

**WORK PLAN FOR REVISED CORRECTIVE ACTION
PLAN (RCAP) IMPLEMENTATION
HPFF BIO-PULSE AIR SPARGE SYSTEM INSTALLATION
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

Prepared for:

Department of the Navy, Atlantic Division



Naval Facilities Engineering Command
Building C, 3rd Floor
6506 Hampton Boulevard
Norfolk, Virginia 23508-1278

Prepared by:



11560 Great Oaks Way, Suite 500
Alpharetta, GA 30022-2424

Task Order 0050/Shaw Project No. 115258
September 2005

**WORK PLAN
FOR
REVISED CORRECTIVE ACTION PLAN (RCAP) IMPLEMENTATION
HPFF BIO-PULSE AIR SPARGE SYSTEM INSTALLATION
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

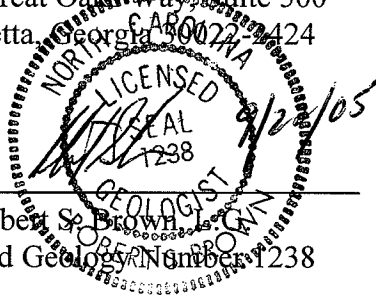
Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-02-D-3260

Naval Facilities Engineering Command, Atlantic
6506 Hampton Boulevard
Norfolk, Virginia 23508-1278

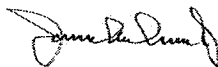
Prepared by:

Shaw Environmental, Inc.
11560 Great Oaks Way, Suite 500
Alpharetta, Georgia 30022-4424


Robert S. Brown
Licensed Geologist Number 1238



Ron Kenyon
Project Manager



James A. Dunn, Jr., P.E.
Program Manager

Task Order 0050
Shaw Project No. 115258
September 2005

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1-1
1.0	Background	1-1
1.1	Site Description and History	1-1
1.1.1	Hadnot Point Fuel Farm Southeast Compound	1-1
1.1.2	Building 1115 Northwest Compound	1-2
1.2	Proposed Remedial Action	1-2
1.3	Objectives	1-3
1.4	Work Plan Organization	1-3
2.0	PRE-CONSTRUCTION ACTIVITIES	2-1
2.1	Pre-Construction Submittals	2-1
2.2	Permits	2-1
2.3	Procurement	2-1
2.4	Pre-Construction Meeting.....	2-2
3.0	PROPOSED REMEDIATION ACTIVITIES.....	3-1
3.1	Mobilization.....	3-1
3.2	Site Preparation.....	3-1
3.3	Bio-Pulse Air Sparge Well Installation.....	3-1
3.4	Vapor Abatement Measures beneath affected Buildings	3-1
3.5	Bio-Pulse Air Sparging Implementation.....	3-2
3.6	Groundwater Recovery and Treatment	3-2
3.7	Bio-Pulse System Monitoring.....	3-3
3.7.1	Building Monitoring	3-4
3.7.2	Monitoring Well Gauging and Groundwater Sample Collection	3-5
3.7.3	AS/SVE System Monitoring.....	3-5
4.0	TRANSPORTATION AND DISPOSAL	4-1
4.1	On-site Waste Management.....	4-1
4.1.1	Soils	4-1
4.1.2	Disposal of PPE	4-1
4.2	Transportation	4-1
4.3	Documentation.....	4-2
5.0	SITE RESTORATION AND DEMOBILIZATION	5-1
5.1	Site Restoration.....	5-1

5.2	Decontamination and Decommissioning	5-1
5.3	Demobilization.....	5-1
6.0	DOCUMENTATION, REPORTS, AND SUBMITTALS	6-1

FIGURES

Figure 1.1	Site Location Map
Figure 1.2	Site Vicinity Map
Figure 3.1	Bio-Pulse Air Sparge Well Location Map
Figure 3.2	Bio-Pulse Well Construction Detail
Figure 3.3	Proposed Groundwater and Bio-Pulse Air Sparge Systems Map
Figure 3.4	Building Vapor Control System Detail
Figure 3.5	Bio-Pulse Air Sparging System Schematic
Figure 3.6	Groundwater Recovery and Treatment System Schematic

APPENDICES

Appendix A - Site Specific Health and Safety Plan Addendum
Appendix B - Sampling and Analysis Plan Addendum
Appendix C - Program Quality Control Plan Addendum
Appendix D - Compliance Reporting Forms
Appendix E – DWQ Groundwater Discharge Permit

1.0 INTRODUCTION

1.0 Background

Shaw Environmental Inc. (Shaw) has been tasked by the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division (NAVFAC) under Contract Number N62470-02-D-3260, Task Order 0050 to prepare this Work Plan describing the technical approach to adding 24 deep (150 feet bls) bio-pulse air sparge wells to the existing AS/SVE remedial system at the Hadnot Point Fuel Farm (HPFF). This project will also require the operation and maintenance of a 30 gpm groundwater extraction and treatment system at the HPFF Southeast Compound to provide hydraulic control of the contaminant plume. The site is located on Marine Corps Base (MCB), Camp Lejeune, in Onslow County North Carolina.

1.1 Site Description and History

The site is located in the Hadnot Point “main side” area of MCB Camp Lejeune, North Carolina. **Figures 1.1** and **1.2** present a site vicinity map and a site location map. The project area, the Hadnot Point Fuel Farm/Building 1115, is generally bound by Holcomb Boulevard to the north, Michael Road to the south, Birch Street to the west, and the Vehicle Ready Fuel Storage facility and Temporary Fuel Farm (off Michael Road) to the east.

The project area consists of two primary source areas: the HPFF (Southeast Compound) and the former underground storage tanks (USTs) associated with Building 1115 (Northwest Compound). Free-phased product has been observed and dissolved-phase contamination appears to have migrated from the source areas and commingled to form a continuous plume of groundwater contamination.

The HPFF Southeast Compound and Northwest Compound have an existing Air Sparge/Soil Vapor Extraction remediation system which has been operational since 1999. The existing air sparge wells are installed to a depth of 50 feet bls. Based on the continuing presence of volatile organics in groundwater at depths greater than 100 feet bls, 24 additional deep (150 feet bls) bio-pulse air sparge wells at the site are to be installed.

1.1.1 Hadnot Point Fuel Farm Southeast Compound

The HPFF was constructed in about 1941 and consisted of 15 fuel storage tanks including: one 600,000-gallon aboveground storage tank, six 12,000-gallon USTs, and eight 15,000-gallon USTs. The tanks contained diesel fuel, gasoline, unleaded gasoline, and kerosene.

There have been numerous recorded losses of product including diesel and unleaded gasoline. Most of the losses likely occurred because of leaks in transfer lines or transfer line valves. Leaks in the fuel lines and tanks were documented as early as 1979.

1.1.2 Building 1115 Northwest Compound

Building 1115 was constructed as a fleet service and refueling area. Seven USTs were located west of the building. Three of the USTs contained gasoline and the other four contained either diesel or gasoline. There have been no reports of known releases from the tanks or distribution system associated with Building 1115. Closure of the seven USTs, which consisted of excavation and removal, was completed in March 1993. Free-phase product was observed in the tank excavation during the UST closure activities.

1.2 Proposed Remedial Action

The project objectives are to recover free product and the treatment of contaminated groundwater and soil at the Hadnot Point Fuel Farm area. The goal is to remove free product from the subsurface to the extent practical, reduce levels of petroleum contaminated groundwater to the 2L GWQS, and reduce TPH contaminated soil to below state action levels.

Due to the apparent effectiveness of the existing sparge/biosparge/vapor extraction treatment systems, operation of these systems will continue. This system was originally installed for containment and reduction of the dissolved-phase groundwater contamination and overlying soils in the hot spots at the former fuel farm. Since installation of the sparging system, the free product plume in the source area has been reduced considerably to the point that expansion of the air sparging/soil vapor extraction system in the source area was recommended in a Revised Corrective Action Plan (RCAP) prepared by CATLIN Engineers. The expansion of the existing system consisting of an additional nine air sparge wells and associated soil vapor extraction wells to treat upper level soil and groundwater contamination in the source area was completed in May 2005.

In addition, hydraulic containment of the contaminant plume will be implemented to prevent further down-gradient migration of the dissolved contaminant plume. This will be accomplished by groundwater recovery from recovery well HPFF-75 which is screened in the high permeability zone located approximately 50 feet to 80 feet bls. Results from a pumping test completed at the site indicated a groundwater recovery rate of 30 gpm will create a 2,000

feet radius of influence from the pumping well. This radius of influence will extend beyond the estimated extent of contaminated groundwater at the site. Recovered groundwater will be treated using the permitted treatment system at the HPFF Southeast Compound and discharged to the Base sanitary sewer.

1.3 Objectives

The objective of this remedial action is to inject air in pulses through a network of strategically placed wells installed to a depth of 150 feet bls. The injected air will diffuse upward through the contaminated groundwater stripping volatile compounds from the groundwater as well as stimulating biologic activity and bioremediation of the contaminate plume by adding dissolved oxygen to the groundwater.

Hydrodynamic control of the contaminate plume will be achieved by pumping groundwater from a high permeable zone located approximately 50 to 80 feet bls. This will be accomplished by placing a submersible pump in well HPFF-75 and recovering groundwater at a rate of 30 gpm. The recovered groundwater will be treated at the existing groundwater treatment system located at the Southwest Compound and discharged to the Base sanitary sewer.

1.4 Work Plan Organization

The introduction provided in this section is followed by a summary of the Pre-construction Activities (Section 2.0), the proposed field activities (Section 3.0), the transportation and disposal of waste (Section 4.0), Site restoration (Section 5.0) and the required reporting and submission of other documents (6.0). *Appendix A* presents the Health and Safety Plan Addendum and *Appendix B* provides the Sampling and Analysis Plan Addendum. A copy of the Construction Quality Control Plan is provided in *Appendix C*.

2.0 PRE-CONSTRUCTION ACTIVITIES

2.1 Pre-Construction Submittals

This Work Plan has been developed to discuss the execution of the project tasks for this task order. Note that the Sampling and Analysis Plan and Health and Safety Plan for the project will be guided by Shaw's Basewide Sampling and Analysis Plan (SAP) and Basewide Health and Safety Plan (HASP) and are to be considered as complementary components to this work plan.

2.2 Permits

Shaw will prepare all appropriate permit applications for submission by the Base as required for the remedial system expansion field work, and will coordinate with the state/federal agencies, Camp Lejeune personnel, and NAVFAC as needed. This will consist primarily of utility clearance and Base construction permits.

Shaw will work with Base personnel to identify and mark all known utilities potentially within the work zones. A Base issued dig permit or excavation permit will be obtained from the Public Works Officer, Utilities Division prior to beginning work. Hot work permits will be completed if torching operations are scheduled.

The groundwater treatment system at the Southeast compound will be operated under DWQ Permit No. WQ0023585. A photocopy of the permit is provided in *Appendix E*.

2.3 Procurement

Upon approval of this work plan, Shaw will complete procurement of equipment, materials, and subcontractors necessary for the execution of the remedial system expansion actions. The following is a list of anticipated subcontractors that may be procured for the project:

- Laboratory analytical services
- Drilling services
- Transportation services
- Waste Disposal Facilities

2.4 Pre-Construction Meeting

Shaw will participate in a pre-construction meeting at MCB Camp Lejeune with Base personnel, NAVFAC personnel, and other necessary parties prior to mobilization to the site. Shaw representatives will include at a minimum the Site Supervisor.

3.0 PROPOSED REMEDIATION ACTIVITIES

This section presents details on the specific work tasks required to install the Bio-Pulse air sparge wells at the site. Other work aspects of the project, such as disposal and site restoration, are discussed in Section 4.0 and 5.0 respectively.

3.1 Mobilization

Mobilization will consist of transporting personnel, materials and equipment to and from the site. Prior to beginning work on site, training will be conducted to brief all site personnel on the Site Specific Health and Safety Plan, construction drawings, operation procedures, and other relevant site-specific plans. Site hazards and conditions will be discussed and all personnel will acknowledge their understanding and compliance with the plan by signing an approved acceptance form.

3.2 Site Preparation

Shaw will employ a utility contracting service to mark the location of all underground utilities in the drilling areas. The locations will be marked with surveyor stakes, pin flags, and/or spray paint as appropriate.

3.3 Bio-Pulse Air Sparge Well Installation

A total of 24 Bio-Pulse air sparge wells were recommended in the RCAP. Initially, two wells (BP-10 and BP-14) will be installed to evaluate operational characteristics and effectiveness of the Bio-Pulse wells. The wells will be installed to a total depth of 150 feet bls using rotonic drilling techniques. The air sparge wells will be constructed using 2-inch diameter Schedule 5 Stainless Steel screen and riser. The screen will be 20-feet long with 0.020-inch wire wrap slots. The locations of the wells are illustrated on *Figure 3.1*. *Figure 3.2* presents a Bio-Pulse air sparge well construction detail.

3.4 Vapor Abatement Measures beneath affected Buildings

The air injection through the petroleum contaminated groundwater may create vapors in locations where known receptors are present. Buildings with slab on fill or crawl space foundations are prime locations for vapors to be trapped and may potentially affect the inhabitants of the building. At system startup, these buildings will be monitored as discussed in Section 3.7.1 to determine if vapor abatement measures are required. Buildings within the estimated areal extent of air sparge influence may require protection using a vapor control

system that would consist of a 2-inch diameter well screen installed beneath the building. The screen would be connected to a small electric blower designed to maintain a negative pressure (1 to 2 inches of water vacuum) beneath the slab or in the crawl space. Vapors will be discharged to the atmosphere from a stack mounted above the gutters of the building.

Occupied buildings that may require vapor control include: Building 1108, Building 1200, Building 1201, Building 1202, and Building 1301. *Figure 3.3* shows the location of the buildings that may require vapor control. *Figure 3.4* illustrates components of the vapor control system, if required.

3.5 Bio-Pulse Air Sparging Implementation

In concept, as air is injected into the well a dewatered subsurface sphere will form around the sparge point. If allowed, this spherical volume of air will continue to grow, displacing groundwater until the top of the sphere intersects the unsaturated zone above groundwater. When this break through occurs, the de-watered sphere will short circuit into the unsaturated zone. To maximize the radial influence of the sparge well, pulses are terminated before this break through occurs. At the completion of each pulse, sparged zones are allowed to re-saturate prior to the next pulse.

Conclusions from the RCAP recommended an air injection rate of 322 CFM at 95 psi. Air will be injected into the subsurface using a mobile air compressor, powered by a diesel generator, that is installed on a mobile trailer. Offsite fabrication of this specialty equipment will be required. The portable equipment will be moved to each location with a pickup truck. *Figure 3.5* provides a schematic of the Bio-Pulse Air Sparging System.

Air will be injected into the subsurface at a depth interval of 130 feet to 150 feet bls. The air sphere is expected to form around the screened interval of the sparge well and expand laterally and vertically until it intersects a higher permeability zone approximately 75 feet bls (a decrease in the injection pressure should occur). At this point air injection will cease, the "sphere area" will be allowed to re-saturate as the sparge air diffuses through the contaminated groundwater to the surface.

3.6 Groundwater Recovery and Treatment

Hydraulic containment of the contaminant plume will be accomplished by groundwater recovery from well HPFF-75. An electric submersible pump will be placed in the well

approximately 55 feet bls. A groundwater recovery rate of 30 gpm is expected to create a radius of influence that will extend beyond the estimated extent of contaminated groundwater. The pump will be connected to the existing groundwater treatment system at the Southeast Compound using 1-inch diameter PVC piping buried 12 inches bls. **Figure 3.3** presents the location of recovery well HPFF-75, the estimated extent of groundwater contamination, the estimated area of influence of the bio-pulse system and the calculated radius of influence of the groundwater recovery well. *Figure 3.6* provides a schematic of the proposed groundwater recovery and treatment system.

In compliance with the Division of Water Quality (DWQ) Discharge Permit No. WQ0023585 the following groundwater sample collection and analysis will be performed:

- Recovery well HPFF-75 will be sampled prior to system startup and one more time within two months following system startup. The groundwater sample will be analyzed for ethylene dibromide using EPA Method 8011; benzene, toluene, xylenes, ethyl benzene, and naphthalene using EPA Method 8260B; and total lead using EPA Method 6010B.
- Following groundwater treatment system startup the treated effluent will be sampled monthly and analyzed for ethylene dibromide using EPA Method 8011; benzene, toluene, xylenes, ethyl benzene, and naphthalene using EPA Method 8260B; and total lead using EPA Method 6010B.
- Submit three copies of the treatment system monthly monitoring report to the NCDWQ. The Report will consist of Form GW-1 (Well Construction record, HPFF-75), Form GW-59 (Groundwater Quality Monitoring: Compliance Report Form), and GW-59A (Compliance Report Form). Photocopies of these forms as well as the Permit are provided in *Appendix D*.

3.7 Bio-Pulse System Monitoring

At system startup daily readings will be collected to monitor air injection pressure (psi) and air flow into the subsurface daily for a time period of approximately one week. In addition, groundwater levels in nearby monitoring wells will be gauged to evaluate the radius of influence of the air sparge wells. At this time it is expected that Catlin personnel will assist with the system startup monitoring.

The goals of the long term monitoring plan are to track plume migration and the reduction in contaminant concentrations, monitor for possible exposure of Base personnel to VOC vapors, and to ensure the remediation system is operating as designed. The following sections discuss monitoring activities that will be completed at the site following Bio-Pulse system startup.

3.7.1 Building Monitoring

Prior to system restart, baseline air monitoring of the interiors of Buildings 1068, 1100, 1101, 1104, 1105, 1108, 1111, 1114, 1115, 1200, 1201, 1202, and 1301 will be completed. Following system startup, routine air monitoring of the interiors of these buildings will begin on a regular basis (daily at first) to ensure undesirable migration of hydrocarbon vapors are not occurring. As system operation continues, the frequency of monitoring may be decreased if monitoring results remain consistently below background for a time period of at least one week.

Because groundwater is relatively close to ground surface (between 5 and 10 feet in most locations), a large rainfall event (greater than 0.5 inches) in a 24 hour time period can raise groundwater levels to within several feet of ground surface in some instances. This groundwater elevation increase could cause migration of VOCs vapors into buildings that had not displayed measurable concentrations prior to the rainfall event. Therefore, air monitoring of the buildings will be completed within 24 hours of a rain event greater than 0.5 inches and will continue daily for at least one week following the rain event.

Monitoring will consist of entering each building and analyzing the ambient air for volatile organic compounds (VOCs) using a hand held organic vapor analyzer equipped with a flame-ionization detector (OVA-FID). In addition, a lower explosion limit (LEL) detector will be used to monitor for explosive conditions in the event VOCs are detected. Locations within the building that will be monitored may include heating ducts, visible cracks in the floor, the breathing space in the office (approximately 4 to 5 feet off the floor), and areas that do not appear to have much ventilation (i.e., rooms with no windows, heating ducts, etc.).

In the event VOCs concentrations are detected above background levels in a building, the Base EMD and Industrial Hygienist (IH) will be notified immediately. In the event the building needs to be evacuated, evacuation will be completed as directed by the IH. Following building evacuation, procedures to vent the building will commence. The procedures will include shutting the air sparge system off, measuring groundwater levels in

monitoring wells near the building, opening of windows in the building, placing fans in the windows to remove the vapors from the building, and ambient air monitoring. Navy personnel will be allowed to return to the evacuated building following approval of the Base IH. The air sparge system will remain off for at least one week prior to restarting. If the occurrence of vapors in the building is thought to be a result of high groundwater levels, the air sparge system will not be restarted until groundwater elevations decrease to pre-rainfall levels.

3.7.2 Monitoring Well Gauging and Groundwater Sample Collection

The current depth to groundwater measurements and free product gauging will continue. AFVR events will continue to be completed at monitoring wells displaying the presence of free product. The semi-annual groundwater sample collection and analysis events will also continue as currently implemented.

Prior to bio-pulse air sparge well use, one groundwater sample will be collected from each of the bio-pulse wells. The samples will be analyzed for VOCs using EPA Method 8260B and SVOCs using EPA Method 8270C.

3.7.3 AS/SVE System Monitoring

At the AS/SVE system startup a vapor sample will be collected from the system discharge stack. The sample will be analyzed for TPH-GRO and VOCs using EPA Method 18. Routine equipment and system monitoring will be continued as currently implemented.

4.0 *TRANSPORTATION AND DISPOSAL*

This section presents Shaws' approach to managing the offsite transportation and disposal of project generated waste streams. Currently, TPH impacted soils are expected for off-site disposal from the project site. Based on our previous work experience at the site, it is probable the soil cuttings will require off site disposal as TPHC contaminated waste.

4.1 On-site Waste Management

4.1.1 *Soils*

All soils generated from drilling operations as well as trenching activities during groundwater manifold installation will be placed in drums and managed on site until they are sampled for disposal characterization analysis and transported to an appropriately permitted facility for final disposal. Shaw always employs best construction practices when managing excavated soils on site. The drums will be sealed and staged in a secure area until disposal of the soil can be arranged.

4.1.2 *Disposal of PPE*

PPE will be stored in plastic trash bags and placed in onsite trash bins as non-hazardous waste.

4.2 Transportation

Following all necessary testing and obtaining analytical results, the soil will be loaded into appropriate transport vehicles using a front-end loader or excavator. Concrete or metal debris will be loaded using either a front-end loader or an excavator. Transport vehicles will be guided to the designated loading location by the Shaw crew.

After loading the transport vehicle, Shaw and the driver will complete the necessary shipping papers as discussed in Section 4.3. Any applicable DOT and/or RCRA placarding of the vehicle will then occur as well as a walk around inspection of the transport vehicle. Shaw reserves the right to reject any transport vehicle without proper permits, licenses, or appears to be unsuitable for transport according to DOT regulations. After loading of waste onto the approved transport vehicle, the truck will be weighed at a certified scale prior to over the road transport. Portable scales will be established at the project location or the Base landfill scales will be used.

4.3 Documentation

All applicable transport documentation will be completed by Shaw and the transporter before the vehicle departs the site. For non-hazardous wastes this will consist of the Bill-of-Lading document and/or a State non-hazardous manifest. For hazardous wastes, a State or Uniform Hazardous Waste Manifest and Land Disposal Restriction form will be prepared.

5.0 SITE RESTORATION AND DEMOBILIZATION

Upon completion of field activities, Shaw will complete site restoration prior to demobilization from the site.

5.1 Site Restoration

After excavation activities are deemed complete, the trench will be backfilled with clean fill material. Clean backfill soil will be placed into the excavation in six-inch lifts. Each lift will be compacted, as required, before the placement of additional soil. For paved areas, the 12 inch deep trench will be backfilled with stone to the bottom elevation of the existing pavement before installing the asphalt or concrete as dictated by pre-existing conditions.

Any impacted grass areas will be seeded, fertilized, limed, and mulched. Grass seed matching existing vegetation will be placed over topsoil areas. Lime and fertilizer shall be spread uniformly over the affected area and mixed into the top four inches of soil. Seed shall be sown 24 hours following the application of fertilizer and lime and preparation of seedbed. Seed will be uniformly sown at appropriate rates. No sowing shall be done during windy weather which prevents even distribution of the seed, when the prepared surface is crusted, or when the ground is frozen, muddy, or otherwise in a non-tillable condition.

Mulch, straw or hay, shall be applied to evenly cover the ground to a depth of at least three-quarters of an inch and not more than one and one-half inches. The mulch shall allow some sunlight to penetrate and air to circulate, at the same time shading the ground, reducing erosion, and conserving soil moisture.

5.2 Decontamination and Decommissioning

All equipment used for excavation activities will be decontaminated prior to demobilizing from the site. Decontamination will consist of scraping and pressure washing to remove visible soil and debris from tires and undercarriage of vehicles and heavy equipment. Decontamination liquids will be containerized and transported to a base treatment facility.

5.3 Demobilization

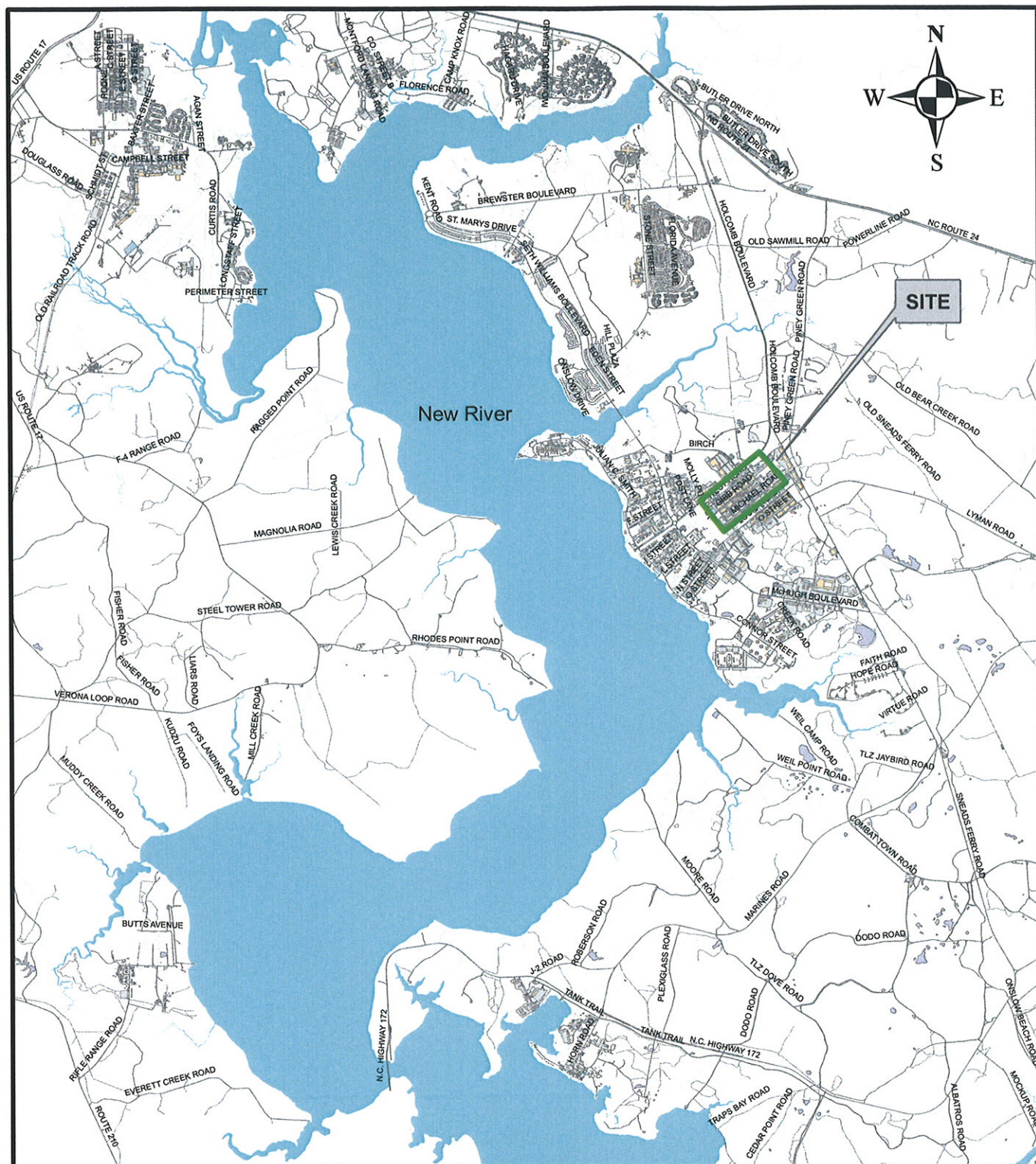
Upon completion of site restoration and decontamination, all equipment and personnel associated with installation activities will be demobilized from the project site.

6.0 DOCUMENTATION, REPORTS, AND SUBMITTALS

All field activities will be recorded in a field logbook. Entries will be made in real time and in permanent ink and will be sufficient to allow complete reconstruction of field activities in an accurate manner. A variety of field forms will be used to record data in the field, and these forms will be considered extensions of the field logbook and will be kept in the project file. Depending on daily field activities, forms will include a Field Activity Data Log, Chain of Custody Record, Sample Collection Log, Sample Tracking Form, Equipment Calibration Log, Project Photographic Record Index, Variance Report, and Daily Construction QC Report. In addition, photocopies of North Carolina Department of Environment and Natural Resources Form GW-59, Form GW-59A and Form NDMR-1 will be maintained in the field log book. Copies of logbooks and field forms will be maintained in the project files and included in reports submitted to NAVFAC.

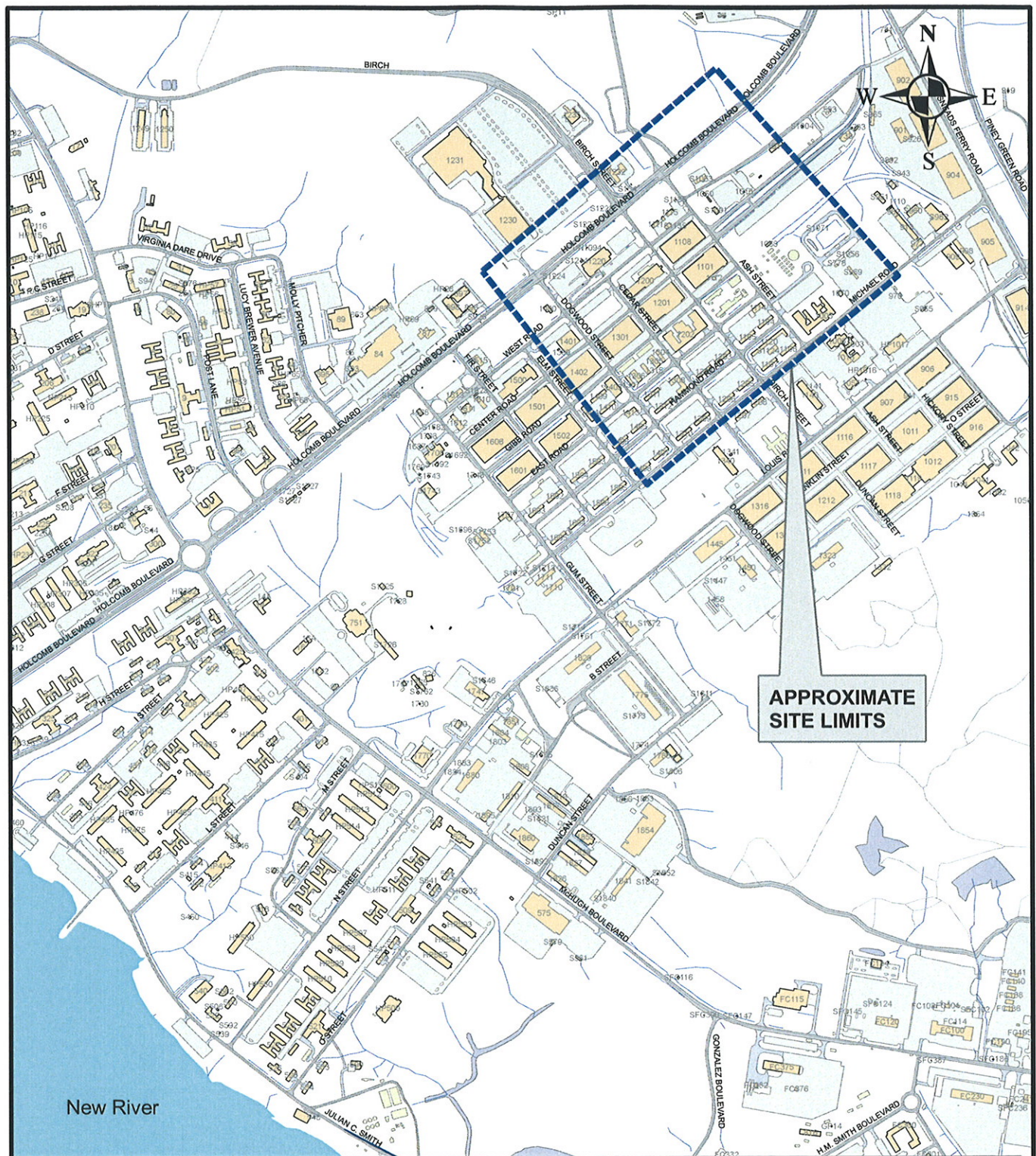
A final report documenting the remedial system expansion installation will be prepared and submitted following system installation completion. Any other submittals required at this time will be provided to NAVFAC as requested.

FIGURES



 Shaw Environmental, Inc.

FIGURE 1.1
SITE LOCATION MAP
 BIO-PULSE SPARGE INSTALLATION SYSTEM
 HADNOT POINT
 CAMP LEJEUNE, NC



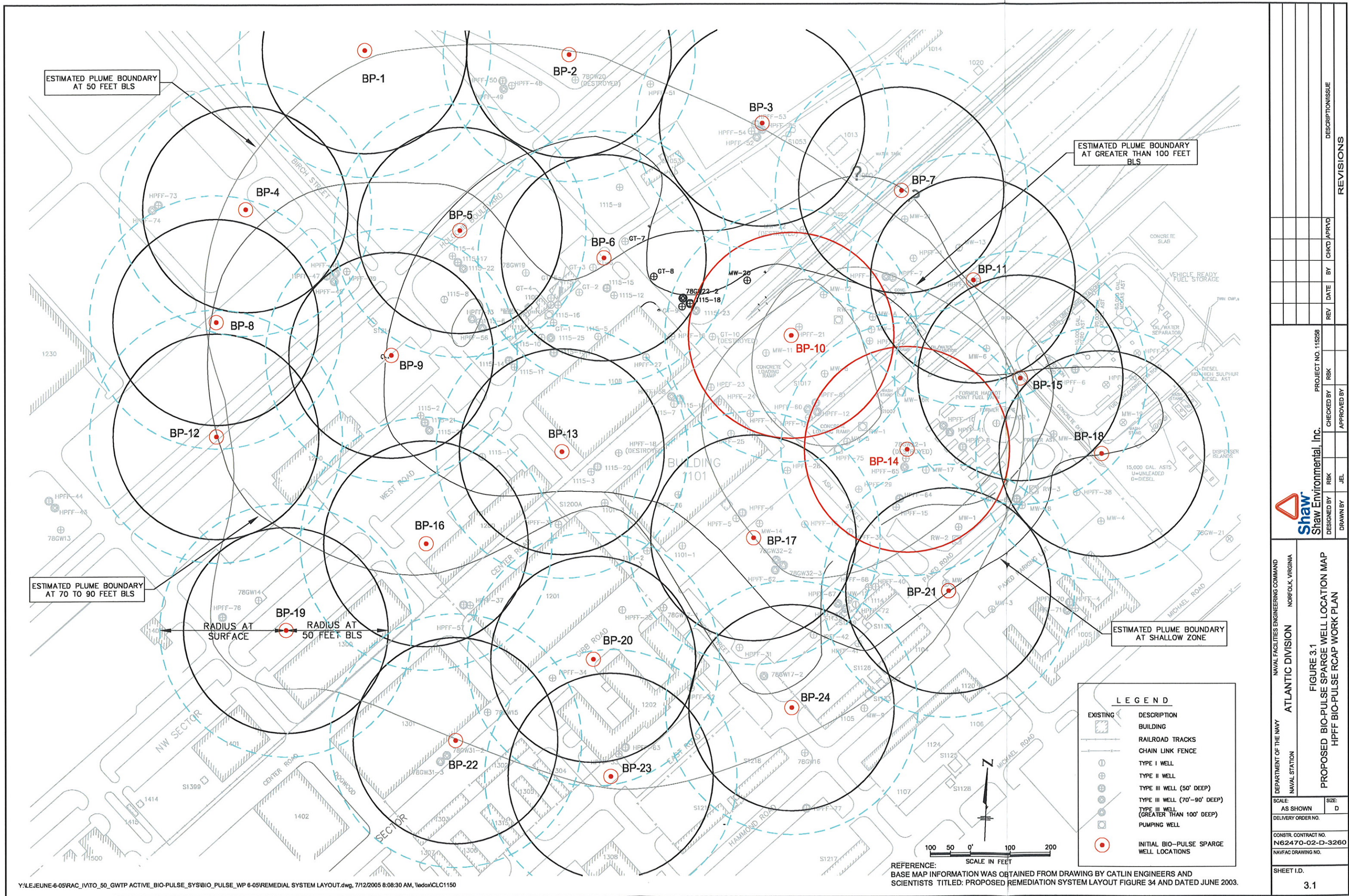
New River

**APPROXIMATE
SITE LIMITS**

0 455 910 1,820 2,730 3,640 Feet

Shaw™ Shaw Environmental, Inc.

**FIGURE 1.2
SITE VICINITY MAP**
BIO-PULSE SPARGE INSTALLATION SYSTEM
HADNOT POINT
CAMP LEJEUNE, NC



Shaw Environmental, Inc.

DESIGNED BY RBK
DRAWN BY JEL

PROJECT NO. 115258

CHECKED BY RBK
APPROVED BY

REVISIONS

REV	DATE	BY	CHKD	APPROV	DESCRIPTION

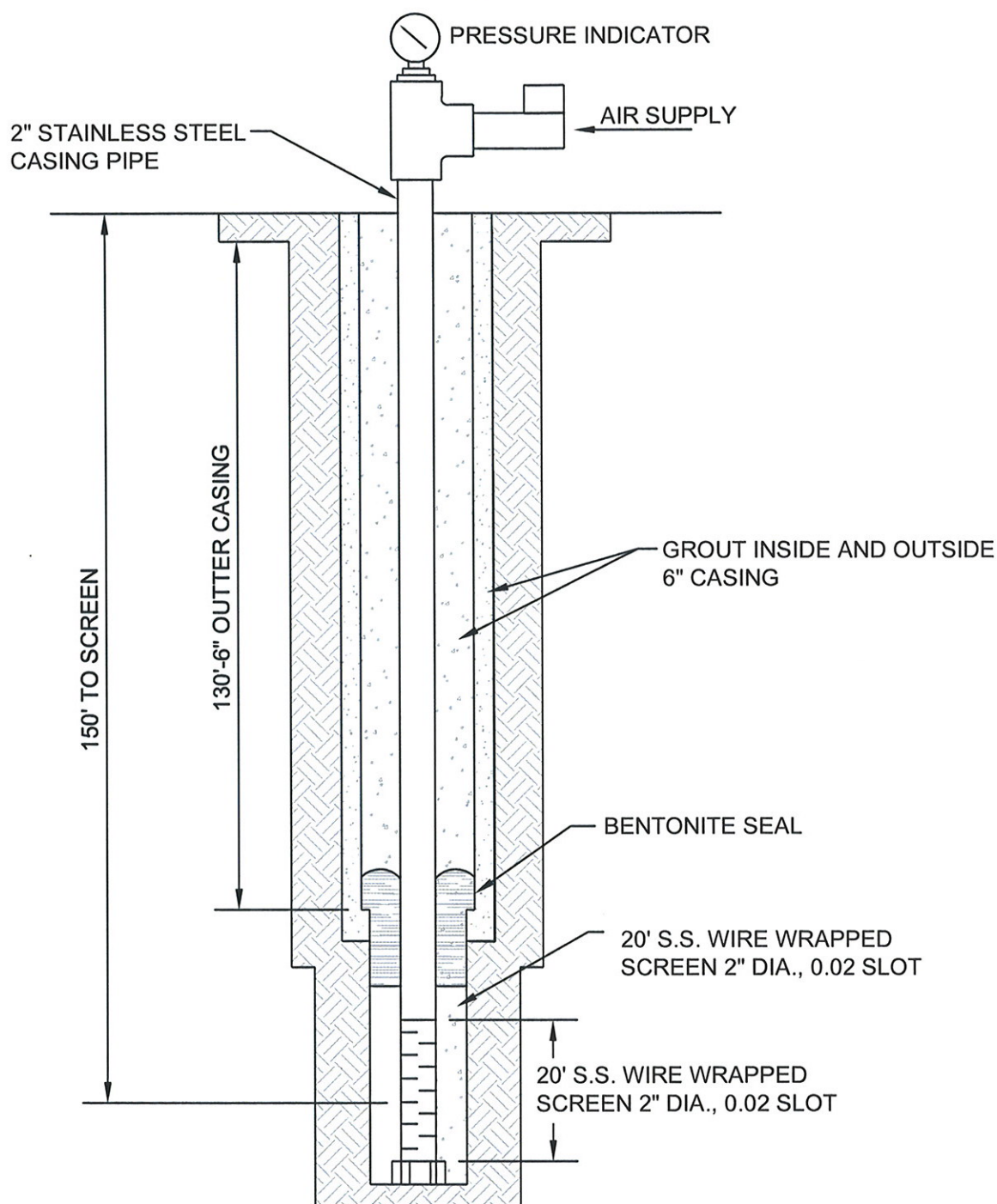
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVY STATION

ATLANTIC DIVISION
NORFOLK, VIRGINIA

FIGURE 3.1
PROPOSED BIO-PULSE SPARGE WELL LOCATION MAP
HPFF BIO-PULSE RCAP WORK PLAN

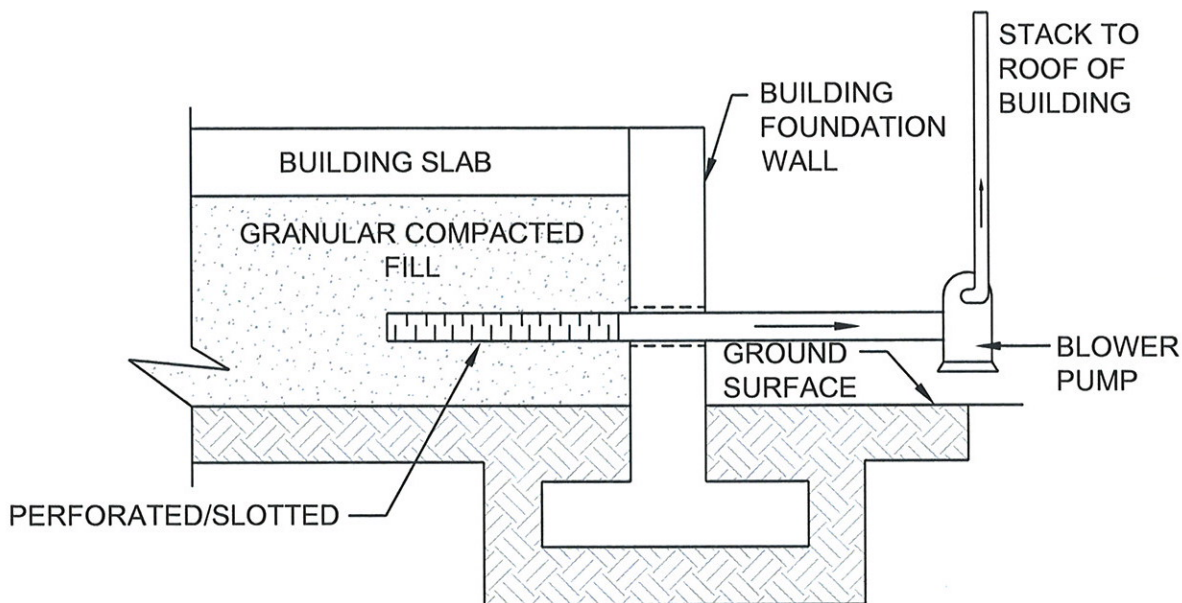
SCALE: AS SHOWN
DELIVERY ORDER NO.
CONSTR. CONTRACT NO. N62470-02-D-3260
NAVFAC DRAWING NO.
SHEET I.D.

3.1



REFERENCE:
BASE MAP INFORMATION WAS OBTAINED FROM DRAWING BY CATLIN ENGINEERS AND
SCIENTISTS TITLED: REMEDIATION SYSTEM DETAILS FIGURE 38 AND DATED JUNE 2003.

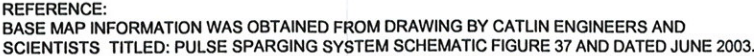
DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND ATLANTIC DIVISION NORFOLK, VIRGINIA NAVAL STATION		 Shaw Shaw Environmental, Inc.		PROJECT NO. 109927	
FIGURE 3.3 BIOPULSE SPARGE WELL DETAIL HPFF BIO-PULSE RCAP WORK PLAN		DESIGNED BY	RBK	CHECKED BY	RBK
		DRAWN BY	JEL	APPROVED BY	
SCALE: AS SHOWN	SIZE: A				
DELIVERY ORDER NO.					
CONSTR. CONTRACT NO. N62470-02-D-3260					
NAVFAC DRAWING NO.					
SHEET I.D.					
3.2					

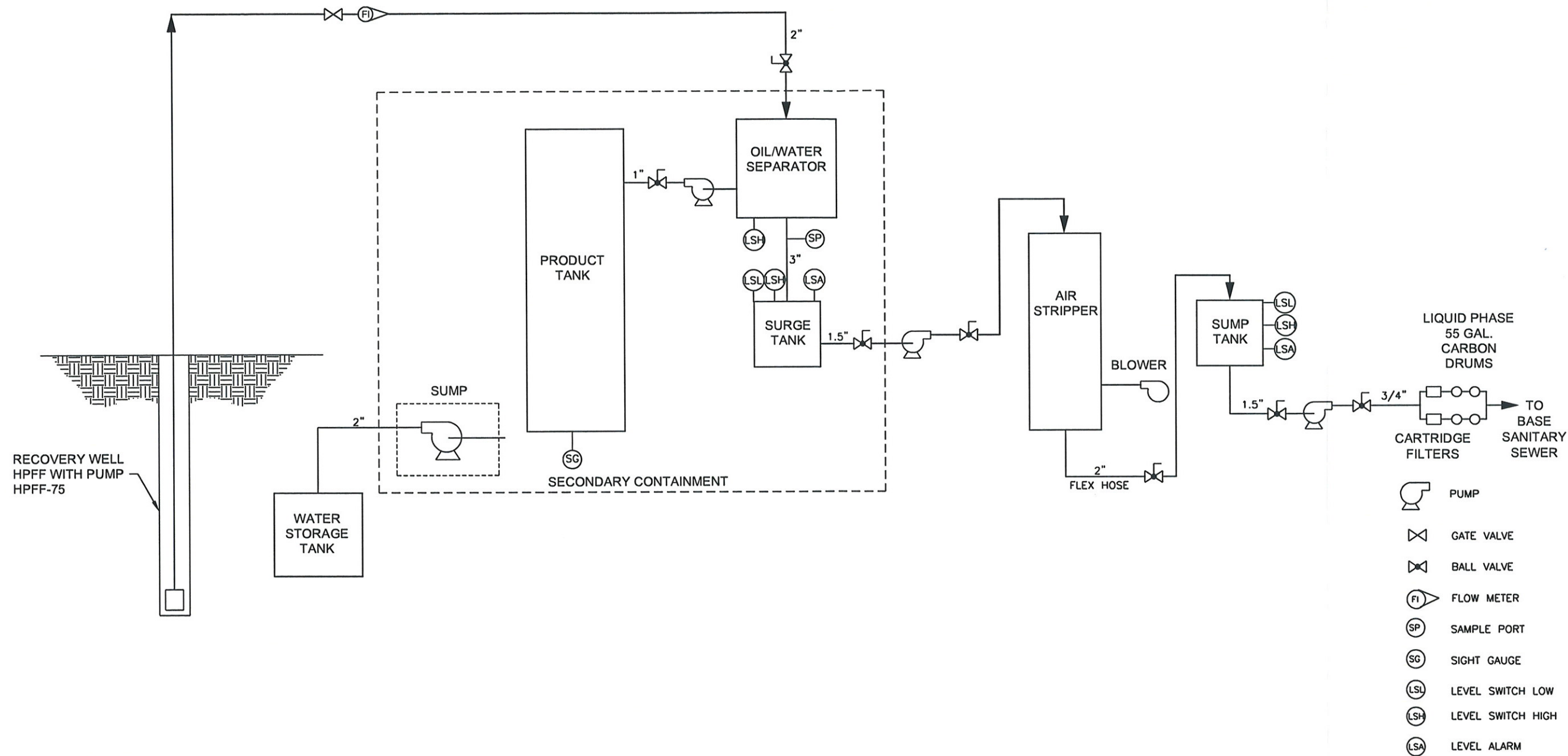


BUILDING VAPOR CONTROL SYSTEM DETAIL
NOT TO SCALE

REFERENCE:
BASE MAP INFORMATION WAS OBTAINED FROM DRAWING BY CATLIN ENGINEERS AND
SCIENTISTS TITLED: REMEDIATION SYSTEM DETAILS FIGURE 38 AND DATED JUNE 2003.

		PROJECT NO. 109927 DESIGNED BY RBK CHECKED BY RBK APPROVED BY JEL		REVISIONS	
DEPARTMENT OF THE NAVY NAVAL STATION		NAVAL FACILITIES ENGINEERING COMMAND ATLANTIC DIVISION NORFOLK, VIRGINIA		FIGURE 3.4 BUILDING VAPOR CONTROL SYSTEM DETAIL HPFF BIO-PULSE RCAP WORK PLAN	
SCALE: AS SHOWN		SIZE: A		DELIVERY ORDER NO.	
CONSTR. CONTRACT NO. N62470-02-D-3260		NAVFAC DRAWING NO.		SHEET I.D.	
				3.4	





Shaw Environmental, Inc.
DESIGNED BY RBK
DRAWN BY JEL

PROJECT NO. 845823
CHECKED BY RBK
APPROVED BY

DEPARTMENT OF THE NAVY
NAVAL STATION
ATLANTIC DIVISION
NORFOLK, VIRGINIA

FIGURE 3.6
GROUNDWATER RECOVERY/TREATMENT SYSTEM
SCHEMATIC
HPFF BIO-PULSE RCAP WORK PLAN

REV	DATE	BY	CHK'D	APR'D	DESCRIPTION/ISSUE

SHEET I.D.
3.6

APPENDIX A

SITE SPECIFIC HEALTH AND SAFETY PLAN ADDENDUM

Site Specific Health & Safety Plan Amendment Documentation

Project Name: **RCAP Implementation HPFF
Bio-Pulse Air Sparge System Installation**

Project No. 115258

Amendment No. 026

Date: July 2005

The Amendment Addresses the Following Sections:

Section 2.2	Scope of Work
Section 4.1	Chemical Hazards
Section 4.3	Physical Hazards
Section 6.0	Protective Equipment

Task(s) Amendment Affects:

The HPFF Southeast Compound and Northwest Compound have an existing Air Sparge/Soil Vacuum Extraction remediation system which has been operational since 1999. Based on the continuing presence of volatile organics in groundwater at depths greater than 100 feet bls, 24 additional deep (150 feet bls) bio-pulse air sparge wells at the site are to be installed.

Reason For Amendment:

The additional work was not addressed in the original Site Specific Health and Safety Plan.

Amendment: 26

Section 2.2: Scope of Work

This amendment to the site specific health and safety plan will address the following:

- Installation of bio-pulse air sparge wells
- Installation of piping in trenches
- Building Monitoring

Section 4.1: Chemical Hazards

Chemical hazards on this portion of the project may include diesel and gasoline.

Summary of Site Contaminants

CHEMICAL	EXPOSURE ROUTES	PEL/TLV	
Diesel Fuel	Inhalation Ingestion, Skin & Eye Contact	TWA 100 mg/m ³	- Respiratory system irritation and light headedness; may cause drowsiness, vomiting; ingestion may cause solvent aspiration into lungs as a result of vomiting and may cause lung and digestive system damage. - Avoid contact with open flames, strong oxidizers
Gasoline*	Inhalation, Ingestion. Skin & Eye Contact	TWA 300 ppm (900 mg/m ³) ST 500 ppm (1500 mg/m ³)	- Irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen] - Avoid strong oxidizers such as peroxides, nitric acid & perchlorates

* Currently no established PEL; listed information from NIOSH Pocket Guide Appendix 'A' 2003 Air Contaminants Update Project: Exposure Limits Not in Effect

Section 4.3: Physical Hazards

Physical hazards on this site include heavy equipment operation, trench excavation, pipe installation, drill rig operation, contact with above/underground utilities, and hazardous energy sources.

- Review attached Activity Hazard Analyses for each general phase of work;
- Obtain a hot work permit and conduct all hot work in accordance with HS-314.
- Utilize spark and explosion proof equipment when connecting into existing lines.
- Isolate equipment swing areas and maintain safe distances to eliminate potential for injury.
- Conduct all excavation activities in accordance with HS-307, Excavation and Trenching
- Treat buildings under the monitoring program as confined spaces, and conduct monitoring accordingly.
- All above and underground utilities shall be identified and marked by the appropriate authority, as required by HS-308, prior to the initiation of activities.

Section 6.0: Personal Protective Equipment:

PPE to be utilized will consist of the following:

Task	Initial PPE Level	Upgrade PPE Level	Skin Protection	Respiratory Protection	Other PPE
Well Installation	Level 'D'	Not Anticipated	Leather-work gloves; use PVC gloves to handle wet concrete	None	Hard-hat, steel-toe work boots, hearing protection >85 dBA.
Installation of Piping in Trenches	Level 'D'	Not Anticipated	Leather work gloves	None	Hard-hat, steel-toe work boots, hearing protection >85 dBA.
Building Monitoring	Level 'D'	Level 'C', based on monitoring results and review of results by HSM	Tyvek coveralls, nitrile inner sample gloves, outer leather work gloves	Full Face Air purifying respirator equipped with organic vapor cartridges	Hard-hat, steel-toe work boots, hearing protection >85 dBA.

Section 8.0 Air Monitoring:

Air monitoring will be conducted in order to characterize personnel exposures and fugitive emissions from site contaminants that may remain. During the installation phase, contamination is not anticipated; however, areas where intrusive work will be conducted will be scanned with an FID to ensure no sources remain that will affect employees. The principle contaminants are gasoline, and diesel. An FID will be utilized to conduct air monitoring in the breathing zone and work area during intrusive activities.

Monitoring will also be conducted to detect oxygen levels and the presence of explosive vapors in the work area with a combustible gas/oxygen meter.

Direct Reading Air Monitoring Requirements

Monitoring Device	Monitoring Location/ Personnel	Monitoring Frequency	Action Level	Action
FID	Breathing zone/ Drill Rig Operator/Equipment Operator (EO) and Recovery Technician (RT) during intrusive activities; During entry for Building Monitoring	Scan area during intrusive activities. Duration of building entry	1.0 ppm* 1.0- 30.0 ppm* No benzene present >30.0 ppm*	Colorimetric tubes for Benzene. Level D Stop work and contact Health and Safety Manager.
Colorimetric Tubes- Benzene	Breathing zone/Drill Rig Operator/Equipment Operator (EO) and Recovery Technician (RT) during intrusive activities; During entry for Building Monitoring	Sustained PID readings of 1 ppm or greater	<1.0 ppm* >1.0 ppm*	Level D Stop work and contact Health and Safety Manager
Combustible Gas/Oxygen Meter	Work area during intrusive activities; During entry for Building Monitoring	Duration of intrusive operations. Duration of building entry.	Oxygen $\geq$ 19.5 % and $\leq$ 22.5%; LEL <10% Oxygen < 19.5% and >22.5%; LEL $\geq$ 10%	Monitor continuously and watch for levels to fluctuate Stop Work, evacuate area and contact Health and Safety Manager.

*Sustained readings above background.

Completed by: Kym Edelman
Health and Safety Coordinator

Approved by: David Mummert, CIH
Health and Safety Manager

By signing this document, I am stating that I have read and understand the Site Health and Safety Plan Amendment No. 26 for personnel and visitors entering MCB-Camp Lejeune RPF Bio-Pulse Air Sparge Site.

[illegible]

ATTACHMENT 2

Material Safety Data Sheets

- 1) Gasoline
- 2) Diesel

MSDSDefinition
of terms**Material Safety Data Sheet for #2 Diesel****1. Chemical Product****MSDS Number:** U7770**MSDS Date:** 01-31-99**Product Name:** #2 Diesel Fuel
24 Hour Emergency Phone: (210) 979-8346
Transportation Emergencies: Call Chemtrec at 1-800-424-9300
MSDS Assistance: (210) 592-4593
Distributors Name and Address:

T.W. Brown Oil Co., Inc.
 1857 Knoll Drive
 Ventura, California 93003

Chemical Name: #2 Diesel Fuel**Cas Number:** 68476-34-6

Synonyms/Common Names: This Material Safety Data Sheet applies to the following product descriptions for Hazard Communication purposes only. Technical specifications vary greatly depending on the product, and are not reflected in this document. Consult specification sheets for technical information.

California Air Resources Board (Carb) Diesel Fuel- On-road, Off-Road, Tax Exempt blends

Premium Diesel Fuel- Low-Sulfur, High-sulfur, On-Road, Off-Road, Tax Exempt blends

#2 Distillate- Low-Sulfur, High-sulfur, On-Road, Off-Road, Tax Exempt blends

#2 Diesel Fuel- Low-Sulfur, High-sulfur, On-Road, Off-Road, Tax Exempt blends

#2 Fuel Oil- Low-Sulfur, High-sulfur, On-Road, Off-Road, Tax Exempt blends

2. Composition, Information On Ingredients

Product Use: This product is intended for use as a fuel in engines and heaters designed for diesel fuels, and for use in engineered processes. Use in other applications may result in higher exposures and require additional controls, such as local exhaust ventilation and personal protective equipment.

Description: #2 Diesel is a complex mixture of hydrocarbons from a variety of chemical processes blended to meet standardized product specifications. Composition varies greatly and includes C9 to C20 hydrocarbons with a boiling range of about 325-675 degrees F. The following is a non-exhaustive list of common components, typical percentage ranges in product, and occupational exposure limits for each.

Component or Material Name	%	CAS Number	ACGIH Limits TLV -- STEL -- Units	OSHA Exposure Limits PEL -- STEL -- C/P -- Units
Cat cracked distillate, light	0-100	64741-59-9	100 -- NA -- mg/m3	N/A -- N/A -- N/A -- N/A
Hydrotreated distillate, middle	0-100	64742-46-7	100 -- NA -- mg/m3	N/A -- N/A -- N/A -- N/A

Hydrotreated distillate, light	0-100	64742-47-8	100 – NA – mg/m3	N/A – N/A – N/A – N/A
Gas oil, light	0-100	64741-44-2	100 – NA – mg/m3	N/A – N/A – N/A – N/A

3. Hazards Identification

Health Hazard Data:

1. The major effect of exposure to this product is giddiness, headache, central nervous system depression; possible irritation of eyes, nose, and lungs; and dermal irritation. Signs of kidney and liver damage may be delayed. Pulmonary irritation secondary to exhalation fo solvent.

2. NIOSH recommends that whole diesel engine exhaust be regarded as a potential occupational carcinogen. Follow OSHA and NSHA rules where diesel engine exhaust fumes may be generated.

3. A life time skin painting study by the American Petroleum Institute has shown that similar naphtha products with a boiling range of 350-700 degrees F usually produce skin tumors and/ or skin cancers in laboratory mice. Only a weak to moderate response occurred. The effect to humans has not been determined.

4. Positive results at 2.0 ml/kg and 6.0 ml/kg noted in mutagenesis studies via in-vivo bone marrow cytogenetics assay in rats.

5. Kerosene is classified as a severe skin irritant. Mutation data has been reported for kerosene products. Hydrotreated kerosene is listed as being probably carcinogenic to humans with limited evidence in humans and sufficient evidence in experimental animals.

Hazards of Combustion Products: Carbon monoxide and carbon dioxide can be found in the combustion products of this product and other forms of hydrocarbon combustion. Carbon monoxide in moderate concentrations can cause symptoms of headache, nausea, vomiting, increased cardiac output, and confusion. Exposure to higher concentrations of carbon monoxide can cause loss of consciousness, heart damage, brain damage, and/or death. Exposure to high concentrations of carbon dioxide can cause simple asphyxiation by displacing available oxygen. Combustion of this and other similar materials should only be carried out in well ventilated areas.

[< Home](#)[Next >](#)



CITGO Gasolines, All Grades Unleaded

Material Safety Data Sheet

CITGO Petroleum Corporation
P.O. Box 4689
Houston, TX 77210

MSDS No. UNLEAD
Revision Date 05/23/2005

IMPORTANT: Read this MSDS before handling or disposing of this product and pass this information on to employees, customers and users of this product.

Emergency Overview

Physical State Liquid.

Color Transparent, clear to amber or red. **Odor** Pungent, characteristic gasoline.

DANGER:

Extremely flammable liquid; vapor may cause flash fire or explosion.

Vapor may travel considerable distance to source of ignition and flash back.

Use Only as a Motor Fuel. Do Not Siphon by Mouth.

Harmful or fatal if swallowed - Can enter lungs and cause damage.

High concentrations of vapor reduce oxygen available for breathing and may cause suffocation.

May be harmful if inhaled or absorbed through the skin.

Mist or vapor may irritate the eyes, mucous membranes, and respiratory tract.

Liquid contact may cause eye and skin irritation.

Overexposures may cause central nervous system (CNS) depression and target organ effects (See Section 3).

Harmful or fatal if swallowed - Can enter lung and cause damage.

Inhalation overexposure can increase the heart's susceptibility to arrhythmias (irregular beats).

Contains Benzene - Cancer Hazard.

Long term exposure to gasoline vapor has caused cancer in laboratory animals.

Avoid Spills. Spills may present both a physical and an environmental hazard.

Hazard Rankings

	HMIS	NFPA
Health Hazard	* 2	1
Fire Hazard	3	3
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details



SECTION 1. PRODUCT IDENTIFICATION

Trade Name	CITGO Gasolines, All Grades Unleaded	Technical Contact	(800) 248-4684
Product Number	Various	Medical Emergency	(832) 486-4700
CAS Number	Mixture.	CHEMTREC Emergency (United States Only)	(800) 424-9300

CITGO Gasolines, All Grades Unleaded

Product Family

Motor fuels.

Synonyms

Unleaded Gasolines; Motor Gasolines; Petrol; Automobile Motor Fuels; Finished Gasolines; Gasoline, Regular Unleaded; Gasoline, Mid-grade Unleaded; Gasoline, Premium Unleaded; Reformulated Gasolines (RFG); Reformulated Motor Fuels; Oxygenated Motor Spirits; Gasoline, Regular Reformulated; Gasoline, Mid-grade Reformulated; Gasoline, Premium Reformulated.

SECTION 2. COMPOSITION

Gasoline is a complex and variable mixture that originates from finished refinery streams. These streams can contain the hydrocarbons and oxygenated chemicals (oxygenates) listed below that are regulated or are associated with certain potential health effects. The typical concentration of oxygenates in gasoline does not exceed 18% (v/v).

Component Name(s)	CAS Registry No.	Concentration (%)
Methyl tertiary-Butyl Ether (MTBE)	1634-04-4	0 - 15
Tertiary-Amyl Methyl Ether (TAME)	994-05-8	0 - 15
Ethyl tertiary Butyl Ether (ETBE)	637-92-3	0 - 15
Tertiary-Amyl Ethyl Ether (TAEE)	919-94-8	0 - 15
Diisopropyl Ether (DIPE)	108-20-3	0 - 15
Ethanol	64-17-5	0 - 10
Toluene	108-88-3	<20
Xylene, all isomers	1330-20-7	<18
n-Hexane	110-54-3	<8
Trimethylbenzenes, all isomers	25551-13-7	<5
Benzene	71-43-2	<5
Cumene	98-82-8	<4
Ethylbenzene	100-41-4	<4
Cyclohexane	110-82-7	<3
Naphthalene	91-20-3	<2
Styrene	100-42-5	<1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact. Eye contact. Inhalation. Ingestion.

Signs and Symptoms of Acute Exposure

Inhalation	Breathing high concentrations may be harmful. Mist or vapor can irritate the throat and lungs. Breathing this material may cause central nervous system depression with symptoms including nausea, headache, dizziness, fatigue, drowsiness, or unconsciousness. Breathing high concentrations of this material, for example, in an enclosed space or by intentional abuse, can cause irregular heartbeats which can cause death.
Eye Contact	This product can cause eye irritation with short-term contact with liquid, mists or vapor. Symptoms include stinging, watering, redness, and swelling. In severe cases, permanent eye damage can result.
Skin Contact	This material can cause skin irritation. The severity of irritation will depend on the amount of material that is applied to the skin and the speed and thoroughness that it is removed. It is likely that some components of this material are able to pass into the body through the skin and may cause similar effects as from breathing or swallowing it. If the skin is damaged, absorption increases.

Ingestion

CITGO Gasolines, All Grades Unleaded

If swallowed, this material may irritate the mucous membranes of the mouth, throat, and esophagus. It can be readily absorbed by the stomach and intestinal tract. Symptoms include a burning sensation of the mouth and esophagus, nausea, vomiting, dizziness, staggered gait, drowsiness, loss of consciousness and delirium, as well as additional central nervous system (CNS) effects.

Due to its light viscosity, there is a danger of aspiration into the lungs during swallowing and subsequent vomiting. Aspiration can result in severe lung damage or death. Cardiovascular effects include shallow rapid pulse with pallor (loss of color in the face) followed by flushing (redness of the face). Also, progressive CNS depression, respiratory insufficiency and ventricular fibrillation leads to death.

Chronic Health Effects Summary

Intentional misuse by deliberately concentrating and inhaling gasoline can be harmful or fatal. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage ("Petrol Sniffers Encephalopathy"), delirium, seizures and sudden death are associated with repeated abuse of gasoline or naphtha.

Chronic effects of ingestion and subsequent aspiration into the lungs may include pneumatocele (lung cavity) formation and chronic lung dysfunction.

Benzene, a component of this product, causes blood disorders and damages the bone marrow (certain types of anemia, leukemia, and lymphoma). It is also capable of causing changes in living cells' genetic material (chromosomes). Benzene is considered to be a mutagen and a cancer-causing agent (leukemogen).

Repeated and prolonged overexposure to n-hexane has been associated with peripheral nerve tissue damage. Adverse effects include numbness, tingling, pain, and loss of muscle control in the extremities, disorientation, impaired vision and reflexes, decline in motor function and paralysis.

Prolonged or repeated overexposure to toluene, a component of this product, has been associated with reproductive effects in experimental animals and in long-term chemical abuse situations. Long-term overexposure to toluene has been associated with impaired color vision. Also, long-term overexposure to toluene in occupational environments have been associated with hearing damage.

Prolonged or repeated overexposure to xylene, a component of this product, has been associated with hearing damage in laboratory animals. Repeated overexposure may cause injury to bone marrow, blood cells, kidney, and liver.

Refer to Section 11 of this MSDS for additional health-related information.

Conditions Aggravated by Exposure

Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin, Respiratory System, Liver, Kidneys, Central Nervous System (CNS), Cardiovascular System, Blood-forming system

Target Organs

May cause damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, mucous membranes, heart, peripheral nervous system, cardiovascular system, upper respiratory tract, skin, auditory system, bone marrow, central nervous system (CNS), eye, lens or cornea.

Carcinogenic Potential

This material may contain benzene, ethylbenzene, naphthalene or styrene at concentrations above 0.1%. Benzene is considered to be a known human carcinogen by OSHA, IARC and NTP. IARC has identified ethylbenzene, styrene, naphthalene, gasoline and gasoline engine exhaust as possibly carcinogenic to humans (Group 2B) based on laboratory animal studies.

CITGO Gasolines, All Grades Unleaded

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification			
Irritant	☒	Sensitizer	☐	Combustible	☐	Explosive	☐
Toxic	☐	Highly Toxic	☐	Flammable	☒	Oxidizer	☐
Corrosive	☐	Carcinogenic	☒	Compressed Gas	☐	Organic Peroxide	☐
						Pyrophoric	☐
						Water-reactive	☐
						Unstable	☐

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation Immediately move victim to fresh air. If victim is not breathing, immediately begin rescue breathing. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If breathing is difficult, 100 percent humidified oxygen should be administered by a qualified individual. Seek medical attention immediately. If exposed to benzene in an emergency situation, a medical evaluation should be completed at the end of the work-shift in accordance with OSHA requirements.

Eye Contact Flush eyes with cool, clean, low-pressure water for at least 15 minutes. Hold eyelids apart to ensure complete irrigation of the eye and eyelid tissue. If easily accomplished, check for and remove contact lenses. If contact lenses cannot be removed, seek immediate medical attention. Do not use eye ointment. Seek medical attention.

Skin Contact Remove contaminated shoes and clothing. Flush affected area with large amounts of water. If skin surface is damaged, apply a clean dressing and seek medical attention. Do not use ointments. If skin surface is not damaged, clean affected area thoroughly with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists.

Ingestion Do not induce vomiting. If spontaneous vomiting is about to occur, place victim's head below knees. If victim is drowsy or unconscious, place on the left side with head down. Never give anything by mouth to a person who is not fully conscious. Do not leave victim unattended. Seek medical attention immediately.

Notes to Physician INHALATION: Inhalation overexposure can produce toxic effects. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.

This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

CITGO Gasolines, All Grades Unleaded

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IB flammable liquid.		
Flash Point	Closed cup: -43°C (-45°F). (Tagliabue [ASTM D-56])		
Lower Flammable Limit	AP 1.4 %	Upper Flammable Limit	AP 7.6 %
Autoignition Temperature	280°C (536°F)		
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons, aldehydes and other products of incomplete combustion.		
Special Properties	Flammable Liquid! This material releases vapors at or below ambient temperatures. When mixed with air in certain proportions and exposed to an ignition source, its vapor can cause a flash fire. Use only with adequate ventilation. Vapors are heavier than air and may travel long distances along the ground to an ignition source and flash back. A vapor and air mixture can create an explosion hazard in confined spaces such as sewers. If container is not properly cooled, it can rupture in the heat of a fire.		
Extinguishing Media	SMALL FIRE: Use dry chemicals, carbon dioxide, foam, or inert gas (nitrogen). Carbon dioxide and inert gas can displace oxygen. Use caution when applying carbon dioxide or inert gas in confined spaces. LARGE FIRE: Use foam, water fog, or water spray. Water May Be Ineffective. Water may not extinguish the fire. Water fog and spray are effective in cooling containers and adjacent structures. However, water can be used to cool the external walls of vessels to prevent excessive pressure, autoignition or explosion. DO NOT use a solid stream of water directly on the fire as the water may spread the fire to a larger area.		
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles. Cover pooling liquid with foam. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines. Be aware that burning liquid will float on water. Notify appropriate authorities of potential fire and explosion hazard if liquid enter sewers or waterways.		

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Flammable Liquid! Release causes an immediate fire or explosion hazard. Evacuate all non-essential personnel from immediate area and establish a "regulated zone" with site control and security. A vapor-suppressing foam may be used to reduce vapors. Eliminate all ignition sources. All equipment used when handling this material must be grounded. Stop the leak if it can be done without risk. Do not touch or walk through spilled material. Remove spillage immediately from hard, smooth walking areas. Prevent spilled material from entering waterways, sewers, basements, or confined areas. Absorb or cover with dry earth, sand, or other non-combustible material and transfer to appropriate waste containers. Use clean, non-sparking tools to collect absorbed material.

For large spills, secure the area and control access. Prevent spilled material from entering sewers, storm drains, other drainage systems, and natural waterways. Dike far ahead of a

CITGO Gasolines, All Grades Unleaded

liquid spill to ensure complete collection. Water mist or spray may be used to reduce or disperse vapors; but, it may not prevent ignition in closed spaces. This material will float on water and its run-off may create an explosion or fire hazard. Verify that responders are properly HAZWOPER-trained and wearing appropriate respiratory equipment and fire-resistant protective clothing during cleanup operations. In an urban area, cleanup spill as soon as possible; in natural environments, cleanup on advice from specialists. Pick up free liquid for recycle and/or disposal if it can be accomplished safely with explosion-proof equipment. Collect any excess material with absorbant pads, sand, or other inert non-combustible absorbent materials. Place into appropriate waste containers for later disposal. Comply with all applicable local, state and federal laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

FLAMMABLE LIQUID AND VAPOR. USE ONLY as a motor fuel. DO NOT siphon by mouth. DO NOT use as a lighter fluid, solvent or cleaning fluid. Prior to handling or refueling, stop all engines and auxillary equipment. Turn off all electronic equipment including cellular telephones. DO NOT leave nozzle unattended during filling or refueling a vehicle. DO NOT re-enter vehicle while refueling. Keep nozzle spout in contact with the container during the entire filling operations.

A static electrical charge can accumulate when this material is flowing through pipes, nozzles or filters and when it is agitated. A static spark discharge can ignite accumulated vapors particularly during dry weather conditions. Always bond receiving containers to the fill pipe before and during loading. Always keep nozzle in contact with the container throughout the loading process. Do not fill any portable container in or on a vehicle. Special precautions, such as reduced loading rates and increased monitoring, must be observed during "switch loading" operations (i.e., loading this material in tanks or shipping compartments that previously contained middle distillates or similar products).

A spill or leak can cause an immediate fire hazard. Keep containers closed and do not handle or store near heat, sparks, or any other potential ignition sources. Do not contact with oxidizable materials. Do not breathe vapor. Use only with adequate ventilation and personal protection. Never siphon by mouth. Avoid contact with eyes, skin, and clothing. Prevent contact with food and tobacco products. Do not take internally.

When performing repairs and maintenance on contaminated equipment, keep unnecessary persons away from the area. Eliminate all potential ignition sources. Drain and purge equipment, as necessary, to remove material residues. Follow proper entry procedures, including compliance with 29 CFR 1910.146 prior to entering confined spaces such as tanks or pits. Use gloves constructed of impervious materials and protective clothing if direct contact is anticipated. Provide ventilation to maintain exposure potential below applicable exposure limits. Use appropriate respiratory protection when concentrations exceed any established occupational exposure level (See Section 8). Promptly remove contaminated clothing. Wash exposed skin thoroughly with soap and water after handling.

Protect the environment from releases of this material. Prevent discharges to surface waters and groundwater. Maintain handling, transfer and storage equipment in proper working order.

Misuse of empty containers can be dangerous. Empty containers may contain material residues which can ignite with explosive force. **Cutting or welding of empty containers can cause fire, explosion, or release of toxic fumes from residues.** Do not pressurize or expose empty containers to open flame, sparks, or heat. Keep container closed and drum bungs in place. All label warnings and precautions must be observed. Return empty drums to a qualified reconditioner. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling, or disposing of empty containers and/or waste residues of this material.

CITGO Gasolines, All Grades Unleaded

Storage

Store and transport in accordance with all applicable laws. Keep containers tightly closed. Store in a cool, dry, well-ventilated place. Clearly label all containers. Do not allow containers to be kept in enclosed vehicles. Keep away from all ignition sources. Ground all equipment containing this material. Containers must be able to withstand pressures that are created from changes in product temperature. Product samples and other small containers of this flammable liquid should be stored in a separate safety cabinet or room. All electrical equipment in areas where this material is stored or handled should be installed and operated in accordance with applicable regulatory requirements and the National Electrical Code.

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Provide ventilation or other engineering controls to keep the airborne concentrations of vapor or mists below the applicable workplace exposure limits indicated below. All electrical equipment should comply with the National Electric Code. An emergency eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. A suitable emergency eye wash water and safety shower should be located near the work station.

Hand Protection

Avoid skin contact. Use gloves (e.g., disposable PVC, neoprene, nitrile, vinyl, or PVC/NBR). Wash hands with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities or leaving work. DO NOT use this material as a skin cleaner.

Body Protection

Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discard contaminated leather goods.

Respiratory Protection

For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134). For airborne vapor concentrations that exceed the recommended protection factors for organic vapor respirators, use a full-face, positive-pressure, supplied air respirator. Due to fire and explosion hazards, do not enter atmospheres containing concentrations greater than 10% of the lower flammable limit of this product.

General Comments

Warning! Use of this material in spaces without adequate ventilation may result in generation of hazardous levels of combustion products and/or inadequate oxygen levels for breathing. Odor is an inadequate warning for hazardous conditions.

Occupational Exposure Guidelines

Substance

Applicable Workplace Exposure Levels

CITGO Gasolines, All Grades Unleaded

Gasoline

ACGIH (United States).

TWA: 300 ppm 8 hour(s).

STEL: 500 ppm 15 minute(s).

ACGIH (United States). Skin

TWA: 50 ppm 8 hour(s).

OSHA (United States).

TWA: 200 ppm 8 hour(s).

CEIL: 300 ppm

PEAK: 500 ppm

ACGIH (United States).

TWA: 100 ppm 8 hour(s).

STEL: 150 ppm 15 minute(s).

OSHA (United States).

TWA: 100 ppm 8 hour(s).

ACGIH TLV (United States).

TWA: 20 ppm 8 hour(s).

ACGIH (United States).

TWA: 50 ppm 8 hour(s).

ACGIH TLV (United States).

TWA: 5 ppm 8 hour(s).

ACGIH (United States). Skin

TWA: 50 ppm 8 hour(s).

OSHA (United States).

TWA: 500 ppm 8 hour(s).

ACGIH (United States).

TWA: 50 ppm 8 hour(s).

OSHA (United States). Skin

TWA: 50 ppm 8 hour(s).

ACGIH (United States).

TWA: 25 ppm 8 hour(s).

ACGIH (United States). Skin

TWA: 0.5 ppm 8 hour(s).

STEL: 2.5 ppm 15 minute(s).

OSHA (United States). Skin Notes: See Table Z-2 for exclusions in 20 CFR 1910.1028 to the PEL.

TWA: 1 ppm 8 hour(s).

STEL: 5 ppm 15 minute(s).

ACGIH (United States).

TWA: 100 ppm 8 hour(s).

STEL: 125 ppm 15 minute(s).

OSHA (United States).

TWA: 100 ppm 8 hour(s).

ACGIH (United States).

TWA: 100 ppm 8 hour(s).

OSHA (United States).

TWA: 300 ppm 8 hour(s).

ACGIH (United States). Skin

TWA: 10 ppm 8 hour(s).

STEL: 15 ppm 15 minute(s).

OSHA (United States).

TWA: 10 ppm 8 hour(s).

ACGIH (United States).

TWA: 20 ppm 8 hour(s).

STEL: 40 ppm 15 minute(s).

OSHA (United States).

TWA: 100 ppm 8 hour(s).

STEL: 200 ppm 15 minute(s).

PEAK: 600 ppm

Toluene

Xylene, all isomers

Tertiary-Amyl Methyl Ether (TAME)

Methyl tertiary-Butyl Ether (MTBE)

Ethyl tertiary Butyl Ether (ETBE)

n-Hexane

Cumene

Trimethylbenzenes, all isomers

Benzene

Ethylbenzene

Cyclohexane

Naphthalene

Styrene

CITGO Gasolines, All Grades Unleaded

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Liquid.	Color	Transparent, clear to amber or red.	Odor	Pungent, characteristic gasoline.
Specific Gravity	0.72 - 0.77 (Water = 1)	pH	Not applicable	Vapor Density	3 to 4 (Air = 1)
Boiling Range	38 to 204°C (100 to 400°F)			Melting/Freezing Point	Not available.
Vapor Pressure	220 to 450 mm Hg at 20°C (68°F) or 6 to 15 Reid-psia at 37.8°C (100°F).			Volatility	720 to 770 g/l VOC (w/v)
Solubility in Water	Hydrocarbon components of gasoline are slightly soluble in water. Oxygenate components, such as MTBE, are more soluble than the hydrocarbon components. Ethanol has greater solubility in water than hydrocarbon components or other oxygenate components.			Viscosity (cSt @ 40°C)	<1
Flash Point	Closed cup: -43°C (-45°F). (Tagliabue [ASTM D-56])				
Additional Properties	Average Density at 60°F = 6.0 to 6.4 lbs./gal. (ASTM D-2161)				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable.	Hazardous Polymerization	Not expected to occur.
Conditions to Avoid	Keep away from heat, flame and other potential ignition sources. Keep away from strong oxidizing conditions and agents.		
Materials Incompatibility	Strong acids, alkalies and oxidizers such as liquid chlorine, other halogens, hydrogen peroxide and oxygen.		
Hazardous Decomposition Products	No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.		

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Gasoline:

VAPOR (TELo) Acute: 140 ppm (Human) (8 hours) - Mild eye irritant.
VAPOR (TELo) Acute: 500 ppm (Human) (1 hour) - Moderate eye irritant.
INHALATION (TCLo) Acute: 900 ppm (Human) (1 hour) - CNS and pulmonary effects.
DERMAL (TDLo) Acute: 53 mg/kg (Human) - Skin allergy effects.
INHALATION (LC50) Acute: 101,200 ppm (Rat, Mouse, & Guinea Pig) (5 minutes).

Gasoline Containing 15% MTBE:

ORAL (LD50) Acute: >5,000 mg/kg (Rat screen level).
DERMAL (LD50) Acute: >2,000 mg/kg (Rabbit screen level).
INHALATION (LC50) Acute: >5,200 ppm (Rat screen level) (8 hours).
DRAIZE EYE Acute: Mild eye irritant. (Rabbit).

CITGO Gasolines, All Grades Unleaded

DRAIZE DERMAL Acute: Moderate skin irritant. (Rabbit).
BUEHLER DERMAL Acute: Non-sensitizing. (Guinea Pig).
28-Day DERMAL Sub-Chronic: Severe skin irritant. (Rabbit).

A major epidemiological study concluded that there was no increased risk of kidney cancer associated with gasoline exposures for petroleum refinery employees or neighboring residents. Another study identified a slight trend in kidney cancers among service station employees following a 30-year latency period. Two-year inhalation toxicity studies with fully vaporized unleaded gasoline (at concentrations of 67, 292 and 2,056 ppm in air) produced kidney damage and kidney tumors in male rats, but not in female rats or mice of either sex. Results from subsequent scientific studies suggest that the kidney damage, and probably the kidney tumor response, is limited to the male rat. The kidney tumors apparently were the result of the formation of alpha-2u-globulin, a protein unique to male rats. This finding is not considered relevant to human exposure. Under conditions of the study, there was no evidence that exposure to unleaded gasoline vapor is associated with developmental toxicity. Experimental studies with laboratory animals did suggest that overexposure to gasoline may adversely effect male reproductive performance. Also, in laboratory studies with rats, the maternal and developmental "no observable adverse effect level" (NOAEL) was determined to be 9,000 ppm (75% of the LEL value). Female mice developed a slightly higher incidence of liver tumors compared to controls at the highest concentration. In a four week inhalation study of Sprague Dawley® rats, gasoline vapor condensate was determined to induce sister chromatid exchanges in peripheral lymphocytes. IARC has listed gasoline as possibly carcinogenic to humans (Group 2B).

Pentanes, all isomers:

Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

Toluene:

Effects from Acute Exposure:

Deliberate inhalation of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system and can cause CNS depression, cardiac arrhythmias and death. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects.

Effects from Repeated or Prolonged Exposure:

Studies of workers indicate long-term exposure may be related to impaired color vision and hearing. Some studies of workers suggest long-term exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest long-term exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals were largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

Heptane, all isomers:

n-Heptane was not mutagenic in the Salmonella/microsome (Ames) assay and is not considered to be carcinogenic.

CITGO Gasolines, All Grades Unleaded

Xylene, all isomers:

Effects from Acute Exposure:

ORAL (LD₅₀), Acute: 4,300 mg/kg [Rat].

INHALATION (LC₅₀), Acute: 4,550 ppm for four hours [Rat].

DERMAL (LD₅₀), Acute: 14,100 uL/kg [Rabbit].

Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross over-exposure.

Effects from Prolonged or Repeated Exposure:

Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

Ethyl tertiary Butyl Ether (ETBE):

ETBE can cause eye, skin and mucous membrane irritation. In a four week inhalation study, moderate ataxia was observed in rats at the highest dose level (4,000 ppm). The test animals appeared normal within 15 minutes of termination of exposure. A no observed adverse effect level (NOAEL) of 500 ppm was indicated by the study authors based on neurotoxic effects. In two unpublished 90 day inhalation studies, rats and mice were exposed six hour/day, five days/week at concentrations of 0, 500, 1750 and 5000 ppm of ETBE vapor. The male rats exhibited time and concentration-dependent nephropathy consistent with alpha-2μ-globulin formation. An ETBE NOAEL for male rats of 500 ppm was suggested based on a finding of testicular lesions. In human studies with eight males, slight, but significant ($p < 0.05$) decreases in objective pulmonary function measures after exposure to ETBE at concentrations of 25 and 50 ppm for two hours.

Tertiary-Amyl Methyl Ether (TAME):

TAME was found to be negative for the induction of structural chromosome aberrations (both metabolically-activated and non-activated) in Chinese hamster ovary (CHO) cells. Inhalation of TAME vapors at concentrations above 250 ppm produced reversible CNS depression in rats and mice. In a four week inhalation study, increases in liver weights with no tissue injury were observed in rats exposed to a TAME concentration of 500 ppm. Birth defects in mice and fetotoxicity in both rats and mice were observed after inhalation exposures to maternally toxic concentrations of TAME.

Methyl tertiary-Butyl Ether (MTBE):

Acute symptoms associated with human exposure to MTBE appear to be mild and transient. In laboratory studies, rats and mice exposed to high doses of MTBE exhibited blood chemistry changes and liver and kidney abnormalities. In laboratory studies, MTBE vapor exposure at the high dose concentration was associated with an increased incidence of liver tumors in female mice. Also, at high dose concentration exposures, MTBE was associated with an increased incidence of kidney and testicular (Leydig cell) tumors in male rats. Additional oncogenicity studies on rats resulted in testicular tumors following administration by ingestion. These data are not generally considered relevant to humans. NTP has not identified MTBE as either a known carcinogen or reasonably anticipated to be carcinogenic to humans. In animal studies, developmental and reproductive toxicity related to MTBE inhalation exposures was observed only at concentrations that were maternally toxic. MTBE was shown to be maternally toxic at 4,000 and 8,000 ppm levels when mice were exposed for six hours per day during their pregnancy. Also, a decrease in the number of successful pregnancies and a reduction in birth weights were observed at these exposure levels. Birth defects (cleft palate) were observed at the high dose level. These data suggest that the risk of developmental and reproductive toxicity in humans is negligible as a result of anticipated

CITGO Gasolines, All Grades Unleaded

exposures to MTBE.

Diisopropyl Ether (DIPE):

Increased kidney and liver weights were observed in rats and mice in subchronic and chronic inhalation studies of DIPE. Also, evidence of microscopic changes (hyaline droplets) were reported in liver tissue and kidney tubules of rabbits and male rats exposed to DIPE at concentrations of 7,100 ppm. These findings were similar those found in gasoline studies. Overexposure by inhalation of pregnant rats to DIPE at concentrations of 3,095 and 6,745 ppm increased the frequency of rudimentary 14th ribs in the offspring. This effect was not observed at exposure concentrations of 430 ppm. The significance of these findings to human exposure is unclear.

Ethanol:

Inhalation exposure to ethanol vapor at concentrations above applicable workplace exposure levels is expected to produce eye and mucus membrane irritation. Human exposure at concentrations from 1000 to 5000 ppm produced symptoms of narcosis, stupor and unconsciousness. Subjects exposed to ethanol vapor in concentrations between 500 and 10,000 ppm experienced coughing and smarting of the eyes and nose. At 15,000 ppm there was continuous lacrimation and coughing. While extensive acute and chronic effects can be expected with ethanol consumption, ingestion is not expected to be a significant route of exposure to this product.

Butane, all isomers:

Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

n-Hexane:

This material contains n-hexane. Long-term or repeated exposure to n-hexane can cause permanent peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Co-exposure to methylethyl ketone or methyl isobutyl ketone increases the neurotoxic properties of n-hexane. In laboratory studies, prolonged exposure to elevated concentrations of n-hexane was associated with decreased sperm count and degenerative changes in the testicles of rats.

Cumene:

Effects from Acute Exposure:

Overexposure to cumene may cause upper respiratory tract irritation and severe CNS depression.

Effects from Prolonged or Repeated Exposure:

Studies in laboratory animals indicate evidence of adverse effects on the kidney and adrenal glands following high level exposure. The relevance of these findings to humans is not clear at this time.

Trimethylbenzenes, all isomers:

Studies of Workers:

Levels of total hydrocarbon vapors present in the breathing atmosphere of these workers ranged from 10 to 60 ppm. The TClO for humans is 10 ppm, with somnolence and respiratory tract irritation noted.

Studies in Laboratory Animals:

In inhalation studies with rats, four of ten animals died after exposures of 2400 ppm for 24 hours. An oral dose of 5 mL/kg resulted in death in one of ten rats. Minimum lethal intraperitoneal doses were 1.5 to 2.0 mL/kg in rats and 1.13 to 12 mL/kg in guinea pigs. Mesitylene (1, 3, 5 Trimethylbenzene) inhalation at concentrations of 1.5, 3.0, and 6.0 mg/L for six hours was associated with dose-related changes in white blood cell counts in rats. No significant effects on the complete blood count were noted with six hours per day exposure

CITGO Gasolines, All Grades Unleaded

for five weeks, but elevations of alkaline phosphatase and SGOT were observed. Central nervous system depression and ataxia were noted in rats exposed to 5,100 to 9,180 ppm for two hours.

Benzene:

ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse].

INHALATION (LC50):

(VAPOR): Acute: 10000 ppm 7 hour(s) [Rat]. 9980 ppm 8 hour(s) [Mouse].

Studies of Workers Over-Exposed to Benzene:

Studies of workers exposed to benzene show clear evidence that over-exposure can cause cancer of the blood forming organs (acute myelogenous leukemia) and aplastic anemia, an often fatal disease. Studies also suggest over-exposure to benzene may be associated with other types of leukemia and other blood disorders. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of aplastic anemia have been reported in the offspring of persons severely over-exposed to benzene.

Studies in Laboratory Animals:

Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and skeletal variations.

Ethylbenzene:

Effects from Acute Exposure:

ORAL (LD50), Acute: 3,500 mg/kg [Rat].

DERMAL (LD50), Acute: 17,800 uL/kg [Rabbit].

INTRAPERITONEAL (LD50), Acute: 2,624 mg/kg [Rat].

Effects from Prolonged or Repeated Exposure:

Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). Also, the incidence of tumors was elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

Cyclohexane:

Cyclohexane can cause eye, skin and mucous membrane irritation, CNS depressant and narcosis at elevated concentrations. In experimental animals exposed to lethal concentrations by inhalation or oral route, generalized vascular damage and degenerative changes in the heart, lungs, liver, kidneys and brain were identified.

Cyclohexane has been the focus of substantial testing in laboratory animals. Cyclohexane was not found to be genotoxic in several tests including unscheduled DNA synthesis, bacterial and mammalian cell mutation assays, and in vivo chromosomal aberration. An increase in chromosomal aberrations in bone marrow cells of rats exposed to cyclohexane

CITGO Gasolines, All Grades Unleaded

was reported in the 1980's. However, a careful re-evaluation of slides from this study by the laboratory which conducted the study indicates these findings were in error, and that no significant chromosomal effects were observed in animals exposed to cyclohexane. Findings indicate long-term exposure to cyclohexane does not promote dermal tumorigenesis.

Naphthalene:

Studies in Humans Overexposed to Naphthalene:

Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from over-exposure to naphthalene. Persons with Glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have also been reported from over-exposure to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect.

Studies in Laboratory Animals:

Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) *in vitro*.

Styrene:

Neurological injury associated with chronic styrene exposure include distal hypesthesia, decreased nerve conduction velocity, and altered psychomotor performance. These effects did not occur with exposures to airborne concentrations that were less than 100 ppm. Increased deaths from degenerative neurological disorders were found in a comprehensive epidemiological study of Danish reinforced plastics workers. These workers were reported to have a 2.5-fold increased risk for myeloid leukemia with clonal chromosome aberrations. Also, there are several studies that suggest potential reproductive effects in humans and experimental animals from overexposure to styrene. Styrene was not mutagenic in the standard (liquid phase) Ames Salmonella/microsome assay, but was weakly positive when tested in the vapor phase. IARC has listed styrene as possibly carcinogenic to humans (Group 2B).

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Unleaded gasoline is potentially toxic to freshwater and saltwater ecosystems. Various grades of gasoline exhibited range of lethal toxicity (LC₁₀₀) from 40 PPM to 100 PPM in ambient stream water with Rainbow Trout (*Salmo irideus*). A 24-hour TLM (Median Toxic Limit) was calculated to be 90 PPM with juvenile American Shad (*Squalius cephalus*). In Bluegill Sunfish (*Lepomis macrochirus*), Grey Mullet (*Chelon labrosus*) and Gulf Menhaden (*Brevoortia patronus*), gasoline exhibited a 96-hour LC₅₀ of 8 PPM, 2 PPM, and 2 PPM, respectively.

The aquatic toxicity of Methyl tertiary-Butyl Ether (MTBE) is considered to be relatively low. In the crustacean Harpacticoid Copepods (*Nitrocras spinipes*), MTBE exhibited an LC₅₀ (96-hour) of 1,000 PPM to 10,000 PPM depending upon various water temperatures. In Bleak Fish (*Alburnus alburnus*), MTBE exhibited an LC₅₀ (24-hour) of 1,700 PPM and an LC₅₀ (96-hour) of 1,000 PPM at 10° C. In Golden Orfe Fish (*Leuciscus idus melanotus*), MTBE exhibited an LC₅₀ (48-hour) of 1,000 PPM and an LC₁₀₀ of 2,000 PPM.

Environmental Fate

CITGO Gasolines, All Grades Unleaded

Avoid spilling gasoline. Spilled gasoline can result in environmental damage. Spilled gasoline can penetrate soil and contaminate ground water. Although gasoline is biodegradable, it may persist for prolonged time periods, particularly where oxygen levels are reduced. The hydrocarbon components of gasoline are slightly soluble in water. Gasoline hydrocarbon components do not readily dissolve in water but can be adsorbed to soils.

Gasoline contains components that are potentially toxic to freshwater and saltwater ecosystems. It will normally float on water. The components of gasoline will evaporate rapidly. Evaporated hydrocarbon components may contribute to atmospheric smog.

MTBE and other oxygenates are more soluble than other gasoline components. In addition, oxygenates such as MTBE do not adsorb to soils, sediments or suspended particulate matter as readily as other gasoline components. MTBE does not degrade as readily as other gasoline components once in ground water or subsoil. MTBE is not expected to bioconcentrate in the aquatic environment.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Maximize material recovery for reuse or recycling. Recovered non-usable material may be regulated by US EPA as a hazardous waste due to its ignitibility (D001) and/or its toxic (D018) characteristics. Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a RCRA "hazardous waste" at the time of disposal.

Transportation, treatment, storage and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specific disposal issues.

SECTION 14. TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status	A U.S. Department of Transportation regulated material.		
Proper Shipping Name	Gasoline, 3, UN 1203, PG II Gasohol, 3, NA 1203, PGII (Use only for gasoline blended with less than 20% ethanol)		
Hazard Class	3 DOT Class: Flammable liquid.	Packing Group(s)	II
		UN/NA Number	UN1203 or NA1203
Reportable Quantity	A Reportable Quantity (RQ) has not been established for this material.		
Placard(s)			



Emergency Response Guide No. 128

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

CITGO Gasolines, All Grades Unleaded

SECTION 15. REGULATORY INFORMATION

TSCA Inventory	This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.
SARA 302/304 Emergency Planning and Notification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.
SARA 311/312 Hazard Identification	The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories: fire, Acute (Immediate) Health Hazard, Chronic (Delayed) Health Hazard
SARA 313 Toxic Chemical Notification and Release Reporting	This product contains the following components in concentrations above de minimis levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: Toluene [CAS No.: 108-88-3] Concentration: <20% Xylene, all isomers [CAS No.: 1330-20-7] Concentration: <18% Methyl tertiary-Butyl Ether (MTBE) [CAS No.: 1634-04-4] Concentration: <15% n-Hexane [CAS No.: 110-54-3] Concentration: <8% Cumene [CAS No.: 98-82-8] Concentration: <4% Benzene [CAS No.: 71-43-2] Concentration: <5% Ethylbenzene [CAS No.: 100-41-4] Concentration: <4% 1, 2, 4 Trimethylbenzene [CAS No.: 95-63-6] Concentration: <4% Cyclohexane [CAS No.: 110-82-7] Concentration: <3% Naphthalene [CAS No.: 91-20-3] Concentration: <2% Styrene [CAS No.: 100-42-5] Concentration: <1%
CERCLA	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are: Toluene [CAS No.: 108-88-3] RQ = 1000 lbs. (453.6 kg) Concentration: <20% Xylene, all isomers [CAS No.: 1330-20-7] RQ = 100 lbs. (45.36 kg) Concentration: <18% Methyl tertiary-Butyl Ether (MTBE) [CAS No.: 1634-04-4] RQ = 1000 lbs. (453.6 kg) Concentration: <15% n-Hexane [CAS No.: 110-54-3] RQ = 5000 lbs. (2268 kg) Concentration: <8% 2,2,4-Trimethylpentane [CAS No.: 540-84-1] RQ = 1000 lbs. (453.6 kg) Concentration: <5% Benzene [CAS No.: 71-43-2] RQ = 10 lbs. (4.536 kg) Concentration: <5% Cumene [CAS No.: 98-82-8] RQ = 5000 lbs. (2268 kg) Concentration: <4% Ethylbenzene [CAS No.: 100-41-4] RQ = 1000 lbs. (453.6 kg) Concentration: <4% Cyclohexane [CAS No.: 110-82-7] RQ = 1000 lbs. (453.6 kg) Concentration: <3% Naphthalene [CAS No.: 91-20-3] RQ = 100 lbs. (45.36 kg) Concentration: <2% Styrene [CAS No.: 100-42-5] RQ = 1000 lbs. (453.6 kg) Concentration: <1%
Clean Water Act (CWA)	This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.
California Proposition 65	

CITGO Gasolines, All Grades Unleaded

This material may contain the following components which are known to the State of California to cause cancer, birth defects or other reproductive harm, and may be subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5): Gasoline (Wholly Vaporized and Engine Exhaust), Benzene [CAS No. 71-43-3], Toluene [CAS No. 108-88-3], Ethylbenzene [CAS No. 100-41-4] and Naphthalene [CAS No. 91-20-3]

New Jersey Right-to-Know Label

Gasoline [NJDEP CAS No. 8006-61-9]

Additional Regulatory Remarks

As minimum requirements, CITGO recommends that the following advisory information be displayed on equipment used to dispense gasoline in motor vehicles. Additional warnings specified by various regulatory authorities may be required: "DANGER: Extremely Flammable. Use as a Motor Fuel Only. No Smoking. Stop Engine. Turn Off All Electronic Equipment including Cellular Telephones. Do Not Overfill Tank. Keep Away from Heat and Flames. Do Not leave nozzle unattended during refueling. **Static Sparks Can Cause a Fire, especially when filling portable containers.** Containers must be metal or other material approved for storing gasoline. PLACE CONTAINER ON GROUND. DO NOT FILL ANY PORTABLE CONTAINER IN OR ON A VEHICLE. Keep nozzle spout in contact with the container during the entire filling operation. **Harmful or Fatal if Swallowed. Long-Exposure Has Caused Cancer in Laboratory Animals.** Avoid prolonged breathing of vapors. Keep face away from nozzle and gas tank. Never siphon by mouth."

WHMIS Class B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

WHMIS Class D-2B: Material causing other toxic effects (TOXIC).

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number 7.0
Revision Date 05/23/2005
Print Date Printed on 05/23/2005.

ABBREVIATIONS

AP: Approximately	EQ: Equal	>: Greater Than	<: Less Than	NA: Not Applicable	ND: No Data	NE: Not Established
ACGIH: American Conference of Governmental Industrial Hygienists				AIHA: American Industrial Hygiene Association		
IARC: International Agency for Research on Cancer				NTP: National Toxicology Program		
NIOSH: National Institute of Occupational Safety and Health				OSHA: Occupational Safety and Health Administration		
NPCA: National Paint and Coating Manufacturers Association				HMIS: Hazardous Materials Information System		
NFPA: National Fire Protection Association				EPA: US Environmental Protection Agency		

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

CITGO Gasolines, All Grades Unleaded

***** END OF MSDS *****

ATTACHMENT 3

Activity Hazard Analysis

ACTIVITY HAZARD ANALYSIS FOR INSTALLATION OF PIPING IN TRENCHES

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Air Monitoring Devices
Installation of Piping in Trenches	Underground/ Overhead Utilities	• Identify all utilities around the site before work commences • Cease work immediately if unknown utility markers are uncovered • Follow requirements of Shaw Policy HS-308 • Utility clearance shall conform with 29 CFR 1926.955 (high voltage >700 kv) 15 feet phase to ground clearance; 31 feet phase to phase clearance		
	Excavation Wall Collapse	• Construct diversion ditches or dikes to prevent surface water from entering excavation • Provide good drainage of area adjacent to excavation • Collect ground water/rain water from excavation and dispose of properly • Store excavated material at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face • Provide sufficient stairs, ladders, or ramps when workers enter excavations over 4 feet in depth • Place ladders no more than 25 feet apart laterally • Treat excavations over 4 feet deep as confined spaces • Complete confined space permit entry procedure • Monitor atmosphere for flammable/toxic vapors, and oxygen deficiency • Slope, bench, shore, or sheet excavations over 5 feet deep if worker entry is required • Assign a competent person to inspect, decide soil classification, proper sloping, the correct shoring, or sheeting • Inspect excavations (when personnel entry is	Hard hat, Safety glasses, Steel toe work boots	

ACTIVITY HAZARD ANALYSIS FOR INSTALLATION OF PIPING IN TRENCHES

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Air Monitoring Devices
		- required) daily, whenever conditions change - Provide at least two means of exit for personnel working in excavations.		
	Struck By/ Against Heavy Equipment	- Wear reflective warning vests when exposed to vehicular traffic - Isolate equipment swing areas - Make eye contact with operators before approaching equipment - Understand and review hand signals	Warning vest, Hard hat, Safety glasses, Steel toe work boots	
	Handling Heavy Objects	- Observe proper lifting techniques - Obey sensible lifting limits (60 lb. maximum per person manual lifting) - Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads		
	Slips, Trips, Falls	- Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris - Mark, identify, or barricade other obstructions - Evaluate fall hazards above 4 ft.; use fall protection equipment (harness/lanyard), standard guardrails or other fall protection systems when working on elevated platforms above 6 ft - Use Aheavy duty industrial≅ (type IA) ladders - Tie-off all straight/extension ladders or manually hold by co-worker at base - Anchorage points for fall arrest systems must support at least 5,400 pounds for each worker		
	Caught In/ Between Moving Parts	- Identify and understand parts of equipment which may cause crushing, pinching, rotating or similar injuries - Assure guards are in place to protect from these parts of equipment during operation - Provide and use proper work gloves when the		

ACTIVITY HAZARD ANALYSIS FOR INSTALLATION OF PIPING IN TRENCHES

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Air Monitoring Devices
		possibility of crush, pinch, or other injury may be caused by moving/stationary edges or objects • Maintain all equipment in a safe condition • Keep all guards in place during use • De-energize and lock-out machinery before maintenance or service		
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use	Wizard or similar cut resistant gloves	
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA TWA	Ear plugs	
	High/Low Ambient Temperature	• Monitor for Heat/Cold stress in accordance with IT Health and Safety Procedures # HS400, HS401 • Provide fluids to prevent worker dehydration • Follow work/rest schedule in Section 3.3.1/3.3.2 of the HASP	Insulated Clothing (subject to ambient temperature)	Meteorological Equipment
Backfilling	Struck By/ Against Heavy Equipment	• Wear reflective warning vests when exposed to vehicular traffic • Isolate equipment swing areas • Make eye contact with operators before approaching equipment • Understand and review posted hand signals	Warning vest, Hard hat, Safety Glasses, Steel toe work boots	
	Slips, Trips, Falls	• Clear, walkways of equipment, vegetation, excavated material, tools and debris		

ACTIVITY HAZARD ANALYSIS FOR INSTALLATION OF PIPING IN TRENCHES

Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Air Monitoring Devices
		• Mark, identify, or barricade other obstructions		
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use	Leather gloves	
	High/Low Ambient Temperature	• Monitor for Heat/Cold stress in accordance with IT Health and Safety Procedures # HS400, HS401 • Provide fluids to prevent worker dehydration • Follow work/rest schedule in Section 3.3.1/3.3.2 of the HASP	Insulated Clothing (subject to ambient temperature)	Meteorological Equipment
EQUIPMENT REQUIRED		INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS	
• Excavator • Shovels, probes • Dump trucks • Piping • Miscellaneous hand and power tools		• Daily equipment inspections as per manufacturers requirements • Excavation inspection/permit • Inspection of all emergency equipment (i.e.: first aid kits, fire extinguishers)	• Review AHA with all task personnel • Review Site Specific Health and Safety Plan. • Review operations/safety manuals for all equipment utilized • Review site specific chemical hazards	

ACTIVITY HAZARD ANALYSIS FOR WELL INSTALLATION				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
Well Installation	Improper Work Practices/Procedures	• Driller and helper must be present during all active operations and TEST KILL SWITCH DURING EACH STARTUP. • Driller helper and other site personnel must know location of emergency shutoff switch. • Ensure jewelry is removed, loose clothing is buttoned and loose PPE is secured close to the body to avoid getting caught in moving parts. • Area of drilling operation must be cordoned off/barricaded. • Inspect wire ropes daily. • When hazardous conditions (including weather) are deemed present, operation must be shut down. • Set rig on stable, level ground; attach guy wires if necessary for stability. • Use adequate blocking materials. • Do not allow drillers to climb to mast while it is erected. • The drilling subcontractor shall have documented safety and emergency action procedures for the equipment to be operated. • Pipe, drill rods, casing, augers, and similar drilling tools should be orderly stacked on racks or sills to prevent spreading, rolling or sliding. • Work areas, platforms, and walkways should be kept free of materials, debris, and obstructions such as ice, grease or oil that could cause a surface to become slick or otherwise hazardous.		
Well Installation (continued)	Improper Work Practices/Procedures (continued)	• Before raising the mast, check for overhead obstructions. • Equipment shall be shut down during manual lubrication and while repairs or adjustments are being made. • Do not move the drill rig from hole to hole with the mast in the raised position. • Before the mast of the drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig should be re-leveled if it settles after the initial setup.		
	Slips, Trips, Falls	• Mark, identify, or barricade other obstruction • Work areas, platforms, and walkways should be kept free of materials, debris, and obstructions such as ice, grease or oil that could cause a surface to become slick or otherwise hazardous • Clear walkways and drilling overburden		

ACTIVITY HAZARD ANALYSIS FOR WELL INSTALLATION				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
		- Clean mud and grease from your boots before mounting a drill platform. Watch for slippery ground when dismounting from the platform - All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel or site visitors from stepping or falling into the holes		
Well Installation (continued)	Underground/ Overhead Utilities	- Identify all utilities around the site before work commences. - Cease work immediately if unknown utility markers are uncovered. - Use manual excavation within 3 feet of known utilities - Utility clearance shall conform with 29 CFR 1926.955 (high voltage >700 kv) 15 feet phase to ground clearance; 31 feet phase to phase clearance. - Complete the underground utility permit in accordance with Shaw Health and Safety Procedure HS308.		
	Struck by/ Against Flying Particles, Protruding Objects	- Wear reflective warning vests when exposed to vehicular traffic - Isolate equipment swing areas - Make eye contact with operators before approaching equipment - Barricade or enclose the drilling area - Require backup alarms on all heavy construction equipment - Restrict work area entry to authorized personnel during drilling activities. - Wear hard hats, safety glasses with side shields, or splash/face shields and goggles and steel-toe safety boots at all times. - Understand and review hand signals. - Use "spotter" when backing. - Ensure the excavator and pump truck are equipped with back-up alarms.	Warning vests, hard hat, safety glasses, goggles, face shield and steel toe work boots	
Well Installation (continued)	Caught In/ Between Moving Parts	- Identify and understand parts of equipment which may cause crushing, pinching, rotating or similar injuries. - Assure guards are in place during equipment operations. - Provide and wear proper work gloves when the possibility of crush, pinch, or other injury may be caused by		

ACTIVITY HAZARD ANALYSIS FOR WELL INSTALLATION				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
		moving/stationary edges or objects • Maintain all equipment in a safe condition. • Keep all guards in place during use. • De-energize and lock-out machinery before maintenance or service in accordance with Shaw Health and safety Procedure HS315 Control of Hazardous Energy Sources.		
	Handling Heavy Objects	• Observe proper lifting techniques. • Obey sensible lifting limits (60 lb. maximum per person manual lifting). • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads.		
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects. • Maintain all tools in a safe condition. • Keep guards in place during use. • Use a long handle shovel to move auger cuttings away from the auger.	Leather gloves	
Well Installation (continued)	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants before starting work. • Monitor breathing zone air to determine levels of contaminants. • Monitor perimeter air	Modified D (See Section 6.0 of SSHSP)	PID and Data RAM
	Hot Soils/Surfaces when Working in Phase I	• An infrared temperature gun will be used for intrusive activities in the Phase I area to determine the temperature of the soils, augers, ect. • Insulated gloves (Revco High temperature) must be worn when handling materials over 120 ° F	High temperature gloves	Infrared temperature gun
	High/Low Ambient Temperature	• Monitor for heat/cold stress in accordance with Shaw Health and Safety Procedures HS400 and HS401. • Provide fluids to prevent worker dehydration.		Meteorological Equipment
EQUIPMENT REQUIRED		INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS	
• Drill rig		• Daily equipment inspections as per manufacturers requirements	• Review AHA with all task personnel	

ACTIVITY HAZARD ANALYSIS FOR WELL INSTALLATION				
Task Breakdown	Potential Hazards	Critical Safety Practices	Personal Protective Clothing and Equipment	Monitoring Devices
- Well materials - PID and Data RAM - Infrared temperature gun		- Inspect Drill Rig in accordance with HS316 - Inspection of all emergency equipment (i.e.: first aid kits, fire extinguishers) - Complete underground utility permit in accordance with HS308	- Review Base-wide SSHSP - Review operations/safety manuals for all equipment utilized - Review site specific contaminants of concern - Review all applicable Shaw Health and Safety Procedures - Review the potential for hot surfaces	

APPENDIX B

SAMPLING AND ANALYSIS PLAN ADDENDUM

Addendum to the Camp Lejeune Basewide Sampling and Analysis Plan for HPFF Bio-Pulse Air Sparge System Installation

1.0 Introduction

This Addendum to the Basewide SAP for Camp Lejeune (CLJ) Marine Corps Base (MCB) was developed to provide task-specific requirements for additional remedial measures at the Hadnot Point Fuel Farm (HPFF) Bio-Pulse Air Sparge System as defined herein. This Addendum is to be used in conjunction with the Basewide SAP. In the case of discrepancies between this Addendum and the Basewide SAP, this document takes precedence.

2.0 Scope of Investigation

The HPFF consists of two primary source areas (Southeast and Northwest) which share an existing Air Sparge/Soil Vapor Extraction remediation system. Historical evidence shows the need for additional bio-pulse air sparge wells in the deep interval (150 feet below land surface). Initially two wells (BP-14 and BP-17) will be installed to evaluate operational characteristics and effectiveness of the bio-pulse wells. Ultimately a total of 24 bio-pulse air sparge wells will be installed to treat upper level soil and groundwater contamination in the source area. This scope includes sampling the new and existing monitoring wells, discharge stack, and stockpiled soils from the well installation activities.

3.0 Sampling and Analytical Methodology

The samples will be collected in accordance with the requirements of the CLJ Basewide SAP. Also reference Table B-1 of this SAP Addendum for sampling procedures. Groundwater and soil samples will be analyzed by a fixed-base laboratory using appropriate SW-846 Update III and other EPA-approved methods. Reference Table B-2 for site-specific quality objectives.

3.1 Prior to System Start-up

Each of the new monitoring wells at the HPFF Bio-Pulse Air Sparge System will be sampled prior to system start-up. These samples will be analyzed for Volatile Organic Compounds by Method 8260B and Polynuclear Aromatic Hydrocarbons by Method 8270C.

3.2 System Start-up

When the system is started, an air sample will be collected from the discharge stack. This sample will be analyzed by method EPA 18 for benzene, toluene, ethylbenzene, xylenes, and gasoline range organics. Additionally two groundwater samples will be collected from recovery well HPFF-75 (one sample at start-up, one sample within two months) for analysis of benzene, toluene, ethylbenzene, xylenes, and naphthalene by 8260B, ethylene dibromide by 8011, and lead by 6010B.

3.3 After System Start-up

Monthly the treated effluent will be tested for benzene, toluene, ethylbenzene, xylenes, and naphthalene by 8260B, ethylene dibromide by 8011, and lead by 6010B. The semi-annual monitoring well sampling events will continue as per previous requirements at the site.

3.4 Disposal Samples

Composite disposal samples will be collected from every 200 cubic yards of segregated soil stockpiles. These samples will be analyzed by the fixed-base laboratory for Full TCLP including pH by Method 9045C, Ignitability by Method 1010, Reactivity compounds Cyanide by Method 9010B and Sulfide by Method 9030, Volatiles by Method 1311/8260B, Semi-volatiles by Method 1311/8270C, Pesticides by Method 8081A, Herbicides by Method 8151A, and Metals by Methods 1311/6010B/7000. The analytical results will be used to determine appropriate disposal.

4.0 Subcontracted Laboratory

A laboratory previously procured for Navy Atlantic Division work will be assigned this task based on the capacity and capabilities of the pre-approved laboratories at the time of sampling.

Tables

TABLE B-1
Sampling and Analysis Summary

Sample Location	Sample Point	Matrix	Sampling Frequency	Approx Sample No	Sampling Method	Sampling Equipment	TAT	QC Level	Required Analysis	Analytical Method	Holding Time	Preservatives	Containers
HPFF Bio-Pulse Air Sparge System	Recovery Well HPFF-75	Ground water	System Start-up + 2nd Month	2 + 1 DUP per event + 1 MS/MSD per event	Grab	Bailer/Pump	14 days	Project Standard	BTEX + Naphthalene	5030B/8260B	14 days	Cool to 4°C pH <2 HCl	3x40mL vials
									Ethylene dibromide	8011	14 days	Cool to 4°C pH <2 HCl	3x40mL vials
									Lead	6010B	180 days	pH <2 HNO ₃	1x500mL HDPE
	Groundwater Treatment System	Treated Effluent Waste water	Monthly	12 + 1 DUP per event + 1 MS/MSD per event	Grab	Bailer/Pump	14 days	Project Standard	BTEX + Naphthalene	5030B/8260B	14 days	Cool to 4°C pH <2 HCl	3x40mL vials
									Ethylene dibromide	8011	14 days	Cool to 4°C pH <2 HCl	3x40mL vials
									Lead	6010B	180 days	pH <2 HNO ₃	1x500mL HDPE
	Bio-Sparge Wells	Ground water	Prior to System Start-up	24 + 3 DUP + 3 MS/MSD	Grab	Bailer/Pump	14 days	Project Standard	Volatile Organic Compounds	5030B/8260B	14 days	Cool to 4°C pH <2 HCl	3x40mL vials
									Polynuclear Aromatic Hydrocarbons	8270C	7 / 40 days	Cool to 4°C	2x1L Amber
	Monitoring Wells	Ground water	Semi-Annual	60 + 3 DUP per event + 2 MS/MSD per event	Grab	Bailer/Pump	14 days	Project Standard	Volatile Organic Compounds	5030B/8260B	14 days	Cool to 4°C pH <2 HCl	3x40mL vials
									Polynuclear Aromatic Hydrocarbons	8270C	7 / 40 days	Cool to 4°C	2x1L Amber
	Discharge Stack	Air	System Start-up	1	Grab	SUMMA	14 days	Project Standard	BTEX + TPH/GRO	EPA 18	180 days	N/A	SUMMA
Disposal from Well Installations	Stockpiles	Soil	1 every 200 cubic yards	5	Composite	SS Spoon SS Bowl	14 days	Project Standard	TCLP Volatiles	1311/8260B	14 / 14 days	Cool to 4°C	1x4oz Glass Jar
									TCLP Semi-Volatiles	1311/8270C	14 / 14 / 40 days		2x16oz Glass Jar
									TCLP Pesticides	1311/8081A	14 / 14 / 40 days		
									TCLP Herbicides	1311/8151A	14 / 14 / 40 days		
									TCLP Metals	1311/6010B/7470A	14 / 180 days		1x4oz Jar
									pH	9045C	None		1x8oz Jar
									Ignitability	1010	None		
									Total Cyanide	9010B	None		
									Total Sulfide	9030	None		

TABLE B-2
Project Quality Control Objectives

		Minimum PQL	Quality Standard (GWQS)	Accuracy Limits MS/MSD	Precision Limits MS/MSD	Accuracy Limits LCS	Precision Limits Field DUP	Completeness Limits
Method No	Analyte / Component	Water	Water	Water	Water	Water	Water	Water
	VOC BY GC/MS	ug/L	ug/L	%	%	%	%	%
8260B	1,1,1,2-Tetrachloroethane	2.5	NS	60-140	<30	62-108	<50	95
8260B	1,1,1-Trichloroethane	4	NS	60-140	<30	65-135	<50	95
8260B	1,1,2,2-Tetrachloroethane	2	0.17	60-140	<30	64-135	<50	95
8260B	1,1,2-Trichloroethane	5	NS	60-140	<30	65-135	<50	95
8260B	1,1-Dichloroethane	2	700	60-140	<30	62-135	<50	95
8260B	1,1-Dichloroethene	6	7	60-140	<30	65-135	<50	95
8260B	1,1-Dichloropropane	5	NS	60-140	<30	65-135	<50	95
8260B	1,2,3-Trichlorobenzene	1.5	NS	60-140	<30	65-147	<50	95
8260B	1,2,3-Trichloropropane	16	NS	60-140	<30	65-135	<50	95
8260B	1,2,4-Trichlorobenzene	2	70	60-140	<30	65-145	<50	95
8260B	1,2,4-Trimethylbenzene	6.5	350	60-140	<30	65-135	<50	95
8260B	1,2-Dichloroethane	3	0.38	60-140	<30	58-137	<50	95
8260B	1,2-Dichlorobenzene	1.5	620	60-140	<30	65-135	<50	95
8260B	1,2-Dibromo-3-chloropropane	13	NS	60-140	<30	49-135	<50	95
8260B	1,2-Dichloropropane	2	0.56	60-140	<30	60-135	<50	95
8260B	1,3,5-Trimethylbenzene	2.5	350	60-140	<30	62-135	<50	95
8260B	1,3-Dichlorobenzene	6	620	60-140	<30	65-135	<50	95
8260B	1,3-Dichloropropane	2	NS	60-140	<30	65-135	<50	95
8260B	1,4-Dichlorobenzene	1.5	75	60-140	<30	65-135	<50	95
8260B	1-Chlorohexane	2.5	NS	60-140	<30	65-135	<50	95
8260B	2,2-Dichloropropane	17.5	NS	60-140	<30	65-135	<50	95
8260B	2-Chlorotoluene	2	NS	60-140	<30	63-135	<50	95
8260B	4-Chlorotoluene	3	NS	60-140	<30	64-135	<50	95
8260B	Benzene	1	1	60-140	<30	65-135	<50	95
8260B	Bromobenzene	1.5	NS	60-140	<30	65-135	<50	95
8260B	Bromochloromethane	2	NS	60-140	<30	63-135	<50	95
8260B	Bromodichloromethane	4	NS	60-140	<30	65-135	<50	95
8260B	Bromoform	6	NS	60-140	<30	65-135	<50	95

TABLE B-2
Project Quality Control Objectives

Method No	Analyte / Component	Minimum PQL	Quality Standard (GWQS)	Accuracy Limits MS/MSD	Precision Limits MS/MSD	Accuracy Limits LCS	Precision Limits Field DUP	Completeness Limits
		Water	Water	Water	Water	Water	Water	Water
	VOC BY GC/MS	ug/L	ug/L	%	%	%	%	%
8260B	Bromomethane	5.5	NS	60-140	<30	62-135	<50	95
8260B	Carbon Tetrachloride	10.5	NS	60-140	<30	52-135	<50	95
8260B	Chlorobenzene	2	NS	60-140	<30	65-135	<50	95
8260B	Chloroethane	5	NS	60-140	<30	55-135	<50	95
8260B	Chloroform	1.5	0.00019	60-140	<30	64-135	<50	95
8260B	Chloromethane	6.5	2.6	60-140	<30	65-135	<50	95
8260B	Cis-1,2-Dichloroethene	6	70	60-140	<30	65-135	<50	95
8260B	Cis-1,3-Dichloropropene	5	0.2	60-140	<30	64-135	<50	95
8260B	Dibromochloromethane	2.5	0.41	60-140	<30	63-135	<50	95
8260B	Dibromomethane	12	NS	60-140	<30	59-137	<50	95
8260B	Dichlorodifluoromethane	5	NS	60-140	<30	65-135	<50	95
8260B	Ethylbenzene	3	29	60-140	<30	65-135	<50	95
8260B	Hexachlorobutadiene	5.5	0.44	60-140	<30	65-135	<50	95
8260B	Isopropylbenzene	2.5	70	60-140	<30	65-135	<50	95
8260B	m-Xylene	2.5	530	60-140	<30	65-135	<50	95
8260B	Methylene Chloride	1.5	5	60-140	<30	65-135	<50	95
8260B	n-Butylbenzene	5.5	NS	60-140	<30	65-135	<50	95
8260B	n-Propylbenzene	2	70	60-140	<30	65-135	<50	95
8260B	Naphthalene	2	21	60-140	<30	65-135	<50	95
8260B	o-Xylene	5.5	530	60-140	<30	65-135	<50	95
8260B	p-Isopropyltoluene	6	NS	60-140	<30	65-135	<50	95
8260B	p-Xylene	6.5	530	60-140	<30	65-135	<50	95
8260B	Sec-Butylbenzene	6.5	NS	60-140	<30	65-135	<50	95
8260B	Styrene	2	0.1	60-140	<30	65-135	<50	95
8260B	Trichloroethylene	5	2.8	60-140	<30	61-135	<50	95
8260B	Tert-Butylbenzene	7	NS	60-140	<30	65-135	<50	95
8260B	Tetrachloroethylene	7	0.7	60-140	<30	61-135	<50	95
8260B	Toluene	5.5	1000	60-140	<30	64-135	<50	95

TABLE B-2
Project Quality Control Objectives

		Minimum PQL	Quality Standard (GWQS)	Accuracy Limits MS/MSD	Precision Limits MS/MSD	Accuracy Limits LCS	Precision Limits Field DUP	Completeness Limits
Method No	Analyte / Component	Water	Water	Water	Water	Water	Water	Water
VOC BY GC/MS		ug/L	ug/L	%	%	%	%	%
8260B	Trans-1,2-Dichloroethene	3	70	60-140	<30	65-135	<50	95
8260B	Trans-1,3-Dichloropropene	5	0.2	60-140	<30	56-135	<50	95
8260B	Trichlorofluoromethane	4	NS	60-140	<30	57-135	<50	95
8260B	Vinyl Chloride	5.5	0.015	60-140	<30	36-144	<50	95
8260B	Dibromofluoromethane (surr)			75-125				
8260B	Toluene-d8 (surr)			75-125				
8260B	4-Bromofluorobenzene (surr)			75-1225				
8260B	1,2-Dichloroethane-d4 (surr)			62-139				
VOC BY GC		ug/L	ug/L	%	%	%	%	%
8260B	1,2-Ethylene Dibromide	3	0.0004	60-140	<30	65-135	<50	95
PAH BY GC/MS		ug/L	ug/L	%	%	%	%	%
8270C	2-Methylnaphthalene	10	28	60-140	<30	41-125	<50	95
8270C	Acenaphthylene	10	210	60-140	<30	47-125	<50	95
8270C	Acenaphthene	10	80	60-140	<30	49-124	<50	95
8270C	Anthracene	10	2100	60-140	<30	45-165	<50	95
8270C	Benzo (a) anthracene	10	0.05	60-140	<30	51-133	<50	95
8270C	Benzo (a) pyrene	10	0.0047	60-140	<30	41-125	<50	95
8270C	Benzo (b) fluoranthene	10	0.047	60-140	<30	37-125	<50	95
8270C	Benzo (g,h,i) perylene	10	210	60-140	<30	34-149	<50	95
8270C	Benzo(k)anthracene	10	0.47	60-140	<30	37-125	<50	95
8270C	Chrysene	10	5	60-140	<30	55-133	<50	95
8270C	Dibenzo (a,h) anthracene	10	0.0047	60-140	<30	50-125	<50	95
8270C	Fluoranthene	10	280	60-140	<30	47-125	<50	95
8270C	Fluorene	10	280	60-140	<30	48-139	<50	95
8270C	Indeno (1,2,3-c,d) pyrene	10	0.047	60-140	<30	27-160	<50	95
8270C	Naphthalene	10	21	60-140	<30	50-125	<50	95
8270C	Phenanthrene	10	210	60-140	<30	54-125	<50	95
8270C	Pyrene	10	210	60-140	<30	47-136	<50	95

TABLE B-2
Project Quality Control Objectives

		Minimum PQL	Quality Standard (GWQS)	Accuracy Limits MS/MSD	Precision Limits MS/MSD	Accuracy Limits LCS	Precision Limits Field DUP	Completeness Limits
Method No	Analyte / Component	Water	Water	Water	Water	Water	Water	Water
PAH BY GC/MS		ug/L	ug/L	%	%	%	%	%
8270C	2-Fluorobiphenyl			43-125				
8270C	Nitrobenzene-d5			32-125				
8270C	Terphenyl-d14			42-126				
METALS BY GC/MS		ug/L	ug/L	%	%	%	%	%
6010B	Lead	5	15	80-120	<20	80-120	<50	95

TABLE B-2
Project Quality Control Objectives

Method No	Analyte / Component	Minimum PQL	Accuracy Limits MS/MSD	Precision Limits MS/MSD	Accuracy Limits LCS	Completeness Limits
		Air	Air	Air	Air	Air
VOLATILES IN AIR BY GC/MS		ug/m3	%	%	%	%
EPA 18	Benzene	5	70-130	<30	70-130	95
EPA 18	Toluene	5	70-130	<30	70-130	95
EPA 18	Ethylbenzene	5	70-130	<30	70-130	95
EPA 18	Xylenes	5	70-130	<30	70-130	95
EPA 18	TPH/GRO	5	70-130	<30	70-130	95

TABLE B-2
Project Quality Control Objectives

		Minimum PQL	Accuracy Limits MS/MSD	Precision Limits MS/MSD	Accuracy Limits LCS	Precision Limits Field DUP	Completeness Limits
Method No	Analyte / Component	Soil	Soil	Soil	Soil	Soil	Soil
CHARACTERISTICS		(mg/kg)	(%)	(%)	(%)	(%)	(%)
9030	Total Sulfide	50	N/A	<50	N/A	<50	90
9010B	Total Cyanide	25	N/A	<50	N/A	<50	90
1010	Ignitability (Pensky Martens)	100°F	N/A	<50	N/A	<50	90
9040	pH (Corrosivity)	N/A	N/A	<50	N/A	<50	90
TCLP VOLATILES		(mg/L)	(%)	(%)	(%)	(%)	(%)
8260B	1,1-Dichloroethylene	0.1	50-150	<50	70-130	<50	90
8260B	1,2-Dichloroethane	0.1	50-150	<50	70-130	<50	90
8260B	Benzene	0.1	50-150	<50	70-130	<50	90
8260B	Carbon Tetrachloride	0.1	50-150	<50	70-130	<50	90
8260B	Chlorobenzene	20	50-150	<50	70-130	<50	90
8260B	Chloroform	1	50-150	<50	70-130	<50	90
8260B	Methyl Ethyl Ketone	20	50-150	<50	70-130	<50	90
8260B	Tetrachloroethylene	0.7	50-150	<50	70-130	<50	90
8260B	Trichloroethylene	0.1	50-150	<50	70-130	<50	90
8260B	Vinyl Chloride	0.05	50-150	<50	70-130	<50	90
TCLP SEMI-VOLATILES		(mg/L)	(%)	(%)	(%)	(%)	(%)
8270C	1,4-Dichlorobenzene	1	50-150	<50	70-130	<50	90
8270C	2,4,5-Trichlorophenol	80	50-150	<50	70-130	<50	90
8270C	2,4,6-Trichlorophenol	0.4	50-150	<50	70-130	<50	90
8270C	2,4-Dinitrotoluene	0.02	50-150	<50	70-130	<50	90
8270C	Cresol	40	50-150	<50	70-130	<50	90
8270C	Hexachlorobenzene	0.02	50-150	<50	70-130	<50	90
8270C	Hexachloroethane	0.5	50-150	<50	70-130	<50	90
8270C	Hexachlorobutadiene	0.4	50-150	<50	70-130	<50	90
8270C	Nitrobenzene	0.4	50-150	<50	70-130	<50	90
8270C	Pentachlorophenol	80	50-150	<50	70-130	<50	90
8270C	Pyridine	1	50-150	<50	70-130	<50	90

TABLE B-2
Project Quality Control Objectives

		Minimum PQL	Accuracy Limits MS/MSD	Precision Limits MS/MSD	Accuracy Limits LCS	Precision Limits Field DUP	Completeness Limits
Method No	Analyte / Component	Soil	Soil	Soil	Soil	Soil	Soil
TCLP PESTICIDES		(mg/L)	(%)	(%)	(%)	(%)	(%)
8081A	Endrin	0.004	50-150	<50	70-130	<50	90
8081A	Lindane	0.08	50-150	<50	70-130	<50	90
8081A	Methoxychlor	1	50-150	<50	70-130	<50	90
8081A	Toxaphene	0.1	50-150	<50	70-130	<50	90
8081A	Chlordane	0.005	50-150	<50	70-130	<50	90
8081A	Heptachlor and its Hydroxide	0.001	50-150	<50	70-130	<50	90
TCLP HERBICIDES		(mg/L)	(%)	(%)	(%)	(%)	(%)
8151A	2,4-D	2	50-150	<50	70-130	<50	90
8151A	2,4,5-TP	0.2	50-150	<50	70-130	<50	90
TCLP METALS		(mg/L)	(%)	(%)	(%)	(%)	(%)
6010B	Arsenic	1	50-150	<50	70-130	<50	90
6010B	Barium	20	50-150	<50	70-130	<50	90
6010B	Cadmium	0.2	50-150	<50	70-130	<50	90
6010B	Chromium	1	50-150	<50	70-130	<50	90
6010B	Lead	1	50-150	<50	70-130	<50	90
7470A	Mercury	0.04	50-150	<50	70-130	<50	90
6010B	Selenium	0.2	50-150	<50	70-130	<50	90
6010B	Silver	1	50-150	<50	70-130	<50	90

APPENDIX C

PROGRAM QUALITY CONTROL PLAN ADDENDUM

**PROGRAM QUALITY CONTROL PLAN ADDENDUM
FOR
HPFF BIO-PULSE AIR SPARGE SYSTEM INSTALLATION
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

TABLE OF CONTENTS

STATEMENT OF QC PROGRAM.....	1
I. QUALITY CONTROL ORGANIZATION	2
II. IDENTIFICATION OF PERSONNEL ASSIGNED TO THE QC ORGANIZATION.....	2
III. APPOINTMENT LETTERS	2
IV. OUTSIDE ORGANIZATIONS	2
V. INITIAL SUBMITTAL REGISTER & REVIEWERS	2
VI. TESTING LABORATORY ACCREDITATION.....	3
VII. TESTING PLAN AND LOG	3
VIII. REWORK ITEMS.....	3
IX DOCUMENTATION PROCEDURES	3
X. QUALITY CONTROL INSPECTION PLAN.....	3
XI. PERSONNEL MATRIX	3

FIGURES

- I-1 QC Organizational Relationship with Production Personnel
- II-1 Site QC Manager / Representative - Resume
- III-1 Site QC Manager / Representative - Letter of Appointment

EXHIBITS

- IV-1 Approved Consultant and Subcontractor List
- V-1 Submittal Register
- V-2 List of Personnel Authorized to Review and Certify Submittals
- VII-1 Test Plan and Log
- VIII-1 Rework Items Log
- X-1 Quality Control Inspection Plan
- XI-1 Personnel Matrix

STATEMENT OF QC PROGRAM

This Site Specific Addendum to the Program QC Plan is prepared and submitted for Task Order 0050, HPFF Bio-Pulse Air Sparge System Installation at the Marine Corps Base, Camp Lejeune, North Carolina. This plan incorporates methods and procedures from the Program Quality Control Plan approved by the Atlantic Division, Naval Facilities Engineering Command. The Program Quality Control Plan was developed specifically to be responsive to the Contract Specification, Contract No. N62470-02-D-3260, Atlantic Division, Naval Facilities Engineering. Shaw Environmental, Inc. (Shaw) will perform the inspections and tests required to ensure that materials, workmanship, and construction conform to drawings, specifications, and contract requirements.

Note to Employees – Concept of Quality Control

Quality control should not be considered a person or an organization of personnel, but a concept to perform in such a manner that the end product of our efforts provides a quality product and customer satisfaction. The quality control individual or group cannot inspect quality into the final product, but only inspect and document the results of our efforts. The only people that can build quality into the product are the individuals performing the task of producing the end product.

It should be noted by all employees that the documentation requirements of Shaw procedures, plans, and the Task Order Specifications are considered equally as important as the end product itself. When it is stated that the documentation will be approved prior to the start of work, this is exactly what is intended. To eliminate problems in this area requires careful planning and execution by everyone.

We would do well to remember that our livelihood depends on how well we satisfy our customer. To accomplish this requires teamwork and attention to detail by all employees and contractors.

I. QUALITY CONTROL ORGANIZATION

The QC Manager will have the authority to implement and manage the QC Plan, the three phases of quality control and the authority to stop work, which is not in compliance with the contract.

Mr. Cano Hernandez will function as the Site QC Manager and also as the Supervisor for this Task Order. Mr. Hernandez has more than 5 years construction management and QA/QC experience and maintains current US Army Corps of Engineers (USACE) Construction Quality Management for Contractors, QC certification.

Mr. Hernandez will work closely with Mr. Charles Wallace who is the Site Superintendent, concerning the operational activities at the sites, but will report directly to Mr. Ernie Duke, Program QC Manager regarding QC related issues on the site.

Mr. Ernie Duke, Shaw Program QC Manager will serve to resolve any QC related issues, which need his involvement. The Site QC Manager will have a direct line of communication to the Program QC Manager on QC issues.

The relationship between the QC Organization, and Production Personnel of the Task Order, is presented in the Organizational Chart, Figure I-1.

II. IDENTIFICATION OF PERSONNEL ASSIGNED TO THE QC ORGANIZATION

Figure II-1 provides the resume of the Site QC Manager. The resumes of Alternate QC personnel will be submitted to the CO or designated representative upon request.

III. APPOINTMENT LETTERS

The Site QC Manager appointment letter is provided as Figure III-1. Similar letters will be provided when necessary to describe the duties and authorities of personnel assigned to the position of Alternate QC Manager or Assistant.

IV. OUTSIDE ORGANIZATIONS

A list of outside organizations such as subcontractors employed by Shaw for work under this task order is provided in Exhibit IV-1. This list provides each firm's name and address and a description of the services each firm will provide. This list will be maintained current and will be available for review.

V. INITIAL SUBMITTAL REGISTER & REVIEWER

V.1 Submittal Register

The Initial Submittal Register is provided as Exhibit V-1. The status of each submittal will be recorded as changes occur.

V.2 Personnel Authorized to Review and Certify Submittals

Personnel authorized to review and certify submittals other than the Site QC Manager are identified on Exhibit V-2. Any additional personnel assigned to perform submittal review and certification must be approved by the CO prior to performance.

VI. TESTING LABORATORY ACCREDITATION

Testing laboratory accreditation requirements are addressed in the Program QC Plan Section 1, part 4.7, Construction Testing.

VII. TESTING PLAN & LOG PREPARATION

A Testing Plan and Log has been prepared for this TO and is provided as Exhibit VII-1.

VIII. REWORK ITEMS

Rework Items will be documented on the Daily QC Report and on the Rework Items Log. This will be used to report and track rework Items.

IX. DOCUMENTATION PROCEDURES

The Daily QC Report form and Daily Production Report form will be used to document daily activities at the site.

X. QUALITY CONTROL INSPECTION PLAN

The Quality Control Inspection Plan, Exhibit X-1, lists the TO Workplan section and definable feature of work with provisions for recording the corresponding checklist/report for each phase of the three-phase control process. As each control phase is satisfactorily preformed, the Site QC Manager will record the corresponding checklist/report number and date.

This list has been prepared to correspond to the subtasks of the task order. It will be maintained as provided in Section 1, Part 4.4 of the PQCP. Each preparatory, initial and follow-up phase checklist/report will reflect the construction activity number derived from the construction schedule.

XI. PERSONNEL MATRIX

The personnel matrix, Exhibit XI-1, shows each section of the TO Workplan with identification of who will review and certify submittals, who will perform and document the three phases of control, and who will perform and document testing. This matrix should be completed as much as possible prior to and during site mobilization.

FIGURE I-1

**QC ORGANIZATIONAL RELATIONSHIP WITH
PRODUCTION PERSONNEL
SHAW ENVIRONMENTAL, INC.
TASK ORDER NO. 0050**

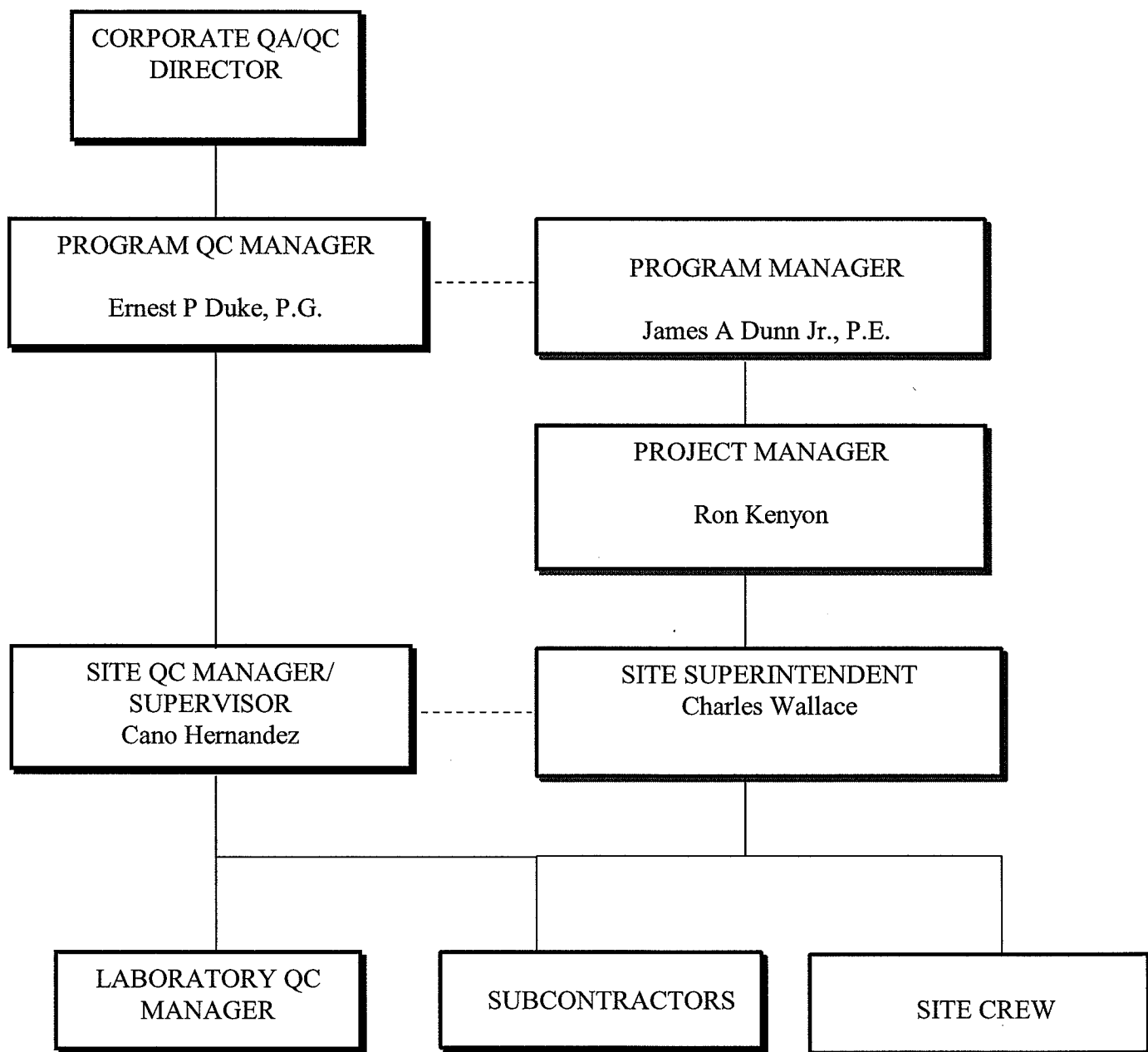


Figure II-1

Cano R. Hernandez Jr. Professional Qualifications

Mr. Hernandez joined Shaw Environmental & Infrastructure, Inc. in 1990 with fifteen years of experience in the petro-chemical, civil, and pipeline construction industry. Last ten years of construction experience has been in the environmental industry and included the following positions: acting project supervisor, project coordinator, equipment supervisor, and lead equipment operator. Supervisory duties included site management of multi-million dollar projects consisting of contaminated soil excavation, monitoring well removal, installation, drum removal (Level "B"), thermal desorption of soils (Level "B"), soil solidification (long stick operator), slurry wall installation (long stick operator), grading, rerouting of water channels in the Florida Everglades, EOD and Non-EOD landfill construction.

Additionally, participation in bid preparation, on-site evaluation, project scheduling, budgeting, and cost estimating.

Education

Additional Training:

40-Hour OSHA 1910.120 Training; 1991

8-Hour OSHA Refresher Certification, Annually

8-Hour Training in Supervision of Hazardous Waste Operations – OSHA 29 CFR 1910.120 (3-26-92)

Confined Space Supervisor; 2002

USACE Contractor Quality Management, 2003

CFR 192.285 #14 Butt Fusion Weld (01-27-00)

First-Aid/CPR (6-11-05)

Hazardous Materials Emergency Response Training

Experience and Background

1990 – Present

Supervisor/ Superintendent, Shaw Environmental & Infrastructure, Inc., Monroeville, Pennsylvania

Supervises on-site Shaw personnel performing multiple tasks and site subcontractors. Directs the operation of heavy equipment and field operational activities at hazardous waste, chemical waste, and non-hazardous remediation sites. Responsible for the daily completion of and adherence to remedial site plan documentation including cost tracking, work plans, spill prevention plans, health and safety plans. Through supervision of construction activities either performs quality control or ensures that all site operations are conducted in compliance with quality control program specifications.

Various locations of Supervision / Management:

11/04 – 12/04, Site Superintendent under the USACE in Wachoula, Florida

The project was performed under FEMA emergency response actions for the construction of a temporary mobile home park.

5/04 – 8/04, Site Superintendent under USACE at Jacksonville, Florida

Construction of a large retention pond and associated structures was the primary scope of the project.

3/03 – 7/03, Site Superintendent under LANTDIV RAC at Bogue Field, North Carolina

The project involved the excavation and disposal of contaminated soil to attain the required cleanup goals. UXO support was necessary due to ordnance encountered at the location.

1/02 – 2/03, Site Supervisor under LANTDIV RAC at Portsmouth, Virginia

An area of calcium hydroxide was excavated adjacent to the James River. Groundwater controls were necessary to reduce inflow of the shallow groundwater. The restoration of a wetland area was also part of the project.

7/01 - 1/02, Site Foreman/Lead Operator under LANTDIV RAC at Dahlgren NSWC, Dahlgren, Virginia

The project consisted of the mitigation of contamination and the reconstruction of two adjacent wetland areas, and the installation of a concrete box culvert to maintain appropriate water levels. Activities were conducted simultaneously, and in close coordination with Base range control, that allowed for the successful completion of this project without interference of explosive testing. The \$2.4 million project was completed within budget and received a 98% award fee. Maintained the daily contact with subcontractors and Base personnel to allow efficient movement of resources.

12/00 - 7/01, Site Foreman/Lead Operator under LANTDIV RAC at the Bainbridge Training Facility in Port Deposit, Maryland

Demolition of failing drainage channel and the reconstruction of the channel. Project was completed on time, within budget, and received a 100% award fee.

4/00 -12/00, Site Foreman/Lead Operator under the LANTDIV RAC at Dahlgren, Virginia.

This project consisted of the consolidation and relocation of approximately 16,000 cubic yards of solid waste. The project incorporated photo-remediation as a means of long-term remedial action to remove mercury and heavy metals from underlying materials. Creation of a 1-acre wetland which included the planting of 40,000+ trees and the installation of an irrigation system to ensure vegetative survivability. This \$2.2 million project was completed on time, \$300K under budget, with a 98% award fee.

1999, Sr. Operator under the LANTDIV RAC at the Dahlgren Naval Surface Warfare Center (NSWC) in Dahlgren, Virginia.

Sr. Operator, of various equipment on a daily field operation for the construction of a multi-layer composite cap over a 5.5-acre sanitary landfill. Completion of the project included the installation of 300 linear feet of slurry wall. During the excavation of the landfill area, approximately 900 unexploded ordnances were removed from the landfill. This was a \$3.3 million project, completed at \$200,000 under budget.

Field Supervisor/Lead Operator at the Lake Opopka Project

Supervisor of a sector client. In charge of all new excavation work and haul road maintenance, as well as maintenance of all the off road equipment. This was very critical to the operation, because of the Everglades with its high water levels that were encountered on a daily basis. In charge of all equipment maintenance and service records for all equipment.

Sr. Operator of the Slurry Wall Team Various Cities.

In charge of slurry wall activities, such as moving HDPE pipe to slurry wall for transfer of slurry to the ditch, and checking height in slurry wall to prevent wall from collapsing. Other activities included preparing Bentonite mixture for backfill of trench. Also operated the long stick excavator, when it was necessary. Four years of travel with the IT Slurry Wall Group across country to various cities such as Point Malotie, California, Port of Seattle, Washington, Philadelphia, Pennsylvania, Syracuse, and New York. Also operated hydraulic, mechanical cranes up to 140 ton to load and unload slurry wall equipment, when necessary.

Feed Prep Supervisor/Operator for the IT Thermal Group at Crosby, Texas.

This was a fast pace incineration project that operated seven days a week, twenty-four hours a day. Supervisor of three, three-man crews on rotation; two shifts on and one shift off. This was a Level "B" project which meant that there was a 30 ft. fresh air trailer hooked to the crew's breathing system at all times. A crew continuously operated a Komatsau Wheel Loader inside the feed prep building while on supplied air with ten minute escape packs. Managed the operation and maintenance in weather temperatures on summer days of 120 degrees in the enclosed buildings of the radial stacker, power screen equipment and mass flow feeder all while on supplied air. Feed was supplied to the kiln twenty-fours a day. This was a \$110 million project.

President/Owner of Hernandez Concrete Pavers in LaPorte, Texas.

Successfully operated a business for four years in and around the Houston Metro, Clear Lake area. Installed sidewalks for theme parks such as Astro World in Houston and also pool decks, driveways, and sidewalks for private sector clients in and around the Houston area.

Figure III-1



July 8, 2005

Shaw Environmental, Inc.
5700 Thurston Avenue Suite 116
Virginia Beach, Virginia 23455-3302

RE: Site QC Manager
Contract N62470-02-D-3260
Task Order 0050

Dear Mr Hernandez:

This letter will serve as your appointment as the Site Quality Control Manager on the referenced project and will also clarify your duties and authority in this position. In this position, you will be authorized to use available resources to satisfy all applicable requirements of the Program and Task Order Quality Control Plans.

This authorization specifically gives you the authority to direct removal and replacement or correction of nonconforming materials or work and stop work authority when continuation would be unsafe to personnel, harmful to the environment, or result in a significant degradation of quality.

You will be expected to work closely with the Project Manager, Site Supervisor and other project personnel, but you will not be directly responsible to anyone but myself for resolution of quality issues when working in the capacity of Quality Control Manager.

If you have any question in this matter, please contact me.

Respectfully,

Ernest P. Duke
Program QC Manager
LANTDIV RAC Program

EXHIBIT IV-1

SUBCONTRACTOR LIST
Shaw Environmental, Inc.
HPFF Bio-Pulse Air Sparge System Installation
Task Order No. 050

COMPANY NAME AND ADDRESS	DESCRIPTION OF SERVICES PROVIDED
Les Craft, Locating Contractor	Utility Locations
TBD	Drilling Services
Donald Hatcher	Welding, Steel Pipe Fabrication
Accutest Laboratories	Chemical Analytical Testing
TBD	Transportation and Disposal Services

EXHIBIT V-1

SUBMITTAL REGISTER

Task Order No. 050 Contract No. N62470-02-D-3260						Project No. 115258 Project Title: HPFF Bio-Sparge System Installation						Revision No. 01 Shaw Environmental, Inc.			
Spec. Sect.	SD Number and Submittal Description	Spec Paragraph Number	Approving Authority	Other Reviewers	Transmittal Control No.	Planned Submittal Date	Contractor Action			Approving Authority				Date Rcvd from Appr Auth	Remarks
							Action Code	Date of Action	Date Forwarded to Appr Auth/ from Contr	Date Forward to Other Reviewer	Date Rcvd from Other Reviewer	Action Code	Date of Action		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)
	SD-01 Preconstruction														
	Work Plan		G												
	Health and Safety Plan Addendum		G												
	Quality Control Plan Addendum		G												
	Sampling and Analysis Plan Addendum		G												
	Base Construction/Dig Permit		G												
	SD-11 Closeout Submittals														
	Contractor's Closeout Report					Closeout Report									
	As-Built Records					Closeout Report									
	Status Reports					Closeout Report									
	Environmental Conditions Report					Closeout Report									
	Test Results Summary Report					Closeout Report									
	Daily Contractor Production Reports					Closeout Report									
	Daily QC Reports					Closeout Report									
	Rework Items List					Closeout Report									
	SD-13 Certifications														
	Testing Laboratory Accreditation					Closeout Report									
	SD-10 Test Reports														
	Lab Test Results for groundwater monitoring					Upon Receipt									
	Lab Test Results for disposal					Upon Receipt									
	Gauging and Recovery Data					Closeout Report									
	SD-08 Statements														
	Disposal Facility Permits					Closeout Report									
	SD-18 Records														
	Disposal Manifests					Closeout Report									

Notes:

Approved By:

G: Government

Blank: QC Manager

Reference: QMP-16.2 Submittal Management Process

ACTION CODES

A: Approved

AN: Approved as Noted

NR: Not Reviewed

RR: Disapproved; Revise and Resubmit

EXHIBIT V-2

LIST OF PERSONNEL AUTHORIZED TO REVIEW AND CERTIFY SUBMITTALS Shaw Environmental, Inc. HPFF Bio-Pulse Air Sparge System Installation Task Order No. 050		
	SUBMITTAL TYPE:	AUTHORIZED PERSONNEL:
Work Plan Submittals	Preconstruction	Project Manager
Technical and Documentation Submittals (1)	All Types	QC Manager, Program QC Manager, Project Manager and Site Engineer

(1) Note: QC Manager shall perform the final review and certification for submittals requiring Government approval.
QC Manager shall perform the final review and approval for submittals requiring Contractor approval.

EXHIBIT VII-1

TESTING PLAN AND LOG Shaw Environmental, Inc. HPFF Bio-Pulse Air Sparge System Installation Task Order No. 050											
CONTRACT NUMBER N62470-02-D-3260			PROJECT TITLE: HPFF Bio-Sparge System Installation LOCATION: Camp Lejeune, NC								
WORK PLAN SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		DATE COMPLETED	DATE FORWARDED TO CONTR. OFF.	REMARKS
			YES	NO			ON SITE	OFF SITE			
WP 3.4	Vapor Abatement Measures	Vacuum Pressure									1 to 2 inches of water vacuum
WP 3.5	Bio-Pulse Air Sparging Implementation	Air Injection Rate									Recommended rate of 322 CFM at 95 psi.
WP 3.6	Groundwater Recovery and Treatment	Groundwater Recovery Rate									Recovery Rate of 30 gpm is expected to create the needed radius of influence
WP 3.6	Groundwater Recovery and Treatment	HPFF 75 to be sampled for benzene, toluene, xylenes, ethyl benzene, ethylene dibromide and naphthalene using EPA 6210D and Total Lead using EPA 3030C									Prior to system startup and within two months following startup.
WP 3.6	Groundwater Recovery and Treatment	Treated effluent to be sampled for benzene, toluene, xylenes, ethyl benzene, ethylene dibromide and naphthalene using EPA 6210D and Total Lead using EPA 3030C									Following groundwater treatment startup treated effluent to be sampled monthly
WP 3.7.1	Bio-Pulse System Building Monitoring	VOC Building Monitoring using an OVA-FID and LEL if VOCs are detected									Per Section 3.7.1 of the Workplan
WP 3.7.2	Bio-Pulse System Monitoring Well Gauging and Sampling	Prior to Bio-Sparge well use, one groundwater sample from each well and analyze for VOCs by EPA 601/602 and SVOCs by EPA 610.									Depth to Groundwater and Free Product Gauging and semi-annual groundwater sampling to continue as currently implemented
WP 3.7.3	Bio-Pulse System AS/SVE System Monitoring	At the AS/SVE System Startup a vapor sample of the system discharge stack and analyze for EPA TO 18, TPH-GRO by EPA 8015M, and VOCs using EPA 8260M.									Routine equipment and system monitoring will continue as currently implemented.
WP 4.0	Disposal	DRO, GRO, TCLP/VOC. TCLP/SVOC & TCLP/Metals									Soil Stockpile - Composite sample analyzed for RCRA TCLP Metals, TCLP VOC, TCLP SVOC (1/1000cy) AND TPH-DRO/GRO (1/200CY)

EXHIBIT VIII-1

REWORK ITEMS LIST
Shaw Environmental, Inc.
HPFF Bio-Pulse Air Sparge System Installation
Task Order No. 050

Contract No. N6247002-D-3260

HPFF Southeast System Expansion

Location: Camp Lejeune NC

[illegible]

EXHIBIT X-1

QUALITY CONTROL INSPECTION PLAN Shaw Environmental, Inc. HPFF Bio-Pulse Air Sparge System Installation Task Order No. 050								
Specification Section	Definable Feature of Work	Activity Number	Control Check Verification					
			Date	Preparatory Phase Checklist/Report No.	Date	Initial Phase Checklist/Report No.		Follow-up Phase Checklist/Report No.
WP 3.1 & 3.2	Mobilization and Site Preparation							
WP 3.3	Bio-Pulse Air Sparge Well Installation							
WP 3.4	Vapor Abatement Measures							
WP 3.5	Bio-Pulse Air Sparging Implementation							
WP 3.6	Groundwater Recovery and Treatment							
WP 3.7	Bio-Pulse System Monitoring							
WP 4.0	Transportation and Disposal							
WP 5.0	Site Restoration and Demobilization							

EXHIBIT XI-1

PERSONNEL MATRIX Shaw Environmental, Inc. HPFF Bio-Pulse Air Sparge System Installation Task Order No. 050			
SPECIFICATION SECTION	SUBMITTALS TO BE REVIEWED BY:	THREE PHASE TO BE PERFORMED BY:	TESTING TO BE PERFORMED BY:
All Sectons	Site QC Manager(1), Program QC Manager, Project Manager or Project Engineer	Site QC Manager	Chemical Analysis - Accutest Laboratories

(1) Note: QC Manager shall perform the final review and certification for submittals requiring Government approval.
QC Manager shall perform the final review and approval for submittals requiring Contractor approval.

APPENDIX D

COMPLIANCE REPORTING FORMS

GROUNDWATER QUALITY MONITORING: COMPLIANCE REPORT FORM

Mail Original
to:

DEPARTMENT OF ENVIRONMENT & NATURAL RESOURCES
WATER QUALITY DIVISION, GROUNDWATER SECTION
1636 MAIL SERVICE CENTER
RALEIGH, NC 27699-1636 Phone: (919) 733-3221

FACILITY INFORMATION

Please Print Clearly or Type

Facility Name: _____
Permit Name (if different): _____
Facility Address: _____
(City) (State) (Zip) County _____
Contact Person: _____ Telephone #: _____
Well Location/ Site Name: _____ No. of Wells to be Sampled: _____
(from Permit)
Well Identification Number (from Permit): _____
Well Depth: _____ ft. Well Diameter: _____ in.
Screened Interval: _____ ft. to _____ ft.
Depth to Water Level: _____ ft. below measuring point.
Measuring Point (M.P.) is: _____ ft. above land surface. Relative M.P. Elevation in ft.: _____
Gallons of water pumped/bailed before sampling: _____ Date sample collected: _____
Field analysis: pH _____, Specific Conductance _____ uMhos
Temp. _____ °C, Odor _____ Appearance _____

For Groundwater Treatment Systems
Check One: ☐ Influent (98)
☐ Effluent (99)

PERMIT #: _____ EXPIRATION DATE: _____
Non-Discharge _____ UIC _____
NPDES _____
TYPE OF PERMITTED OPERATION BEING MONITORED
_____ Lagoon _____ Remediation: Infiltration Gallery
_____ Spray Field _____ Remediation: _____
_____ Rotary Distributor _____ Land Application of Sludge
_____ Other: _____

NOTE: Values should reflect dissolved and colloidal concentrations.

Date sample analyzed: _____
Laboratory Name: _____
Certification No. _____

PARAMETERS (Samples for metals were collected unfiltered _____ YES _____ NO and field acidified _____ YES _____ NO)

COD _____ mg/l	Nitrite (NO ₂) as N _____ mg/l	Ni - Nickel _____ mg/l
Coliform: MF Fecal _____ /100ml	Nitrate (NO ₃) as N _____ mg/l	Pb - Lead _____ mg/l
Coliform: MF Total _____ /100ml	Phosphorus: Total as P _____ mg/l	Zn - Zinc _____ mg/l
(Note: Use MPN method for highly turbid samples)	Orthophosphate _____ mg/l	Ammonia Nitrogen _____ mg/l
Dissolved Solids: Total _____ mg/l	Al - Aluminum _____ mg/l	Other (Specify Compounds and Concentration Units) _____
pH (when analyzed) _____ units	Ba - Barium _____ mg/l	_____
TOC _____ mg/l	Ca - Calcium _____ mg/l	_____
Chloride _____ mg/l	Cd - Cadmium _____ mg/l	_____
Arsenic _____ mg/l	Chromium: Total _____ mg/l	_____
Grease and Oils _____ mg/l	Cu - Copper _____ mg/l	_____
Phenol _____ mg/l	Fe - Iron _____ mg/l	_____
Sulfate _____ mg/l	Hg - Mercury _____ mg/l	_____
Specific Conductance _____ uMhos	K - Potassium _____ mg/l	_____
Total Ammonia _____ mg/l	Mg - Magnesium _____ mg/l	_____
TKN as N _____ mg/l	Mn - Manganese _____ mg/l	_____

ORGANICS: (GC,GC/MS,HPLC)
(Specify test and method #. Attach lab report.)
Report Attached? Yes _____ (1) No _____ (0)
VOC _____ : method # = _____
_____ : method # = _____
_____ : method # = _____

I certify that, to the best of my knowledge and belief, the information submitted in this report is true, accurate, and complete, and that the laboratory analytical data was produced using approved methods of analysis by a North Carolina DWQ (formerly DEM) certified laboratory. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Permittee (or Authorized Agent) Name and Title - Please print or type

Signature of Permittee (or Authorized Agent)

(Date)

GW-59A COMPLIANCE REPORT FORM

Permit # _____

(Submit one each monitoring period with GW-59 forms.)

1	Enter date monitoring results were due. (_____) Will this monitoring report (GW-59 and GW-59A) be submitted after the established due date?	YES	NO
2	Was any required information missing on the GW-59 report forms?	YES	NO
	<i>IF the answer to question 1 or 2 is "YES", list in the space provided below the well identification number(s) and explain the problems encountered in obtaining the required information.</i>		
3	Are any of the monitor wells in need of repair or maintenance (damaged casing, unlocked or missing cap, missing identification plate, area overgrown, etc.)? <i>If the answer is "Yes", contact the Regional Office for guidance.</i>	YES	NO
4	Are any monitored constituents equal to or above the established standards?	YES	NO
	<i>If the answer to question 4 is "NO", skip to section 8. If the answer to question 4 is "YES" list the affected wells individually with constituent(s) and concentration(s) exceeding standards in the space provided below:</i>		
5	For the constituents identified in question 4 above, have standards been exceeded previously for the same constituent(s) in the same well(s) in the last two years?	YES	NO
	<i>If the answer to question 5 is "NO", skip to section 8. If the answer to question 5 is "YES", list in the space provided below, each well with constituent(s) exceeding standards, concentration(s) reported, and sample collection date for each occurrence (for the last two years).</i>		
6	Are the monitoring wells listed in section 5 located at or beyond the review boundary?	YES	NO
	<i>If the answer is "YES", a groundwater quality problem may be occurring. CONTACT THE REGIONAL OFFICE IMMEDIATELY FOR GUIDANCE. If the answer is "NO", monitoring wells may be improperly located; contact the Regional Office.</i>		
7	Is the permittee implementing previously approved actions required by the Division involving this groundwater quality problem?	YES	NO
	<i>If the answer to question 7 is "YES", describe those actions in the space provided below. If the answer to question 7 is "NO", <u>contact the Regional Office within 90 days; an evaluation may be required to determine the impact the waste disposal system is having at the review and compliance boundaries surrounding this facility. Failure to do so may subject the permittee to a Notice of Violation, fines, and/or penalties.</u></i>		
8	The person completing this portion (GW-59A) of the monitoring report should sign below and submit this form with GW-59 forms for required wells to the address provided at the top of the current GW-59 form. I hereby acknowledge that the above information was evaluated and the information submitted in this report (Compliance Report GW-59A) is true and complete to the best of my knowledge. _____ Signature of Permittee (or Authorized Agent) _____ Date		

NON DISCHARGE WASTEWATER MONITORING REPORT**Facility Status:**

Please answer the following question:

1. Does all monitoring data and sampling frequencies meet permit requirements?

Compliant (Y,N)

☐

If the facility is **non-compliant**, please explain in the space below the reason(s) the facility was not in compliance with its permit. Provide in your explanation the date(s) of the non-compliance and describe the corrective action(s) taken. Attach additional sheets if necessary.

"I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that all qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations."

(Signature of Permittee)*

Date

(Name of Signing Official-Please print or type)

(Permittee-Please print or type)

(Position or Title)

(Phone Number)

(Permit Exp. Date)

(Permittee Address)

Parameter Codes:

01002 Arsenic	31504 Coliform, Total	00600 Nitrogen, Total	00929 Sodium
01022 Boron	00094 Conductivity	00630 NO2&NO3	00931 SAR
00310 BOD5	01042 Copper	00620 NO3	00745 Sulfide
01027 Cadmium	00300 Dissolved Oxygen	00556 Oil-Grease	70295 TDS
00916 Calcium	31616 Fecal Coliform	WQ09 PAN (Plant Available)	00010 Temperature
00940 Chloride	01051 Lead	00400 pH	00625 TKN
50060 Chlorine, Total Residual	00927 Magnesium	32730 Phenols	00680 TOC
	71900 Mercury	00665 Phosphorus, Total	00530 TSS/TSR
01034 Chromium	00610 NH3asN	00937 Potassium	00076 Turbidity
00340 COD	01067 Nickel	00545 Settleable Matter	01092 Zinc

Parameter Code assistance may be obtained by calling the Water Quality Compliance/Enforcement Unit at (919) 733-5083 ext. 529.

The monthly average for Fecal Coliform is to be reported as a GEOMETRIC mean. Use only the units designated in the reporting facility's permit for reporting data.

* If signed by other than the permittee, delegation of signatory authority must be on file with the state per 15A NCAC 2B.0506 (b)(2)(D).

APPENDIX E

DWQ GROUNDWATER DISCHARGE PERMIT



Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E. Director
Division of Water Quality

December 10, 2004

COMMANDING GENERAL, MCB CAMP LEJEUNE
USMC - HADNOT POINT
I&E/EMD/EQB
PSC BOX 20004
MCB CAMP LEJEUNE, NC 28542-0004

Subject: Permit No. WQ0023585
USMC - Hadnot Point
Groundwater Remediation Facilities
Onslow County

Dear Commanding General, MCB Camp Lejeune:

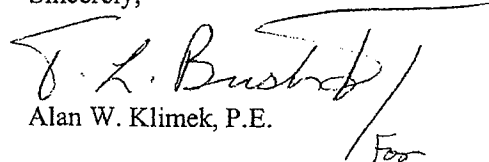
In accordance with your permit application received December 16, 2003, and subsequent additional information received January 14, 2004, February 9, 2004, April 21, 2004, August 20, 2004 and September 23, 2004, we are forwarding herewith Permit No. WQ0023585, dated December 10, 2004, to USMC - Hadnot Point for the modification and continued operation of the subject groundwater remediation facility.

This permit shall be effective from the date of issuance until November 30, 2009, shall void Permit No. WQ0023585 issued October 15, 1990, and shall be subject to the conditions and limitations as specified therein. Please pay particular attention to the monitoring requirements in this permit. Failure to establish an adequate system for collecting and maintaining the required operational information will result in future compliance problems.

If any parts, requirements, or limitations contained in this permit are unacceptable, you have the right to request an adjudicatory hearing upon written request within thirty (30) days following receipt of this permit. This request must be in the form of a written petition, conforming to Chapter 150B of the North Carolina General Statutes, and filed with the Office of Administrative Hearings, 6714 Mail Service Center, Raleigh, NC 27699-6714. Unless such demands are made this permit shall be final and binding.

If you need any additional information concerning this matter, please contact Tom Cadwallader at (919) 715-6183.

Sincerely,



Alan W. Klimek, P.E.

cc: Onslow County Health Department
Wilmington Regional Office, Aquifer Protection Section
Scott A. Brewer, Director, Environmental Management, PSC Box 20004, Camp Lejeune, NC 28542-0004
Technical Assistance and Certification Unit
APS - Central Files
APS Files

One
North Carolina
Naturally

Aquifer Protection Section
Internet: <http://h2o.enr.state.nc.us>

1636 Mail Service Center
2728 Capital Boulevard

Raleigh, NC 27699-1636
Raleigh, NC 27604

Phone (919) 733-3221
FAX (919) 715-0588

Customer Service
1-877-623-6748

NORTH CAROLINA
ENVIRONMENTAL MANAGEMENT COMMISSION
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

GROUNDWATER REMEDIATION PERMIT

In accordance with the provisions of Article 21 of Chapter 143, General Statutes of North Carolina as amended,
and other applicable Laws, Rules, and Regulations

PERMISSION IS HEREBY GRANTED TO

USMC - Hadnot Point
Onslow County

FOR THE

modification and continued operation of a 43,200 GPD groundwater remediation facility consisting of one 80 feet deep recovery well with pump and flow meter followed by an above ground oil/water separator, a surge tank and pump, an air stripping tower followed by another pump and dual filters each followed by two carbon canisters in series before recombining at a sampling point and then discharging to the base sewer system at collection manhole MO814 to serve the Hadnot Point groundwater remediation program, with no discharge of wastes to the surface waters, pursuant to the application received December 16, 2003, and subsequent additional information received by the Division of Water Quality (Division), and in conformity with the project plan, specifications, and other supporting data subsequently filed and approved by the Division and considered a part of this permit.

This permit shall be effective from the date of issuance until November 30, 2009, shall void Permit No. WQ0023585 issued October 15, 1990, and shall be subject to the following specified conditions and limitations:

I. PERFORMANCE STANDARDS

1. Upon completion of construction and prior to operation of this permitted facility, a certification must be received from a professional engineer certifying that the permitted facility has been installed in accordance with this permit, the approved plans and specifications, and other supporting materials. If this project is to be completed in phases and partially certified, you shall retain the responsibility to track further construction approved under the same permit, and shall provide a final certificate of completion once the entire project has been completed. Mail the Certification to: **Aquifer Protection Section, Groundwater Protection Unit, 1636 Mail Service Center, Raleigh, NC 27699-1636.**
2. The Wilmington Regional Office, telephone number (910) 395-3900, shall be notified at least forty-eight (48) hours in advance of operation of the installed facilities so that an in-place inspection can be made. Such notification to the regional supervisor shall be made during the normal office hours from 8:00 a.m. until 5:00 p.m. on Monday through Friday, excluding State Holidays.

3. The groundwater treatment system shall consistently achieve at least 95% removal of the influent contaminants or 15A NCAC 2L Section .0202(g) Class GA Standards (whichever is higher) prior to discharge to the effluent manhole. The treated water discharged into the manhole must not cause a violation of Class GA Standards for any constituent beyond the Compliance Boundary, nor cause the migration of the contamination into unaffected areas. If the treatment system fails to consistently achieve this standard, additional treatment units or changes in operational needs may be required.
4. The issuance of this permit shall not relieve the Permittee of the responsibility for damages to surface or groundwaters resulting from the operation of this facility.
5. Any residuals generated from these treatment facilities must be disposed in accordance with General Statute 143-215.1 and in a manner approved by the Division.
6. Diversion or bypassing of the untreated groundwater from the treatment facilities is prohibited.

II. OPERATION AND MAINTENANCE REQUIREMENTS

1. The facilities shall be properly maintained and operated as a non-discharge system to prevent the discharge of any wastewater resulting from the operation of this facility. The groundwater recovery, treatment and disposal system shall be inspected weekly. If it is determined that the system is malfunctioning or leading to the release of wastes to the environment, a threat to human health, or a nuisance, all repairs should be made as soon as possible and reported to the Wilmington Regional Office (see Section V. **NONCOMPLIANCE NOTIFICATION**). All components of the groundwater recovery, treatment, and disposal system shall be properly weatherproofed to prevent freezing and failure of the system.
2. Upon classification of the wastewater treatment and remediation facilities by the Water Pollution Control System Operators Certification Commission (WPCSOCC), the Permittee shall designate and employ a certified operator to be in responsible charge (ORC) and one or more certified operator(s) to be back-up ORC(s) of the facilities in accordance with 15A NCAC 8G .0201. The ORC shall visit the facilities in accordance with 15A NCAC 8G .0204 or as specified in this permit and shall comply with all other conditions specified in these rules.
3. If requested by the owner, the Division will consider remote monitoring in lieu of (frequency) physical inspections, on a case-by-case basis, following at least two years of successful operation.
4. The Permittee shall maintain an inspection log or summary including at least the date and time of inspection, observations made, and any maintenance, repairs, or corrective actions taken by the Permittee. This log of inspections shall be maintained by the Permittee for a period of three years from the date of the inspection and shall be made available to the Division or other permitting authority, upon request.
5. Any duly authorized officer, employee, or representative of the Division may, upon presentation of credentials, enter and inspect any property, premises or place on or related to the disposal site or facility at any reasonable time for the purpose of determining compliance with this permit, may inspect or copy any records that must be maintained under the terms and conditions of this permit, and may obtain samples of groundwater, surface water, or leachate.

III. MONITORING REQUIREMENTS

1. The effluent from the treatment system shall be sampled every month for the parameters specified below:

Benzene	Toluene	Ethyl Benzene
Xylene	Napthalene	Lead
Water flow	Ethylene Dibromide (EDB)	

2. The Recovery well (RW-1) shall be sampled prior to waste disposal operations, and thereafter every March, June, September and December for the parameters listed in **III. 1.above**.
3. The analysis of the hydrocarbon compounds are to be performed by Standard Method 6210D. The samples shall be prepared and analyzed for lead by Standard Method 3030C. Additionally, during the initial baseline analysis and the final site closure analysis, duplicate samples to confirm the concentration of EDB in RW-1 and the effluent shall be analyzed by EPA Method 504.1.
4. Any laboratory selected to analyze parameters must be Division of Water Quality certified for those parameters required.
5. Any additional groundwater quality monitoring, as deemed necessary by the Division, shall be provided.

IV. REPORTING REQUIREMENTS

1. Three (3) copies of the following forms shall be mailed to the address below:

- 1) GW-1 Well Construction Record (RW-1)
- 2) GW-59 Groundwater Quality Monitoring : Compliance Report Form
- 3) GW-59A Compliance Report Form

Mail these documents to the following address: **Division of Water Quality
1617 Mail Service Center
Information Processing Unit
Raleigh, NC 27699-1617**

Updated blank forms (GW-1, GW-30, GW-59, GW-59A) may be downloaded from the Division of Water Quality website at <http://h2o.enr.state.nc.us/> or requested from the address mentioned above.

2. The results of the sampling and analysis must be received on forms GW-59 and GW-59A on or before the last working day of the month following the sampling month. The data of all groundwater sampling analyses required by the permit conditions must be reported using the most recent GW-59 and GW-59A forms along with attached copies of the laboratory analyses.
3. For the initial sampling of the well (RW-1), the permittee shall submit a copy of the GW-1 form with form GW-59 to the address listed above. Initial GW-59 forms that do not include copies of the GW-1 form may be returned to the permittee without being processed. Failure to submit these forms as required by this permit may result in enforcement activities pursuant to NC General Statutes 143-215.6A.
4. The permittee shall retain records of all monitoring information, including calibration and maintenance records, continuous monitoring data and reports required by this permit, for at least 3 years from the date of the sample measurement, report or application. Records of this monitoring information shall include, but not be limited to, the following:
 - 1) the date, exact place, and time of sampling or measurements,
 - 2) the individual who performed the sampling or measurements,
 - 3) the date the analyses were performed,
 - 4) the analytical techniques or methods used, and
 - 5) the results of such sampling, measurements, and analyses.
5. The permittee shall report to the Wilmington Regional Office (see Section **V. NONCOMPLIANCE NOTIFICATION**) any monitoring or other information which indicates:

- 1) any contaminant may cause an endangerment to an underground source of drinking water,
- 2) any noncompliance with a permit condition due to a malfunction of the system, or
- 3) any cause of fluid migration outside the injection zone or area.

The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance, including exact dates and times. If the noncompliance is not corrected and is expected to continue, steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance shall be provided to the Regional Office in a timely manner.

6. The permittee shall submit an annual report summarizing the volume of effluent discharged into the effluent manhole and the summary results of related groundwater, influent, and effluent monitoring. Isoconcentrations (horizontal and vertical direction) and water level contour maps shall be prepared on an annual basis and submitted with this report. If an annual report containing this information (e.g. corrective action plan) is required by a regulatory agency, the permittee may submit two (2) copies of that report in lieu of the preceding information within thirty days of its publication. The permittee shall submit this report to the following address: **Aquifer Protection Section, Groundwater Protection Unit, 1636 Mail Service Center, Raleigh, NC 27699-1636.**

V. NONCOMPLIANCE NOTIFICATION

1. The Permittee shall report by telephone to the Wilmington Regional Office, telephone number (910) 395-3900, as soon as possible, but in no case more than 24 hours or on the next working day following the occurrence or first knowledge of the occurrence of any of the following:
 - 1) Any occurrence at the groundwater remediation facility which results in the treatment of significant amounts of contaminated groundwaters which are abnormal in quantity or characteristic, such as the dumping of the contents of a basin or tank, the known passage of a slug of hazardous substance through the facility, or any other unusual circumstances;
 - 2) Any process unit failure, due to known or unknown reasons, that renders the groundwater treatment and disposal system incapable of adequate treatment and disposal, such as mechanical or electrical failures of pumps, aerators, compressors, etc.;
 - 3) Any failure of a pumping station, sewer line, or treatment facility resulting in a by-pass directly to receiving waters without treatment of all or any portion of the influent to such station or facility; or
 - 4) Any time that self-monitoring information indicates that the groundwater treatment and disposal system is not in compliance with any specified permit limitations.
2. Occurrences outside normal business hours may also be reported to the Division's Emergency Response personnel at telephone number (800) 858-0368 or to the Emergency Management's switchboard at (919) 733-3300. Also, persons reporting such occurrences by telephone shall file a written report within five (5) days following first knowledge of the occurrence. This report must outline the actions taken or proposed to be taken to ensure that the problem does not recur.

VI. APPLICABLE BOUNDARIES

1. The COMPLIANCE BOUNDARY for the disposal system is specified by regulations in 15A NCAC 2L, Groundwater Classifications and Standards. The Compliance Boundary for the disposal system individually permitted on or after December 30, 1983 is established at either 250 feet from the waste disposal area, or 50 feet within the property boundary, whichever is closest to the waste disposal area. An exceedance of Class GA Standards at or beyond the Compliance Boundary is subject to remediation action according to 15A NCAC 2L .0106(d)(2).
2. The REVIEW BOUNDARY is established around the disposal systems midway between the Compliance Boundary and the perimeter of the waste disposal area. Any exceedance of Class GA Standards at the Review Boundary may require action in accordance with 15A NCAC 2L .0106(d)(1).

VII. GENERAL CONDITIONS

1. Issuance of this permit does not constitute approval for reimbursement from the Leaking Petroleum Underground Storage Tank Cleanup Fund (15A NCAC 2P) or any other fund. Additionally, the issuance of this permit does not remove the permittee's responsibility to comply with the corrective action requirements of the Division of Waste Management. Furthermore, the permittee should notify and report all changes concerning the remedial system to the Division of Waste Management. It is the permittee's responsibility to comply with the requirements of all involved agencies.
2. This permit shall become voidable unless the facilities are constructed in accordance with the conditions of this permit, the approved plans and specifications, and other supporting data.
3. This permit is effective only with respect to the nature and volume of wastes described in the application and other supporting data.
4. This permit is not transferable. In the event there is a desire for the facilities to change ownership, or there is a name change of the Permittee, a formal permit request must be submitted to the Division accompanied by an application fee, documentation from the parties involved, and other supporting materials as may be appropriate. The approval of this request will be considered on its merits and may or may not be approved.
5. A set of approved plans and specifications for the subject project must be retained by the Permittee for the life of this project.
6. Failure to abide by the conditions and limitations contained in this permit may subject the Permittee to an enforcement action by the Division in accordance with North Carolina General Statute 143-215.6A to 143-215.6C.
7. The annual administering and compliance fee must be paid by the Permittee within thirty (30) days after being billed by the Division. Failure to pay the fee accordingly may cause the Division to initiate action to revoke this permit as specified by 15A NCAC 2H .0205 (c)(4).
8. The issuance of this permit does not preclude the Permittee from complying with any and all statutes, rules, regulations, or ordinances, which may be imposed by other government agencies (local, state, and federal), which have jurisdiction.
9. Sixty (60) days prior to closure of the Recovery Well RW-1, the permittee must request a rescission of the permit from the Division of Water Quality.
10. If the permittee wants to continue operation of this system, at least six (6) months prior to the expiration of this permit, the permittee shall request its extension. Upon receipt of the request, the Commission will review the adequacy of the facilities described therein, and if warranted, will extend the permit for such period of time and under such conditions and limitations as it may deem appropriate.

Permit issued this the 10th day of December, 2004

NORTH CAROLINA ENVIRONMENTAL MANAGEMENT COMMISSION



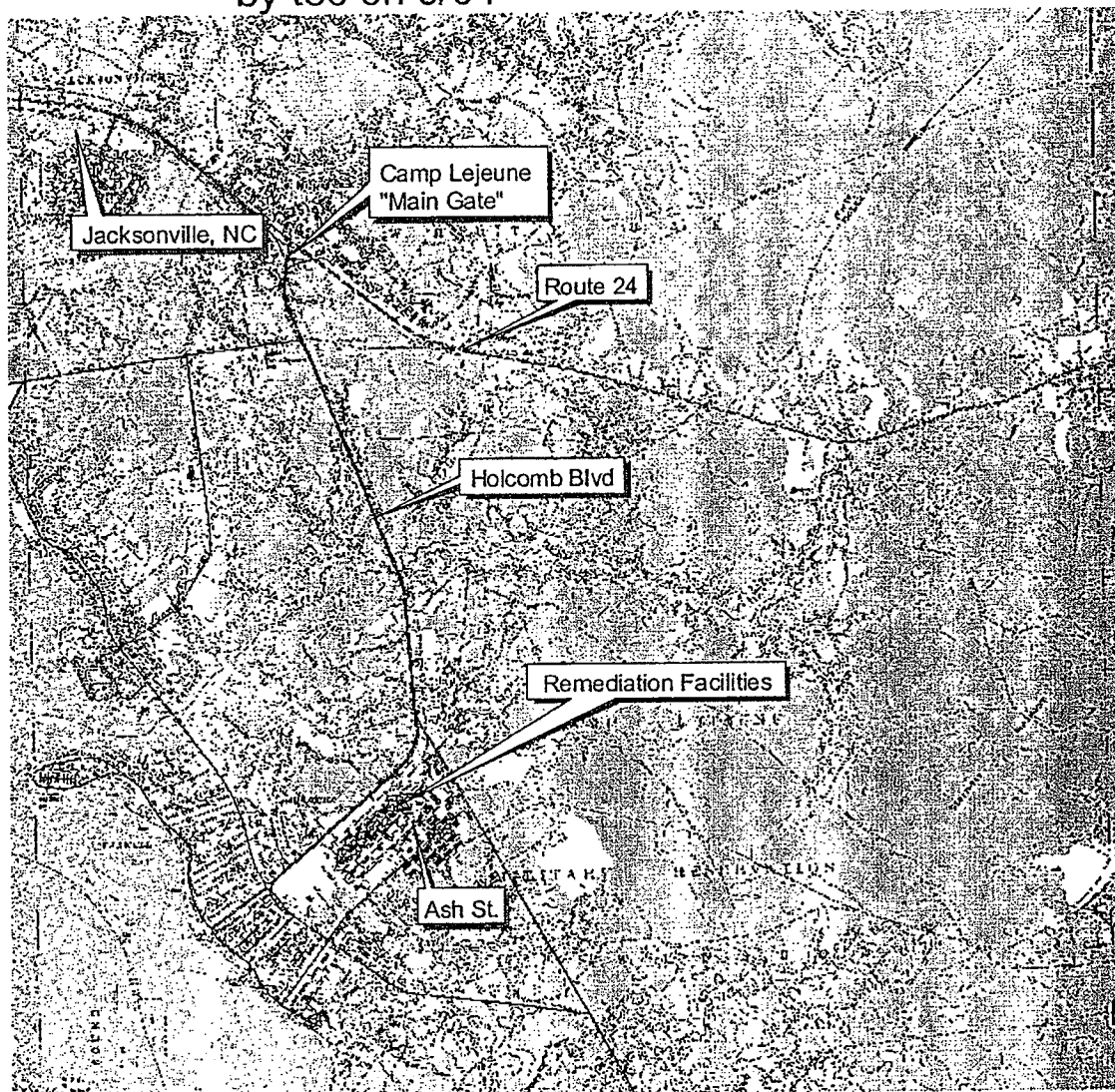
Alan W. Klimek, P.E., Director

Division of Water Quality

By Authority of the Environmental Management Commission

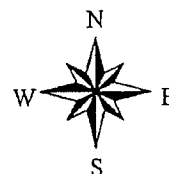
Permit Number WQ0023585

US Marine Corps, Camp Lejeune, NC
Hadnot Point Remediation Pretreatment
Vicinity Map
by tec on 9/04

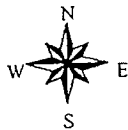
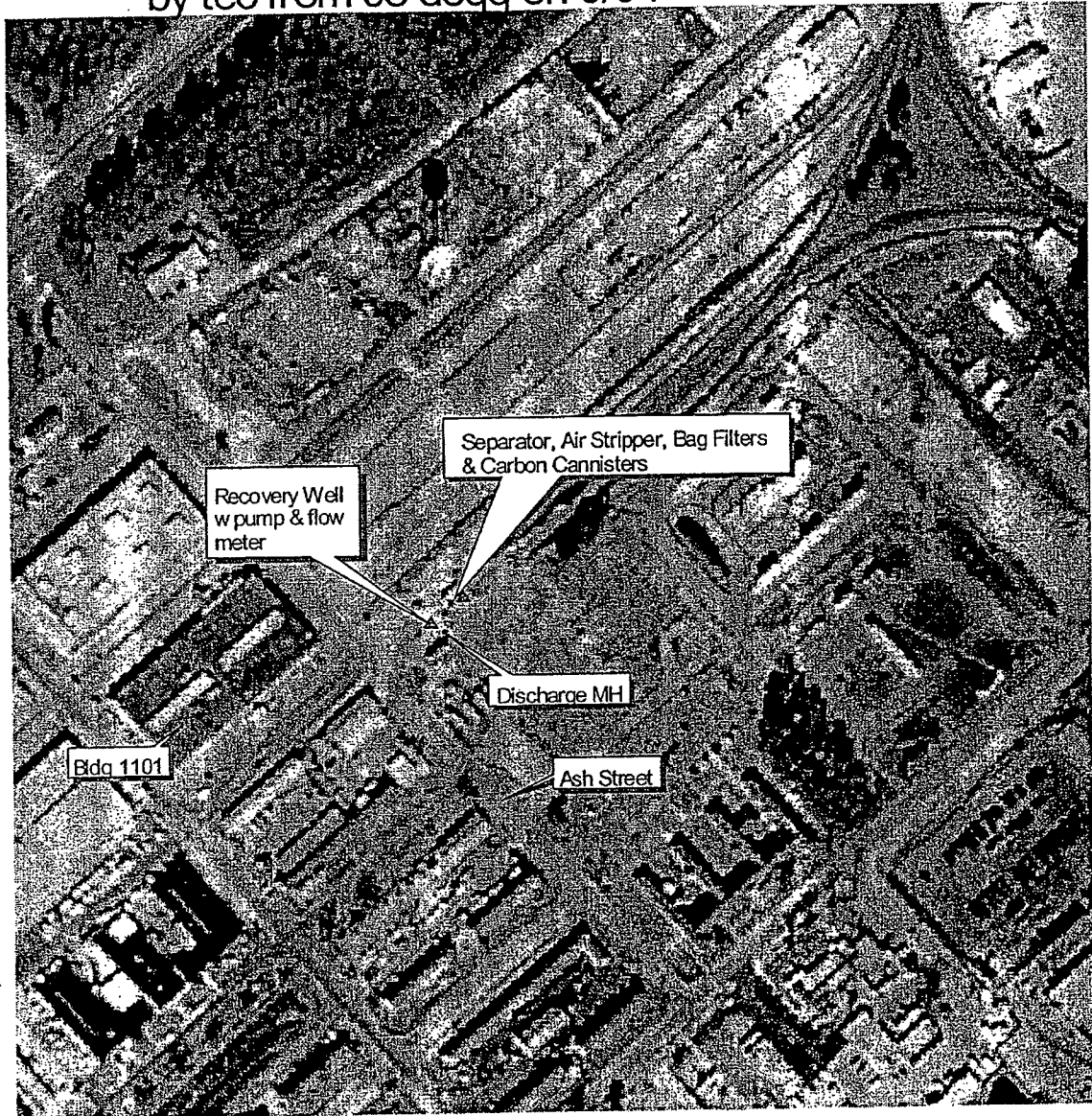


8000 0 8000 16000 Feet

WQ0023585



US Marine Corps, Camp Lejeune, NC
Hadnot Point Remediation Pretreatment Layout
by tec from 98 dogg on 9/04



WQ0023585