adequate resources are provided to the field staff to carry out their responsibilities as outlined below
- Participates in periodic inspections

3.2 Program Health and Safety Manager (PHSM) - Grey Coppi

- Provides for the development and approval of the IPP
- Serves as the primary contact to review health and safety matters that may arise
- Approves revised or new safety protocols for field operations
- Coordinates revisions of this IPP with field personnel
- Assists in the investigation of major accidents
- Conducts periodic inspections for compliance with the IPP

3.3 Treatment Plant Operator - Todd Wert

Mr. Todd Wert, the system operator, will be the company official assigned to establish communications with the NOSC/NOSCDR, the LEPC, and other potential emergency response organizations.

- Performs work in compliance with this IPP
- Notifies the PM and the PHSM of all accidents/incidents
- Completes and maintains Accident/Incident Report forms
- Reports to PM and the PHSM to provide summaries of field operations and progress
- Maintains health and safety field log books
- Takes steps necessary to correct unsafe acts or conditions
- Establishes communications with the NOSC/NOSCOR, the LEPC and other potential emergency response organizations

4.0 SITE HISTORY AND PROJECT DESCRIPTION

4.1 Location

The NETC is located at the Newport, Rhode Island, Naval base, in the towns of Newport, Middletown and Portsmouth, Rhode Island, approximately 25 miles southeast of Providence, RI. The Naval Base facility is shown in **Figure 4-1**.

4.2 Site Background and Description

The groundwater was believed to be contaminated with waste oil from a leaking underground storage tank farm.

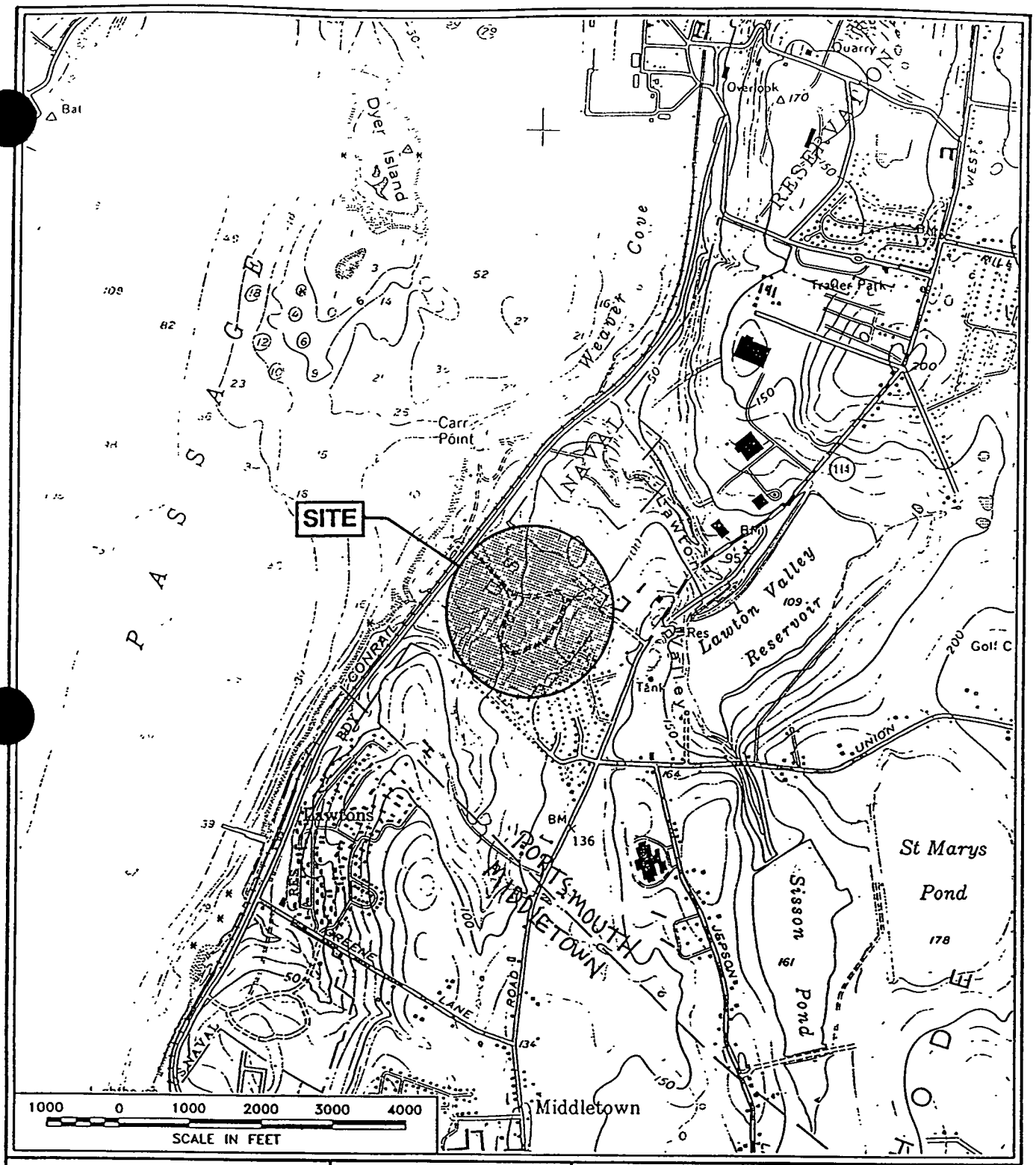
5.0 POTENTIAL HAZARDS OF THE SITE AND RISK EVALUATION

5.1 Chemical Hazards

Exposure to in-situ chemical hazards during O&M operations is not expected to be a concern as referenced by past groundwater sampling results. The potential for exposure will be low as long as procedures outlined in this IPP are followed and that the proper personal protective equipment (PPE) is utilized, where appropriate.

Material Safety Data Sheets for process chemicals (raw materials) that will be used during general O&M operations will be contained in **Appendix F** when they are obtained. Raw materials to be used on-site include:

- Flocculent
- Sulfuric acid



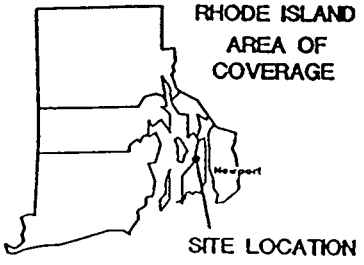


FIGURE 4-1

Naval Education and Training Center
Newport, Rhode Island

SITE LOCATION MAP

SCALE: AS SHOWN

CADFILE-1284FG11 DWG

- Sodium hydroxide
- Hydrogen peroxide
-

5.2 Physical Hazards

Most physical hazards and their control measures are discussed in the Activity Hazard Analysis for O&M operations. The following hazards have been identified:

- Slips, trips, and falls
- Strains and sprains
- Cuts / punctures
- Fires
- Lockout/tagout.

The risk of exposure to safety hazards during O&M operations is low to moderate.

5.3 Safety Hazards

Most safety hazards are discussed in the Activity Hazard Analyses for the different phases of O&M operations. Hazards that may arise include those from poor housekeeping; equipment operation; the use of hand and portable power tools; handling and storage of raw materials; use of electrical power; and work on elevated work surfaces or platforms.

The risk of exposure to safety hazards during this project is low. In addition to the AHAs, standard work rules and other safety procedures are described in **Section 10** of this IPP.

6.0 ACTIVITY HAZARD ANALYSES (AHAs)

Activity Hazard Analyses (AHAs) have been developed for each major phase of work planned to take place during the O&M operations of the groundwater remediation pump and treat system for the NETC site located on the Naval Base. The AHAs reflect the hazards discussed in **Section 5.2** and some control measures.

Additional AHAs should be developed by the PHSM, or designee, for all unanticipated phases of work and / or prior to working on a new task.

The AHAs will be used to instruct person(s) on the hazards of activities during a phase preparatory meeting prior to commencement of each task. AHAs are included in **Appendix B** for the following phases of work:

- Vessel charging
- Product sampling
- Raw material handling
- Waste disposal

7.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) represents the hazard analysis and PPE selection required by 29 CFR 1910.132. For the purposes of PPE selection, the PHSM or designee are considered competent persons. The signatures on the front of the IPP constitute certification of the hazard assessment. For activities not covered by the IPP, the operator will conduct the hazard assessment and select the PPE using the blank form provided in **Appendix C** and shall certify the assessment by signing the form. PPE selection will be made in consultation with the PHSM.

Modifications for initial PPE selections may also be made by the operator in consultation with the PHSM. A written justification for downgrades will be provided to the PHSM for approval as a field change request.

7.1 PPE SELECTION

Activity	Level of Protection
Normal Plant Operations	D
Charging Vessels/Mixing Chemicals	D Mod with Full face shield
Sampling Influent / Effluent	D with rubber gloves
Materials Handling	D Mod
Spill Response	D Mod

Level D	Level D Modified
Hard Hat *	Hard Hat *
Safety Glasses	Safety Glasses **
Steel-toed Work Boots	Steel-toed Work Boots
Rubber Gloves*	Vinyl Liquid Proof Apron
Outer Cotton Gloves*	Rubber Gloves
Hearing Protection *	Neoprene or Nitrile
	Outer Booties or
	Outer Boots - Rubber
	Hearing Protection *

* Optional

** Add splash shield during mixing and handling chemicals

8.0 AIR MONITORING REQUIREMENTS

During O&M operations for the Groundwater Remediation Activities, there will be no real-time air monitoring performed due to the absence of volatile contaminants in the groundwater, as indicated by Navy personnel.

9.0 ZONES, PROTECTION AND COMMUNICATION

9.1 Site Zones

The NETC Groundwater Treatment Facility (GWTF) was designed in order to reduce or eliminate the potential for exposures (to operating personnel) to less than the OSHA PEL's during normal operations. As a result, protective clothing during normal operations is Level D. During normal operations, all systems are sealed and the passive vacuum system is drawing vapors from tanks. As a result, during normal operations the entire GWTF is classified as a work zone (WZ), but will only require Level D protection.

During maintenance activities and/or other activities where contact with contaminants or process chemicals is possible, the special work area will be established around that activity which will require an upgrade to modified Level D protection to control the exposure to and spread of contaminants. The remaining GWTF areas will be considered normal operations.

Any WZs and CRZs established inside of the GWTF will be properly demarcated as described below. Any personnel inside of the facility will be notified of the establishment of special WZs and CRZs and to remain outside of these zones.

9.1.1 Work Zone (WZ)

The WZ is the suspected area of contamination or exposure and presents the greatest potential for worker exposure. A WZ will also be established when contact with site contaminants or process chemicals is likely. Personnel entering WZs must wear the required levels of protection for the activity being performed and receive Hazard Communication Training according to the FWENC Health and Safety Program Manual (HS 4-2). See **Section 7.1** for task specific PPE information.

Work zones shall be identified through the use of caution tape and stanchions. The WZ must include all areas of potential exposure and usually will extend at least 5 feet from the work activity. The zone size will be modified as necessary based upon the work being performed.

9.1.2 Contamination Reduction Zone (CRZ)

The CRZ is established as a buffer between the WZ and the support zone. The CRZ shall provide sanitary towelettes for personnel and a method for collecting used PPE and other miscellaneous items used during O&M activities. The CRZ area will be located near the door to the office (support zone).

9.1.3 Support Zone (SZ)

The SZ is an uncontaminated area (control room) that will be used for supporting O&M operation. The SZ provides for personnel communications and emergency response equipment. Potentially contaminated personnel / materials are not allowed in this zone. The only exception to this will be appropriately packaged / decontaminated and labeled samples. The office space in the GWTF will act as a support zone since it has a door and walls which separate it from the rest of the work area.

9.2 General Rules

The following requirements are necessary to protect the health and safety of workers at the site.

- Toasters, toaster ovens and microwave ovens are prohibited in the GWTF.
- Smoking is prohibited in the GWTF Building. Smoking is permitted outside the GWTF only in designated areas.
- Consumption of food and drink is permitted only at the operator's desk. Hands and face must be washed upon leaving the GWTF and before eating, drinking, chewing gum or tobacco, and smoking or other activities which may result in ingestion of contaminants.
- Visitors must sign in and out of the site and must be escorted whenever inside of the facility.

All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, will be subject to disciplinary action. Proper decontamination procedures, if necessary, must be followed before leaving the WZ.

10.0 SAFETY CONSIDERATIONS

10.1 Fire

Storage of flammable liquids (fuels, solvents) indoors will be discouraged. All raw materials will be appropriately segregated and stored per their MSDS's. The treatment plant operator will receive

Hazard Communication Training according to section HS 4-2 of the FWENC Health and Safety Program Manual and will be provided by the PHSM. Tanks and piping will be labeled as to their constituents and numbered per the P&ID.

In the event of a fire, procedures will include immediately evacuating the work zone, notification of the Naval fire department and other appropriate emergency response groups. No personnel will fight a fire beyond the stage where it can be put out with an ABC-type portable fire extinguisher (incipient stage). The facility will have as a minimum, two ten pound ABC-type fire extinguishers.

10.2 Noise

Noise is not expected to be a potential hazard associated with the operation of the treatment system. Noise monitoring is not a part of this IPP. Hearing protection devices will be worn if the operator is around a piece of process equipment which requires him to have to shout to a co-worker at a distance of 3 feet to be heard. All FWENC employees receive an audiogram as part of their pre-employment examination.

10.3 Fall Protection

When working on surfaces greater than 6 feet aboveground, the operator shall be provided with fall protection that may include: 1) personal fall arrest system; 2) standard rails; and, 3) other fall protection/prevention methods approved by the PHSM.

10.4 Confined Space

Confined Space / Limited Egress areas must be identified and labeled as a Confined Space. At this time it is not anticipated that employees will need to enter a confined space; however, if confined space work is required, the PHSM shall be notified and the Corporate Confined Space Program (HS 6-2) will be followed. Entry into a confined space shall not be attempted until the proper training for the application is provided.

10.5 Other Considerations

Depending on the activities included in the O&M operations, other Foster Wheeler programs and procedures will be implemented at the site. Examples include:

- Material Storage -- HS 3-7 (flammable, compressed gases, corrosives, radiation sources)

- Lockout/Tagout -- HS 6-5 (procedures shall be developed and followed if the operator is expected to perform system repairs and maintenance of the water treatment plant)

10.6 General Health and Safety Work Rules

A list of work rules has been included in the Foster Wheeler Environmental Health and Safety Program Manual (HS 3-6). These rules have been incorporated into the IPP as **Appendix D.** The work rules will be posted in a conspicuous location at the site.

11.0 WASTE DISPOSAL PROCEDURES

All discarded materials, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard or causing litter to be left on site. All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. Liquid rinsate will be collected, drummed, labeled and stockpiled on-site for final disposition or pumped into the treatment system. All non-contaminated materials shall be collected and bagged for appropriate disposal as non-hazardous solid waste.

12.0 MEDICAL SURVEILLANCE REQUIREMENTS

All contractor and subcontractor personnel performing field work where the potential for exposure to contaminants exist at the site are required to have passed a medical surveillance examination reviewed by a certified occupational physician in accordance with 29 CFR 1910.120(f). This requirement shall be evaluated by the PHSM person on a case-by-case basis.

According to OSHA standard 1910.120(f), an employer must establish a medical surveillance program for:

- All employees exposed or potentially exposed to hazardous substances or health hazards above the permissible exposure limits for more than 30 days per year:
- Workers exposed above the published exposure levels (if there is no permissible exposure limit for these substances) for 30 days or more a year:
- Workers who wear approved respirators for 30 or more days per year on site: and
- Workers who are exposed to <u>unexpected</u> or <u>emergency releases</u> of hazardous wastes above exposure limits (without wearing appropriate protective equipment), or who show signs, symptoms, or illness that may have resulted from exposure to hazardous substances.

All FWENC personnel performing field work where potential exposure to contaminants exist at the site are required to have passed a medical surveillance examination in accordance with 29 CFR 1910.120(f).

A medical clearance was issued to the treatment plant operator as part of the FWENC pre-employment physical examination. The FWENC Corporate Medical Consultant, Dr. Peter Greaney, a board certified occupational physician, administers the FWENC medical surveillance program.

12.1 General

Foster Wheeler personnel working at the NETC site will have completed a medical examination prior to performing O&M operations. The medical examination requirements are identified below:

- Medical and occupational history
- General physical examination (including evaluation of major organ system)
- Urinalysis with microscopic examination
- CBC
- Chemistry panel
- Electrocardiogram
- Chest X-ray
- Urine analysis screening for the presence of drugs

12.2 Medical Data Sheet

A medical data sheet is provided in **Appendix E**. This medical data sheet will be completed by all on-site personnel and kept at the site. Where possible, this medical data sheet will accompany the personnel needing medical assistance or transport to hospital facilities. The medical data sheet will be maintained in a secure location, treated as confidential, and used only on a need-to-know basis.

13.0 EMERGENCY RESPONSE PLAN

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly and require an immediate response; therefore, contingency planning and advanced training of staff are essential. Specific elements of emergency support procedures which are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures. Emergency procedures will be tested at least once a quarter to make sure emergency contact personnel are still available at the numbers posted.

13.1 Responsibilities

13.1.1 Program Health and Safety Manager (PHSM)

The PHSM oversees and approves the Emergency Response/Contingency Plan and performs audits to determine that the plan is in effect and that all pre-emergency requirements are met. The PHSM acts as a liaison to applicable regulatory agencies.

13.1.2 Treatment Plant Operator

The **Treatment Plant Operator** is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized (if permitted in the O&M Manual) in the event of a stop work order or evacuation. The Operator is required to immediately notify the PHSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the PHSM can notify OSHA within the required time frame (eight hours). The PHSM and the PM will be notified of all OSHA recordable injuries, fires, spills/splashes to body, releases or equipment damage in excess of $500 within 24 hours.

13.1.3 Emergency Coordinator (EC)

The Emergency Coordinator is the **Treatment Plant Operator**. The EC shall locate emergency phone numbers and identify hospital routes.

It is recognized that the treatment plant operator will be working alone during most of this project. Nevertheless, whenever additional personnel enter the GWTF to perform limited duties, he/she will be given a basic understanding of the requirements of the IPP and his/her responsibilities.

The EC shall implement the Emergency Response/Contingency Plan whenever conditions at the site warrant such action. The EC will be responsible for prior coordination of the emergency treatment and transport of site personnel as necessary, and notification of emergency response units.

13.1.4 Site Personnel

Site personnel, when applicable, are responsible for understanding their roles with regard to the Emergency Response/Contingency Plan and the procedures contained herein.

Site Personnel are expected to notify the EC of situations that could constitute a site emergency. A meeting shall take place between the site response chief and the project manager to discuss roles.

Base personnel shall not enter the GWTF and shall await the arrival of the treatment plant operator.

Table 13-1

EMERGENCY TELEPHONE NUMBERS

Contact	Firm or Agency	Telephone Number
Police	NETC Portsmouth State	911 or 401-841-3241 911 or 401-683-0300 911 or 401-849-4444
Fire	NETC Portsmouth	911 or 401-841-3333 911 or 401-683-1155
Hospital	Newport Hospital	401-845-1640
Ambulance	NETC Newport Fire Department	911 or 401-841-2222 911 or 401-846-2211
Site Superintendent	Foster Wheeler Environmental	401-847-4888
PHSM - Grey Coppi	Foster Wheeler Environmental	215-702-4079
SHSO	Foster Wheeler Environmental	TBD
Navy ROICC, Ltc. Charles Peterson	Navy	401-841-1764
Navy On-Scene Coordinator (NOSC	Navy Fire Chief	401-841-3333
Local Emergency Planning Community (LEPC)	Newport Fire Department	401-847-2695
Poison Control Center		800-552-6337
Chemtrec		800-424-9300
National Response Center		800-424-8802

13.2 Communication

The primary form of communication during an emergency between the site and outside emergency response groups will be the telephone. Prior to starting operations at the site, the emergency phone numbers will be posted in conspicuous locations throughout the site. In addition, the emergency numbers will be field tested to assure proper response by emergency services.

13.3 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on-site:

- Telephone
- One industrial size first aid kit
- Burn kit
- Spill absorbents and neutralizers
- Shovels/brooms
- Emergency eye wash / shower - meeting ANSI approval Z358.1-1990
- Two fire extinguishers-ABC type - 10 pound
- One 85 gallon overpack drum
- Two 55-gallon drums for waste containerization
- One emergency eye wash/shower - meeting ANSI approval Z358.1-1990
- Two plastic shovels and two brooms
- Fifty pounds of absorbent such as clay or "DRI-Z0RB"
- Citric acid or equivalent to neutralize caustic spills
- Lime, baking soda or equivalent to neutralize acid spills - may substitute pH nine neutralizer
- Thirty-pound pail - available from Lab Safety, for acid/base neutralization
- Twenty-five solvent sheets (diapers)
- Fifty feet of sausage shaped absorbent booms

13.4 Postings

The following information shall be posted in the GWTF Building:

- Emergency telephone numbers
- General health and safety rules
- Hospital route
- Job safety and health (OSHA) poster
- Map of emergency equipment locations
- Primary evacuation routes

13.5 Potential Emergency Situations and Procedures

13.5.1 Emergency Telephone Numbers

A list of emergency telephone numbers is presented in Table 13-1. This list will be posted in a conspicuous location and in all vehicles.

The hospital location map is presented in Figure 13-1.

13.5.2 Personnel Injury

The procedures and rules in this IPP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it must be reported to the PHSM and PM immediately.

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that is available on-site. Unless they are in immediate danger, injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. First aid instructions that can be obtained from doctors or paramedics, prior to the arrival of the emergency-response squad or before the injured person can be transported to the hospital, will be followed.

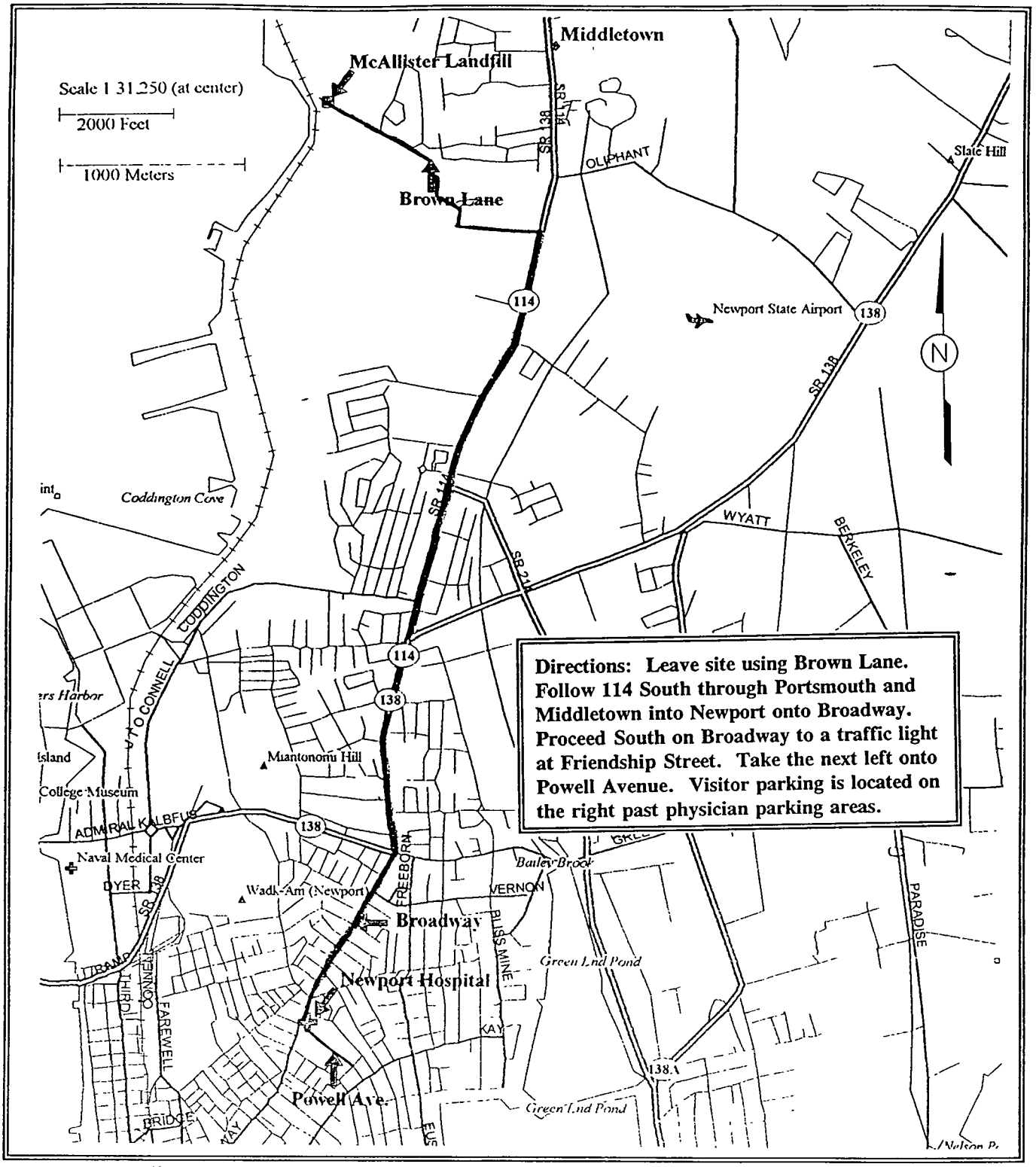
13.6 Emergency Site Evacuation Procedures

In order to mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear chain of authority will be established. The EC will take charge of all emergency response activities and dictate the procedures that will be followed for the duration of the emergency. The EC will assess the seriousness of the situation, and direct the efforts of site/base personnel until the emergency response units arrive, provided that workers have the appropriate training and experience necessary to deal with the particular situation. In consultation with the PHSM and PM, the EC also may order the closure of the site for an indefinite period.

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs, including but not limited to fire, explosion or significant release material and/or gas, the operator will call the base security, the PM and the PHSM.

The EC will remain at the site to provide any assistance requested by emergency-response squads as they arrive to deal with the situation.

Figure 13-1



Hospital Location Map

13.7 Potential or Actual Fire or Explosion

Fires may be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials
- Storage of flammable liquids and gases away from oxidizers
- Storage of acids away from caustics
- No smoking within the GWTF
- No hot work allowed
- Grounding and bonding metal containers during transfer of flammable liquids
- Fire extinguishers rated at least 10 pounds ABC
- Monthly inspections of all fire extinguishers

In the event of a fire or explosion, procedures will include immediately evacuating the site, notification of local fire and police departments the PM, PHSM, base personnel and other appropriate emergency response groups. Personnel will not fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

13.8 Overt Chemical Exposure

Skin Contact:	Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, then provide appropriate medical attention. An emergency eyewash shower is located in the GWTF. Eyes should be rinsed for 15 minutes upon chemical contamination. Skin should also be rinsed for 15 minutes if contact with caustics, or acids occurs.
Eye Contact:	An emergency eyewash is located in the GWTF. Eyes should be rinsed for a minimum of 15 minutes and / or continuously while in route to the emergency medical facility.
Inhalation:	Move to fresh air and / or, if necessary, decontaminate and transport to the emergency medical facility.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration:	Decontaminate and transport to emergency medical facility.

13.9 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or postponed. The operator or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The PM or PHSM will be available for consultation with hospital staff regarding the properties of the contaminants if the operator is injured. An MSDS of the known or suspected contaminants will be brought or faxed to the hospital following the incident. The outer garments can be removed on site if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier shall be placed between the injured individual and clean surfaces to help prevent contaminating the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim on site, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, standard decontamination procedures will be followed.

13.10 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met by the Operator (EC), the following parties are to be contacted by telephone:

1. Dan Kopcow, Project Manager - 215-702-4076

2. Grey Coppi, Program Health and Safety Manager - 215-702-4079

3. The employer of any injured worker who is not an employee of Foster Wheeler Environmental.

Written confirmation of the verbal report shall be submitted immediately by site security. The report form entitled "Accident / Incident Report" is to be used for this purpose.

For reporting purposes, the term incident refers to fatalities, lost time injuries, spill or exposure to hazardous materials (radioactive, toxic, explosive, flammable or corrosive), fire, explosion, damage to property, or potential occurrence of the above.

13.11 Spill Control and Response

Proper neutralizing agents should be available based upon the properties of the materials expected on-site as well as those brought onto the site. All small hazardous spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS should be consulted to assist in determining the best means of containment and cleanup. For small spills sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be neutralized carefully prior to attempting recovery. All spill containment materials will be properly disposed. A work zone around the spill area should be established.

The following steps should be taken by the Emergency Coordinator:

1. Determine the nature and major spill components.
2. Make sure all unnecessary persons are removed from the spill area.
3. Notify appropriate response teams and authorities.
4. If a flammable liquid, gas or vapor is involved, remove or shut down all ignition sources such as heaters, and use nonspark and/or explosive proof equipment to contain or clean up the spill;
5. Increase building ventilation by opening all doors, vents and engage fans.
6. Use proper PPE when dealing with the spill.
7. If possible, one or more of the following procedures may be performed:

   - Upright a drum that may have spilled
   - Apply neutralizing agents to the spill
   - Close or open the valve

13.12 Restoration and Salvage

Following an emergency, prompt restoration of utilities, overflow protection devices, pressure relief valve (PRV), fire protection equipment and medical supplies will reduce the possibility of further losses. Some of the items that may need to be addressed are:

Resetting of process parameters:

- Low/high alarm setpoints/flow controllers
- Refilling fire extinguishers
- Refilling first aid supplies
- Replacing used containment and absorbent materials

14.0 TRAINING

14.1 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site and will highlight all provisions contained within this IPP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Records of work training will be kept in the office on-site.

14.2 First Aid and CPR

It is expected that a minimum of one person at the NECT site will be trained in first aid and cardiopulmonary resuscitation (CPR) in order to render aid if needed.

14.3 Hazard Communication

Hazard communication training will be provided in accordance with the requirements contained in the Foster Wheeler Environmental Health and Safety Program Manual, Section 4-2.

15.0 LOGS, REPORTS, AND RECORD KEEPING

The following is a summary of required health and safety logs, reports, and recordkeeping to be maintained by the treatment plant operator when applicable.

15.1 Field Change Request (FCR)

This form will be completed to initiate a change to the IPP. The approval of the PHSM and Program Manager or designee is required. The original will be kept in the project file. Approved changes will be reviewed with affected field personnel at a safety briefing. Copies will be distributed to the Client Representative.

15.2 Accident / Incident Reports

The incident reporting and investigations will follow the procedures described in **Section 13.10** of this IPP and Foster Wheeler Environmental Corporation Health and Safety Program Manual, section HS 1-8.

15.3 Medical and Training Records

Verification of personnel training and medical qualifications must be reviewed by the PM, PHSM and/or designee prior to assignment. Medical records for all site personnel will be maintained by the CMC in accordance with Foster Wheeler Environmental Corporation Health and Safety Program Manual, Section HS 1-8.

16.0 REFERENCES

1. Foster Wheeler Environmental, 1995 Health and Safety Program Manual

2. BNA Safely CD, February 1996, Federal Regulations, Title 29, Parts 1910 & 1926

3. Operation and Maintenance Manual, August 1995

4. Interim Remedial Action Naval Education and Training Center, Prepared by Zenone, Inc.

17.0 FIELD PERSONNEL REVIEW FORM

The Field Personnel Review Form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the IPP. It is maintained on site as a project record. Each person shall sign this section after site training is completed and prior to the commencement of field activities.

APPENDIX B

ACTIVITY HAZARD ANALYSES

ACTIVITY HAZARD ANALYSIS

Project Identification: Newport, RI	Location: General Work Areas	Estimated Start Date: March 13, 1996
Phase of Work: Other	Analysis Performed By: Grey P. Coppi	Analysis Approved By: Grey P. Coppi
TASK	**POTENTIAL HAZARDS**	**CONTROL MEASURES**
General	1. Chemical Exposure to raw materials via inhalation and skin	1. Provide adequate level of protection upon task ventilation i.e., fans, vents, general ventilation. • Provide level "D" or modified Level "D" protection
	2. Slips, trips, falls	2. Maintain work areas safe and orderly.
	3. Manual lifting and material handling	3. Instruct personnel in proper lifting techniques and use lifting aids whenever possible.
	4. Fire	4. Smoking not allowed in GWTF. • Flammables stored properly. • In-compatibles stored properly. • Electrical maintenance performed by licensed electrican. • Fire extinguishers available.
	5. Spills, overflows	5. Install high alarms with auto shut offs. • Verify proper system operating parameters. • Provide secondary containment for raw materials. • Hard-pipe transfers, where feasible.

ACTIVITY HAZARD ANALYSIS

Project Identification: Newport, RI	**Location:** General Work Areas	**Estimated Start Date:** March 13, 1996
Phase of Work: Start-up Operation	**Analysis Performed By:** Grey P. Coppi	**Analysis Approved By:** Grey P. Coppi
TASK	**POTENTIAL HAZARDS**	**CONTROL MEASURES**
Delivery of Chemicals	1. Contact with hazardous chemicals used in groundwater treatment	1. Wear proper PPE and clothing.
	2. Spill or rupture of container or tank	2. Follow proper delivery procedures. • Have spill equipment readily available. • Don't leave delivery personnel alone, monitor their activities. • Maintain safe distances between chemicals. • Follow chemical-specific procedures from manufacturers.
	3. Lifting injuries	3. Use proper lifting techniques and use lifting aids whenever possible
Transferring Process Chemicals from Drums to Tanks	1. Chemical Contact with acid/base	1. Wear proper PPE and clothing including splash shields, goggles, gloves and apron.
	2. Manual Lifting and Material Handling	2. Instruct personnel in proper lifting techniques and use lifting aids whenever possible.
	3. Improper Mixing of Chemicals	3. Follow proper mixing procedures described in MSDS and/or O&M Manual such as; pour acid slowly into water, constantly stirring.
	4. Spills	4. Ensure stable base prior to opening/ transfer of chemicals • Open and transfer only on secondary containment • Use lifting aid and drum movers • Ensure all drums, piping and tanks are clearly labelled.

ACTIVITY HAZARD ANALYSIS

ject Identification: Newport, RI	**Location:** General Work Areas	**Estimated Start Date:** March 13, 1996
Phase of Work: O+M	**Analysis Performed By:** Grey P. Coppi	**Analysis Approved By:** Grey P. Coppi
TASK	**POTENTIAL HAZARDS**	**CONTROL MEASURES**
Vessel Charging and Additions	1. Manual lifting and material handling. 2. Slips, trips, falls 3. Caustic acid burns to eyes/skin	1. Instruct personnel in proper lifting techniques and use lifting aids whenever possible. 2. Maintain work areas safe and orderly; unloading areas should be on level level terrain; mark and repair tripping hazards if possible. 3. Wear splash shield, goggles, rubber gloves and MOD "D" protection. Use pump to transfer liquids into containers.
Influent/Effluent Sampling	1. Slips, trips, falls 2. Contact with hazardous chemicals (acid/base) used in groundwater treatment 3. Spill of material	1. Maintain work areas safe and orderly. 2. Wear proper PPE and clothing. Modified Level D clothing, at a minimum 3. Avoid spills. Open sample valves slowly. Use large container.
Waste Disposal	1. Manual lifting and material handling. 2. Slips, trips, falls 3. Exposure to raw mateials	1. Instruct personnel in proper lifting techniques and use lifting aids whenever possible. 2. Maintain work areas safe and orderly. 3. Provide adequate ventilation i.e., fans, vents, general ventilation. • Don PPE when needed

APPENDIX C

PPE FORM

Foster Wheeler Environmental Corporation

PERSONAL PROTECTIVE EQUIPMENT SELECTION

ACTIVITY:_____

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR

APPENDIX D

WORK RULES

FOSTER WHEELER ENVIRONMENTAL CORPORATION

GENERAL HEALTH AND SAFETY WORK RULES

1. All site personnel must attend each day's Health and Safety Briefing.

2. Any individual taking prescribed drugs shall inform the HSO of the type of medication. The HSO will review the matter with the Project Health and Safety Manager and the Corporate Medical Consultant (CMC), who will decide if the employee can safely work on-site while taking the medication.

3. The personal protective equipment specified by the HSO and the HASP shall be worn by all site personnel. This includes hard hats and safety glasses which must be worn at all times in active work areas.

4. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.

5. All personnel must sign the site log and the exclusion zone log when used at the site.

6. Personnel must follow proper decontamination procedures and shower at the end of the work shift.

7. Eating, drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the PHSM to allow fluid intake during heat stress conditions.)

8. All lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.

9. All signs and demarcations shall be followed. Such signs and demarcation shall not be removed except as authorized by the HSO.

10. No one shall enter a permit-required confined space without a permit. Confined space entry permits must be followed as issued.

11. All personnel must follow Hot Work Permits as issued.

12. All personnel must use the Buddy System in the Exclusion Zone.

13. All personnel must follow the work-rest regimens and other practices required by the heat stress program.

14. All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.

15, No person shall operate equipment unless trained and authorized.

16. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.

17. Ladders and scaffolds shall be solidly constructed, in good working condition and inspected prior to use. No one may use defective ladders or scaffolds.

18. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.

19. Safety belts, harnesses and lanyards must be selected by the Supervisor. The user must inspect the equipment prior to use. No defective personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.

20. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.

21. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out walkways and puddles unless protected and rated for the service.

22. Improper use, mishandling or tampering with health and safety equipment and samples is prohibited.

23. Horseplay of any kind is prohibited.

24. Possession or use of alcoholic beverages, controlled substances or firearms on any site is forbidden.

25. All accidents, no matter how minor must be reported immediately to the Supervisor.

26. All personnel shall be familiar with the Site Emergency Response Plan.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with all regulations set forth by OSHA, the FWENC Corporate H&S Manual, the HASP, the client, FWENC Supervisors and the HSO.

APPENDIX E

MEDICAL DATA SHEET

Foster Wheeler Environmental Corporation

MEDICAL DATA SHEET

The brief medical data sheet shall be completed by all on-site personnel and will be kept in the Support Zone by the HSO as a project record during the conduct of site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project: _____

Name: _____ Home Telephone: _____

Address: _____

Age: _____ Height: _____ Weight: _____ Blood Type: _____

Name and Telephone Number of Emergency Contact: _____

_____

Drug or Other Allergies: _____

Particular Sensitivities: _____

Do You Wear Contacts? _____

Provide A Check List Of Previous Illnesses: _____

_____

_____

_____

What Medications Are You Presently Using? _____

_____

_____

Do You Have Any Medical Restrictions? _____

_____

Name, Address, And Phone Number Of Personal Physician: _____

_____

_____

RE/96-245

APPENDIX F

LOCKOUT/TAGOUT PROCEDURES

NETC - MIDDLETOWN, RHODE ISLAND GROUNDWATER TREATMENT FACILITY SITE-SPECIFIC LOCKOUT/TAGOUT PROCEDURES		
Equipment	**Operation**	**Lockout Method/Location**
Control panel	Inspection and repair	Disengage main breaker; lock and tag breaker box.
Groundwater Recovery Pumps	Inspection, cleaning, and repair	Disengage main breaker; lock and tag breaker box.
Equalization tank mixer M-1	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position; unplug mixer, lock and tag mixer plug.
Sodium hydroxide tank feed pump CIP-05	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; turn off pump, unplug pump, lock and tag pump plug.
Floor sump pump VP-01	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; turn off pump, unplug pump, lock and tag pump.
Equalization tank transfer pump P-01A	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position.
Equalization tank transfer pump P-01B	Inspection, cleaning and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position.
Coagulant mixer M-2	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; unplug mixer, lock and tag mixer plug.
Coagulant tank feed pump CIP-06	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; turn pump off, unplug pump, lock and tag pump plug.
Flocculant mixer M-3	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; unplug mixer, lock and tag mixer plug.
Flocculant tank feed pump CIP-02	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; turn pump off, unplug pump, lock and tag pump plug.
Sludge tank feed pump SP-01	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; unplug pump, lock and tag pump plug

NETC - MIDDLETOWN, RHODE ISLAND GROUNDWATER TREATMENT FACILITY SITE-SPECIFIC LOCKOUT/TAGOUT PROCEDURES		
Equipment	**Operation**	**Lockout Method/Location**
Equalization tank recycled water feed pump P-05	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; unplug pump, lock and tag pump plug.
Clearwell tank #2 transfer pump P-02A	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position.
Clearwell tank #2 transfer pump P-02B	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off " position.
Pressure sand filter backwash pump P-04	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position; watch pressure gauge as pressure relieves; begin work when pressure gauge reads zero.
Clearwell tank # 3 mixer M-4	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position; unplug mixer, lock and tag mixer plug.
Sulfuric acid tank feed pump CIP-03	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; turn pump off, unplug pump, lock and tag pump plug.
Clearwell tank #3 transfer pump P-03A	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position.
Clearwell tank #3 transfer pump P-03B	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position.
Hydrogen peroxide tank feed pump CIP-01	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; turn pump off, unplug pump, lock and tag pump plug.
Ultra-violet oxidation unit	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; disengage local handswitch, lock and tag in "off" position.

NETC - MIDDLETOWN, RHODE ISLAND GROUNDWATER TREATMENT FACILITY SITE-SPECIFIC LOCKOUT/TAGOUT PROCEDURES		
Equipment	**Operation**	**Lockout Method/Location**
Air compressor	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position; drain reservoir of compressed air, or lock and tag valve handles in "closed" position.
Filter press	Inspection, cleaning, and repair	Disengage circuit breaker #21, lock and tag in "off" position.

Prepare in quintuplicate (original and 4 copies)

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

CONTROL NO 1B

CONTRACT NO	DELIVERY ORDER #	ACTIVITY LOCATION
N62472-94-D-0398	0011 (Melville) / Job #2	Naval Education and Training Center - Melville, RI

PROJECT TITLE:
Soil Stabilization and Removal at Naval Education and Training Center (NETC), Melville, RI

FROM:	DATE
Foster Wheeler Environmental Corp. - Program QCM: Akram Aziz	May 21, 1996
TO: ROICC	DATE
LTJG. C. Peterson (2 copies)	May 21, 1996

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:

[X] COTR [ ] DESIGNER [ ] OTHER

P. BRIEGEL (6COPIES)

SIGNATURE AND DATE 5/21/96

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

ITEM NO.	SUBMITTAL DESCRIPTION	PREPARED/ SUBMITTED BY	APPROVED	DISAPPROVED	REMARKS
1B	SD-18, Records	A. Aziz			
	Final Health and Safety Plan for soil				
	pile remediation, Melville NETC, RI				
	to include response to Navy comments				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

May 21, 1996
File #: 1284.0011.96.0298

Commanding Officer
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, PA 19113
ATTN: P. Briegel (Code 402A)

Subject: NAVY RAC - CONTRACT NO. N62472-94-D-0398
NAVAL EDUCATION AND TRAINING CENTER - MELVILLE, RI
DELIVERY ORDER #0011 - DRAFT SITE HEALTH & SAFETY PLAN
RESPONSE TO COMMENTS

Dear Mr. Briegel:

We have reviewed the Navy comments, provided by NEHC, regarding the draft Site Health and Safety Plan (SHSP) for the subject project. The comments and our responses are presented below.

1. **COMMENT:** Page 2, Section 1.3, "Application": This section states "The SHSP applies to all personnel in the above tasks who wish to gain access to the active work area, including but not limited to: Client representatives, Federal, state or local representatives, and Foster Wheeler Environmental employees and subcontractors."

Recommendations: We recommend that each subcontractor, as a minimum, provide their own "task-specific" hazard analysis.

RESPONSE: FWENC provides subcontractors with the SHSP and an opportunity to offer comments. The following has been included in Section 1.3, "Subcontractor will be provided an opportunity to review AHAs specifically relating to their task and offer comments; however, all subcontractors will be required to follow Foster Wheeler Environmental's SHSP."

2. **COMMENT:** Page 3, Section 2.0, "Project Organization and Responsibilities": No company official has been assigned to establish communications with the NOSC/NOSCDR, the LEPC, and other potential emergency response organizations.

Recommendation: Assign these coordination activities to an appropriate company official.

RESPONSE: The assigned Site Superintendent will be the company official assigned to establish communications with the NOSC/NOSCDR, the LEPC, and other potential emergency response organizations. This was stated in Section 2.2 in the final SHSP.

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

3. **COMMENT:** Page 5, Section 3.1, "NETC Background": The second sentence of the second paragraph states, "However, the trace amounts of asbestos present in some of the samples prevent its use and/or recycling for other purposes." This is the only mention of asbestos in the plan and it is not clear why it is not listed as a contaminant of potential concern (COPC).

Recommendation: Provide justification for excluding the asbestos in the soil as a COPC, or supply pertinent air monitoring and PPE information in the final SHSP.

RESPONSE: Recommendation noted, the level of protection will be upgraded to Level C during all work activities involving the soil pile contaminated with asbestos. Personal air monitoring will be performed for asbestos during the asbestos pile removal and subsequent treatment. Additional decontamination procedures were also added to Section 8.0.

4. **COMMENT:** Page 8, Section 5.0, "Activity Hazard Analysis": Information pertaining to heat related illness, such as signs and/or symptoms of heat illness, work-rest cycles, at what temperature physiological monitoring must commence, particularly if wearing semi-permeable or impermeable clothing is not provided.

Recommendation: We recommend providing the above listed information, with emphasis on the proper field treatment and management of heat casualties, in the final SHSP.

RESPONSE: Recommendation included in the final SHSP as an additional hazard in the AHAs.

5. **COMMENT:** Page 9, Section 6.0, "Personal Protective Equipment": The sixth paragraph states, "Level D modified PPE will be the initial level of protection used for soil stabilization, soil loading and transportation to the landfill, provided the air monitoring results are below the action levels specified for Level C PPE as described in Table 7.1." This is contrary to the standard industrial hygiene procedure of using the higher level of PPE and then downgrading as data is obtained.

Recommendation: We recommend thoroughly reviewing anticipated site operations and revising PPE assignments, as necessary, to protect site workers at all times.

RESPONSE: PPE requirements will initially include using Level C PPE for the pile containing lead and asbestos; however, the remaining soil piles contaminated with TPH will be removed in Modified Level D as stated previously with real time air monitoring performed to support this decision. This latter decision is based upon FWENC experience and the type of activity performed.

6. **COMMENT:** Page 10, Section 7.0, "Air Monitoring":

6a) The fourth sentence in Section 7.1, states, "Dust monitoring as surrogate for lead exposure will not be performed because the lead in soil concentration is unknown." As information regarding potential lead contamination levels is not provided in this document, it is unclear how the determination to initially use Level D Modified PPE versus Level C or higher was made.

6b) Provisions for conducting personal monitoring of site personnel at greatest risk of exposure to hazardous materials is not provided as required by 29 CFR 1910.120 and 29 CFR 1926.65.

6c) Information as to how site workers will be informed of site monitoring results is not provided in the SHSP.

Recommendation: a) Prior to starting work, determine the lead in soil concentration. If the lead in soil concentration exceeds 2000 ug/g, state what PPE will be required and how personal monitoring will be conducted. b) Include appropriate guidance for monitoring high risk personnel in the final SHSP. c) Provide information as to how workers will be informed of their monitoring results.

RESPONSE:

6a) Real time dust monitoring will be performed during Task 1 activities with the action levels included in Table 7.1. The dust action level in soil is calculated to be 2.5 mg/m^3 based on the lead levels (approximately 900 ppm) in soils.

6b) Due to the low lead concentration in soil, a total dust level of approximately 55 mg/m^3 would have to be attained to reach the OSHA PEL of .050 mg/m3.

$$\frac{106 \times .050(\text{PEL})}{900 \text{ ppm (soil conc.)}} = \frac{55.5 \text{ mg/m}^3}{4 \text{ (safety factor)}} = 14.0 \text{ mg/m}^3 \text{ (derived dust action level)}$$

Respirable dust OSHA PEL =

$$\frac{5.0 \text{ mg/m}^3}{2 \text{ (safety factor)}} = 2.5 \text{ mg/m}^3 \text{ (site dust action level)}$$

2.5 mg/m^3 = The chosen action level for this site based upon the lead in soil concentration

6c) Personal air monitoring for lead will not be performed unless sustained real-time dust levels exceed 2.5 mg/m^3. Air monitoring results are always discussed with employees and are posted on-site.

7. **COMMENT:** Page 12, Section 8.0, "Zones, Protection and Communication":

7a) Information is not provided stating that all site personnel and/or visitors, will be required to log-in and log-out, when entering the CRZ or the EZ.

7b) Information in Section 8.2.1, Personnel Decontamination Station," appears to be generic, and not site-specific information. The second paragraph states, " Level D and Level D modified will be a dry decon which requires..." and the last sentence states, " All workers should wash their face and hands prior to leaving the site." Also, information directing the collection and containment of spent decontamination fluids is not provided.

7c) As an administrative comment, we feel that it would be helpful if information in Section 11.0, "Waste Disposal Procedures" were incorporated with the decontamination information in Section 8.2, "Contamination Control."

Recommendation: a) Provide a statement in the final SHSP requiring personnel to log-in/log-out from the site. b) Provide site-specific decontamination guidance, which includes provisions for collection and containerizing spent decontamination liquids. Additionally, we recommend that as a minimum, upon exiting the CRZ/EZ, that all personnel thoroughly wash their face, hands and arms prior to eating, drinking, smoking or any other activity that may allow for hand to mouth transfer of site COCs.

RESPONSE:

7a) Recommendation will be included as part of SHSP.

7b) Recommendation will be included as part of SHSP.

7c) Section 11.0 will be moved to Section 8.4 as per recommendation.

8. COMMENT: Page 20, Table 12.1, "Emergency Telephone Numbers": Information in this table is incomplete or misleading. For example, no telephone number is provided for the NOSC/NOSCDR, the LEPC, or the Base medical facility. Additionally, it is not clear if the telephone numbers provided for the police and fire departments are base or civilian organizations. As this is a naval installation, the base emergency response organizations would normally be the initial point of contact.

Recommendation: Provide appropriate telephone numbers in the final SHSP and verify them prior to starting site work.

RESPONSE: Telephone numbers have been corrected and verified.

9. COMMENT: Page 21, Section 12.5, "Emergency Site Evacuation Routes and Procedures":

9a) The text contradicts itself on what actions personnel would take in the event of a hazardous materials release. For example, the first paragraph of Section 12.5, states, "The EC will take charge of all emergency response activities and dictate the procedures that will be followed for the duration of the emergency. The EC will...direct whatever efforts are necessary until the emergency response units arrive." The last sentence in the second paragraph states, "All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at..." It is not clear if the site personnel will respond to an emergency or will evacuate the site.

9b) If site personnel will function as emergency response personnel, then an emergency response plan in accordance with 29 CFR 1910.120 (l) must be established.

Recommendation: a) Clearly state what action(s) site personnel will take in an emergency situation. If site personnel will act as emergency responders, indicate that they have received sufficient training to safely act in this capacity. b) If site personnel will respond to emergencies, revise this section so it meets the requirements of paragraph (l) of 29 CFR 1910.120.

RESPONSE:
9a) The final SHSP will be changed to state, Foster Wheeler site personnel will not act as emergency responders.

9b) See Response 9a, no changes will be made to SHSP.

10. COMMENT: Page 27, Section 13.6, "First Aid and CPR": The second sentence states, "It is expected that a minimum of one field person on-site will be certified in First Aid and CPR.

Recommendation: We recommend that a minimum of two personnel, trained and certified in adult first aid/CPR, be on-site during periods of site operations.

RESPONSE: Since this project is within an operating naval base with accessibility to base and off-site medical response personnel as well as another FWENC site, FWENC will provide a single first aid/CPR trained individual.

11. COMMENT: Appendix B, "Activity Hazard Analysis": Information regarding potential for site personnel to experience heat stress illness is not provided.

Recommendation: We recommend reviewing site operations and providing appropriate information for avoiding/managing heat stress related injuries on-site.

RESPONSE: Recommendation will be included as part of the final SHSP.

12. COMMENT: Appendix H, "Work Rules": Item 7 states, "Eating, drinking, chewing tobacco or gum,...prohibited in the exclusion zone or contamination reduction zone. (Exceptions may be permitted by the PHSM to allow fluid intake during heat stress conditions.)"

Recommendation: We recommend that smoking, eating, drinking, or other hand to mouth activities be restricted to the support zone. During periods where physiological monitoring requirements are in effect, site personnel should as a minimum, thoroughly wash their face, hands and arms upon exiting the CRZ/EZ and prior to consuming any food or beverage.

RESPONSE: Following personnel decontamination, our experience and policy allows for fluid consumption in the CRZ by employees. This allows for quicker and more frequent breaks for employees.

If you have any questions or comments regarding the above responses, please call me at (215)702-4016.

Very truly yours,

Arthur B. Holcomb, P.E., C.I.H.
Program Manager

cc: A. Aziz, FWENC
G. Coppi, FWENC
D. Kopcow, FWENC
LTJG C. Peterson, ROICC
File

SITE HEALTH AND SAFETY PLAN

Site:	NAVAL EDUCATION AND TRAINING CENTER (NETC), MELVILLE
Location:	MELVILLE, RI
Prepared By:	FOSTER WHEELER ENVIRONMENTAL CORPORATION
Date Prepared:	APRIL 22, 1996
Revision:	O
Project Description:	SOIL STABILIZATION AND REMOVAL
Delivery Order #:	0011

Waste Types:	Solid
Characteristics:	Volatile,Toxic
Status:	Active, Military
Background Review:	Complete
Overall Hazard:	Low

This plan reflects the May 1996 Navy comments.

FOSTER WHEELER ENVIRONMENTAL CORPORATION, FOSTER WHEELER SUBCONTRACTORS, AND FOSTER WHEELER'S CLIENT DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

APPROVALS

By their signature, the undersigned hereby certify that this SHSP has been reviewed and approved for use at NETC, Melville, Rhode Island.

SENIOR PROJECT MANAGER/ENGINEER	DATE 5/21/96
PROJECT HEALTH AND SAFETY MANAGER	DATE 5/21/96
SITE HEALTH AND SAFETY OFFICER	DATE

SITE HEALTH AND SAFETY PLAN
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1.0 INTRODUCTION

1.1 Purpose

This Site Health and Safety Plan (SHSP) addresses the health and safety practices that will be employed by all site workers participating in soil removal activities at NETC, Melville, RI. The SHSP takes into account the specific hazards inherent to soil removal and presents procedures to be followed by Foster Wheeler Environmental Corporation, its subcontractors, and all other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. Activities performed under this SHSP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926, USACOE EM 385-1-1, Navy/Marine Installation and Restoration Manual and the Foster Wheeler Environmental Corporation Health and Safety Program Manual. Many programs from the manual are referenced in this SHSP but are not included. A copy of the manual will be maintained at the site. Modifications to the SHSP may be made with the approval of the PHSM using the Field Change Request Form found in Appendix A.

1.2 Scope

This SHSP has been developed to address the health and safety hazards that may be encountered during stabilization and removal activities of six soil piles. The scope of work requires the stabilization of soil pile 5 contaminated with lead (TCLP) and asbestos; and, the subsequent loading, transporting, and disposal of the stabilized soil and remaining soil piles, approximately 7,619 cubic yards, at the McCallister Point Landfill located at NETC, RI.

Work will be performed concurrently with DO0019 remedial activities at Newport, RI to take advantage of the facilities and equipment that has been mobilized to the Newport site.

Task 1 - Stabilization, Loading, Transport and Disposal of Lead and Asbestos Contaminated Soil: Soil from pile 5 will be screened and stabilized on site utilizing a screen and cement dust or kiln dust. The dirt will be placed into a mixer with a front end loader where the soil will undergo stabilization as part of the standard cement to water ratio procedure. The soil mix shall then be stockpiled on site. The hardened soil will be transported by truck and disposed at McCallister Point.

Task 2 - Loading, Transport, and Disposal of TPH Contaminated Soil: Soil will be loaded into dump trucks that have a 12 cubic yard capacity. Sufficient trucks will be provided to support continuous loading cycle. The task will take approximately 3 weeks and requires an SHSO/Superintendent, one to two operating engineers and 1 to two to laborers to spot and to control traffic. Equipment required to conduct work includes: mixer, 2.5 cubic yard bucket loader, dump trucks, pressure washer and an organic vapor analyzer to monitor volatiles during stabilization and loading..

1.3 Application

The SHSP applies to all personnel involved in the above tasks who wish to gain access to active work areas, including but not limited to:

- Client representatives
- Federal, state or local representatives
- Foster Wheeler Environmental employees and subcontractors

Subcontractors will be provided an opportunity to review AHAs specifically involving their task and offer comments; however, all subcontractors will be required to follow Foster Wheeler Environmental's SHSP.

1.4 Summary of Major Risks

- Exposure to toxic, volatile materials
- Operation of heavy equipment (bucket loader, dump trucks)
  Operation of hot pressure washer

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section specifies the Foster Wheeler Environmental Project Organization. For this project the SHSO and the site Superintendent will be the same person.

2.1 Project Health and Safety Manager (PHSM)

The PHSM is an individual certified by the American Board of Industrial Hygiene as a Certified Industrial Hygienist (CIH) or by the Board of Certified Safety Professionals as a Certified Safety Professional (CSP) with experience in hazardous waste site remediation activities. The PHSM is Grey Coppi.

- Provides for the development and approval of the SHSP
  Serves as the primary contact to review health and safety matters that may arise
- Approves revised or new safety protocols for field operations
- Approves individuals who are assigned HSO responsibilities
  Approves HSOs to fulfill other project roles
- Coordinates revisions of this SHSP with field personnel
  Coordinates upgrading or downgrading of personal protective equipment with the SHSO
  Assists in the investigation of major accidents
  Conducts periodic inspections for compliance with the SHSP

2.2 Site Health and Safety Officer (SHSO)/Site Superintendent

The SHSO is a person knowledgeable in appropriate safety and health regulations and serving in a H&S staff role on hazardous waste remediation sites. The SHSO is to be determined.

- Works as a member of the project team to ensure implementation of site safety plans
- Ensures that all health and safety activities identified in site safety plans are conducted and/or implemented
- Identifies operational changes which require modifications to health and safety procedures and site safety plans, and ensures that the procedure modifications are implemented and documented through changes to the site safety plan
- Directs and coordinates health and safety monitoring activities
- Ensures that proper personal protective equipment is utilized by field teams
- Assists in conducting and documenting daily safety briefings
- Monitors compliance with this SHSP
- Notifies PHSM of all accidents/incidents
- Maintains Accident/Incident Report Forms
- Determines upgrades or downgrades of personal protective equipment (PPE) based on site conditions and/or real-time monitoring results
- Ensures that monitoring instruments are calibrated
- Reports to PHSM to provide summaries of field operations and progress and,
- Maintains health and safety field log books.
- Provide for the necessary training of field crews
- Conduct routine safety inspections of their work areas
- Enforces health and safety rules and compliance with the SHSP
- Plans field work using appropriate safe procedures and equipment
- Establish communications with the NOSC/NOSCDR, the LEPC, and other potential emergency response organizations

2.3 Site Personnel

- Report any unsafe or potentially hazardous conditions to the SHSO
- Maintain knowledge of the information, instructions and emergency response actions contained in the SHSP
- Comply with rules, regulations and procedures as set forth in this SHSP and any revisions
- Prevent admittance to work sites by unauthorized personnel and,
- Inspect all tools and equipment, including PPE, daily prior to use.

3.0 SITE LOCATION

The U.S. Naval Education Training Center is located 5 miles south of the fuel pier which is part of the Defense Fuel Supply Point. The facility is located in Portsmouth, Rhode Island, next to the eastern passage of Narrangasett Bay.

Figure 3.1 is a vicinity map of the facility.

3.1 NETC Background

Six piles of soil were stocked-piled at NETC as a result of underground storage tank (UST) removal. The products contained in the USTs included various petroleum products.

Based upon the sampling results, five of the piles of soil are assumed to be non-hazardous and may be disposed at the McCallister Point Landfill. However, the non-hazardous levels of TPH and trace amounts of asbestos prevent the soil to be reused and/or recycled. One pile contains RCRA hazardous levels of lead and asbestos over TSCA limits. This pile will be handled separately to the other five piles.

4.0 POTENTIAL HAZARDS OF THE SITE

This section presents an assessment of the chemical and physical hazards that may be encountered during the tasks specified under SHSP Section 1.0. Additional information can be found in Appendix B-Activity Hazard Analyses.

4.1 Properties of Chemical Contamination

The most likely chemicals to be encountered during this investigation includes lead, petroleum products such as various blends of gasoline and diesel fuel and asbestos. Petroleum products contain various volatile hydrocarbons of health concern such as benzene, ethylbenzene, toluene, naphthalene and xylene. Table 4.1 contains a summary of the toxicological properties of the chemical compounds that may be encountered during this site investigation.

Exposure to these compounds during this investigation may occur through inhalation of contaminated dust particles, asbestos fibers, inhalation of volatile and semivolatile compounds, dermal absorption, skin contamination, or accidental ingestion of the contaminant.

The action levels for volatile and semivolatile compounds were chosen based on the unknown concentration of contaminants, physical and chemical properties, toxicity, and distribution of these compounds at the sites. The predominant volatile compounds of concern at these sites are various petroleum hydrocarbons. Due to the vapor pressure of these chemicals, inhalation becomes the primary route of exposure. Skin absorption is also a possible route of exposure, leading to the same symptoms as inhalation overexposure. TPH may consist of aromatic hydrocarbons and are generally local irritants and blood vessel dilators. These compounds are potent narcotics and may

cause central nervous system (CNS), lung, and blood vessel damage. These compounds have a synergistic effect when combined with alcohol.

Lead is a naturally occurring element that may lead to central nervous system, reproductive and blood forming organ disorders.

Asbestos is a naturally occurring compound which was used for insulation and tiles for construction. The compound has been linked with lung cancer, asbestosis and other forms of lung disease.

4.2 Physical Hazards

Most safety hazards are discussed in the Activity Hazard Analysis(AHA) in Appendix B for the different phases of the project. In addition to the AHAs, general work rules and other safety procedures are described in Section 10 of this SHSP.

4.2.1 Noise

Noise is a potential hazard associated with the operation of the mixer, heavy equipment and the pressure washer. Suspected high noise operations will be evaluated by the SHSO to determine if protective measures are warranted. Workers with 8-hour TWA exposures exceeding 85 dBA will be included in the Foster Wheeler Environmental Corporation Hearing Conservation Program (HS 4-4).

4.2.2 Heat Stress

Heat stress is a significant potential hazard, which is greatly exacerbated with the use of PPE in hot environments. A heat stress prevention program will be implemented when ambient temperatures exceed 70°F for personnel wearing impermeable clothing and of other personnel when the WBGT index exceeds the ACGIH TLVs. The following are the main elements of the Foster Wheeler Environmental Corporate Health and Safety Program Manual (HS 4-6).

- Selection of PPE to reduce the risk of heat related illness
- Hydration
- Cool rest areas
- Engineering controls (i.e., air conditioned cabs, drenching)
  Administrative controls (work schedules, acclimatization, work/rest regimens)
  PPE (i.e., ice vests, vortex tubes)
- Monitoring (body core temperature, pulse rate)
- Identification of heat related illnesses (heat cramps, heat exhaustion, and heat stroke)
- Employee training

Table 4.1 Chemical Data

CHEMICAL/CLASS	EXPOSURE ROUTES	PEL/TLV	HEALTH HAZARDS
VOCs and SVOCs	Inhalation, eyes, skin, ingestion	Various	Central Nervous system depression; fatigue, weakness, confusion; headache, drowsiness; vomiting
PAHs	Inhalation, skin, ingestion	.1 mg/m^3	Dermatitis; bronchitis; carcinogen
Lead	Inhalation, ingestiion	PEL 0.50 mg/m^3	Reproduction, blood clot, central nervous system
Asbestos	Inhalation	.1 fibers/cc	Asbestosis, lung cancer and other forms of lung diseases

5.0 ACTIVITY HAZARD ANALYSES

The Activity Hazard Analysis (AHA) is a systematic way of identifying the potential health and safety hazards associated with major phases of work on the project and the methods to avoid, control and mitigate those hazards. The AHAs follow the guidance of the Foster Wheeler Environmental Corporate Program Manual HS 3-5. AHAs will be developed for all activities as necessary, prior to start-up. The AHAs will be used to train work crews in proper safety procedures during phase preparatory meetings.

An AHA is included in Appendix B of this SHSP. An AHA has been developed for soil stabilization and soil removal.

6.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) detailed below represents the hazard analysis and PPE selection required by 29 CFR 1910.132. For the purposes of PPE selection, the PHSM and SHSO are considered competent persons. The signatures on the front of the SHSP constitutes certification of the hazard assessment. For activities not detailed below, the SHSO will conduct the hazard assessment and select the PPE using the form provided in Appendix C and shall certify the assessment by signing the form. PPE selection will be made in consultation with the PHSM. The tasks specific level of PPE required for each task is described in Appendix B. The following is a list of PPE required for each level of work.

Level D PPE includes the following:

- Work clothes (shirts and pants)
- Gloves
- Steel-toed boots
- Hard hat
- Hearing protection
- Eye protection

Level D Modified PPE includes Level D plus the following:

Site dedicated coveralls or Tyvek

- Inner and outer gloves, if appropriate

Level C PPE includes Level D Modified plus the following:

Full face air-purifying respirator with combination organic vapor and high efficiency particulate air cartridge

Modifications for initial PPE selection may also be made by the SHSO in consultation with the PHSM. A written justification for downgrades will be provided to the PHSM for approval as a field change request.

Level D Modified PPE will be the initial level of protection used for soil stabilization, soil loading and transportation to the landfill provided, the air monitoring results are below the action levels specified for Level C PPE as described in Table 7.1. Pressure washing will be performed in Level D Modified PPE.

Task 1
Level C PPE will be the initial level of protetion used for soil handling, screening, soil stabilization and soil loading until the asbestos and lead containing material is fully removed from the other piles and shipped to the McCallisterLandfill.

Task 2
Level D Modfiied will be used as PPE protection for the remaining soil piles. Pressure washing will be performed in Level C PPE.

7.0 AIR MONITORING

The following sections contain information describing the types, frequency and location of real time air monitoring.

7.1 Real-Time Air Monitoring

This section addresses the real time air monitoring that will be conducted including instrumentation selection, frequency of air monitoring and the location of air monitoring. Real-time air monitoring will be conducted during soil stabilization, loading and soil transporting. Table 7.1 provides real-time air monitoring action levels to be used for this project.

Dust monitoring as surrogate for lead exposure will be performed regularly (every hour) during the Task 1 activities. Dust suppression techniques will be used, if requested by the SHSO. Results will be posted daily.

7.1.1 Dust Monitoring

Personal air monitoring of the breathing zone will be performed during Task 1 activities. Air monitoring will be performed for asbestos on two people daily until Task 1 activities are completed, and all material from pile 5 has been removed from the site. Asbestos results will be provided to personnel 24 hours after original sampling period.

TABLE 7.1 REAL TIME AIR MONITORING ACTION LEVELS

AIR MONITORING INSTRUMENT	MONITORING LOCATION	ACTION LEVEL	SITE ACTION	REASON
PID/FID	Breathing Zone, sample	>5 ppm above background	No respiratory protection	VOCs and SVOCs are expected to be very low or not present; unknowns
PID/FID	Breathing Zone, sample	>5 ppm - 50.0 ppm	Upgrade to Level C respiratory protection; Initiate vapor suppression control efforts	VOCs and SVOCs are expected to be very low or not present; unknowns
PID/FID	Breathing Zone, sample	>50.0 ppm	Stop work, consult with PHSM to determine if work can continue in Level C, do not start work until consulting with PHSM	VOCs and SVOCs are expected to be very low or not present, unknowns
Dust Meter	Pile 5 excavation and treatment only. Breathing Zone, sample		Upgrade to Level C respiratory protection. Wet soil to suppress dust.	Dust levels are expected to be very low or not present, lead.

7.1.2 PID/FID

Monitoring will be performed regularly (every hour) until sufficient data has been recorded by the SHSO to determine if a reduction in air monitoring is justified. Monitoring shall be performed during the loading and transporting of non-stabilized soil into the mixer, during soil mixing, stockpiling of mixed soil and the stockpiling and loadout of the stabilized soil into trucks. The SHSO shall use judgment in consultation with the PHSM to determine the frequency of monitoring. A calibrated FID or PID organic vapor analyzer will be utilized to monitor the area and the employee breathing zone.

7.2 Data Quality Assurance

7.2.1 Calibration

Instrument calibration shall be documented and included in a dedicated safety and health log book or on separate calibration pages. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

7.2.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on-site by the SHSO for reference.

8.0 ZONES, PROTECTION AND COMMUNICATION

8.1 Site Control

Site zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion zone (EZ), Contamination Reduction zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site when operations begin.

This project is a hazardous waste remediation project, and any person working in an area where the potential for exposure to site contaminants exists, will only be allowed access after providing the SHSO with proper training and medical documentation. All personnel enterin and exiting the EZ will need to sign in and out of the zone.

The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area (trailers, offices, etc.) that will be the field support area for most operations. The SZ provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides for an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for Exclusion Zone entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an exclusion zone (EZ). This zone will be clearly delineated by cones, tapes or other means. The SHSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the site SHSO allowing adequate space for the activity to be completed, field members and emergency equipment.

8.2 Contamination Control

The SHSO shall establish decontamination areas or limit the exposure potential to site contaminants by altering the means and methods of accomplishing the tasks. One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination.
Procedures for contamination avoidance include:

Personnel

- do not walk through areas of obvious or known contamination;
  do not handle or touch contaminated materials directly
  make sure all personal protective equipment has no cuts or tears prior to donning
- fasten all closures on suits, covering with tape, if necessary
- particular care should be taken to protect any skin injuries
- stay upwind of airborne contaminants
- do not carry cigarettes, gum, etc. into contaminated areas

Sampling, Monitoring

- when required by the HSO, cover instruments with clear plastic, leaving openings for sampling ports
- bag sample containers prior to emplacement of sample material.

Heavy Equipment

- limit the amount of contamination that comes in contact with heavy equipment
- cover clean equipment with plastic to avoid cross contamination
  keep excavated soils contained and out of the way of workers

8.2.1 Personnel Decontamination Station

Task 1

Safety briefings shall explain these decontamination procedures for personnel. The level of contamination at this site is expected to be very low, based on analytical results of the piles. Personnel exiting the Exclusion Zone shall be thoroughly decontaminated. All personnel shall wet tyvek and mask prior to removing tyvek and protective respirator.. Discarded protective clothing will be disposed in plastic bags. The respirator will be the last item removed after PPE has been bagged.

Task 2

Level D and D modified will be a dry decon which requires personnel to remove and dispose PPE (Tyvek, gloves, and overboots) as they leave the EZ. Level C PPE will require additional decon for respirators. Respirators will be deconned with water and a sanitizing agent after each use. The respirator will be the last item removed after PPE has been bagged. All workers should wash their face and hands prior to leaving the site.

8.2.2 Heavy Equipment Decontamination

Heavy equipment will not be permitted to leave the EZ unless it has been thoroughly decontaminated and visually inspected by the SHSO or his designee. This inspection will be documented on the form located in Appendix D. Heavy equipment will be decontaminated with a steam cleaner until no signs of visible contamination remain.

8.3 Communication

- Telephones - A cellular telephone will be located on-site.
- Hand Signals - Hand signals shall be used by field teams along with the buddy system. They shall be known by the entire field team before operations commence and their use covered during site-specific training. Typical hand signals are the following:

SIGNAL	MEANING
Grip on a partner's wrist or placement of both hands	Leave the area immediately, no

around a partner's waist.	debate.
Hands on top of head	Need assistance
Thumbs up	Okay, I'm all right, I understand.
Thumbs down	No, negative.

8.4 Waste Disposal Procedures

All discarded materials, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard or causing litter to be left on site. All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal according to state and federal regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as non-hazardous solid waste.

9.0 MEDICAL SURVEILLANCE PROCEDURES

All contractor and subcontractor personnel performing field work where potential exposure to contaminants exist at the site are required to have taken, passed and obtained medical clearance in accordance with 29 CFR 1910.120(f).

The Foster Wheeler Environmental Corporate Medical Surveillance Program is described in detail in Section 4.5 of the Health and Safety Program Manual. The Corporate Medical Consultant is Greaney Medical Group in California. Dr. Peter Greaney is Board certified in occupational medicine.

9.1 Medical Surveillance Requirements

A physician's medical release for work will be confirmed by the SHSO before an employee can work in the exclusion zone. The examination will be taken annually at a minimum, and upon termination of hazardous waste site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the PHSM in consultation with the Corporate Medical Consultant and the SHSO if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other site conditions warrant further medical surveillance.

9.2 Medical Data Sheet

A medical data sheet is provided in Appendix E. This medical data sheet is voluntary and should be completed by all on-site personnel and will be maintained at the site. Where possible, this

medical data sheet will accompany the personnel needing medical assistance. The medical data sheet will be maintained in a secure location, treated as confidential, and used only on a need-to-know basis.

10.0 SAFETY CONSIDERATIONS

10.1 General Health and Safety Work Rules

A list of work rules and general safe work practices has been included in the Foster Wheeler Environmental Health and Safety Program Manual, Section 3-6. These rules have been incorporated into the SHSP as Appendix F. The work rules will be posted in a conspicuous location at the site.

10.2 General Construction Hazards

The following is a list of applicable safety considerations for this site. Further information is provided in the specific Activity Hazard Analysis and the Foster Wheeler Environmental Health and Safety Program Manual section.

- Heavy Equipment (bucket loader, dump truck)
- Fire Hazards
  Slips/Trips/Falls
- Lifting/Materials Handling

11.0 EMERGENCY RESPONSE PLAN

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff are essential. Specific elements of emergency support procedures which are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures.

11.1 Responsibilities

11.1.1 Project Health and Safety Manager (PHSM

The PHSM is Grey Coppi.

The PHSM oversees and approves the Emergency Response/Contingency Plan and performs audits to determine that the plan is in effect and that all pre-emergency requirements are met. The PHSM acts as a liaison to applicable regulatory agencies and notifies OSHA of reportable accidents.

11.1.2 Site Health and Safety Officer (SHSO)

The SHSO is to be determined.

The SHSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The SHSO is required to immediately notify the PHSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the PHSM can notify OSHA within the required time frame. The PHSM will be notified of all OSHA recordable injuries, fires, spills, releases or equipment damage in excess of $500 within 24 hours. The SHSO also serves as the Alternate Emergency Coordinator.

11.1.3 Emergency Coordinator

The Emergency Coordinator is to be determined.

The emergency coordinator shall make contact with Local Emergency Response personnel prior to beginning work on site. In these contacts the emergency coordinator will inform interested parties about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. The emergency coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on site. The emergency coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator shall implement the Emergency Response/Contingency Plan whenever conditions at the site warrant such action

11.1.4 Site Personnel

Site personnel are responsible for knowing the Emergency Response/Contingency Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency.

11.2 Local Emergency Support Units

Table 11.1 contains emergency numbers which will be posted prominently in the field office at Newport NETC and field vehicles.

Table 12-1

EMERGENCY TELEPHONE NUMBERS

Contact	Firm or Agency	Telephone Number
Police	NETC Portsmouth State	911 or 401-841-3241 911 or 401-683-0300 911 or 401-849-4444
Fire	NETC Portsmouth	911 or 401-841-3333 911 or 401-683-1155
Hospital	Newport Hospital	401-845-1640
Ambulance	NETC Newport Fire Department	911 or 401-841-2222 911 or 401-846-2211
Site Superintendent	Foster Wheeler Environmental	401-847-4888
PHSM - Grey Coppi	Foster Wheeler Environmental	215-702-4079
SHSO	Foster Wheeler Environmental	TBD
Navy ROICC, Ltc. Charles Peterson	Navy	401-841-1764
Navy On-Scene Coordinator (NOSC	Navy Fire Chief	401-841-3333
Local Emergency Planning Community (LEPC)	Newport Fire Department	401-847-2695
Poison Control Center		800-552-6337
Chemtrec		800-424-9300
National Response Center		800-424-8802

A map showing the quickest route to the nearest hospital will be included in the final SHSP and will be posted adjacent to the above emergency telephone numbers in the field office and field vehicles. Newport Hospital will be used for emergencies and is located 8 miles south of the facility on Broadway Street.

11.3 Pre-emergency Planning

Foster Wheeler Environmental will communicate directly with administrative personnel from the emergency room at the hospital in order to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from exposure to any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

Before the field activities begin, the local emergency response personnel will be notified of the schedule for field activities and about the materials that are thought to exist on the site so that they will be able to respond quickly and effectively in the event of a fire, explosion, or other emergency.

Before field work on the site commences, each person who will be working there or observing the operations will complete a medical data sheet. These data sheets will be filled out during the initial site safety training meeting and will be kept on the site.

In the event of an incident where a team member becomes exposed or suffers from an acute symptom of exposure to site materials and has to be taken to a hospital, a copy of his/her medical data sheet will be presented to the attending physician.

11.4 Emergency Medical Treatment

The procedures and rules in this SHSP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it will be reported to the SHSO immediately. First-aid equipment will be available on site at the following locations: During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Unless they are in immediate danger, severely injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

Only in non-emergency situations will an injured person be transported to the hospital by means other than an ambulance.

11.5 Emergency Site Evacuation Routes and Procedures

In order to mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear chain of authority will be established. The EC or Site Superintendent will take charge of all activities and dictate the procedures that will be followed for the duration of the emergency. The EC will report immediately to the scene of the emergency, assess the seriousness of the situation, and direct whatever efforts that may be performed safely until the emergency response units arrive. At his/her discretion, the EC also may order the closure of the site for an indefinite period.

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, an air horn will be sounded on the site. The horn will sound continuously for one blast, signaling that immediate evacuation of all personnel is necessary due to an immediate or impending danger. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the following locations. Personnel will remain at the designated locations until directed by the EC.

The EC will give directions for implementing whatever actions are necessary. Any project team member may be assigned to be in charge of emergency communications during and emergency. He/she will attend the site telephone specified by the EC from the time the alarm sounds until the emergency has ended.

After sounding the alarm and initiating emergency response procedures, the EC will check and verify that access roads are not obstructed. If traffic control is necessary, as in the event of a fire or explosion, a project team member, who has been trained in these procedures and designated at the site safety meeting, will take over these duties until local police and fire fighters arrive.

The EC will remain at the site to provide any assistance requested by emergency-response squads as they arrive to deal with the situation.

11.5.1 Evacuation Drills

Evacuation drills will be conducted to test the emergency system.

The drills will simulate situations that may be likely to occur onsite. A critique of the drill according to Foster Wheeler Environmental Health and Safety Program Manual HS 2-1 will be conducted.

11.6 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site (air horn will sound for a single continuous blast), and notification of local fire and police departments. No

personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

11.6.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials;
  Storage of flammable liquids and gases away from oxidizers
- Shutting off engines to refuel
  Grounding and bonding metal containers during transfer of flammable liquids
- Use of UL approved flammable liquid storage containers
- Fire extinguishers rated at least 5 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities
- Monthly inspections of all fire extinguishers.

11.7 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet or recommended by the Corporate Medical Consultant will be followed, when necessary.

SKIN AND EYE CONTACT:	Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. Skin should also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs.
INHALATION:	Move to fresh air. Decontaminate and transport to hospital or local medical provider.
INGESTION:	Decontaminate and transport to emergency medical facility.
PUNCTURE WOUND OR LACERATION:	Decontaminate and transport to emergency medical facility.

11.8 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or postponed. The SHSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed on the site if they do not cause delays, interfere

with treatment or aggravate the problem. Respiratory equipment must always be removed on the site. Protective clothing can be cut away on the site. If the outer contaminated garments cannot be safely removed on-site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

11.9 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

- Project Health and Safety Manager
- Project Manager
- The employer of any injured worker who is <u>not</u> a Foster Wheeler Environmental employee.

Written confirmation of verbal reports are to be submitted within 24 hours. The accident/incident report is found in the Foster Wheeler Environmental Corporate Health and Safety Program Manual Section HS 1-7. If the employee involved is not a Foster Wheeler Environmental employee, his employer shall receive a copy of the report.

11.10 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or designee will determine if work can continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds)
- Limited visibility (fog)
- Potential for electrical storms
- Earthquakes
- Other major incidents

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The SHSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

11.11 Spill Control and Response

All small hazardous spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. Drains or drainage areas should be blocked. All spill containment materials will be properly disposed as hazardous waste. An exclusion zone of 50-100 feet around the spill area should be established depending on the size of the spill.

The following steps should be taken by the Emergency Coordinator:

- Determine the nature, identity and amounts of major spill components
- Make sure all unnecessary persons are removed from the spill area
- Notify appropriate response teams and authorities
  Use proper PPE in consultation with the SHSO
- If a flammable liquid, gas or vapor is involved, remove all ignition sources and use nonsparking and/or explosive proof equipment to contain or clean up the spill (diesel only vehicles, air operated pumps, etc.)
- If possible, try to stop the leak with appropriate material and,
- Remove all surrounding materials that can react or compound with the spill.
- Notify Regulatory Affairs located in Langhorne, PA.- Mr. Tom Teeling at 215-702-4078

11.12 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on-site.

- Industrial first aid kit
- Portable eye washes meeting ANSI 358.1-1991 (one per field team)
- Air horns (one per field team)
- Fire extinguishers (one per trailer/vehicle, trailers and located at hot work stations)
- Fire Blanket
- Absorbent Material

11.13 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and

other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers
- Refilling medical supplies
- Recharging eyewashes and/or showers
- Replenishing spill control supplies and,
- Replacing used air horns

12.0 TRAINING

12.1 General Health and Safety Training

In accordance with Foster Wheeler Environmental corporate policy, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

12.1.1 Three Day Supervised On the Job Training

In addition to the required initial hazardous waste operations training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

12.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for field work. The training will cover a review of 1910.120 requirements and related company programs and procedures.

12.3 Eight Hour Supervisor Training

The site supervisor assigned to this project has taken the FWENC 8 hour supervisor training class.

12.4 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and

emergency services at the site and will highlight all provisions contained within this SHSP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

12.5 On-Site Safety Briefings

Project personnel and visitors will be given on-site health and safety briefings by the FOL to assist site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity for the SHSO to periodically update the crews on monitoring results. Prior to starting any new activity, a training session using the Activity Hazard Analysis will be held for crew members involved in the activity.

12.6 First Aid and CPR

The SHSO will identify those individuals requiring first aid and CPR training in order to ensure that emergency medical treatment is available during field activities. It is expected that a minimum of two field person onsite will have first aid and CPR training. The training will be consistent with the requirements of the American Red Cross Association and included information of Bloodborne Pathogens Training..

12.7 Hazard Communication

Hazard communication training will be provided in accordance with the requirements contained in the Foster Wheeler Environmental Health and Safety Program Manual, Section 4-2.

13.0 LOGS, REPORTS AND RECORDKEEPING

The following is a summary of required health and safety logs, reports and recordkeeping.

13.1 Field Change Request

To be completed for initiating a change to the SHSP. The PHSM and Project Manager or designee approval is required. The original will be kept in the project file. Approved changes will be reviewed with affected field personnel at a safety briefing. Copies will be distributed to the Client Representative.

13.2 Medical and Training Records

Copies or verification of training (40 hour, 8 hour, supervisor, site specific training and documentation of three day OJT) and medical clearance for hazardous waste site work and respirator use will be maintained onsite. Records for all subcontractor employees will also be kept onsite. All employee medical records will be maintained by the Corporate Medical Consultant - Greaney Medical Group in accordance with Foster Wheeler Environmental Corporation Health and Safety Program Manual, section HS 1-8.

13.3 On-site Log

A log of personnel on-site each day will be kept by the Project FOL or designee.

13.4 Weekly Health and Safety Reports

The SHSO shall complete and submit weekly health and safety reports to the PHSM. The report is provided in Appendix G.

13.5 Accident/Incident Reports

The incident reporting and investigation during site work will follow Foster Wheeler Environmental Corporation Health and Safety Program Manual, section HS 1-7.

13.6 OSHA Form 200

An OSHA Form 200 will be kept at the project site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to Regional Health and Safety Manager for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 200 form. The incident report form referenced in section 11.11 meets the requirements of the OSHA Form 101(supplemental record) and must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

13.7 Health and Safety Logbooks

The SHSO will maintain logbooks during site work. The daily site conditions, personnel, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

13.8 Hazard Communication Program/MSDS

Material Safety Data Sheets (MSDS) will be obtained for applicable substances and included in the site hazard communication file. The hazard communication program will be maintained onsite in

accordance with 29 CFR 1910.1200 and Foster Wheeler Environmental Corporation Health and Safety Program Manual Section HS 4-2.

14.0 FIELD PERSONNEL REVIEW

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the SHSP. It is maintained on site by the SHSO as a project record.

Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read, or have been informed of, the Site-Specific Health and Safety Plan and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	Date

15.0 REFERENCES

American Conference of Governmental Industrial Hygienists, Inc., 1992, Documentation of the Threshold Limit Values and Biological Exposure Indices 6th Ed., ACGIH, Cincinnati, Ohio.

American Conference of Governmental Industrial Hygienists, Inc., 1987, Guidelines for the Selection of Chemical Protective Clothing; Third Edition, ACGIH, Cincinnati, Ohio, February 1987.

American Conference of Governmental Industrial Hygienists, Inc., 1994-1995, Threshold limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices; ACGIH, Cincinnati, Ohio.

Federal Acquisition Regulation, F.A.R. Clause 52.236-13: Accident Prevention.

Foster Wheeler Environmental Corporation, Foster Wheeler Environmental Corporation Health and Safety Manual, 1995.

NIOSH/OSHA/USCG/EPA, 1985, Occupational Safety And Health, Guidance Manual for Hazardous Waste Site Activities; October 1985.

Sax, N. Irving, 1992, Dangerous Properties of Industrial Materials, 8th Ed; Van Nostrand Reinhold Co. Inc., New York, NY.

U.S. Army Corps of Engineers, 1987, Safety and Health Requirements Manual; EM 385-1-1, revised October 1992.

U.S. Department of Labor, Occupational Safety and Health Administration, 1989, 29 CFR Part 1910 Hazardous Waste Operations and Emergency Response, Final Rule, March 6, 1989; Construction Industry Standards, 29 CFR 1926; and General Industry Standards, 29 CFR 1910.

U.S. Environmental Protection Agency, 1988, Standard Operating Safety Guides; July, 1988.

U.S. Environmental Protection Agency, no date, Response Safety Decision-Making; Course Manual, Office of Emergency and Remedial Response, Hazardous Response Support Division.

APPENDIX B

ACTIVITY HAZARD ANALYSIS

ACTIVITY HAZARD ANALYSIS

Project. NETC, MELVILLE
Activity. TASK 1 - SOIL STABILIZATION, TRANSPORT AND DISPOSAL

Location: MELVILLE, RI

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1. Mobilization of equipment and supplies (Hazards and Controls 1-9 apply)	1 Back Injuries	1. Site personnel will be instructed on proper lifting techniques; Mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available; Instruct personnel on proper lifting techniques.
2. Haul soil via loader and transport to mixer (Hazards and Controls 2,3,6-11 apply)	2 Slips/Trips/Falls	2. Maintain work areas safe and orderly; unloading areas should be on even terrain; mark and repair if possible tripping hazards.
3. Mixing of contaminated soil with cement dust (Hazards and controls 3,4,6,7,8,9,10,11 apply)	3. Vehicular Traffic	3. Spotters will be used when backing up trucks, heavy equipment and moving equipment shall be quipped with back up alarms
4. Transport soil to stockpile area via front end loader (Hazards and Controls 2,3,6-11 apply)	5 Dropped Objects	5. Steel toe boots meeting ANSI Standard Z41 will be worn
5. Pressure wash bucket loader (Hazards and Controls 2, 7, 10-12 apply)	4 Overhead Hazards	4. Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; hevy equipment will be designed and carry ROPS
6 Load soil onto dump trucks and transport to landfill (Hazards and Controls 2, 3, 6-9 apply)	6. Noise	6. Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); SHSO will determine the need for hearing protection; all equipment will be equipped with manufacturer's required mufflers
	7. Eye Injuries	7. Safety glasses meeting ANSI Standard Z87 will be worn during soil sampling and soil removal operations; Pressure washing requires chemical goggles and a full-faced shield
	8 Operation of Heavy Equipment (rollovers, overhead hazards, spills, struck by or against) during loading, mixing, stockpiling and loadout of soil	8. Equipment will have rollover protective structures and seat belts, operators shall wear seat belts when operating equipment; do not operate equipment on grades which exceed manufacturer's recommendations; equipment will have guards, canopies or grills to protect from flying objects, ground personnel will stay clear of all suspended loads, all slings chains and ropes will be rated for the load in which it is expected to lift; spills and absorbent materials will be readily available; drip pans, polyethylene sheeting or other means will be used for secondary containment; eye contact with operators will be made before approaching equipment; equipment will not be approached on blind sides; avoid equipment swing areas; know hand signals; all equipment will be equipped with backup alarms; no loose clothing, gauntlet-type gloves, rings or watches will be worn
	9. Fire	9. ABC type fire extinguishers shall be readily available, No smoking in work area
	10. Chemical Exposure to asbestos and lead during loadout, mixing and transporting	10. Protective clothing (i.e., chemical gloves and chemical goggles) will be worn during sampling operations; skin will be rinsed with water if contact with hazardous material occurs; Soil removal will require Level C PPE; a portable eye wash station will be located by work area; Pressure washing requires the use of chemical goggles, Tyvek and respirator
	11. Inhalation Exposure	11. Soil removal will be conducted in Level C PPE, Air monitoring will performed as required by SHSP

Project: NETC, MELVILLE
Activity. TASK 1 - SOIL STABILIZATION, TRANSPORT AND DISPOSAL

Location· MELVILLE, RI

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
	12 Struck By (water stream)	12 Proper instruction on safe use of pressure washers will be conducted, operators will not fix the hand trigger in the open position such that if the wand were left unattended, water would spray from the tip, all pressure washers will be equipped with a deadman switch
	13 Heat Stress	13 Provide work/rest breaks; provide shading from radiant heat, provide and encourage workers to drink fluids; perform tasks early in day, if possible, institute FWENC heat stress prevention program; only wear tyvek where required by hazard, to be evaluated by SHSO.

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1 Bucket Loader 2 Modified Level D PPE and Level D PPE 3 First Aid Kits 4. Portable Eyewash 5. Fire Extinguishers 6 PID/FID 7. Pressure Washer	1 Weekly inspections will be performed on fire extinguishers. 2 Daily safety and weekly inspections will be performed on first aid kits. 3. Initial inspections will be performed on heavy equipment prior to each use. 4. Portable eye wash will be inspected weekly. 5 Monitoring equipment will be pre and post calibrated daily. 6 Pressure washer and hoses will be inspected prior to each use.	1. Personnel have read and comply with SHSP 2. Site specific training 3. Qualified operators will be used for heavy equipment operation 4. Instruct personnel on proper use of fire extinguishers 5. At least 2 individuals on-site will have current CPR and First aid training

ACTIVITY HAZARD ANALYSIS

Project. NETC, MELVILLE — Location· MELVILLE, RI

Activity TASK 2 - LOADING, TRANSPORTATION AND DISPOSAL OF TPH CONTAMINATED SOIL

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
1 Mobilization of equipment and supplies (Hazards and Controls 1-9 apply)	1 Back Injuries	1 Site personnel will be instructed on proper lifting techniques, Mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available; Instruct personnel on proper lifting techniques.
2. Haul soil via loader and transport to mixer (Hazards and Controls 2,3,6-11 apply)	2 Slips/Trips/Falls	2. Maintain work areas safe and orderly, unloading areas should be on even terrain; mark and repair if possible tripping hazards.
3. Mixing of contaminated soil with cement dust (Hazards and controls 3,4,6,7,8,9,10,11 apply)	3. Vehicular Traffic	3 Spotters will be used when backing up trucks, heavy equipment and moving equipment shall be quipped with back up alarms
4. Transport soil to stockpile area via front end loader (Hazards and Controls 2,3,6-11 apply)	5. Dropped Objects	5. Steel toe boots meeting ANSI Standard Z41 will be worn
6. Pressure wash bucket loader (Hazards and Controls 2, 7, 10-12 apply)	4 Overhead Hazards	4 Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; hevy equipment will be designed and carry ROPS
5. Load soil onto dump trucks and transport to landfill (Hazards and Controls 2,3,6-9 apply)	6 Noise	6. Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); SHSO will determine the need for hearing protection; all equipment will be equipped with manufacturer's required mufflers
	7 Eye Injuries	7. Safety glasses meeting ANSI Standard Z85 will be worn during soil sampling and soil removal operations; Pressure washing requires chemical goggles and a full-faced shield
	8. Operation of Heavy Equipment (rollovers, overhead hazards, spills, struck by or against) during loading, mixing, stockpiling and loadout of soil	8. Equipment will have rollover protective structures and seat belts; operators shall wear seat belts when operating equipment; do not operate equipment on grades which exceed manufacturer's recommendations; equipment will have guards, canopies or grills to protect from flying objects; ground personnel will stay clear of all suspended loads; all slings chains and ropes will be rated for the load in which it is expected to lift, spills and absorbent materials will be readily available, drip pans, polyethylene sheeting or other means will be used for secondary containment, eye contact with operators will be made before approaching equipment; equipment will not be approached on blind sides; avoid equipment swing areas; know hand signals; all equipment will be equipped with backup alarms; no loose clothing, gauntlet-type gloves, rings or watches will be worn
	9 Fire	9 ABC type fire extinguishers shall be readily available; No smoking in work area
	10. Chemical Exposure to asbestos and lead during loadout, mixing and transporting	10. Protective clothing (i e , chemical gloves and chemical goggles) will be worn during sampling operations; skin will be rinsed with water if contact with hazardous material occurs; Soil removal will require Level C PPE; a portable eye wash station will be located by work area; Pressure washing requires the use of chemical goggles, Tyvek and respirator
	11 Inhalation Exposure	11 Soil removal will be conducted in Level C PPE; Air monitoring will performed as

Project. NETC, MELVILLE
Activity TASK 2 - LOADING, TRANSPORTATION AND DISPOSAL OF TPH CONTAMINATED SOIL

Location· MELVILLE, RI

MAJOR STEPS	POTENTIAL HAZARDS	PROTECTIVE MEASURES/CONTROLS
		required by SHSP
	12 Struck By (water stream)	12 Proper instruction on safe use of pressure washers will be conducted, operators will not fix the hand trigger in the open position such that if the wand were left unattended, water would spray from the tip; all pressure washers will be equipped with a deadman switch
	13 Heat Stress	13 Provide work/rest breaks; provide shading from radiant heat; provide and encourage workers to drink fluids; perform tasks early in day, if possible, institute FWENC heat stress prevention program; only wear tyvek where required by hazard, to be evaluated by SHSO.

EQUIPMENT USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1. Bucket Loader 2. Modified Level D PPE and Level D PPE 3. First Aid Kits 4. Portable Eyewash 5 Fire Extinguishers 6 PID/FID 7. Pressure Washer	1. Weekly inspections will be performed on fire extinguishers. 2 Daily safety and weekly inspections will be performed on first aid kits 3 Initial inspections will be performed on heavy equipment prior to each use 4 Portable eye wash will be inspected weekly 5. Monitoring equipment will be pre and post calibrated daily. 6. Pressure washer and hoses will be inspected prior to each use	1. Personnel have read and comply with SHSP 2. Site specific training 3. Qualified operators will be used for heavy equipment operation 4. Instruct personnel on proper use of fire extinguishers 5. At least 2 individuals on-site will have current CPR and First aid training

APPENDIX C

PPE SELECTION FORM

Foster Wheeler Environmental Corporation

TABLE 6 1 PERSONAL PROTECTIVE EQUIPMENT SELECTION

ACTIVITY _____

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR

APPENDIX D

HEAVY EQUIPMENT DECONTAMINATION FORM

DECONTAMINATION CERTIFICATE

SUBJECT:

EQUIPMENT ID: _____

_____

_____

To:

The above referenced equipment was decontaminated (Date: _____) in accordance with the requirement referenced in Section _____, of the Project Specifications.

Very truly yours,

_____

FWENC Representative

Comments: _____

_____

_____

APPENDIX E

MEDICAL DATA SHEET

Foster Wheeler Environmental Corporation

MEDICAL DATA SHEET

The brief medical data sheet shall be completed by all on-site personnel and will be kept in the Support Zone by the HSO as a project record during the conduct of site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project: _____

Name: _____ Home Telephone: _____

Address: _____

Age: ____ Height: ____ Weight: ____ Blood Type: ____

Name and Telephone Number of Emergency Contact: _____

_____

Drug or Other Allergies: _____

Particular Sensitivities: _____

Do You Wear Contacts? _____

Provide A Check List Of Previous Illnesses: _____

_____

_____

What Medications Are You Presently Using? _____

_____

_____

Do You Have Any Medical Restrictions? _____

_____

_____

Name, Address, And Phone Number Of Personal Physician: _____

_____

_____

RE/96-245

APPENDIX F

WORK RULES

FOSTER WHEELER ENVIRONMENTAL CORPORATION

GENERAL HEALTH AND SAFETY WORK RULES

1. All site personnel must attend each day's Health and Safety Briefing.

2. Any individual taking prescribed drugs shall inform the HSO of the type of medication. The HSO will review the matter with the Project Health and Safety Manager and the Corporate Medical Consultant (CMC), who will decide if the employee can safely work on-site while taking the medication.

3. The personal protective equipment specified by the HSO and the HASP shall be worn by all site personnel. This includes hard hats and safety glasses which must be worn at all times in active work areas.

4. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.

5. All personnel must sign the site log and the exclusion zone log when used at the site.

6. Personnel must follow proper decontamination procedures and shower at the end of the work shift.

7. Eating, drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the PHSM to allow fluid intake during heat stress conditions.)

8. All lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.

9. All signs and demarcations shall be followed. Such signs and demarcation shall not be removed except as authorized by the HSO.

10. No one shall enter a permit-required confined space without a permit. Confined space entry permits must be followed as issued.

11. All personnel must follow Hot Work Permits as issued.

12. All personnel must use the Buddy System in the Exclusion Zone.

13. All personnel must follow the work-rest regimens and other practices required by the heat stress program

14. All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.

15, No person shall operate equipment unless trained and authorized.

16. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.

17. Ladders and scaffolds shall be solidly constructed, in good working condition and inspected prior to use. No one may use defective ladders or scaffolds.

18. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.

19. Safety belts, harnesses and lanyards must be selected by the Supervisor. The user must inspect the equipment prior to use. No defective personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.

20. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.

21. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out walkways and puddles unless protected and rated for the service.

22. Improper use, mishandling or tampering with health and safety equipment and samples is prohibited.

23. Horseplay of any kind is prohibited.

24. Possession or use of alcoholic beverages, controlled substances or firearms on any site is forbidden.

25. All accidents, no matter how minor must be reported immediately to the Supervisor.

26. All personnel shall be familiar with the Site Emergency Response Plan.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with all regulations set forth by OSHA, the FWENC Corporate H&S Manual, the HASP, the client, FWENC Supervisors and the HSO.

APPENDIX G

WEEKLY REPORT

FOSTER WHEELER ENVIRONMENTAL CORPORATION
WEEKLY HEALTH AND SAFETY REPORT

Project Name: _____
Location: _____
Delivery Order No. _____

SITE INFORMATION	INJURIES AND ILLNESSES
Week Ending:	Yes or no (circle)
Hours Worked:	Describe and attach reports:
Level Of Protection: B C D (circle)	

MAJOR ACTIVITIES CONDUCTED THIS WEEK
(drum handling, sampling, excavation, abatement/T&D, etc.)

SIGNIFICANT EVENTS THIS WEEK
(regulatory visits, equipment malfunctions, process start-up or shut down)

FUTURE ISSUES
(schedule, manpower allocation, monitoring equipment, other resources needed)

SITE AUDIT/INSPECTIONS CONDUCTED Yes or No (circle)
(describe outstanding findings and attach results)

AIR MONITORING:
Real Time

Major Activity	Location(s)	Worker Occupation	FID/PID Range	CGI/O2 Range	PDM Range	Other

PERSONAL AIR MONITORING

Analyte	Activity Monitored	Occupation	Location	Result	Type of Sample*

SUBCONTRACTORS ON SITE

Company Name	Task or Function	Return to Site Next Week (Y/N)

Health and Safety Officer - Signature

Date