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BASE REALIGNMENT AND CLOSURE TANK MANAGEMENT PLAN CNC CHARLESTON SC

8/28/1996

CHARLESTON ENVIRONMENTAL DETACHMENT

BASE REALIGNMENT AND CLOSURE

TANK MANAGEMENT PLAN

CHARLESTON NAVAL COMPLEX
CHARLESTON, SOUTH CAROLINA

Facilities: **NSY**
NSC
NAVSTA
FLEMINEWARTRACEN
SUBTRAFAC

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Prepared for:

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Foreword

During the 90 year history of Charleston Naval Complex, the Navy has performed a variety of operations, involving handling, storage, and disposal of hazardous materials. Accidental spills and leaks have contributed to entrance of contaminants into the environment. Other contributions to environmental contamination occurred due to disposal or storage methods which were not environmentally sound by today's standards. In recent years, the Department of Defense has implemented numerous programs to investigate, evaluate, and remediate suspected past releases at DOD facilities.

The Comprehensive Long-Term Environmental Action, Navy Underground Storage Tank program is one of the programs used by DOD striving to achieve environmental cleanup goals. This program complies with Subtitle I of the Resource Conservation and Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments of 1984 (HSWA). In addition, the program was established to insure compliance with State and Local regulations as the regulations pertain to each Naval Facility.

The UST program encompasses the following:

- Registration and management of Navy storage tank systems
- Contamination assessment planning
- Site field investigations
- Preparation of contamination assessment reports
- Remedial (corrective) action planning
- Implementation of remedial action plans
- Tank and pipeline closures

The UST program at the Charleston Naval Complex is overseen by the Southern Division of Naval Facilities Engineering Command (SDIV) and the South Carolina Department of Health and Environmental Control (DHEC).

Other programs address the implications and concerns of Base Realignment and Closure. A Closure Team (BCT) composed of representatives from the Naval Complex, SDIV, Federal and State regulation agencies has been established to discuss and resolve the multitude of problems and concerns surrounding base closure. Also, the BCT will tackle the tough environmental concerns associated with leasing government faeilities to private organizations. The team approach is intended to foster partnering, accelerate the environmental cleanup process, and expedite timely, cost-effective, and environmentally responsible disposal and reuse decisions.

At the Charleston Naval Complex, the BRAC process includes the evaluation of the environmental condition of the property to ensure the suitability of transfer, reuse, or lease. Questions regarding the UST program at the Charleston Naval Complex should be addressed to Mr. Gabriel Magwood, Code 1849, at (803) 820-7307.

Executive Summary

The Charleston Environmental Detachment was contracted by SDIV to develop a Tank Management Plan (TMP) that facilitates identification and efficient closure of tanks and pipelines requiring remedial action. The scope of services for the work is described in the Statement of Work and the corresponding Proposal developed by the Charleston Environmental Detachment.

Charleston Naval Complex was placed on the 1993 Base Realignment and Closure Commission (BRAC) list by a bipartisan commission appointed by the President and confirmed by the Senate in accordance with the Defense Base Closure and Realignment Act of 1990. The primary goal of the BRAC is to effect an efficient transfer of areas suitable for property transfer and to identify and coordinate the necessary remedial actions for areas not suitable for immediate transfer.

This TMP only addresses those areas that require additional investigation under State petroleum storage tanks guidelines.

The scope of services developed to execute the TMP includes:

- Identification, classification, and location of existing storage tanks and pipelines at the Charleston Naval Complex and annexes
- Documentation of the locations of existing storage tanks and pipelines
- Develop guidelines and basic generic procedures for the proper closure of storage tanks and pipelines meeting the applicable requirements
- Development of outlines describing the management of investigative derived wastes (IDW) and management of initial removal action contaminated soils.

This TMP utilizes the Tank Inventory and Management System (TIMS) as a database that provides all the physical planning information for all petroleum storage tanks systems at the Charleston Naval Complex. Drawings and maps are included to provide pictorial representation of tank and pipeline locations. Other figures present schedules for tank removal and closure activities.

The investigative procedures for the tank closure and contamination assessment of petroleum contaminated sites are also provided. Flow charts describing the decision process and assessment activities have been developed and are included herein.

The TMP should serve to assist in planning and expediting tank closure and assessments for the Charleston Naval Complex through 1998.

Ser:152
18 SEPT 1996

MEMORANDUM

From: Director, Supervisor of Shipbuilding, Conversion and Repair, USN, Portsmouth, Va, Environmental Detachment, Charleston, SC (SPORTENVDETCHASN)

To: Southern Division Naval Facilities Engineering Command
(Code 1849, Gabriel Magwood)

Subj: REVISION TO THE TANK MANAGEMENT PLAN (TMP)

Ref: (a) South Carolina Department of Health and Environmental Control (SCDHEC) and United States Environmental Protection Agency (USEPA) Comments on the TMP, dtd June 18, 1996

Encl: (1) SCDHEC and USEPA Comments and Revision Notes
(2) Tank Management Plan, Revision 1

1. The Tank Management Plan has been revised based on the Reference (a) comments. A copy of the comments along with a brief notes indicating the TMP change locations are compiled in Enclosure (1). The revised TMP is included as enclosure (2). If there are any questions, please contact Jack Amey at 743-6777.

E. R. Dearhart

Copy to:
J.N.K. Tunstall

SOUTH CAROLINA DEPARTMENT OF
HEALTH AND ENVIRONMENTAL CONTROL
COMMENTS

The Ground Water Protection Division (GWPD) and the Bureau of Underground Storage Tank Management (BUSTM) of the South Carolina Department of Health and Environmental Control have reviewed the referenced Tank Management Plan (TMP) and offers the following comments:

1) The TMP has been reviewed by the USEPA's underground storage tank program. The referenced comments are enclosed and the GWPD concurs with the comments. The GWPD and the BUSTM have expanded on these comments and included additional remarks of their own.

No action required

2) The TMP does not include regulated chemical tanks as indicated in USEPA's comment #1. Chemical USTs are regulated by the BUSTM per the SC Underground Storage Tank Control Regulations, R.61-92, Part 280. These USTs must be properly abandoned and assessed as outlined in R.61-92. In addition all chemical USTs in operation must have secondary containment structures by 1998 to be in compliance.

If at the time of abandonment and/or assessment, it is indicated that a release to the environment from the chemical USTs may have occurred, additional investigation of that release would be transferred to the RCRA program.

A paragraph on Non-Petroleum tanks was added.
Page 1-2, Para. 1.4 inserted, Old Para 1.4 now 1.5

3) As outlined in USEPA comment #2, the GWPD utilizes specific chemical values to determine site conditions. These values can be determined site specifically utilizing the leachablilty calculations outlined in the Risk Based Corrective Action for Petroleum Releases dated June 1 995 (RBCA) or by using the risk based screening levels (RBSLs) outlined in the same document. At this time, due to the limited assessment proposed in the TMP for each UST removal, the GWPD recommends that the RBSLs outlined in the RBCA document be utilized in lieu of TPH. If site conditions warrant calculation of site specific RBSLs, they can be determined during any additional site assessment that may be necessary.

Please note, RBSLs are for specific constituents, not for Total Petroleum Hydrocarbons (TPH). Therefore, the usefulness of TPH data is limited and cannot be utilized, by itself, to consider a tank removal clean. Supporting data in the form of specific constituent analyses will be necessary. The Department recommends that specific constituent levels (RBSLs) be added to the plan and the use of TPH be eliminated.

RBCA added to Page 2-1, Para. 2.0
Defined on Page 2 Para 4.1.1..

Enclosure (1)

4) The TMP indicates that an attempt was made to perform a field screening investigation at some of the tank locations. The effort was discontinued after encountering difficulties with underground obstructions. Please forward all results obtained from this attempt in any reports concerning the tanks where this screening was attempted.

All available field data, as discussed in paragraphs 3.1.1, 4.1.1.1, and 4.2.1.1 will be included in the UST Assessment Reports.

5) Please submit all closure reports to the DOD petroleum contact, Mr. Tim Mettlen, who will forward, if necessary, the reports to the appropriate personnel within the BUSTM.

An Assessment Report will be furnished to DOD contact.
Page 4-1, para 4.1.1 and Page 4-4, para 4.2.1

6) In Section 4.1.2.2, it is unclear when and if a closure report (CR) will be submitted to the Department. The Department requests that a CR for every tank be submitted to the DOD contact upon completion of tank removal, regardless of the potential for additional site investigation.

An Assessment Report will be furnished to the state
Page 4-1, para 4.1.1 and Page 4-4, para 4.2.1

7) The TMP proposes to excavate all soils deemed "excessively contaminated". After stockpiling, the soils are to be tested for TPH. If less than 100 ppm, the soils are to be placed back into the excavation. As indicated in comment 3, the Department does not utilize TPH to determine if soils can be returned to the excavation. Therefore, the Department recommends that the TMP be changed to reflect that any soils with impact indicated less than the RBSLs may be returned to the excavation. Soils with impact above the RBSLs must be removed and treated.

Please note, any soils (or solid IDW) removed from the tank location to be treated, must be treated to below acceptable detection limits to be used as clean fill.

The RBCA RBSL's have been added &
Defined on Page 4-2 Para 4.1.1.1 and 4.2.1.1

8) All stockpiled soils must be underlain and covered with plastic (minimum of 6mil) to prevent exposure to rain wind, etc. and to prevent dermal contact.

6 mil Poly requirement added to Page 5-4, para 5.3.1, bullet 1

ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE
NAVAL BASE CHARLESTON
BASE REALIGNMENT AND CLOSURE TANK MANAGEMENT PLAN

1) The Tank Management Plan (TMP) is limited to Petroleum tanks that are still in service or have not been permanently closed. It is assumed that petroleum tanks which were previously closed complied with appropriate closure requirements. It should also be noted that this TMP does not address hazardous substance underground storage tank (UST) systems which are regulated under the Underground Storage Tank Program.

A paragraph on Non-Petroleum tanks was added.
Page 1-2, Para. 1.4 inserted, Old Para 1.4 now 1.5

2) On Page 2-1 is a list of regulatory guidelines and industry documents used in developing the TMP. South Carolina Department of Health and Environmental Control's (SCDHEC's) Risk-Based Corrective Action for Petroleum Releases (June 1995) guidance document should be included in this list and used to develop the definition of excessively contaminated soil and determine how much remediation is needed at individual release sites to protect human health and the environment. The use of SCDHEC's Risk-Based Corrective Action guidance may change how the TMP defines excessively contaminated soil. Presently, the TMP defines excessively contaminated soil as having a photoionization analyzer (PID) reading exceeding 100 Volume parts per million (Vppm). SCDHEC's Risk-Based Corrective Action guidance establishes appropriate corrective actions based on specific chemical constituents' concentration and not on a total petroleum hydrocarbon concentration.

The RBCA Guidelines are added to Page 2-1, Para. 2.0
& Defined on Page 4-2 Para 4.1.1.1 and 4.2.1.1

3) On Page 4-1, it is stated that soil samples will be screened by an organic vapor analyzer equipped with a PID. No indication is given as to which PID manufacturer' s analyzer would be used. PIDs from various manufacturers will give different meter readings for the same sample. Because it is proposed to use the PID readings to indicate which soils will be associated, knowing which PID instrument is being used is very important. Readings from one manufacturer's PID could indicate that the soil was excessively contaminated where another manufacturer' s PID would indicate that the soil was not. PID readings from HNu, Thermo Environmental Instruments, Inc. and Photovac instruments will have different meter readings for the same sample. This is normal and inherent to the way manufacturers design their instruments.

If an alternative method, such as immunoassay, is used for determining which soils are excavated, a correlation between the level of contamination with the method results should be established. An immunoassay reading of 100 ppm is not the same as a 100 ppm reading on a PID.

The Photovac 2020 is now referenced in Para 4.1.1.1 & 4.2.1.1

4) On Page 4-1, it is stated that soil samples will be screened by headspace procedures described in EPA Publication #530/UST-90-003, September 1990, "Field Measurements, Dependable Data When You Need It." The TMP does not mention which of the headspace methods discussed in the EPA publication is to be used. Headspace analysis using the Polyethylene bag sampling system will give constant and reliable results. Results from other headspace methods will be controlled by the rate at which volatiles evolve into headspace. Volatilization from the soil into the headspace is by diffusion and hence is matrix controlled. Matrix control depends on: grain size, grain size distribution, adsorption, moisture, sample temperature and time.

Polyethylene bag is the method we use, it is now referenced in para 4.1.1.1 and 4.2.1.1

5) Section 4.5, Field Investigation, describes the conventional approach to characterizing a release site. The use of expedited site assessment techniques, as described in the provisional Accelerated Site Characterization standard by the American Society for Testing and Materials (PST -95), should be considered. Directs push technologies, small diameter monitoring wells/points and field analytical methods can give a more timely and detailed analysis of a release site.

The option to use innovative technologies is now referenced on page 4-7, para 4.5

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Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, SC

GLOSSARY

AST	Aboveground Storage Tank
BCT	Base Closure Team
BEI	Bechtel Environmental, Inc.
BLS	Below Land Surface
BRAC	Base Realignment and Closure
CA	Contamination Assessment
CAR	Contamination Assessment Report
CED	Charleston Environmental Detachment
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action, Navy
COC	Chemicals of Concern
DHEC	South Carolina Department of Health and Environmental Control
DOD	Department of Defense
DOT	US Department of Transportation
EBS	Environmental Baseline Survey
EPA	US Environmental Protection Agency
IDW	Investigation Derived Waste
IR	Installation Restoration Program
IRA	Initial Remedial Action
MOP	Monitoring Only Plan
NFA	No Further Action
NPDES	National Pollution Discharge Elimination System
OVA	Organic Vapor Analyzer
PID	Photo Ionization Detector
PPB	Parts per Billion
PPM	Parts per Million
QA/QC	Quality Assurance/Quality Control
RAC	Remedial Action Contract
RAM	Responsibility Assignment Matrix
RAP	Remedial Action Plan
RBCA	Risk Based Corrective Action for Petroleum Releases
RBSLs	Risk Based Screening Levels
RCRA	Resource Conservation and Recover Act
RFA	RCRA Facility Assessment
SDIV	Southern Division, Naval Facilities Engineering Command
TIMS	Tank Inventory and Management System
TMP	Tank Management Plan
UST	Underground Storage Tank

1.0 INTRODUCTION

Charleston Environmental Detachment (CED) was contracted by SDIV to develop a Tank Management Plan (TMP) that facilitates the identification and efficient closure of tanks and pipelines requiring remedial action. The scope of services for the work is described in the Statement of Work and the corresponding proposal developed by the Charleston Environmental Detachment.

1.1 BACKGROUND AND PURPOSE

Charleston Naval Complex was placed on the 1993 Base Realignment and Closure Commission list by a bipartisan commission appointed by the President and confirmed by the Senate in accordance with the Defense Base Closure and Realignment Act of 1990. The primary goal is to effect an efficient transfer of areas suitable for property transfer and to identify and coordinate the necessary remedial actions for areas not suitable for immediate transfer. The recent Environmental Baseline Survey (EBS) divided the Charleston Naval Complex into twelve zones. The EBS was performed by Ensafe/Allen & Hoshall Inc. Petroleum sites at the base fall into three categories:

- Areas suitable for immediate transfer of property
- Areas requiring additional investigation under State petroleum storage tank guidelines
- Areas requiring additional investigation under the Navy's Installation Restoration Program (IR)

The primary goal of the BRAC effort is to assess and, if necessary, remediate sites at the base as quickly as possible to allow property transfer. The TMP will only address those areas that fall within State petroleum storage tank guidelines.

1.2 SCOPE

The scope of services:

- Identification, classification, and location of existing petroleum storage tank systems and pipelines at the Charleston Naval Complex and associated annexes
- Provide site maps of tanks and pipeline locations
- Develop generic procedures for the proper closure of existing petroleum storage tanks and pipelines
- Effective and efficient handling and disposal of IDW

1.3 TANK SITES NOT INCLUDED IN THE TANK MANAGEMENT PLAN (TMP)

Several tank sites at the Charleston Naval Complex and associated annexes are not included in the TMP as they will handled under other contracts. The storage tank systems that are not included in this plan are:

- Tanks associated with the new Naval Hospital
- Chicora Tank Farm
- Temporary Tanks

In addition, Tanks containing propane are not be addressed by this TMP. Propane is not considered a petroleum contamination risk because it is highly volatile and would be released as a gas, not a liquid or solid. The TMP addresses the removal and possible investigation of those tanks that contain petroleum products that may lead to soil, surface water, or groundwater contamination.

1.4 NON-PETROLEUM TANKS

Although the TMP is primarily written to deal with petroleum storage tanks, it is possible that some tanks which have contained solvents or chemicals may be found during building closure and UST work. These non-petroleum tanks will be identified to SDIV and handled as Chemical USTs per the SC Underground Storage Tank Control Regulations, R. 62-92, Part 280. If an assessment reveals that there has been a release into the environment from a chemical UST/AST, additional investigation of that release would be transferred to the RCRA program.

1.5 RESPONSIBILITY ASSIGNMENT MATRIX

The Responsibility Assignment Matrix (RAM), shown in Table 1-1, outlines the specific tasks associated with a project. Each member of the project team is assigned responsibility for a given task. A team member's responsibility can be designated as lead, support, review, approval, or information. The team member with the lead (L) responsibility is tasked with taking the lead in terms of project coordination, execution, and staffing. The support (S) role is one in which the team member will provide task support to the lead team member when called upon. Those members of the team responsible for review of a task or a task specific report are designated with an (R). Those team members who hold approval authority for a task completion or approval of a document are designated with an (A). In many instances, team members are tied into the loop for informational purposes. In these cases, the team members are designated with an (I).

The team members for the tasks associated with the TMP include SDIV, a CLEAN/RAC contractor, CED, and the South Carolina Department of Heath and Environmental Control (DHEC).

Table 1-1
Petroleum Assessment and Remediation Responsibility Assignment Matrix (RAM)

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

TASK	CED	Contractor	SCDHEC	SDIV
Develop Tank Management Plan	L		I	A
Inventory Tanks	L			
Identify Removals	S			L
Prioritize Removal	S			L
Sample Unknown Tank Contents	L			
Removal Work Plan	L			A
Removal Health and Safety Plan	L			A
Removal Quality Control Plan	L			A
Removal Budget	L			A
Removal Schedule	L			A
Tank Removals	L		A/I	A
Remove Tank Contents	L			
Sample Tank Bottom Sludge	L			
Remove Tanks	L			
Perform Interim Soil Removals	L			
Waste Transport and Disposal	L			
Fill /Grade Excavation	L			
Contamination Assessment	L	S	A	A
Contamination Assessment Report	L	S	A	A
Monitoring	L	S	A	A
Monitoring Only Plan	L	S		
Install/Remove Monitoring Wells	L	S		
Perform Monitoring	L	S		
Closure Report	L	S	A	A

Notes CED = Charleston Environmental Detachment
BEI = Bechtel Environmental, Inc.
DHEC = South Carolina Department of Health and Environmental Control
SDIV = Southern Division, Naval Facilities Engineering Command

I = Information
L = Lead Responsibility
S = Supporting Responsibility
R = Review Responsibility
A = Approval

2.0 REGULATORY REQUIREMENTS

South Carolina control regulations for underground storage tanks are contained in DHEC regulation R.61-92, Part 280, "Underground Storage Tank Control Regulations, March 23, 1990". In addition to the state's UST regulation, the following industry and regulatory guidance documents were used in developing the TMP and will be used in subsequent tank removal and assessment operations:

- DHEC, "UST Assessment Guidelines for Permanent Closure and Change-In-Service," June 1995;
- DHEC, "Soil/Groundwater Remediation Guidance Document," March 3, 1992,
- DHEC, "Hydrogeologic Assessment Guidance Document," April 4, 1991;
- American Petroleum Institute Recommended Practice 1604, "Removal and Disposal of Used Underground Petroleum Storage Tanks";
- American Petroleum Institute Recommended Practice 2015, "Cleaning of Petroleum Storage Tanks";
- DHEC, "Standard Limited Assessment," June 1995;
- DHEC, "Risk-Based Corrective Action For Petroleum Releases," June 1995;

For the most part, the main exemption under the UST regulations which pertains to the Charleston Naval Complex are USTs used for storing heating oil for consumptive use on the premises where stored. Also, there are no DHEC environmental regulations designed specifically to regulate the use of petroleum aboveground storage tanks (ASTs). Therefore, the ASTs and most of the USTs in the Charleston Naval Complex are exempt from the DHEC regulations governing use, transfer, and closure under the UST program. Although these storage tank systems are exempt from regulation, the possibility of previous releases to soil and groundwater must be considered; therefore, the UST recommendations and regulations are used in assessing both exempt and regulated USTs as well as ASTs and associated piping. Copies of these regulations, guidance documents, and recommended practices are presented in Appendix A.

3.0 STORAGE TANK DATA, INVENTORY AND LOCATIONS

3.1 DATA COLLECTION METHODS

The following section describes data collection methods for field screening and waste sampling.

3.1.1 Field Screening

Field Screening analysis was accomplished using a Photovac model 2020 photo ionization detector (PID). Although the dependability of PID is questionable under different operating conditions, the purpose of field screening was to provide general knowledge of the site's contamination level. In addition to PID readings, the soil's odor was also used as a field screening tool.

A background level for volatile organic was measured by recording the PID readings of a soil sample at a similar depth in an area assumed to be free of contamination. PID readings were in the range of 2 - 3 ppm TPH. For the purpose of this report, PID readings above 10 ppm TPH were considered to be evidence of some level of contamination. PID readings below 10 ppm TPH were considered to be inconclusive and require further investigation to eliminate the site as a suspected source of contamination. Further investigation was beyond the scope of this report.

The methods used to accomplish PID field screening was the polyethylene bag method and a slightly modified bag method using a jar and plastic wrap. All field screening was accomplished using EPA document EPA/530/UST-90/003 *Field Measurements - Dependable Data When You Need it* - September 1990 as a guide. In general, the soil sample was collected and placed in a bag and sealed. The container was agitated for approximately two minutes and then scanned using a PID. Reading times varied and were terminated when readings started to decrease or stabilized.

Field sampling procedures involved augering a hole at each end of the tank and one at the approximate middle to a depth just at the water table. Subsurface interference could cause variations in the location of the holes and possible elimination of the hole completely. The depth of the hole varied from location to location and was based on the depth to ground water. As soon as a PID reading over 10 ppm TPH was recorded no further sampling was performed.

All of the USTs at the Charleston Naval Complex could not be field screened due to various difficulties.

- In many cases, subsurface obstructions were encountered at various depths even though preliminary probing was accomplished using a fiberglass rod. These obstructions required additional holes to be augered at a slightly different location. Subsurface obstructions could include piping, roots, construction debris, etc.

- Tanks totally covered by concrete or asphalt could not be screened. The hit and miss nature of manual augering of sampling holes was not conducive to concrete coring. In many cases, the facility drawings were not available or the drawings were not sufficiently detailed to determine the tanks orientation or exact location thus complicating the field screening effort.

Due to the difficulty in accomplishing field screening and the inconsistent/inconclusive nature of PID readings, field screening was discontinued. To aid in the closure of the USTs and ASTs covered by this report, CED is investigating the potential use of immunoassay analysis to facilitate more accurate soil screening during removal operations.

In the absence of field screening data, age, depth, material of construction, and known corrosion preventive measures were considered in determining the potential for tank leakage. Additionally, several other sources of information were used to developed tank removal determinations.

- The Navy's policy for tank closure is tank removal
- Industry's life expectancy "rule of thumb" for an unprotected UST is approximately 16 years
- A SDIV memo (Code 1143/13 dated 2 December 1987) states that all tanks older than 16 years should be removed.

3.1.2 Tanks Containing Unknowns/Waste Oil

Tanks containing waste oil or unknown substances will be sampled for the eight RCRA metals and F001-F005 solvents. In some cases, sampling could not be performed due to the efforts of a Charleston Naval Shipyard task team which cleaned and placed some tanks in a temporary closure status. Oil collected from these cleaning procedures was placed in the used oil recycling program. Unacceptable material was disposed of properly as hazardous waste. Additional sampling was not possible in these instances and the previous results of the sampling efforts were used in compilation of this report for the tanks involved. The results are provided in Appendix B.

3.1.3 Other Areas of Concern

In several instances, possible tank locations were identified which could not be confirmed due to past facility demolition. Site investigations and facility drawing searches were performed; however, the results were inconclusive and no record of removal could be found. These tanks are listed in the TIMS and annotated in the remarks section. Further investigation is recommended to appropriately address the possibility of contamination.

3.2 TANK INVENTORY MANAGEMENT SYSTEM (TIMS) DATABASE

The TIMS database was developed for SDIV in 1988 as part of the storage system management plan. The TIMS database was developed as a dynamic management tool to provide the activity and SDIV data on the physical information for the storage systems at the activity.

The TIMS database was developed to contain mainly the physical information on a single database with capabilities to query for specific storage system characteristics and to provide a user-friendly system for managing all the storage systems at each naval activity.

3.2.1 Description of the TIMS

TIMS was developed for SDIV on a personal computer using DBASE III Plus Software. Later, SDIV developed and incorporated a more user-friendly menu program into the system using the CLIPPER™ software package.

3.2.2 TIMS Information Sources

The information contained in TIMS was obtained from the following sources:

- Naval activity reports related to petroleum storage systems previously prepared for SDIV by Harding Lawson Associates (1986)

- Environmental Baseline Survey previously submitted by Ensafe/Allen & Hoshall (1994)

- RCRA Facility Assessment previously submitted by Ensafe/Allen & Hoshall (1995)

- RCRA Facility Investigation Work Plan for Zone H previously submitted by Ensafe/Allen & Hoshall (1995)
- Information including design drawings and contract specifications for storage tank systems, provided by naval activity personnel
- Information sources such as building inventory lists, and contract petroleum supplier lists
- Various Shipyard Correspondence
- Field investigations performed in conjunction with completion of the TMP by the Charleston Environmental Detachment personnel
- Tank list developed by the Charleston Naval Shipyard tank cleaning closure group

3.2.3 Information Contained in the TIMS Database

TIMS contains information on two areas of storage tank management. These two areas include naval activity information and physical information on the storage tank system.

As part of the TMP, the TIMS database was updated based on information obtained during the Environmental Baseline Survey and preliminary UST and AST surveillance the Charleston Environmental Detachment conducted at Charleston Naval Complex and its annexes in the Summer and Fall of 1995. In addition, other explanations and clarifications of the field findings were included. Appendix C contains a copy of the updated database in tabular form. The appendix includes Table C-1, physical information on storage systems. An electronic self extracting archive of the TIMS database for the Charleston Naval Complex is contained on a 3-1/2" computer diskette in Appendix C. Two copies are included.

3.3 TANK LOCATIONS AND SCHEDULE

This section discusses the number of USTs and ASTs at Charleston Naval Complex and its annexes and illustrates their locations on figures. Information presented in this section was compiled from the TIMS database, the Environmental Baseline Survey, and preliminary UST and AST location surveillance's conducted by the Charleston Environmental Detachment.

3.3.1 Site Location

The Charleston Naval Complex is located in and around Charleston, South Carolina. The Complex consists of five distinct areas. The main facility is the Naval Base. Four additional areas are located in various areas around the local commuting area. Figure 3-1 shows approximate locations of the facilities.

- Naval Base Charleston is comprised of 2,985.64 acres situated on the western bank of the Cooper River.
- The Naval Station Annex is comprised of 42 acres used for housing, small maintenance activities, and ancillary activities.
- The Naval Shipboard Electronic Systems Evaluation Facility (SESEF) is located on Sullivan's Island, South Carolina. The total area involved is 4.08 acres. (This facility was transferred to NISEEAST and will not be covered in this report).

- The Degaussing Station is comprised of a building and degaussing pier on 2.81 acres in downtown Charleston, South Carolina.

- The Short Stay Facility is a recreational facility in Berkeley County, South Carolina, used by naval station personnel and dependents. The facility is comprised of 56.6 acres leased from the South Carolina Public Service Authority. Recently, the facility was transferred to CINCLANTFLT.

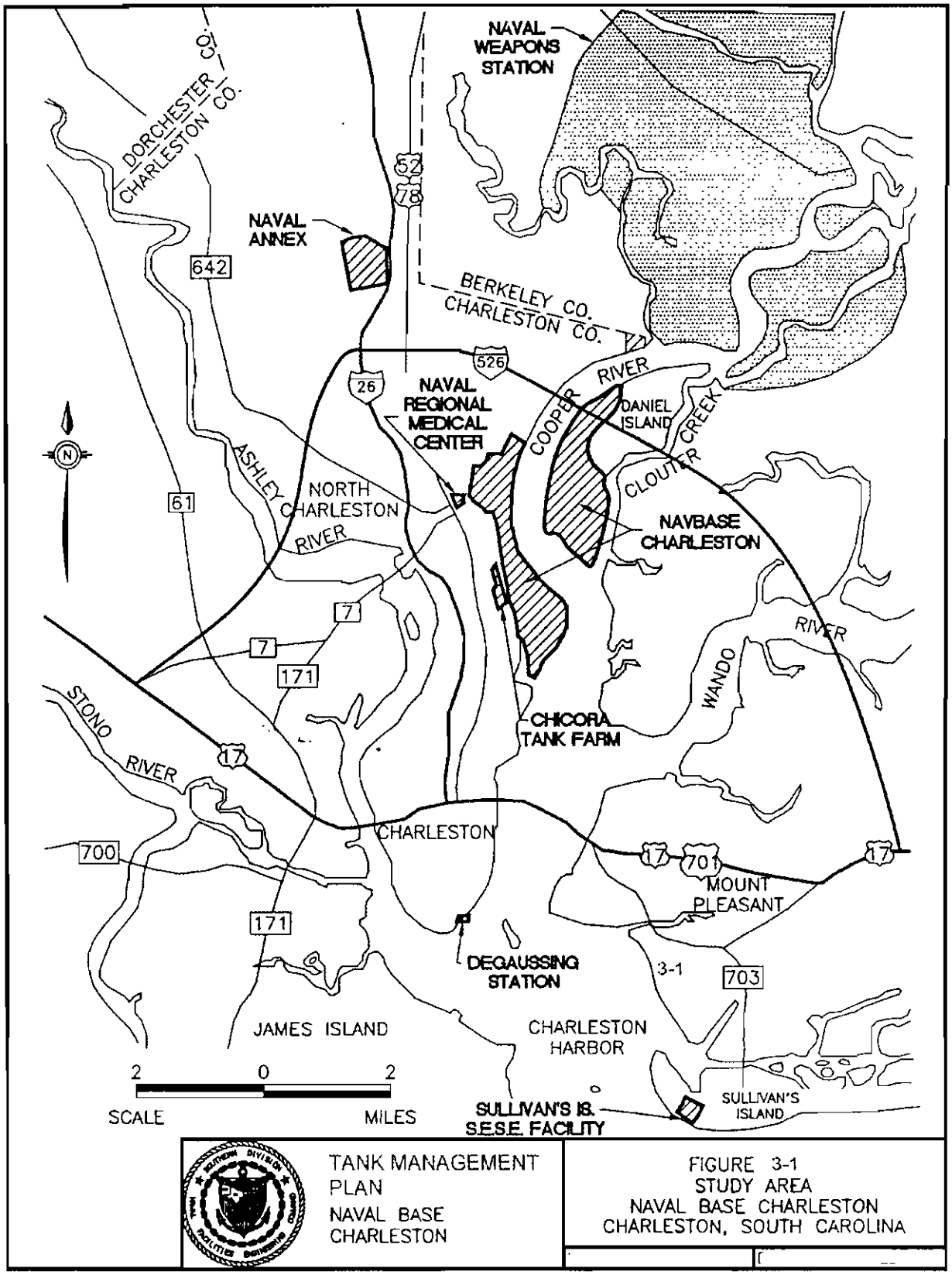
3.3.2 Tank Removal and Closure Schedule

Currently, there are 230 inventoried storage tank systems in the TIMS database at the Charleston Naval Complex. Of these 230 tanks, 27 have been removed/closed or have been scheduled for removal under separate contracts. A schedule, developed by the Charleston Naval Environmental Detachment, calls for the removal of 27 tanks in 1996, 56 tanks in 1997, and 47 tanks in 1998. Information showing the number and type of tanks at each of the Charleston Naval Complex facilities and the removal year is presented in Table 3-1. Maps showing tank locations, types, identification numbers, contents, removal dates, and regulatory status are contained in Appendix D.

In addition, 19 USTs will require further investigation due to demolition of the surrounding building and/or the inability to locate records describing tank removal. There are 39 ASTs which will require assessment in accordance with paragraph 4.3. These tank assessments and investigations will be accomplished and scheduled as needed.

The tank removal schedule was developed by the Charleston Environmental Detachment, and is based on the future use of the building, evidence of contamination, and the age and condition of the tank. All tank removals have been scheduled to occur after the official BRAC closure date (1 April 1996).

The Charleston Environmental Detachment will perform tank removal operations, initial remedial actions, and soil and groundwater assessments for this project. The Charleston Environmental Detachment will make every attempt to assess storage tank locations and retain a backlog of sites where IRAs will be conducted so that scheduling of sites in advance will be possible.


NAVAL WEAPONS STATION
DORCHESTER CO.
CHARLESTON CO.
52
78
NAVAL ANNEX
642
BERKELEY CO.
CHARLESTON CO.
526
26
NAVAL REGIONAL MEDICAL CENTER
COOPER RIVER
DANIEL ISLAND
CLOUTER CREEK
ASHLEY RIVER
NORTH CHARLESTON
61
NAVBASE CHARLESTON
7
7
171
RIVER
WANDO
STONO RIVER
17
CHICORA TANK FARM
CHARLESTON
700
17
701
17
MOUNT PLEASANT
171
DEGAUSSING STATION
3-1
703
JAMES ISLAND
CHARLESTON HARBOR
2 0 2
SCALE MILES
SULLIVAN'S IS. S.E.S.E. FACILITY
SULLIVAN'S ISLAND
TANK MANAGEMENT PLAN
NAVAL BASE CHARLESTON
FIGURE 3-1
STUDY AREA
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA

A total of 130 tanks are currently scheduled for removal from the Charleston Naval Complex. It is expected that most of the tanks will require soil and possibly groundwater assessment. Large field constructed tanks and ASTs require further assessment/investigation and then subsequent closure scheduling as applicable.

Table 3-1
Storage Tank Removal by Base Area and Year

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Base Area	1996		1997		1998		Total	
	AST	UST	AST	UST	AST	UST	AST	UST
Shipyard	2	18	*	25	*	26	2	69
Naval Station	*	7	*	20	*	21	*	48
Naval Station Annex	0	0	8	3	0	0	8	3
Degaussing Facility	0	0	0	0	0	0	0	0
Total	2	25	8	48	0	47	10	120

Notes: AST = aboveground storage tanks
UST = underground storage tanks
* = disposition of ASTs pending assessment per paragraph 4.3

4.0 TANK CLOSURE AND ASSESSMENT PROCEDURES

The following chapter presents the tank closure and assessment procedures for tank removal operations, contaminated site assessment, and remediation associated with this project. Procedures contained in this TMP should be used in coordination, cooperation, and conjunction with the RAC contractor. This TMP provides guidance for development of tank removal work plans. These work plans will be developed prior to tank removal operations.

Procedures described in this chapter are designed to obtain the necessary information for the DHEC, Underground Storage Tank Assessment Guidelines and reach tank closure in an effective and efficient manner. A copy of these requirements are contained in Appendix A of this TMP.

The success of this TMP and the tank removal project will depend on successful communication, cooperation, and coordination among all team members designated in the RAM. Because the schedule is ambitious and very important in this program, completing assigned tasks in the RAM, on schedule, is essential to the success of the program.

In some circumstances, facilities have been leased and the UST or AST provides the only means of heating the facility. In order to provide necessary heating for the facilities, a new or temporary AST will be installed in accordance with appropriate regulations to accommodate heating demands.

4.1 REGULATED UNDERGROUND STORAGE TANKS (USTs)

The decision making process for UST removal, contamination assessment, and, if necessary, remediation at the Charleston Naval Complex sites is presented in the flow chart shown on Figure 4-1 and discussed in the following sections.

Regulated USTs are defined as those USTs that are greater than 110 gallons in capacity and the volume of which (including the volume of underground pipes connected thereto) is 10 percent or more beneath the surface of the ground. USTs described in the exclusions and exceptions under DHEC Underground Storage Tank Control Regulations R.61-92, Part 280 are not classified as regulated USTs.

4.1.1 UST Assessment Report

Procedures for assessing regulated USTs with no visible evidence of contamination or prior history of releases will follow the UST system closure procedures established in DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service*. The Charleston Environmental Detachment will collect and analyze all appropriate soil and groundwater samples associated with closure procedures. An EPA certified lab will be used in conjunction with Table 4-1. Each tank will have an Assessment Report form completed per DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service* and submitted to the DHEC Department of Defense (DOD) petroleum contact.

4.1.1.1 Tank Removal Operations

After a utility search, the Charleston Environmental Detachment will remove the USTs and perform all soil sampling/screening during the tank removal process. Soil samples collected during tank removal may also have headspace screening performed using a Photovac model 2020 PID. The best method for this field analysis is the polyethylene bag method described in EPA Publication #530/UST-90-003, September 1990, *"Field Measurements, Dependable Data When You Need It"* . Alternative methods for field screening may be used, such as, immunoassays.

Field sampling is a valuable tool in locating areas of possible release, but since the only information currently available from field sampling is for Total Petroleum Hydrocarbons (TPH), its usefulness is limited and cannot be used to consider a tank removal site clean. Instead, laboratory sampling for specific chemicals of concern (COC) will be performed as outlined in Table 4-1. These COC's will be checked using SC DHEC's *Risk Based Corrective Action for Petroleum Releases* (RBCA), dated June 1995 as guidance using the risked based screening levels (RBSL's) to determine whether soil is contaminated. Soil with COC's below the RBCA RBSL's will be returned to the excavation, while contaminated soil will be removed from the excavation and treated.

Free product encountered in the excavation pit will also be removed using the best available method (i.e. vacuum truck, skimmer pump, sorbent pads, etc.). Contaminated soil will be removed to the assessed depth of contamination or to the water table, whichever comes first. Excavation limitation aspects include but are not limited to, the following: (1) jeopardizing the structural integrity of a building, or (2) exceeding the abilities of the Charleston Environmental Detachment. As a guide, excessively contaminated soil is described as soil that is saturated with petroleum or petroleum products or soil that has COC's that are above the RBCA RBSL's. After the excessively contaminated soils are removed, final confirmatory sampling will be done in accordance with DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service*.

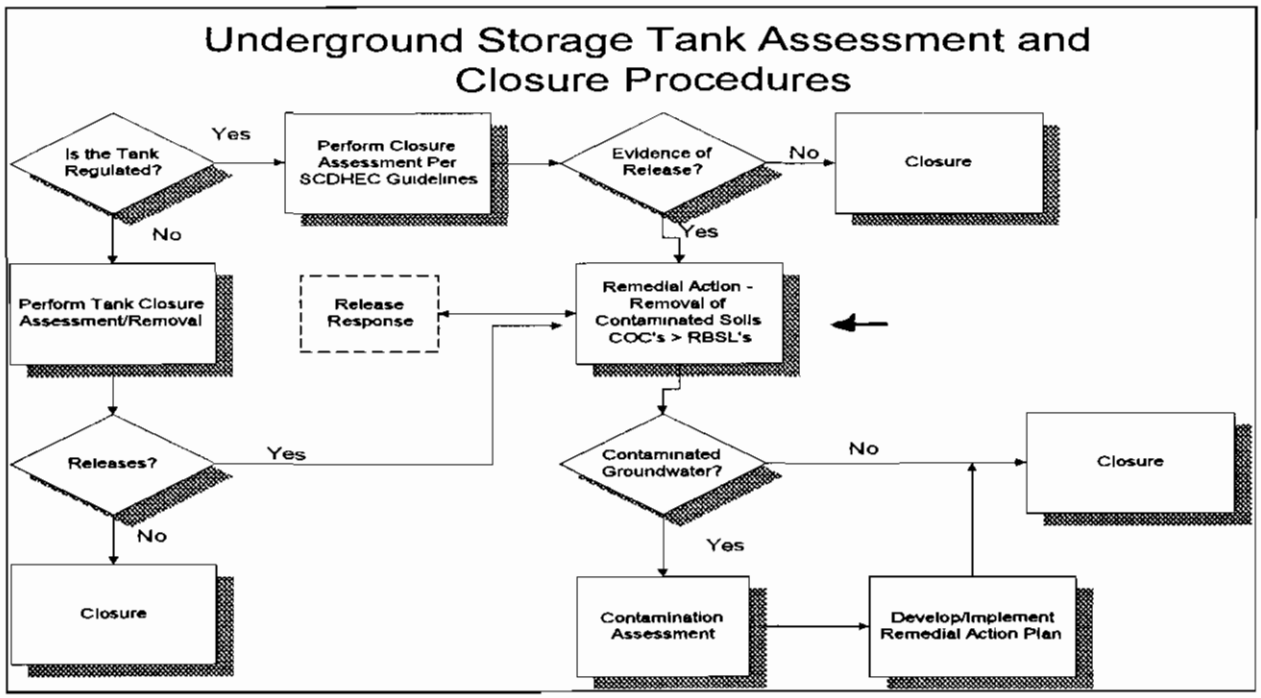


Figure 4 - 1

4.1.1.2 Assessment Program at Sites Where USTs Have Previously Been Removed

Although previously removed UST assessment does not fall under the scope of this document, it is recommended that investigations be performed to evaluate removal actions of tanks where a closure report does not exist. Some tanks were removed during a time period where, although not illegal, the methods of removal were not in compliance with today's strict standards. A contamination assessment is recommended.

4.1.2 Contamination Assessment and Initial Remedial Actions

If petroleum contamination remains either in the soil or groundwater after tank removal activities, a contamination assessment will be conducted. After development of an approved sampling plan, a soil boring program will be initiated to assess the horizontal and vertical extent of soil contamination. Soil borings will be advanced to the water table with samples being collected at 1 foot bls and every 2 feet thereafter until the water table is encountered. Samples collected from the soil borings will be field screened utilizing a PID or immunoassay analysis.

4.1.2.1 Initial Remedial Soil Removal Actions

After the horizontal and vertical extent of the contaminated soil has been assessed, the Charleston Environmental Detachmeut will remove the contaminated soil from the site and replace it with clean fill. Free product encountered in the excavation will be removed using the best available method (i.e., vacuum truck, skimmer pump, sorbent pads, etc.) Final determination of contaminant removal will be made using lab analysis and Table 4-1.

Table 4-1
Petroleum Analytical Groups
for Surface Water and Groundwater Samples
South Carolina Department of Health and Environmental Control

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

PRODUCT	SOIL SAMPLES			WATER SAMPLES		
	Analyate	**Method***	**RL****	**Analyate**	**Method***	**RL****
Gasoline	BTEX	8260	5ug/kg	BTEX	8260	5ug/l
Diesel	Naphthalene	8260	5ug/kg	Naphthalene	8260	5ug/l
Fuel Oil	PAH	8270	660ug/kg	MTBE	8260	40ug/l
Kerosene				PAH	8270	10ug/l
Used Oil	BTEX	8260	5ug/kg	BTEX	8260	5ug/l
	Naphthalene	8260	5ug/kg	Naphthalene	8260	5ug/l
	PAH	8270	660ug/kg	PAH	8270	660ug/l
	TPH	9071	10mg/kg	TPH	9070	10mg/l
	Metals	AA-ICP		Metals	AA-ICP	

BTEX	=	Benzene, Toluene, Ethyl-benzene, Xylene
PAH	=	Polynuclear Aromatic Hydrocarbons (Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene)
MTBE	=	Methyl Tertiary Butyl Ether
TPH	=	Total Petroleum Hydrocarbon
METALS	=	Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver
AA-ICP	=	Atomic Absorption - Inductively Coupled Plasma
*	=	Or EPA equivalcnt method
**	=	Reporting Limit (RL)

4.1.2.2 Decision Process

If groundwater contamination exists at the site in significant amounts or soil contaminant levels continue to be above the levels for excessively contaminated soil, further contamination assessment will be conducted at the site to assess the horizontal and vertical extent of groundwater and soil contamination. If no or minimal groundwater contamination is detected at the site and soil contaminant levels are below the levels for excessively contaminated soil, the UST Assessment Report should suffice as a site closure report.

Further contamination assessment will be performed for the site when groundwater contaminant concentrations exceed the target levels for clean closure or excessively contaminated soil is still present.

4.2 NON-REGULATED USTs

The decision making process for UST removal, assessment and, if necessary, remediation at non-regulated UST sites is presented in the flow chart shown on Figure 4-1 and discussed in the following sections.

Regulated USTs are defined as those USTs that are greater than 110 gallons in capacity and the volume of which (including the volume of underground pipes connected thereto) is 10 percent or more beneath the surface of the ground. USTs described in the exclusions and exceptions under DHEC Underground Storage Tank Control Regulatious R.61-92, Part 280 are not classified as regulated USTs.

Non-regulated USTs that will be removed at the Charleston Naval Complex are predominantly heating oil storage tanks over 16 years old. Propane tanks have not been included in this TMP.

4.2.1 UST Assessment Report

Because the Charleston Naval Complex is being closed and base property transferred, non-regulated USTs on the base should undergo closure assessment similar to the requirements for regulated USTs. Therefore, the Charleston Environmental Detachment will collect and analyze appropriate soil and groundwater samples associated with UST closure procedures. Each tank will have an Assessment Report form completed per DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service* and submitted to the DHEC DOD petroleum contact.

4.2.1.1 Tank Removal Operations

After a utility search, the Charleston Environmental Detachment will remove the USTs and perform all soil sampling/screening during the tank removal process. Soil samples collected during tank removal may also have headspace screening performed using a Photovac model 2020 PID. The best method for this field analysis is the polyethylene bag method described in EPA Publication #530/UST-90-003, September 1990, *"Field Measurements, Dependable Data When You Need It"* . Alternative methods for field screening may be used, such as, immunoassays.

Field sampling is a valuable tool in locating areas of possible release, but since the only information currently available from field sampling is for Total Petroleum Hydrocarbons (TPH), its usefulness is limited and cannot be used to consider a tank removal site clean. Instead , laboratory sampling for specific chemicals of concern (COC) will be sampled for as outlined in Table 4-1. These COC's will be checked using SC DHEC's *Risk Based Corrective Action for Petroleum Releases* (RBCA), dated June 1995 as guidance using the risked based screening levels (RBSL's) to determine whether soil is contaminated. Soil with COC's below the RBCA RBSL's will be returned to the excavation, while contaminated soil will be removed from the excavation and treated.

Free product encountered in the excavation pit will also be removed using the best available method (i.e. vacuum truck, skimmer pump, sorbent pads, etc.). Contaminated soil will be removed to the assessed depth of

contamination or to the water table, whichever comes first. Excavation limitation aspects include but are not limited to, the following: (1) jeopardizing the structural integrity of a building, or (2) exceeding the abilities of the Charleston Environmental Detachment. As a guide, excessively contaminated soil is described as soil that is saturated with petroleum or petroleum products or soil that has COC's that are above the RBCA RBSL's. After the excessively contaminated soils are removed, final confirmatory sampling will be done in accordance with DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service*.

4.2.1.2 Assessment Program at Sites Where USTs Have Previously Been Removed

Although previously removed UST assessment does not fall under the scope of this document, it is recommended that investigations be performed to evaluate removal of tanks where a closure report does not exist. Some tanks were removed during a time period where, although not illegal, the methods of removal were not in compliance with today's strict standards A contamination assessment is recommended.

4.2.2 Contamination Assessment and Initial Remedial Actions

A modified contamination assessment will be conducted at each site that continues to have contamination either in the soil or groundwater following tank removal. After development of an approved sampling plan, a soil boring program will be initiated to assess the horizontal and, perhaps, vertical extent of soil contamination. Soil borings will be advanced to the water table and soil samples will be collected at 1 foot bls and every 2 feet thereafter, until the water table is reached. Soil samples collected from soil borings will be screened with a PID or immunoassay.

4.2.2.1 Initial Remedial Soil Removal Actions

After the horizontal and vertical extent of contaminated soil has been assessed, the Charleston Environmental Detachment will remove the contaminated soil from the site and replace it with clean fill. In addition to the contaminated soil, if any free product is encountered in the excavation pit, it will be removed by the best available method (i.e., vacuum truck, skimmer pump, sorbent pads, etc.). Final determination of contamination removal will be made using lab analysis and Table 4-1.

4.2.2.2 Decision Process

If groundwater contamination exists at the site in significant amounts or soil contaminant levels continue to be above the levels for excessively contaminated soil, further contamination assessment will be conducted at the site to assess the horizontal and vertical extent of the groundwater and soil contamination. If no or minimal groundwater contamination is detected at the site and soil contaminant levels are below the RBCA RBSL's for excessively contaminated soil, the UST Assessment Report should suffice as a site closure report.

4.3 AST TANK CLOSURE ASSESSMENT

The decision making process for AST removal, assessment, and if necessary, remediation of AST sites is presented in the flow chart shown on Figure 4-2 and discussed in the following sections.

Currently, the state of South Carolina has no regulations governing the removal and closure of ASTs. In determination of how to close the applicable ASTs on the Charleston Naval Complex a conservative approach will be used. ASTs will undergo closure and assessment using procedures for regulated UST closure as a guide. The Charleston Environmental Detachment will collect and analyze appropriate soil and/or groundwater samples associated with AST closure procedures.

4.3.1 Tank Removal Operations

The Charleston Environmental Detachment will remove the ASTs, if necessary. Maps accurately depicting the locations of the ASTs have been developed as part of the TMP; therefore, tank locations can be found after removal. Soil excavation is not expected to occur during AST tank removal.

4.3.2 Soil Boring Program at AST Sites

The ASTs have been divided into two categories based on the tank size. For those ASTs with capacities greater than 550 gallons, five soil borings will be conducted. One soil boring will be placed directly beneath the area where the tank was located with four additional soil borings being placed around the tank perimeter at a maximum spacing of 20 feet. For ASTs of less than 500 gallon capacity, a minimum of one soil boring will be conducted. In each case, additional borings may be required based on piping configuration, visual evidence of a release, or if historical data on the tank system indicates that a release occurred at the site. For AST's installed in concrete berms, the number of soil borings/samples and locations will be based on engineering evaluation of the berm and the tank system. The soil boring will be advanced to the water table and soil samples will be collected at 1 foot bls and every 2 feet thereafter until the water table is encountered. Soil borings will be conducted via hand augering. It should be noted that a utility search will be performed for each site prior to soil boring.

If soil contamination is not detected during the soil boring program, no further assessment will be conducted at the site and a closure report will be prepared. If soil screening analyses indicate a discharge occurred at the site or there is soil contamination, an IRA will be initiated.

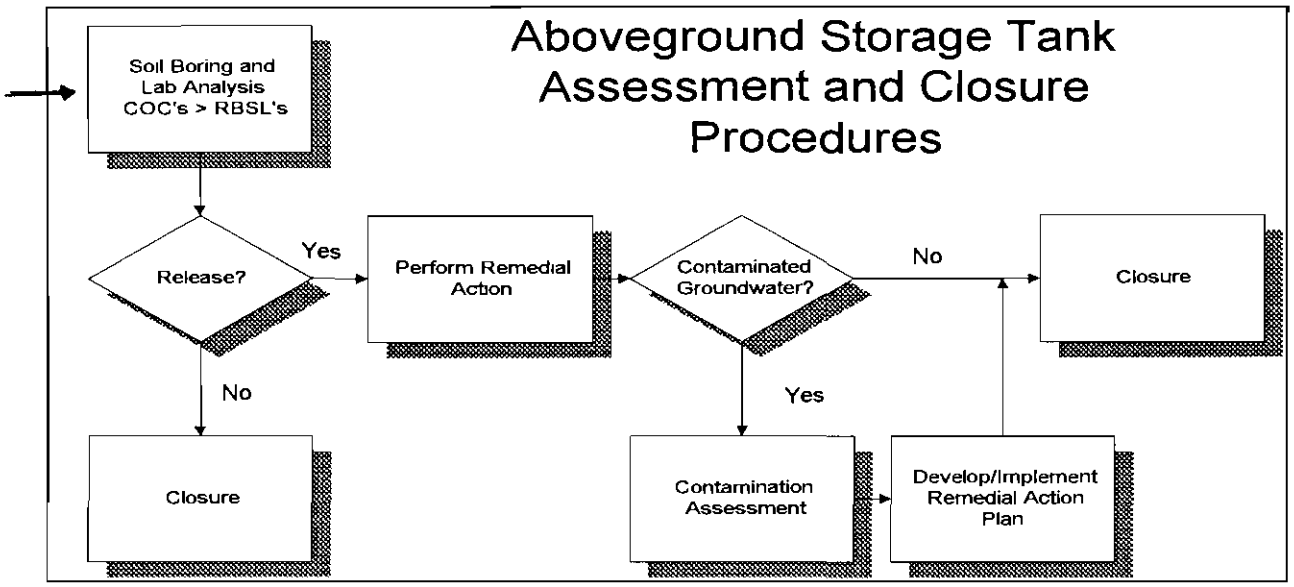


Figure 4 - 2

4.3.3 Initial Remedial Soil Removal Actions

The Charleston Environmental Detachment will assess the extent of soil contamination before performing IRA activities by conducting additional soil borings. Once the horizontal and vertical extent of contaminated soil has been assessed, the contaminated soil will be removed and replaced with clean fill. The detachment will advance soil borings around the perimeter of the excavation and collect samples to verify, based on RBCA RBSLs, that

petroleum contaminated soil has been removed from the site. Free product encountered in the excavation will be removed using the best available method (i.e., vacuum truck, skimmer pump, sorbent pads, etc.).

Contaminated soil will be removed to the assessed depth of contamination or to the water table, whichever comes first. Excavation limitations include but are not limited to, the following: (1) jeopardizing the structural integrity of a building, (2) exceeding the capabilities of the Charleston Environmental Detachment.

4.3.4 Decision Process

If groundwater contamination exists at the site in significant amounts or soil contaminant levels continue to be above the levels for excessively contaminated soil, further contamination assessment will be conducted at the site to assess the horizontal and vertical extent of the groundwater and soil contamination. If no or minimal groundwater contamination is detected at the site and soil contaminant levels are below the RBCA RBSL's for excessively contaminated soil, the UST Assessment Report should suffice as a site closure report.

4.4 POST TANK REMOVAL PLANNING AND SCHEDULING

Upon completion of tank removal operations, additional assessment work will be conducted at those sites that have confirmed soil or groundwater contamination. Investigations and assessments will be coordinated to support the transfer of property as needed.

4.5 FIELD INVESTIGATION

Contamination Assessment (CA) phase of the project will continue at each site determined to require further assessment. The CA will continue with the placement and sampling of an appropriate number of groundwater monitoring wells at the site to adequately characterize the groundwater contaminant plume and to assess the horizontal and vertical extent of the plume. All monitoring wells, whether temporary or permanent, will have DHEC approval using the applicable request forms.

While groundwater monitoring wells provide the conventional approach to site assessment, the use of other innovative technologies will also be considered. Examples of site characterization techniques to be considered are, direct push technologies, small diameter monitoring wells, and other innovative field analytical methods which may give more timely and detailed analysis.

4.6 CONTAMINATION ASSESSMENT REPORT

Upon completion of field investigation and receipt of the groundwater laboratory analytical results of the groundwater samples, a Contamination Assessment Report (CAR) will be prepared and submitted to SDIV for review.

A general CAR will be prepared for tank sites at the Charleston Naval Complex which exhibited soil/groundwater contamination. The general CAR will discuss procedures and methodologies used during the assessment and remedial actions performed. Information will include a description of the soil and hydrology in the immediate area, local receptors, etc. The DHEC Assessment Report Form will be included in each case.

4.7 FOLLOW-UP REPORTS AND POTENTIAL REMEDIAL ACTION

Based on the findings and conclusions of the CARs, a No Further Action (NFA) proposal, a Monitoring Only Plan (MOP), or a Remedial Action Plan (RAP) will be prepared for each site.

5.0 MANAGEMENT OF INVESTIGATIVE DERIVED WASTES (IDW)

This Section describes procedures for IDW management that will be implemented during BRAC field investigation and IRAs at the Charleston Naval Complex tank removal sites. Section 5.1 defines specific types of IDW expected to be generated at the facility and presents the disposal options available for each type of IDW. Section 5.2 describes equipment and logistics that will be used for IDW management. A list of options for disposal of petroleum contaminated solid earthen waste and other non hazardous IDW are presented in Section 5.3.

Procedures outlined in this section will be used at the Charleston Naval Complex to minimize the amount of IDW generated and to remove those wastes that pose an immediate threat to human health or the environment. While managing IDW, the goal of the project team is also to minimize disturbance of the site created by IDW handling, transportation, and management.

For the purposes of IDW management, a site is generally considered to be a discrete land area on or in which there is contiguous contamination. An example of such a site may include the area occupied by a UST or AST and the surrounding contaminated soil.

5.1 TYPE OF IDW

Three general types of IDW are expected to be generated during tank removal operations, field investigations, and IRAs: solid earthen wastes (e.g. dry drill cuttings), solid non-earthen wastes (e.g. personal protective equipment), and liquid wastes (e.g. purge water from monitoring wells and wash water from decontamination procedures). Subsections 5.1.1 through 5.1.3 provide general descriptions of solid and liquid IDW and the disposal options available for each. Figure 5-1 illustrates the steps in the solid IDW management decision making process. Figure 5-2 illustrates the steps in the liquid IDW management decision making process. IDW will be managed in accordance the Ensafe/Allen & Hoshall, *Final Comprehensive Sampling and Analysis Plan*.

Drilling mud and wet drill cuttings generated during mud rotary and hollow stem auger drilling activities are IDW that are composed of both liquids and solids; therefore, the strategies for liquid or solid waste management are, individually, not sufficient for these types of waste disposal. Specific procedures for the proper management of drilling mud and wet cuttings are presented in Subsection 5.1.3.

5.1.1 Earthen Waste

Contaminants of concern at UST program sites are assumed to be petroleum related products and, as such, are excluded from being classified as Resource Conservation and Recovery Act (RCRA) hazardous waste under the Code of Federal Regulations, Title 40, Part 261.4 (40 Code of Federal Regulation [CFR] 261.4). Petroleum contaminated earthen waste will be disposed using one or more of the approved disposal options. Options for disposal of petroleum contaminated soil are listed in Section 5.3.

All soils generated during investigations or UST removals will be appropriately containerized or stock piled until contamination levels can be determined. The following are possible disposal scenarios for the soils:

- Soil determined to be below RBCA RBSL's will be returned to the site.
- Soil determined to above RBCA RBSL's, but not a hazardous waste will be treated/disposed of using an applicable method listed in paragraph 5.3.
- Soil determined to be a listed hazardous waste or characteristically hazardous will be managed and disposed of in accordance with applicable State and Federal Regulations.

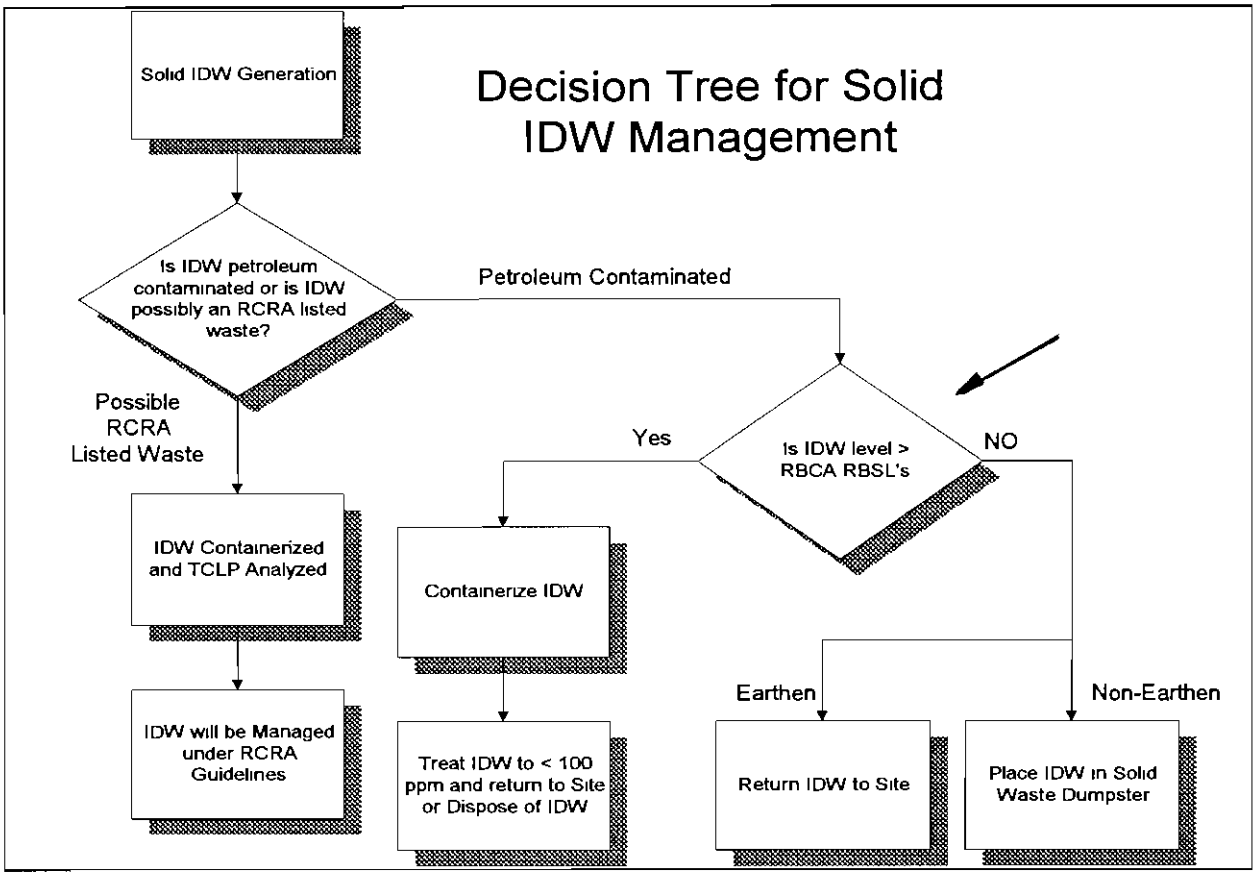


Figure 5 - 1

5.1.2 Liquid Waste

Liquid waste includes development or purge water from monitoring wells, decontamination fluids, and oily water from tank excavations. All liquid waste will be containerized until contamination levels are determined. The following are possible disposal scenarios for the liquids:

- Liquids meeting the NPDES discharge limits will be disposed of by discharging to a sanitary sewer.
- Liquid above NPDES limits for oily water will be processed through an oil water separator. The water will be discharged as described above. Resultant oily waste will be disposed of in accordance with applicable State and Federal regulations.
- Liquid containing listed RCRA wastes or is characterized as hazardous will be disposed of in accordance with the applicable state and Federal regulations.

5.1.3 Drilling Mud and Wet Drill Cuttings

Drilling mud and wet drill cuttings are characteristically slurries or sludge-like substances, consisting of both liquid and solid earthen constituents. Drilling mud should be containerized and temporarily stored at the location of generation. The mud containers must remain undisturbed to facilitate gravity separation of solids and liquids. The liquid waste will then be decanted and treated as liquid IDW as described previously.

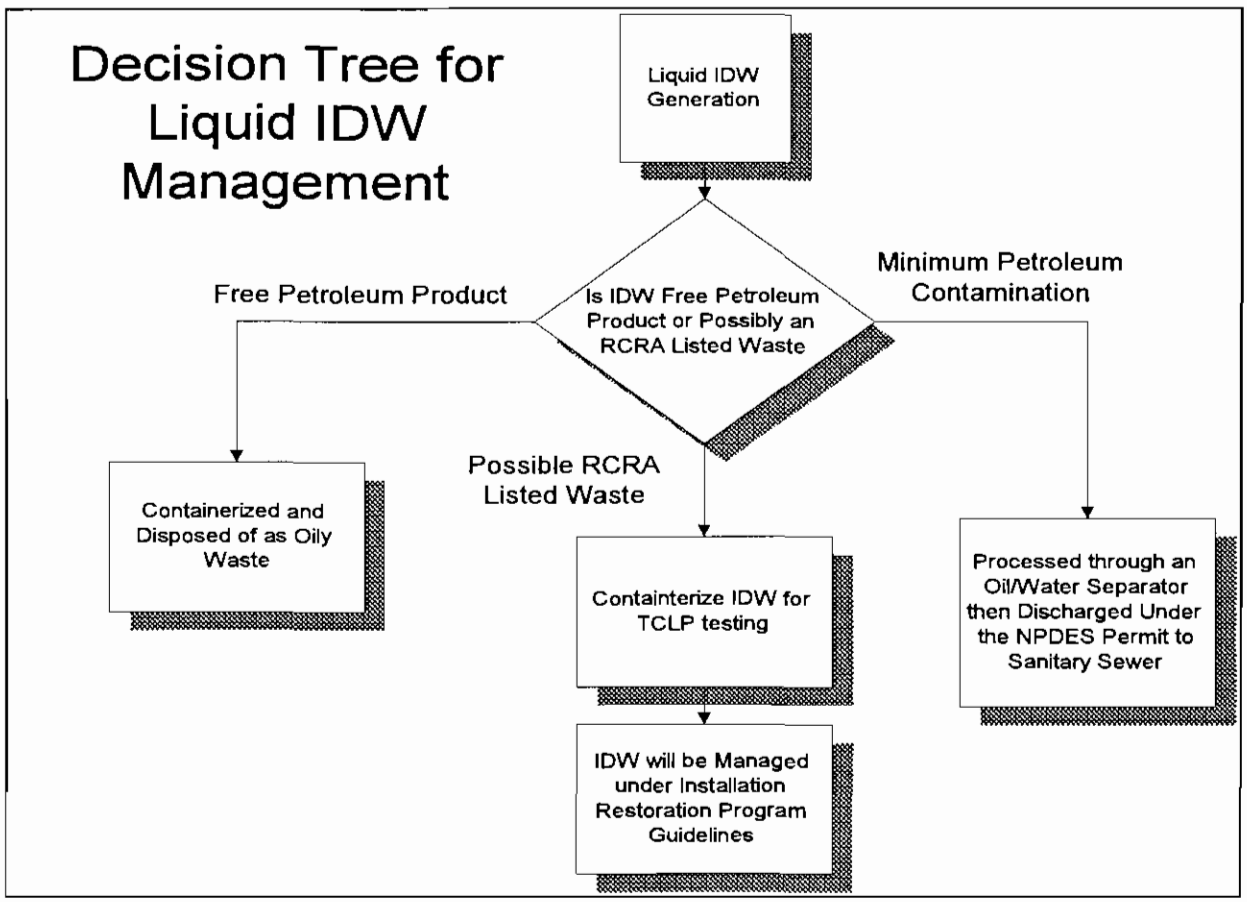


Figure 5 - 2

5.2 EQUIPMENT

5.2.1 Decontamination Pads

Equipment to be decontaminated during the project may include drilling rigs, tools, monitoring equipment, respirators, sample containers, trucks or trailers, and laboratory equipment. Decontamination will be accomplished using Ensafe/Allen and Hoshall's, *Final Comprehensive Sampling and Analysis Plan* which was developed for the Charleston Naval Complex and the EPA's *Standard Operating Procedures Quality Assurance Manual.*

Three types of decontamination pads may be used:

- Small temporary decontamination facilities may be established on site for tank removal and IRAs.
- A small decontamination station may be used to decontaminate field sampling equipment. Rinsate is captured in the bottom of the station and managed as liquid IDW.

A large decontamination station located on base may be used to decontaminate heavy equipment. Decontamination fluids are collected in a drum and managed as a liquid IDW.

5.2.2 Containers

Most of the containers used on site will be H- type or F- type 55- gallon steel drums. The drums must be in compliance with US Department of Transportation (DOT), 49 CFR Part 173. Open head drums (H type) will be constructed of 16- gauge steel, top, bottom, and body, as a minimum. Tops will be secured with a 12 -gauge bolt ring, bolt, nut, and a sponge rubber gasket. Closed head drums (F type) will be constructed of 18- gauge steel, top, bottom, and body, as a minimum. F- type drums will have two fittings in the top, 2 -inch and 0.75- inch, one for filling and one for venting.

Other containers that may be used on site for storagc of liquid IDW include: a watcr truck or tanker, 300- to 1,000-gallon high density polyethylene (HDPE) tanks, and Baker tanks. Other containers that may be used on sitc for solid IDW storage include a dump truck, dumpster, or roll -off container.

5.2.2.1 Labels

Drummed wastc must be clearly marked with the contents, well number/site number, and date containerized. All containerized waste must have either a hazardous waste or non-hazardous waste label affixcd to the drum. Labeling will be accomplished using Ensafe/Allen & Hoshall, *Final Comprehensive Sampling and Analysis Plan* as a guide.

5.2.2.2 Waste Storage and Management

All containerized earthen wastes left on site for management during pending remedial aetions will be stored in a manner that is appropriately protected (e.g. roll-off bins will be covered to avoid potential exposure to personnel). Measures will be taken to prevent inadvertent access to stored waste where determined by the Navy to be necessary or otherwise appropriate. Empty drums must be rinsed to remove significant soil deposits and transported to a designated storage area. The drums must be stored in a manner that minimizes the area required while maintaining easy access. Drums must not be stacked greater than two in height. Lids must be secured on the drums to prevent rainfall intrusion.

5.3 DISPOSAL OPTIONS FOR PETROLEUM-CONTAMINATED SOIL

Contaminated soil excavated from a site during tank removal activities or IRAs will be treated or disposed of either on the Charleston Naval Base Complex or off site. Soil disposal at a thermal treatment facility, landfill, or ex-situ bio-remediation facility are the preferred options for soil remediation.

5.3.1 Site Considerations

The disposal option should be identified before excavation takes place.

- Contamination should not be spread into previously uncontaminated areas through untreated discharges or improper treatment/disposal techniques. Stockpiled soils which are exposed to the weather, will be underlain and covered with plastic (minimum of 6 mil) to prevent exposure to the rain, wind, etc. and to prevent dermal contact. Stockpiling soil on site indefinitely is unacceptable.

- Soil contaminated with waste oil will be segregated from other petroleum contaminated soils. Soils contaminated with waste oil require additional sampling in accordance with the DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.*

- At sites where both gasoline and diesel contamination may exist, care must be taken in assessing the extent of contamination due to the differences in volatility.

6.0 SCHEDULE

The Charleston Naval Complex is scheduled for operational closure on 1 April 1996.

The schedule for tank removal is based on building use, function, and planning, whether the storage tank provides the only source of heat or hot water to building, and the age and condition of the tank. Storage tank removals have been scheduled for 1996, 1997, and 1998. A more detailed description on the tank removal schedule is contained in section 3.3.2.

7.0 REPORTS

The overall objective of the initiative that includes the TMP is to remove storage tank systems at the Charleston Naval Complex and to investigate and remediate any associated petroleum contamination resulting from operations of those storage tank systems. The primary reports generated for this program will be UST Assessment Reports. Other reports include Contamination Assessment Reports, No Further Action Proposals, Monitoring Only Plans, and Remedial Action Plans.

7.1 UST ASSESSMENT REPORTS

UST Assessment Reports include a discussion of the sample types, sample locations, and measurement methods; a site map; methods of maintaining QA/QC; and the results of all analyses of samples from the site. The report is described in the DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service*.

At sites where contaminated soil is encountered during tank removal operations and an IRA is conducted, information on the OVA/immunoassay concentrations of contaminants in the soil, the amount of soil removed, and disposal of the contaminated soil will be included with the UST Assessment Report.

7.2 OTHER REPORTS

For those sites where there is a significant amount of soil or groundwater contamination such that an IRA cannot bring the contamination below target levels, a CAR will be prepared after additional field investigations obtain all necessary data. A discussion of the contents of the CAR is presented in Section 4.6. After the CAR has been submitted to and approved by DHEC, a follow-up report will be prepared. The follow-up report will depend on the amount and extent of the contamination and could include a No Further Action Request, a Monitoring Only Plan, or a Remedial Action Plan. A discussion of the follow-up reports is presented in Section 4.7.

Whichever report pathway is taken, the overall objective of the program is to reach tank closure in as short a time as possible. Follow-up report plans such as a MOP or RAP will contain alternatives that reflect the short schedule philosophy.

8.0 HEALTH AND SAFETY PLAN

Health and Safety precautions necessary while conducting the tasks outlined in the TMP are covered in the *Comprehensive Health and Safety Plan* written for the Charleston Naval Complex by Ensafe/Allen & Hoshall . More detailed information concerning site specific health and safety concerns will be addressed in the individual Work Plan as a Site Specific Health and Safety Plan.

9.0 REFERENCES

Ensafe/Allen & Hoshall, Inc., 1994, Environmental Baseline Survey for the Charleston Naval Complex, Charleston, SC: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, SC.

Ensafe/Allen & Hoshall, Inc., 1994, Final Comprehensive Sampling and Analysis Plan for the Charleston Naval Complex, Charleston, SC: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, SC.

Ensafe/Allen & Hoshall, Inc., 1995, Final RCRA Facility Assessment for the Charleston Naval Complex, Charleston, SC: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, SC.

Ensafe/Allen & Hoshall, Inc., 1995, Final RCRA Facility Investigation, Workplan for Zone H, for the Charleston Naval Complex, Charleston, SC: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, SC.

Harding Lawson Associates, 1987, Final Report Underground Storage Tank Evaluation Naval Activities State of South Carolina, naval activity reports relating to petroleum storage systems: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, SC.

Sirrine Environmental Consultants, Inc., 1992, Release Detection Manual for Underground Storage Tanks, NH, NS, and NSYD.

Underground Storage Tank
Assessment Guidelines
for
Permanent Closure, Change-In-Owner and Change-In-Service

June, 1995

Underground Storage Tank Program

South Carolina Department of Health and Environmental Control

Underground Storage Tank Assessment Guidelines

for
Permanent Closure, Change-In-Owner and Change-In-Service
June, 1995
(Revised from August 13, 1993)

I INTRODUCTION

The Underground Storage Tank Program of the South Carolina Department of Health and Environmental Control (Department) has developed this technical guidance at the request of the regulated community to help underground storage tank (UST) owners and operators assess their sites. South Carolina UST Control Regulations (SCUSTCR) require, before permanent closure, change-in-owner, or a change-in-service is completed, that owners and operators must measure for the presence of a release where contamination is most likely to be present at the UST site. In selecting sample types, sample locations, and measurement methods, the method of closure, the nature of the stored substance, the type of backfill, the depth to ground water, and other factors appropriate for identifying the presence of a release must be considered.

To provide better service and response times, a standardized assessment report (AR) has also been developed. The use of this format will provide the Department with all information needed to evaluate the report without additional requests for information. The AR can be submitted as a stand-alone document or included as an appendix in a more comprehensive report. All permanent closure, change-in-service, and change-in-owner reports should be submitted as a completed AR. The AR and instructions for its use are included in the appendix of this document.

If you have any questions regarding these guidelines, or would like a copy of the South Carolina UST Control Regulations or other UST related documents, please contact the Underground Storage Tank Program at (803) 734-5331, FAX (803) 734-3604.

II FOR YOUR INFORMATION

Always include the Department's site ID number on any correspondence concerning the site.

An UST must be permanently closed if it has been temporarily closed for longer than 12 months and does not meet the performance standards for new systems or the upgrading requirements for existing systems.

The Department does not license or certify contractors performing UST installation, upgrading, closure, or assessment activities. SCUSTCR reference industry standards that may be used to ensure compliance with installation, upgrading, or closure. UST owners and operators are solely responsible for ensuring that these activities are performed in accordance with referenced standards.

To permanently close an UST, it must be emptied and cleaned of all liquids and accumulated sludges. Product lines must be purged of all liquids. The UST must also be removed from the ground or filled in place with an inert solid material such as sand, foam, or concrete. Water is not an inert solid material and cannot be used for in place closure. The physical closure of the UST (either by removal or filling in place) must conform to the established industry standards listed below:

1. American Petroleum Institute Recommended Practice 1604, "Removal and Disposal of Used Underground Petroleum Storage Tanks";

2. American Petroleum Institute Publication 2015, "Cleaning Petroleum Storage Tanks".

Owners and operators must notify the Department at least 30 days prior to permanent closure or change-in-service. A change-in-service is the continued use of an UST to store a non-regulated substance.

An assessment is required for the permanent closure, change-in-service, or change-in-ownership of an UST system. It should include information for the USTs, product piping, and dispenser islands. If the UST system is being sold, a Transfer-of-Ownership form (included in the appendix) should be submitted. Submittal of copies of the last twelve months of external release detection methods (vapor monitoring and ground water monitoring only), which have been performed in accordance with SCUSTCR and indicate no release has occurred, will satisfy assessment requirements for that component (USTs, product piping, dispenser islands) of the system being monitored.

ARs should be submitted to the Department within 120 days of the notification of permanent closure or change-in-service. If the assessment was performed as a result of anticipated change-in-owner, the AR should be submitted prior to the sale of the UST system.

When evaluating potential contractors or consultants, UST owners and operators can do several things to ensure a quality job. Always ask for, and check, references. Request a list of the latest jobs the contractor has completed. Recent jobs should be specified, otherwise the owner and operator may only get a list of those customers who were satisfied.

A written contract that clearly specifies what work is to be done and which party will be responsible for completing each step of the process should always be provided. For example, if the owner and operator wants the contractor to supply a copy of their report to the Department, that requirement should be included in the contract.

The price for work can vary widely. The Department recommends that you get competitive bids from several reputable firms.

All analytical data collected during the assessment should be reported in the AR. For analytical parameters (for specific petroleum products), analytical methods, and reporting limits, please refer to Part VI of this document, SOIL/GROUND WATER LABORATORY ANALYSIS.

If free product or contamination is discovered at a site, the UST owner/operator must report the release to the Department within 72 hours of discovery. An UST 72 Hour Release Report form is attached to this guidance document.

Please be aware that even if a full service firm is hired to handle all aspects of the project that the UST owner and operator are responsible for satisfying all regulatory requirements. If the work is not done properly, the owner and operator will be held responsible for correcting any problems.

CAUTION: South Carolina law and Departmental guidance permit private individuals to permanently close USTs. The Department, however, strongly advises these individuals to practice safety precautions when doing so. USTs can contain large quantities of explosive vapors which may ignite if handled improperly.

III BASIC SITE ASSESSMENT INFORMATION

A) If ground water is encountered in any boring, at least one sample should be collected for analysis. If ground water is expected to be encountered at a site, a monitoring well request (per R.61-71) should be submitted to the Department prior to beginning the assessment. All monitoring wells, whether temporary or permanent, must be approved by the Department.

B) If ground water is encountered in any excavation at least one sample should be collected for analysis. Document the presence or absence of a petroleum (iridescent) sheen, or free product, on the water in the excavation. Soil samples should be taken from the excavation walls at or immediately above the static water level located at the ends of the USTs and/or in areas of contamination noted through sight, smell and/or organic vapor analyzer (OVA) measurements.

C) Samples for laboratory analysis must be collected and stored using proper methods. See REFERENCES FOR SAMPLING PROTOCOL listed below.

D) An OVA may be used to assist in the selection of samples for laboratory analysis. Please note OVAs are **not** as effective with higher boiling point products such as diesel fuel, kerosene, or waste oil.

E) Ground water samples may be collected in lieu of soil samples.

F) Chemicals of concern (COC) are specific constituents that are identified for evaluation in the assessment process. Reporting limits for COCs in soil and water samples are provided in Part VI, SOIL/GROUNDWATER LABORATORY ANALYSIS. If detection limits must be elevated for highly contaminated samples, the dilution must be documented with the analytical results.

G) Appropriate chain of custody forms must be maintained for the laboratory reports to be considered valid.

H) Analyses must be performed by a laboratory certified by the Department (per R.61-81) using Environmental Protection Agency (EPA) analytical methods. The laboratory report of analyses results must include the SC Laboratory Identification number of the laboratory which performed the **actual** analysis. Contact the Department's Laboratory Certification Section at (803) 935-7025 to confirm a laboratory's certification.

I) REFERENCES FOR SAMPLING PROTOCOL

1) EPA Publication #600\2-85\104, September, 1985, "**Practical Guidance for Ground-Water Sampling**"

2) EPA Publication #OSWER-9950.1, September, 1986, "**RCRA Ground-Water Monitoring Technical Enforcement Guidance Document**".

3) EPA Publication SW-846, "**Test Methods for Evaluating Solid Waste**", 3rd edition, 1986.

4) EPA Publication #530/UST-90-003, September, 1990, "**Field Measurements, Dependable Data When You Need It.**"

5) DHEC Laboratory Certification Section Guidance, June, 1995, "**Petroleum Hydrocarbon Analytical Methodology for Ground-Water and Soil Assessment.**"

IV RECOMMENDED SAMPLING LOCATIONS

It is important that assessment information be representative of site conditions. The sampling program used should consider the method of closure. The two UST closure methods are treated differently since USTs that are removed from the ground enable the bottom of the excavation to be visually inspected. In this case, the visual inspection of the exterior of the UST and excavation is an important component of the closure activity and can provide information to determine if a release has occurred. Holes in the UST (and the corresponding area in the excavation) and/or areas of stained soils should be noted in the AR. Using this information, sampling locations can be tailored to make an initial determination concerning the presence of contamination.

The exterior of USTs that are closed in place cannot be visually inspected. Consequently, the presence or size of releases cannot be determined and a more comprehensive assessment is necessary.

In addition to the USTs, the product piping and dispenser islands must also be assessed. The majority of releases associated with UST systems are a result of releases from product piping and dispenser islands. Regardless of the method of closure, it is imperative that the assessment include information for all components of the system - the USTs, product piping, and dispenser islands.

A) FOR UST CLOSURE BY REMOVAL

The recommended minimum number of soil samples to be collected from a single UST excavation is equal to the number of USTs, plus one. The samples should be collected from areas of the excavation judged most likely to be contaminated. The most likely sampling areas would include UST ends, the area directly beneath the USTs and in those areas of noted UST failure (discolored soils or petroleum odors). After excavating only enough soil to remove the USTs from the ground, soil samples should be taken from the undisturbed (native) soils at the bottom of the excavation. If the excavation walls appear contaminated, additional soil samples should be collected from these areas.

If ground water is encountered in any excavation at least one sample should be collected for analysis.

B) FOR UST CLOSURE IN PLACE, CHANGE-IN-OWNER, OR CHANGE-IN-SERVICE

The recommended minimum numher of soil samples collected from each area where the USTs are located is equal to twice the number of USTs. Borings should be placed at or near each end of every UST. Samples should be taken at least two feet below the base of the UST.

If ground water is encountered in any boring, at least ONE sample should be collected for analysis. If ground water is expected to be encountered at a site, a monitoring well request should be submitted to the Department prior to beginning an assessment.

C) PRODUCT PIPING

Samples should be taken at every junction and change in direction as well as every twenty (20) feet along straight runs of piping which are thirty (30) feet or longer. Straight runs of piping less than thirty (30) feet in length should be sampled at the midpoint. Samples should be collected approximately two feet below the bottom of the piping from each location.

D) DISPENSER ISLANDS

All dispenser islands should be sampled. If the dispenser island is located above or immediately adjacent (less than five feet) to the UST, the sample for the island can be incorporated into the sample for that UST. Otherwise, dispenser islands should be individually sampled. Samples should be collected approximately two feet below the bottom of the associated piping.

V UST CLOSURE ACTIVITIES

A) BEFORE CLOSURE

1) Notify the Department in writing **30 days** before UST system closure. Written confirmation will be returned and should be on site during closure. To allow the Department's District Tank Representative an opportunity to attend the UST closure, please call the local Department's District Office at least ten days before the closure to alert them to the intended closure date and again 48 hours before the actual closure date. The District telephone number will be on the written response. Other local agencies (fire marshall, etc.) may also need notification of closure activity. Contact the local governing agency for information.

2) All USTs must be emptied and cleaned by removing all liquids and accumulated sludge for a permanent closure. The cleaning methods, quantity of materials removed, and the disposal location must be documented (manifests, etc.) in the AR.

3) Contact the local Department District Office **prior** to any de-watering activities. De-watering activities are actions necessary for removing water from the excavation for permanent closure or installation of USTs.

B) DURING CLOSURE

For Closure by Removal

1) Waste products, sludges, contaminated water, and contaminated paving material must be disposed of at a Department permitted treatment or disposal facility. Additional information and assistance may be obtained from the Bureau of Solid and Hazardous Waste by calling (803) 896-4000.

2) Temporarily excavate only enough soil to remove the emptied and cleaned tanks and piping.

3) After a UST system removal, inspect and document all USTs and piping for indications of failure. Noticeable failures should influence soil/water sampling locations.

4) Conduct a closure assessment where contamination is most likely to be found. (See Part IV; RECOMMENDED SAMPLING LOCATIONS)

5) All excavated soils are to be returned to the excavation except where authorized by the Department's District Tank Representative. Unsecured stockpiled soils pose a significant health hazard and can result in surface run off. The need for further assessment and/or corrective action will be determined by the Department based upon the AR. The excavation should be filled to grade with clean material.

6) Contaminated paving material cannot be placed into the excavation and must be disposed of at a facility permitted by the Division of Solid Waste Management. No paving material or construction debris should be placed into a contaminated excavation. If there are no indications of contamination, paving material may be placed into the excavation (at the landowner's option).

7) Follow all applicable transportation regulations if moving USTs off site. Please contact the local office of the Department of Transportation for additional information.

For Closure In Place

1) Waste products, sludges, and contaminated water must be disposed of at a Department permitted treatment or disposal facility. Additional information and assistance may be obtained from the Bureau of Solid and Hazardous Waste Management by calling (803) 896-4000.

2) Conduct a closure assessment where contamination is most likely to be found. (See Part IV; RECOMMENDED SAMPLING LOCATIONS)

3) Fill the empty and cleaned UST and piping with an inert solid material (i.e., sand, concrete slurry, foam, etc.).

C) RECEPTOR SURVEY

The location and type of receptors that are, or may be, affected by a release must be identified. Receptors such as underground structures and utilities located within 100 feet of the UST system should be included. Receptors such as surface water, sensitive habitats, and water supply wells within 1000 feet of the UST system should also be included. Refer to Appendix 4, Part XI for specific requirements.

D) AFTER CLOSURE

1) If free product is present at the site, the UST owner and operator must take immediate action regarding the release response and corrective action as outlined in Subparts E and F of SCUSTCR.

2) If free product or contamination is present at the site, the UST owner/operator must report the release to the Department within 72 hours of discovery. An UST 72 Hour Release Report form is included in the appendix.

VI SOIL/GROUND WATER LABORATORY ANALYSIS

A) FOR UST SYSTEMS THAT CONTAIN PETROLEUM PRODUCTS

ANALYZE FOR EACH OF THE FOLLOWING:

	SOIL SAMPLES	WATER SAMPLES
PRODUCT	**Analyate.....Method*.....RL****	**Analyate.....Method*.....RL****
GASOLINE **DIESEL** **FUEL OIL** **KEROSENE**	**BTEX.....8260.....5 ug/kg** **Naphthalene.....8260.....5 ug/kg** **PAH.....8270.....660 ug/kg**	**BTEX.....8260.....5 ug/l** **Naphthalene.....8260.....5 ug/l** **MTBE.....8260.....40 ug/l** **PAH.....8270.....10 ug/l**
USED OIL	**BTEX.....8260.....5 ug/kg** **Naphthalene.....8260.....5 ug/kg** **PAH.....8270.....660 ug/kg** **TPH.....9071.....10 mg/kg** **Metals.....AA-ICP**	**BTEX.....8260.....5 ug/l** **Naphthalene.....8260.....5 ug/l** **PAH.....8270.....660 ug/l** **TPH.....9070.....10 mg/l** **Metals.....AA-ICP**

OTHER PETROLEUM:	REPRESENTATIVE PARAMETERS

BTEX = **Benzene, Toluene, Ethyl-benzene, Xylene**
PAH = **Polynuclear Aromatic Hydrocarbons (Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene)**
MTBE = **Methyl Tertiary Butyl Ether**
TPH = **Total Petroleum Hydrocarbon**
METALS = **Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver**
AA-ICP = **Atomic Absorption - Inductively Coupled Plasma**
* = **Or EPA equivalent method**
** = **Reporting Limit (RL)**

B) FOR UST SYSTEMS THAT CONTAIN HAZARDOUS SUBSTANCES

When assessing an UST system that has contained a CERCLA listed hazardous substance all analyses must be performed by a laboratory certified by the Department. Analytical methods should be for representative parameters. Questions concerning appropriate analytical methods should be directed to the Underground Storage Tank Program.

VII REPORTING

Please do not submit ARs for multiple sites bound under one cover. Since each site assessment is addressed individually, delays may result while the report is separated and may result in the possible loss of data.

Incomplete ARs may not be reviewed until all necessary information is submitted. Incomplete ARs may also fail to achieve permanent status change and may also result in additional UST fee invoices.

Two copies of the AR should be submitted to the Department.

VIII QUESTIONS AND ATTACHMENTS

On all correspondence related to the site, please reference the Department site ID Number. Questions should be addressed to the Underground Storage Tank Program at (803) 734-5331. FAX (803) 734-3604.

The following forms are attached to this document

Appendix 1	UST 72 Hour Release Report Form
Appendix 2	Transfer of Ownership Form
Appendix 3	Environmental Quality Control District List
Appendix 4	UST Assessment Report Form and Instructions
Appendix 5	Insurance Statement

AG-13.44:TXT

South Carolina
DHEC
Department of Health and Environmental Control

APPENDIX 1 - UNDERGROUND STORAGE TANK 72 HOUR RELEASE REPORT

SITE ID NUMBER: (ON ANNUAL INVOICE) _____

FACILITY NAME: _____

Address: _____

_____

_____

Contact: _____ Telephone _____

1) Number of USTs at this site: In Service _____ Out of Service _____
2) Date of LAST System test. _____ (Attach copy)
3) Are there any drinking water wells on or near the site? Yes No
4) Is the drinking water contaminated? Yes No
5) Date release discovered. _____
6) How was the release discovered? _____

_____

7) Type of product(s) discovered _____

Describe **actions** taken to: (attach additional sheets if needed)

8) Discover the **cause** of the release. _____

_____

9) **Prevent** further release. _____

_____

10) **Clean up** the site. _____

_____

Follow the directives of Subpart E of the SC UST Control Regulations, notify proper local authorities and neighboring property owners potentially affected by the release. On all correspondence related to a particular site, please reference the **Site ID Number**. Questions should be addressed to the Underground Storage Tank Program at (803) 734-5331.
FAX (803) 734-3604

Reported by (PRINT) _____ Telephone _____

Signature _____ Date _____

RR-13.2 950620

Stamp

Manager, Regulatory Section
Underground Storage Tank Program
SC Department of Health & Environmental Control
2600 Bull Street
Columbia, SC 29201

South Carolina
DHEC
ment of Health and Environmental Control

APPENDIX 2 - UNDERGROUND STORAGE TANK TRANSFER OF OWNERSHIP

SITE ID NUMBER: (ON ANNUAL INVOICE) _____

FACILITY NAME: _____

Address: _____

_____

Change facility name to: _____ (Optional)

Number of USTs at this site: In Service _____ Out of Service _____

In accordance with §280.72(a) of the SCUSTCR, was an assessment performed?:

Yes _____ (If yes, see "NOTE" below) No _____ (If no, please give explanation)

FORMER OWNER		NEW OWNER	
Name:	_____	Name:	_____
Address:	_____	Address:	_____
	_____		_____
P' .	_____	Phone:	_____

NEW OWNER SIGNATURE: _____ DATE: _____

Notary Signature and Stamp: _____

DATE OF TRANSFER OF OWNERSHIP: _____

NOTE!: If the date of transfer is after **March 23, 1990** please include a copy of the site assessment as required by the SC UST Control Regulations, §280.72 or the last year of leak detection records. Assessment Guidelines and UST Regulations are available from the Department upon request. Questions should be addressed to the Underground Storage Tank Program at (803) 734-5331.

SC UST Control Regulations require, before permanent closure, change-in-owner, or a change-in-service is completed, that owners and operators must measure for the presence of a release where contamination is most likely to be present at the UST site. In selecting sample types, sample locations, and measurement methods, owners and operators must consider the method of closure, the nature of the stored substance, the type of backfill, the depth to ground water, and other factors appropriate for identifying the presence of a release. **The requirements of this section are satisfied if one of the external release detection methods allowed in Section 280.43(e) and (f) is operating in accordance with the requirements in Section 280.43 at the time of closure, and indicates no release has occurred.**

If contaminated soils, contaminated ground water, or free product is discovered follow the directives of Subpart E of the SC UST Control Regulations, notify proper local authorities and neighboring property owners potentially affected by the release. On all correspondence related to a particular site, please reference the Department Site ID Number.

13.2 950620

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Appendix 3 - Environmental Quality Control District List

Appalachia I
Counties: Anderson, Oconee
2404 N. Main St.
Anderson, SC 29621
Office # : (803) 260-5569
FAX # : (803) 260-5676

Appalachia II
Counties: Greenville, Pickens
301 University Ridge
Suite 5800
Greenville, SC 29601
Office # : (803) 241-1090
FAX # : (803) 241-1092

Appalachia III
Counties: Cherokee, Spartanburg, Union
P. O. Box 8778
Spartanburg, SC 29305
Office # : (803) 596-3800
FAX # : (803) 596-2136

Catawba
Counties: Chester, Lancaster, York
P. O. Box 100
Fort Lawn, SC 29714
Office # : (803) 285-7461
FAX # : (803) 285-5594

Central Midlands
Counties: Fairfield, Lexington, Newberry, Richland
P. O. Box 156, Bldg #5
State Park, SC 29147
Office # : (803) 935-7015
FAX # : (803) 935-6724

Pee Dee
Counties: Chesterfield, Dillon, Darlington, Florence, Marion, Marlboro
145 E. Cheves Street
Florence, SC 29506
Office # : (803) 661-4825
FAX # : (803) 661-4858

Low Country
Counties: Beaufort, Colleton, Hampton, Jasper
1313 Thirteenth St.
Port Royal, SC 29935
Office # : (803) 522-9097
FAX # : (803) 522-8463

Lower Savannah
Counties: Aiken, Allendale, Bamberg, Barnwell, Calhoun, Orangeburg
218 Beaufort St. NE
Aiken, SC 29801
Office # : (803) 641-7670
FAX # : (803) 641-7675

Upper Savannah
Counties: Abbeville, Edgefield, Greenwood, Laurens, McCormick, Saluda
613 S. Main St.
Greenwood, SC 29646
Office # : (803) 223-0333
FAX # : (803) 223-6935

Trident
Counties: Berkeley, Charleston, Dorchester
2470 Air Park Rd.
N. Charleston, SC 29418
Office # :(803) 740-1590
FAX # : (803) 740-1595

Waccamaw
Counties: Georgetown, Horry, Williamsburg
705 Oak St. Plaza, Suite 2
Myrtle Beach, SC 29577
Office # : (803) 448-1902
FAX # : (803) 946-9390

Wateree
Counties: Clarendon, Kershaw, Lee, Sumter
105 N. Magnolia St.
Sumter, SC 29151
Office # : (803) 778-1531
FAX # : (803) 778-6366

Appendix 4

UST Assessment Report Form and Instructions

Please follow these instructions carefully and provide the requested information.

I. OWNERSHIP OF UST(s)

Owner Name

- List the name of the corporation, individual, public agency, etc. that owns the UST system.

Mailing Address

- Give the mailing address for the UST owner.

Telephone Number

- Give the telephone number for the UST owner.

Contact Person

- List the name and telephone number of the person within your business or organization that will handle all UST related correspondence.

II. SITE IDENTIFICATION AND LOCATION

Site I.D.#

- Each registered UST system in South Carolina has been assigned a Site ID Number. It will look like this, though the characters may differ:

  N-55-NO-12345

  or it may be shortened to only the last five numbers:

  12345

  You MUST provide the site number so that your report will be assigned to the proper file. If you do not know your Site ID Number, please contact the UST Program at (803) 734-5331.

Facility Name or Company Site Identifier

- List the name your company or organization uses to identify this site. If this name has changed from the name with which this site was originally registered, please give the original name in parenthesis.

Street Address or State Road (as applicable)

- Give the street address of the site. If the street address is different from the mailing address of the site, give the street address. Please do not give post office box addresses.

City

- Give the city in which the site is located.

County

- Provide the county in which the site is located.

III. CLOSURE INFORMATION

This section should be completed only if the tank system is closed. If your UST system is to remain operational, please supply the name of your consultant, if applicable, in the appropriate space.

Closure Started

- Give the month, day, and year when you began work on closing your UST system.

Closure Completed

- Give the month, day, and year when permanent closure (removal or filling) of your UST system was completed.

Number of USTs Closed

- Give the number of USTs that you permanently closed with this report.

Consultant (if applicable)

- If you hired a consulting company to assist you in closing or assessing your UST system, provide the company name.

UST Removal Contractor

- If you or your consultant hired a contractor to remove or fill your tanks, provide the contractor's name.

IV. CERTIFICATION

- The individual or company representative responsible for the UST system should complete this section.

V. UST INFORMATION

Please complete this table by providing the requested information for each tank in your UST system that is permanently closed.

A. Product

- List the type of material that the tank formerly contained. For example: gasoline, diesel, waste oil, motor (unused) oil, etc.

B. Capacity

- Provide the capacity (in gallons) for the UST.

C. Age

- Provide the year the UST system was installed. If you are unsure, provide your best estimate.

D. Construction Material

- Please provide the material from which the tank was constructed. You may abbreviate as follows: S = Steel
  SC = Fiberglass Coated Steel
  F = Fiberglass

E. Month/Year of Last Use

- For each tank closed, provide the month and year when the tank was last used.

F. Depth (ft.) to Base of Tank

- Give the depth (in feet) from the level of the surrounding land surface to the bottom of each tank. This is easily obtained by measuring from the top of the fill riser to the bottom of the tank prior to closure.

G. Spill Prevention Equipment

- Was the UST system equipped with spill prevention equipment that meets Section 280.20(c) or 280.21(d) requirements of SCUSTCR?

H. Overfill Prevention Equipment

- Was your UST system equipped with overfill prevention equipment?

I. Method of Closure

- Give the method you used to permanently close each tank in your UST system. You may abbreviate as follows: RG = Removed from the ground
  FP = Filled in place with an inert material

J. Visible Corrosion or Pitting

- Was your UST system corroded or pitted?

K. Visible Holes

- Were holes visible in the UST?

L. Method of Disposal for any USTs Removed from the Ground.

- USTs must be properly disposed of after removal, either as scrap, conversion to non-UST use, or by recertification for UST use by the manufacturer. List how you disposed of each UST that you removed. Attach copies of any disposal manifests to the end of this report.

M. Method of Disposal for any Liquid Petroleum, Sludge, Waste Water, or Paving Material.

- List how you disposed of any waste products removed from the UST or excavation. Attach copies of any disposal manifests to the end of this report.

N. If any corrosion, pitting, or holes were observed, describe the location and extent for each UST.

- Describe the location and extent of any holes, pitting, or corrosion that was observed on any tanks in the UST system.

VI. PIPING INFORMATION

Complete this table by providing the requested information for each tank in your UST system that is closed.

A. Construction Material

- Indicate the material used to construct the piping. You may abbreviate as follows: S = Steel
  F = Fiberglass
  X = Flexible Plastic

B. Distance from UST to Dispenser

- Provide the distance in feet from the tank to the dispenser. If the tank serves more than one dispenser, give the distance to each dispenser. If the dispenser was located directly above the tank, answer zero.

C. Number of Dispensers

- Give the number of dispensers served by each tank in your UST system

D. Type of System

- Indicate whether the tank was equipped with a suction pumping system or a pressurized pumping system. Abbreviate as follows: P = Pressurized
  S = Suction

E. Was piping removed from the ground?

- Indicate if the piping was removed from the ground when the UST system was closed.

F. Visible Corrosion or Pitting

- Indicate if corrosion or pitting was observed on the UST piping.

G. Visible Holes

- Please indicate if holes were observed on the UST piping.

H. If any corrosion, pitting, or holes were observed, describe the location and extent for each piping run.

- Describe the location and extent of any corrosion, pitting, or holes that were observed on the piping.

VII. BRIEF SITE DESCRIPTION AND HISTORY

Provide a brief description of the site, including the type of buildings (if any) located there, whether the site is paved, if the surrounding area is residential or commercial, and any other pertinent information. Also, please give a brief history of the site, including the type of business, if any, that operated (or still operates) there.

VIII. SITE CONDITIONS

A. Were any petroleum-stained or contaminated soils found in the UST excavation, soil borings, trenches, or monitoring wells?

- Indicate if petroleum-stained soils were encountered in any of these locations. If yes, indicate the depth and location on the site map. If you do not know, answer unknown.

B. Were any petroleum odors detected in the excavation, soil borings, trenches, or monitoring wells?

- Please indicate if petroleum odors were noted in any of these locations. If yes, indicate the location on the site map and describe the odor (strong, mild, degraded, etc.).

C. Was water present in the UST excavation, soil borings, or trenches?

- Indicate if you encountered water at any of these locations. If yes, indicate the depth to water below the surrounding land surface and the depth and location on the site map.

D. Did contaminated soils remain stockpiled on site after closure?

- Indicate if contaminated soils were removed and not returned to the excavation. Provide the name of the Department representative who authorized you to excavate and stockpile soils. Indicate the location of any soil stockpiles on the site map.

E. Was a petroleum sheen or free product detected in the soils of the excavation or on any excavation or boring water?

- Please indicate if a petroleum sheen or free product (1/8 inch or more of liquid petroleum floating on water or soil saturated with petroleum) was observed at any of these locations. If yes, indicate the location on the site map.

IX. SAMPLE INFORMATION

Column 1: Location

- Give a brief description of the location from which the samples were collected. For example: Bottom of the pit near the fill end of tank 1

Column 2: Sample Type

- Indicate whether the sample consisted of soil or water.

Column 3: Depth

- Provide an estimated depth to the location where the sample was collected. This should be in feet below the surrounding land surface.

Column 4: Date/Time of Collection

- Provide the date and time the samples were collected. Indicate AM or PM.

Column 5: Collected By

- Indicate whether the sample was collected by the UST owner/operator or a consultant.

Column 6: OVA #

- If an organic vapor analyzer (OVA) was used to screen the samples for selection, provide the highest OVA reading for each sample selected for analysis. If an OVA was not used, disregard this column.

X. SAMPLING METHODOLOGY

After choosing a Department certified laboratory, contact them for prepared sample containers and a chain-of-custody form. Guidance concerning correct containers and instructions for completing the chain-of-custody can be obtained from the laboratory.

Clean tools must be used to collect each sample. After collection of each sample, the collection tools must be cleaned with organic-free soap and water. Your laboratory should be able to assist you in obtaining this type of soap. Be sure to thoroughly rinse the tools after cleaning.

Samples must be chilled immediately after collection. Fill the sample container completely and seal it. Containers must be placed on ice and remain chilled until delivery to the laboratory. Samples should be delivered immediately. Results from samples held too long or not chilled are invalid. Laboratory reports should be attached to this document as Appendix 2.

When preparing this report, a detailed description of the methods used to collect the samples must be provided. Please use the space provided on the form to supply this information.

XI. RECEPTORS

Provide information concerning potential receptors around the UST system.

A. Are there any lakes, ponds, streams, or wetlands located within 1000 feet of the UST system?

- Indicate if there are any of these types of surface waters within 1000 feet of the UST system. If yes, indicate the type, distance, and direction on the site map. If you do not know, answer unknown

B. Are there any public, private, or irrigation water supply wells within 1000 feet of the UST system?

- Indicate if there are any wells of these types within 1000 feet of the UST system. If yes, indicate the type of well, distance, and direction on the site map. If you do not know, answer unknown.

C. Are there any underground structures (e.g., basements) located within 100 feet of the UST system?

- Indicate if there are any basements or other underground structures located within 100 feet of the UST system. Show the location of all underground structures on the site map.

D. Are there any underground utilities (e.g., telephone, water, electricity, gas, sewer, storm drain) located within 100 feet of the UST system that could possibly come in contact with the contamination?

- Indicate if any of these or any other underground utility is located within 100 feet of the UST system. Show the location of all underground utilities on the site map.

E. Has contaminated soil been identified at a depth of less than three 3 feet below land surface in an area that is not capped by asphalt or concrete?

- Indicate if contaminated soil has been identified less than three feet below land surface beneath an area of the site that is not covered by asphalt or concrete. Show the location of the contaminated soil on the site map.

SITE MAP

You must include a scaled site map. The map should accurately depict distances between objects and the size of the objects. Dimensions should be accurate within two feet. Tax maps are acceptable if the required information is included, up-to-date, and sample locations can be accurately depicted.

The map should include all important features at the site. This should include buildings, UST locations, any above ground tanks, piping runs, dispenser islands, roads, sample locations, any receptors described in Section XI, and any other features that will give the Department a clear idea of how the site appears.

ANALYTICAL RESULTS

You should use this space to attach the certified analytical reports for your samples as well as the completed chain-of-custody form.

NOTE:

Photographs are often very helpful for evaluating a report. They are not required, but if you choose to document your UST closure with photographs, you may include copies with this report.

South Carolina Department of Health and Environmental Control (SCDHEC)

Underground Storage Tank (UST) Assessment Report

Received

State Use Only

Submit Completed Form To:
UST Regulatory Section
SCDHEC
2600 Bull Street
Columbia, South Carolina 29201
Telephone (803)734-5331

I. OWNERSHIP OF UST(S)

Owner Name (Corporation, Individual, Public Agency, Other)

Mailing Address

City | State | Zip Code

Area Code | Telephone Number | Contact Person

II. SITE IDENTIFICATION AND LOCATION

). #

Facility Name or Company Site Identifier

Street Address or State Road (as applicable)

City | County

III. CLOSURE INFORMATION

Closure Started | Closure Completed | Number of USTs Closed

Consultant | UST Removal Contractor

IV. CERTIFICATION (Read and sign after completing entire submittal.)

I certify that I have personally examined and am familiar with the information submitted in this and all attached documents; and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

(Type or print.)

Signature

V. UST INFORMATION

	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 6
A. Product.....						
B. Capacity.....						
C. Age.....						
D. Construction Material.....						
E. Month/Year of Last Use.....						
F. Depth (ft.) To Base of Tank.....						
G. Spill Prevention Equipment Y/N.....						
H. Overfill Prevention Equipment Y/N.....						
I. Method of Closure Removed/Filled.....						
J. Visible Corrosion of Pitting Y/N.....						
K. Visible Holes Y/N.....						

L. Method of disposal for any USTs removed from the ground (attach disposal manifests)

M. Method of disposal for any liquid petroleum, sludges, or waste waters removed from the USTs (attach disposal manifests)

If any corrosion, pitting, or holes were observed, describe the location and extent for each UST

VI. PIPING INFORMATION

	Tank 1	Tank 2	Tank 3	Tank 4	Tank 5	Tank 6
A Construction Material.....						
B Distance from UST to Dispenser.....						
C. Number of Dispensers.....						
D. Type of System P/S.....						
E. Was Piping Removed from the Ground? Y/N						
F. Visible Corrosion or Pitting Y/N.....						
G. Visible Holes Y/N.....						
H. Age.....						

If any corrosion, pitting, or holes were observed, describe the location and extent for each line.

VII. BRIEF SITE DESCRIPTION AND HISTORY

VIII. SITE CONDITIONS

	Yes	No	Unk
A. Were any petroleum-stained or contaminated soils found in the UST excavation, soil borings, trenches, or monitoring wells? If yes, indicate depth and location on the site map.			
B. Were any petroleum odors detected in the excavation, soil borings, trenches, or monitoring wells? If yes, indicate location on site map and describe the odor (strong, mild, etc.)			
C. Was water present in the UST excavation, soil borings, or trenches? If yes, how far below land surface (indicate location and depth)? _____			
D. Did contaminated soils remain stockpiled on site after closure? If yes, indicate the stockpile location on the site map. Name of DHEC representative authorizing soil removal: _____			
E. Was a petroleum sheen or free product detected on any excavation or boring waters? If yes, indicate location and thickness.			

IX. SAMPLE INFORMATION

A. SCDHEC Lab Certification Number _____

B.

Sample #	Location	Sample Type (Soil/Water)	Depth*	Date/Time of Collection	Collected by	OVA #
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

* = Depth Below the Surrounding Land Surface

X. SAMPLING METHODOLOGY

Provide a detailed description of the methods used to collect and store (preserve) the samples. Please use the space provided below.

XI. RECEPTORS

		Yes	No
A.	Are there any lakes, ponds, streams, or wetlands located within 1000 feet of the UST system? If yes, indicate type of receptor, distance, and direction on site map.		
B.	Are there any public, private, or irrigation water supply wells within 1000 feet of the UST system? If yes, indicate type of well, distance, and direction on site map.		
C.	Are there any underground structures (e.g., basements) located within 100 feet of the UST system? If yes, indicate the type of structure, distance, and direction on site map.		
D.	Are there any underground utilities (e.g., telephone, electricity, gas, water, sewer, storm drain) located within 100 feet of the UST system that could potentially come in contact with the contamination? If yes, indicate the type of utility, distance, and direction on the site map.		
E.	Has contaminated soil been identified at a depth less than 3 feet below land surface in an area that is not capped by asphalt or concrete? If yes, indicate the area of contaminated soil on the site map.		

SITE MAP

You must supply a scaled site map. It should include all buildings, road names, utilities, tank and pump island locations, sample locations, extent of excavation, and any other pertinent information.

(Attach Site Map Here)

ANALYTICAL RESULTS

You must submit the laboratory report and chain-of-custody form for the samples. These samples must be analyzed by a South Carolina certified laboratory.

(Attach Certified Analytical Results and Chain-of-Custody Here)

Did You Remember to Include the Following?

-- **Site ID Number**

-- **Sample Collection and Storage Methods**

-- **Scaled Site Map with ALL Requested Information**

-- **Laboratory Chain-of-Custody Form**

-- **Certified Analytical Results**

-- **Completed and Notarized Insurance Statement (see attached form)**

-- **A Copy of Your Environmental Insurance Policy (if applicable)**

-- **Samples from all Dispenser Islands and Piping Runs**

-- **Photographs (if available)**

Appendix 5 - INSURANCE STATEMENT

This site is potentially eligible to receive state monies to assist you in site rehabilitation, if required. Before eligibility for State Underground Petroleum Environmental Response Bank (SUPERB) funds can be determined, written confirmation of the existence or non-existence of an environmental insurance policy for this site is required. Please complete the following information:

_____ I do not have any insurance that would cover releases from underground storage tanks.

_____ I have an insurance policy that covers releases from underground storage tanks.

My policy provider is: _____
The policy deductible is: _____
The policy limit is: _____

If you have this type of insurance, please include a copy of the policy with this report.

Signature: _____

Date: _____

To be Completed by Notary Public:

Sworn before me this_____day of_____, 19____.

_____
(Name)

Notary Public for the state of _____.

My commission expires _____.

Please affix State Seal if you are commissioned outside South Carolina.

SCDHEC

South Carolina Department of Health and Environmental Control
Columbia, South Carolina 29201

Notification for Underground Storage Tanks No Longer in Operation

Tanks taken out of operation after January 1, 1974, but still in the ground

1 Name and address of the facility	2 Business mailing address of facility if different from location address	3 Owner of tank (*name, business address, and phone number*)	4 Contact person for the facility (*Name and phone number*)

5 Type of owner (*Mark X in appropriate box*)

☐ Non-Federal ☐ Federal (*Give GSA #*)

6 For State Use Only

Complete the following section(s) to the best of your knowledge using the examples provided as guidance. Check appropriate boxes and fill in blanks where applicable. If you need more space, photocopy this page or use a continuation sheet.

Tanks taken out of use after January 1, 1974 but still in the ground

a Tank No.	b Date of last use		c Age when last used (*yrs*)					d Total capacity (*gal*)	e Material of construction			f Internal protection		g External protection				h Substance left stored if any					i Estimated quantity (*gal*)
	Month	Year	0-5	6-10	11-15	16-20	20+		Steel	Fiberglass reinforced plastic	Other (*specify*)	Lined	Unlined	Coated	Wrapped	Cathodic protection	Other (*specify*)	Hazardous substance name and/or Chemical Abstract Service (CAS) # if known	Petroleum products				
																			Gasoline	Diesel	Kerosene	Other (*specify*)	
sample	6	75			X			8,000	TP				X	X					X				120
1																							
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							

8. Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete.

a Name and Official Title of Owner or Owner's Authorized Representative (*Type or print*)

b Signature

c Date signed

South Carolina
DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201

HYDROGEOLOGIC ASSESSMENT GUIDANCE DOCUMENT April 4, 1991

The Assessment and Development Section of the Ground-Water Protection Division (GWPD) of South Carolina Department of Health and Environmental Control (SCDHEC) has developed the following guidance for sites where a ground-water/hydrogeologic assessment is necessary.

ASSESSMENT PLAN

A ground-water assessment plan must be submitted to and approved by the Ground-Water Protection Division prior to implementation. This plan should outline an approach which will fully: 1) define the horizontal and vertical extent of soil and ground-water contamination, and 2) characterize the ground-water quality and nature of the contaminants. This assessment plan must be prepared by a qualified professional registered in the State of South Carolina.

For an assessment plan to be considered complete, the following should be included (where appropriate):

1) Brief discussion of the background, purpose, and scope of the proposed investigation.

2) A summary of the initial abatement actions taken to eliminate the source and any on-going corrective action measures such as free-product recovery.

3) A qualitative description of the contaminants present.

4) All existing ground-water quality data.

5) Number, location, approximate depth and proposed construction details of additional monitoring wells, along with justification of proposed well locations.

6) Suspected or probable ground-water flow directions, site topography, local ground-water usage (locations of any private or public supply wells proximal to the site), and ground-water discharge areas.

7) A scaled site map that includes locations of the source(s) of the contamination, all existing wells, buildings, above-and below-ground utilities, USTs and other appurtenances that could potentially affect contaminant migration or could become impacted by contaminants.

8) Proposed list of chemical parameters to be analyzed.

9) Sampling methods, laboratory analytical methods, and analytical protocols.

10) Proposed methodologies (slug test, pumping test, etc.) to determine aquifer characteristics.

11) Implementation schedule.

Two (2) copies of the assessment plan should be submitted. Questions should be directed to the appropriate SCDHEC project manager at the Assessment & Development Section, Ground-Water Protection Division at (803) 734-5331.

dgb/ASSEPLAN.A&D

South Carolina
DHEC
Department of Health and Environmental Control

STANDARD LIMITED ASSESSMENT

June, 1995

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millimeter, respectively.

- Piping and Dispenser Area; five borings are to be advanced to the water table or a maximum depth of 10 feet. The borings should be located as close as possible to the piping and/or dispensers. Soil samples are to be collected at two foot intervals for field screening analysis. The soil sample that exhibits the highest concentration of COC should be submitted for laboratory analysis. If all soil samples from the boring exhibit similar concentrations, the sample from the greatest depth in the vadose zone should be submitted for analysis.

- Background Soil Boring; one boring is to be advanced to a depth of 10 feet in an area away from the USTs, product lines, dispensers, and other potential sources of COC. A soil sample should be collected from below the soil "A" horizon unless precluded by a shallow water table. This sample should be analyzed in a laboratory for total organic carbon content via Environmental Protection Agency (EPA) method 415.1. The presence of calcareous soil should be noted for possible analytical interference.

For a release from another source (e.g., aboveground storage tank), the seven soil borings outlined above in the UST, piping, and dispenser areas shall be replaced by seven soil borings to be strategically placed in the suspected source area. A background soil boring shall also be advanced as described above.

Soil Boring Abandonment

All soil borings (with the exception of the one boring converted to a monitoring well) must be properly abandoned pursuant to the **South Carolina Well Standards and Regulations** R.61-71.

Monitoring Well Installation and Sampling

Three monitoring wells constructed of two-inch diameter PVC casing with a ten-foot PVC screen bracketing the water table are to be installed. The wells should be positioned such that the direction of ground-water flow and the concentration of COC in the source area can be determined. Two wells are to be constructed in separate boreholes from the soil borings. The remaining well is to be constructed in the soil boring containing the highest concentration of COC. The wells must be installed by a South Carolina certified well driller and constructed in compliance with the **South Carolina Well Standards and Regulations.**

Soil samples are to be collected at five-foot intervals for organic vapor analysis during the drilling of the borehole for each intended well. The soil sample exhibiting the highest concentration of COC from each borehole should be submitted for laboratory analysis. For each well where free product is not encountered, a ground-water sample shall be collected and submitted to a laboratory for analysis. If free product is present, the thickness should be measured.

- Provide information on present and future site use.

- Give a brief history of past site use and any previous releases.

- Provide information on use of the property on which the release occurred and adjacent land use (residential, commercial, industrial, agricultural, etc.).

- Describe the nature and estimated quantity of the release. Provide any documentation substantiating the estimate.

Site Characteristics

Site Geography

- Describe the topography of the site and surrounding area.

- Give the mean elevation of the site.

- Provide additional comments as necessary.

- Insert Figure 1. The site location should be indicated on a copy of the relevant portion of a United States Geological Survey (USGS) topographic map.

Exposure Analysis and Tier Evaluation

- Locate and describe any receptors (as defined in the RBCA Guidance Document) within 1000 feet of the site. If a water well is identified and the information is available, provide the type of well (public, private, etc.), well screen depth and interval, and the aquifer in which the well is screened.

- Identify any other potential receptors or human exposure pathways (as defined in the RBCA Guidance Document) within 1000 foot radius of the site. Identify any structures with basements that are on or adjacent to the site.

- As outlined in the RBCA Guidance Document, compare site concentration of COC to RBSL and perform a Tier 1 evaluation.

- Provide additional comments as necessary.

Utilities Survey

- Locate and survey location, identify burial depth, and describe any subsurface utilities at the site that could serve as potential preferential pathways for migration of COC.

- Indicate the soil organic carbon (TOC) background concentration in mg/kg.

COC

- Report the presence of a strong petroleum odor if encountered in the soil borings.
- Discuss the horizontal and vertical extent of COC in the soil.
- Provide additional comments as necessary.
- Insert Figure 3. The COC site map should depict the ground-water flow direction (arrow), all soil boring and monitoring well locations, and accompanying soil and ground-water data. The soil analytical data should be plotted adjacent to each boring using the following format:

SB - #
Sample Depth (feet)
BTEX (mg/kg)
PAHs (mg/kg)

The ground-water data should be plotted adjacent to the monitoring wells using the following format:

MW - #
Benzene (ug/l)
Toluene (ug/l)
Ethylbenzene (ug/l)
Xylenes (ug/l)
PAHs (ug/l)

Chemicals of Concern - Ground-Water

Ground-Water Assessment

- Provide the monitoring well installation, development, and sampling dates.
- Provide a brief justification for the location of the monitoring wells in relation to source areas.
- Summarize the monitoring well and ground-water data in tabular form as follows:

MW Number	Sampling Date	Screen Depth(ft)	Screened Interval(ft)	Depth to Water(ft)	Water Table Elev(ft)

Appendices

The appendices required for the SLA report are as follows:

Appendix A. Boring Logs

The soil boring logs should indicate lithology, water level, split-spoon sample intervals, and field screening results. Also, the presence of hydrocarbon odors and qualitative indication of soil conditions (dry, moist, wet, saturated) should be noted on the logs.

Appendix B. Well Construction Logs

The monitoring well construction logs must include all information as outlined in the S.C. Well Standards and Regulations R.61-71.11E(2).

Appendix C. Laboratory Data

The laboratory data should include field sampling logs, chain of custody forms, certificates of analyses, and the lab certification number. The sampling logs should note the location and type of each sample submitted for analysis.

Appendix D. Aquifer Calculations

The slug test summary forms and all data, graphs, and equations that were used to derive the aquifer characteristics and hydrologic parameters should be included in Appendix D.

Appendix E. Leachability Model for Petroleum-Contaminated Soil

The In-Situ Soil Risk Evaluation forms (2 pages) should be completed for each chemical of concern and included in Appendix E. Page 1 summarizes the pertinent site data necessary to calculate the soil risk. Page 2 is a summary of the results and conclusions of the model.

SUMMARY of SLUG TEST

SOUTH CAROLINA
Department of Health and Environmental Control (DHEC)

Site Data

SITE ID: # _____ COUNTY _____

FACILITY NAME _____

Slug Data

See Appendix ____ Table_____ Figure____ for a list of all data measurements.
(water level logs, etc.) (Complete as appropriate).

Water Level Recovery Data was measured by _____ .
(Hermit Data Logger, Manually with Water Level Indicator, etc.) (List Method).

Complete the following table for each well tested.
COMPETE A SECOND SHEET IF MORE THAN FOUR WELLS ARE TESTED

Slug Test Conducted in well(s) number				
'tial Rise/Drawdown in well (feet)				
)dius of Well Casing (feet)				
⊏ffective Radius of Well (feet)				
Static Saturated Aquifer Thickness (feet)				
Length of Well Screen (feet)				
Static Height of Water Column in Well (ft)				

Calculations

See Appendix ____ Table_____ Figure____ for calculations. (Complete as appropriate).

The method for aquifer calculations was _____ (i.e. Bouwer–Rice, Cooper, etc

Calculated values by well were as follows:

Slug Test Conducted in well(s) number			
Hydraulic Conductivity			

Thickness of the aquifer used to calculate hydraulic conductivity was _____ feet.
The aquifer is _____ confined _____ semi–confined _____ water table (Check as appropriate).

The estimated seepage velocity is _____ feet per year based on
a hydraulic conductivity of _____, a hydraulic gradient of _____, and
a porosity of _____ per cent for _____ soil (list type i.e., silty sand ,clay, etc).

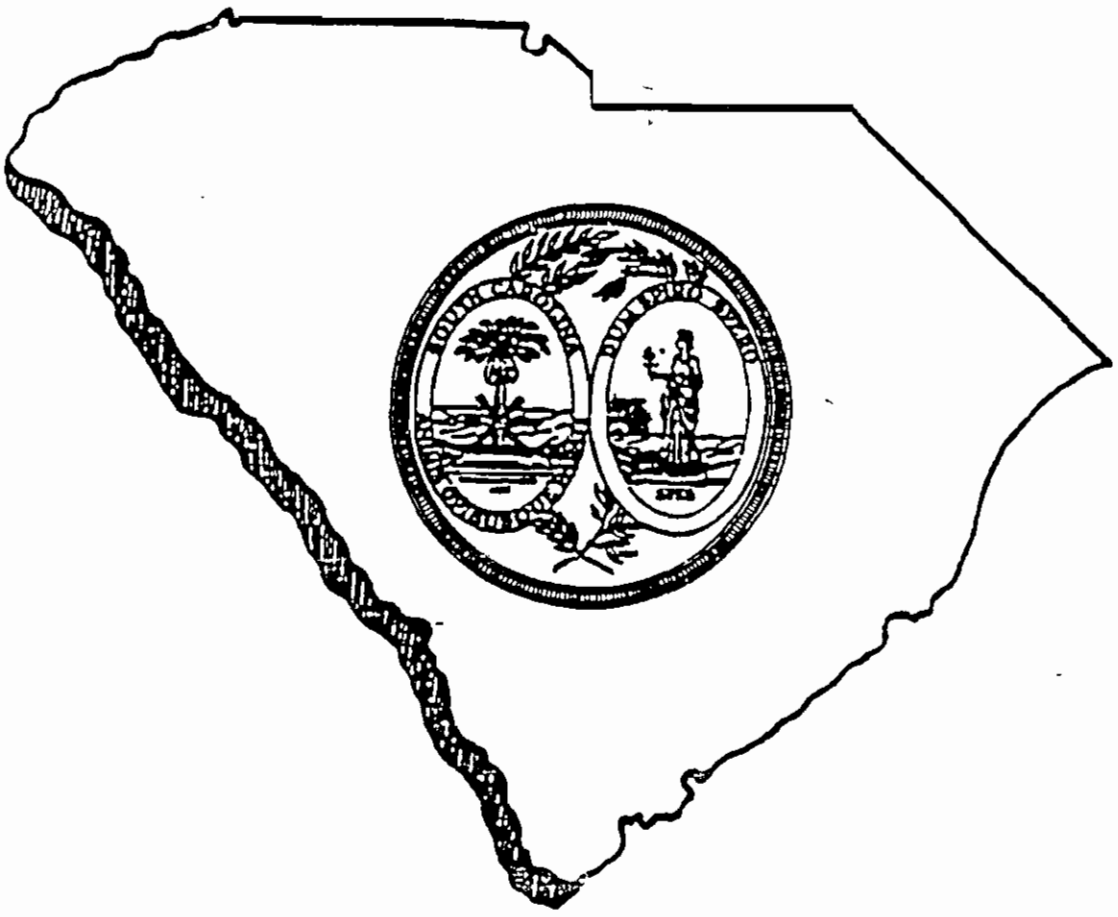
SUMMARY of SLUG TEST

SOIL/GROUND-WATER

REMEDIATION GUIDANCE DOCUMENT

March 3, 1992

(Revised from January 1, 1991)



South Carolina Department of Health and Environment Control

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SOIL/GROUND-WATER REMEDIATION GUIDANCE DOCUMENT

January 1, 1992 (Revised from June 17, 1991)

CORRECTIVE ACTION PLAN

INTRODUCTION

The Ground-Water Protection Division (GWPD) of South Carolina Department of Health and Environmental Control (SCDHEC) has developed the following guidance for sites requiring remediation under the S.C. Pollution Control Act and Subtitle I of RCRA. This document outlines the information which should be collected and presented to SCDHEC prior to initiating soil and/or ground-water corrective action.

The information is to be presented in the form of a Corrective Action Plan (CAP) which is to be submitted to and approved by the SCDHEC program area prior to its implementation. The information discussed below should be derived prior to and included in the CAP to provide adequate justification that the proposed remediation efforts (soil and/or ground water) will be effective. This CAP must be prepared by a qualified professional registered in the State of South Carolina.

GROUND-WATER CORRECTIVE ACTION

Elements of a Ground-Water CAP

For a Ground-Water CAP to be considered complete, the following should be included, as appropriate:

1) Historical background documenting the source(s) and circumstances related to the release;

) A summary of the initial abatement actions taken to eliminate the source and any on-going corrective action measures such as free-product recovery;

3) A qualitative description of the contaminants present;

4) Results of the site investigations (soil and ground water) that accurately define the horizontal and vertical extent of contamination. This should include, but not be limited to:

- o a scaled site map that includes locations of the source(s) of the contamination, all existing and proposed borings, monitoring and recovery wells, buildings, above and below-ground utilities, underground storage tanks (USTs), and other appurtenances that could potentially affect contaminant migration or could become impacted by contaminants.
- o all geological logs and well construction details.
- o all soil and ground-water quality, water level and product thickness data presented in tabular form.
- o potentiometric maps (scaled) utilizing representative data.
- o areal extent of dissolved contamination, defined with the contaminant concentration values for each sampling event plotted on a scaled map of the investigation area.
- o two stratigraphic cross sections of the site with one parallel to the site maximum hydraulic gradient (horizontal) and one perpendicular to the maximum hydraulic gradient (horizontal).
- o vertical extent of dissolved contamination superimposed on the stratigraphic cross-sections.
- o isopleths of free-phase product for each sampling event on the scaled map of the investigation area.

- o a summary of the selected water treatment/disposal option which will be expounded upon in the appropriate permit application or engineering report (discussed below).

5). Site geological information that includes relevant soil and/or aquifer parameters which are necessary to design an effective remediation system, i.e., one that will eliminate any remaining source (e.g., soil contamination) and/or capture the entire ground-water contaminant plume. This should include, but not be limited to:

- o hydraulic conductivity;
- o hydraulic gradient;
- o calculated ground-water flow velocity and direction;
- o effective porosity;
- o transmissivity;
- o storativity; and,
- o specific yield (for unconfined aquifers).

For the above, all calculations shall be presented with assumptions and unknowns clearly stated. References should be cited where applicable.

6) Any other computations and all hydrogeological data used that demonstrate the proposed plan will effectively remediate the contamination. These may include simple (i.e. graphical) to complex models with all input included (e.g., pumping rates, equations, calculations).

7) A recovery monitoring and reporting program (separate from any treatment system monitoring program) that will adequately demonstrate the effectiveness of the recovery system.

WORST CASE WELL ANALYSIS

Before ground-water recovery can be initiated, the ground-water quality and contaminants must be thoroughly characterized. The well that is documented to have the highest levels of contamination or the well with the greatest thickness of free product (if present) must be sampled for an expanded list of parameters (worst-case well analysis). The parameters to be determined should be any water soluble component of the material released. For

gasoline, the parameters to be included, at a minimum, are:

1) Environmental Protection Agency (EPA) analytical methods 601/602 (gasoline) or equivalent, to include:
    - o benzene, toluene, ethylbenzene, and xylenes (BTEX)
    - o methyl tert-butyl ether (MTBE)
2) lead (total)
3) naphthalene
4) pH
5) BOD_5
6) any other constituents believed present.

For all hydrocarbon products other than gasoline, the above list should be used by replacing items 1) and 3) with EPA analytical methods 624 and 625, plus xylenes. For products other than hydrocarbons, the facilty should determine all contaminants present. The final parameters will be determined in conjunction with the GWPD on a site-by-site basis.

INJECTION/DISPOSAL OPTIONS FOR RECOVERED TREATED GROUND WATER

Ground-water remediation may consist of withdrawal, treatment, and then injection or other disposal of recovered, treated ground water. The injection and disposal options typically used are listed below along with a brief discussion and the time frames for submittal of necessary information for each of these options. Other technologies can be utilized if sufficient documentation is provided as to their effectiveness. All disposal or return options have associated quality requirements for the treated water, which will vary by option and site of disposal.

CORRECTIVE ACTION WELLS

Recovered treated ground water may be returned to the sub-surface via injection through class VA Corrective Action Wells. In addition to conventional wells, Class VA injection wells include subsurface infiltration galleries and drainfields. If this option is chosen, an Underground Injection Control (UIC) Permit Application, worst case well analysis, CAP, and an engineering report (for any water treatment system) should be submitted. Requirements for permitting are detailed in the State Underground Injection Control Regulations (R.61-87) and in the Department guidance document "Instructions for Attachments to Form 1 UIC for Corrective Action Wells." The engineering report (for

/astewater treatment/discharge) should be submitted as a separate document from the CAP and the UIC Application. The requirements for the engineering report are outlined the "Guidance Manual for Industrial Wastewater Division Permitting Requirements for Hydrocarbon Contaminated Ground-Water Remediation Projects."

DISCHARGE TO POTW

If a discharge is to be sent to a Publicly Owned Treatment Works (POTW) with or without pretreatment, the procedure should be followed as outlined the "Guidance Manual for Industrial Wastewater Permitting Requirements". If this option is chosen, the POTW should be contacted expeditiously and this office should be copied on all written correspondence. The POTW should also be provided with the worst case well analysis. A CAP and the information required in Section II (6) should be submitted within 30 days of receipt of the required discharge limits from the POTW. An engineering report should be submitted at the same time when pretreatment is necessary prior to discharging to the POTW. The engineering report to be submitted shall also demonstrate that the POTW will have the capability to accept the discharge without subsequent violations of their existing permit.

LAND APPLICATION

Land application (i.e., spray irrigation) can be used as a method of treatment and disposal. It may also increase the rate of recovery at the site by flushing soils and enhancing natural biodegradation of the contaminants. If this option is chosen, a worst case well analysis, CAP, and an engineering report (for any treatment system) should be submitted. The engineering report should be submitted as a separate document from the CAP. The requirements for the engineering report are outlined in the "Guidance Manual for Industrial Wastewater Division Permitting Requirements for Hydrocarbon Contaminated Remediation Ground-Water Projects."

NPDES PERMIT

The "Guidance Manual for Industrial Wastewater Division Permitting Requirements" details the National Pollution Discharge Elimination System (NPDES) permit process. If this option is chosen, a completed NPDES application and the worst case well analysis described above should be submitted with the assessment report. Once a draft NPDES permit establishing the discharge limitations has been issued, the responsible party must finalize a CAP and an engineering report for the treatment system design and submit the package within 30 days. If the treated water is planned to be discharged into a drainage structure

'ying in a SC Department of Highways and Public Transportation (SCDHPT) right-of-way, the permit application should include a separate (detachable) discussion as to way this is the only feasible discharge. The permittee shall also apply to SCDHPT for an encroachment permit noting that SCDHEC is requiring ground-water remediation and that the requested encroachment is for the public purpose of remediating contaminated ground-water.

SOIL CORRECTIVE ACTION

INTRODUCTION

A CAP is also required for in-situ remediation (i.e., clean-up of soils "in-place") and/or remediation of excavated soils to demonstrate that the proposed soil treatment system is designed, constructed, monitored, and maintained so that it will remediate the contaminated soils, and that a soil and/or ground-water impact will not occur as a result of the proposed corrective action. Requests for off-site soil disposal/treatment (i.e., landfilling, incineration) should be submitted to the SCDHEC project manager which in turn will contact the appropriate Bureaus for review and action.

A complete CAP may not necessary for off-site thermal treatment of impacted soil and for the disposal at an off-site landfill.

ELEMENTS OF A SOIL CAP

All CAPs addressing soil remediation, regardless of the proposed method of corrective action, should include the following introductory information, as appropriate:

- Brief discussion of the background, purpose, and scope of the proposed corrective action;
- A scaled site map that includes locations of all existing and proposed monitoring, recovery, and injection wells, buildings, surface water bodies, etc;
- Location and description of any drinking water wells within one-quarter mile of the site;
- A detailed description of the site hydrogeology;
- Analytical results documenting the types and concentrations of soil

contaminants;

- The amount and/or area of contaminated soil;
- A soil and/or ground-water monitoring program to demonstrate the effectiveness of the remedial action will be necessary (soil and/or ground-water monitoring will be necessary for any un-lined treatment system; quarterly monitoring is recommended unless an alternative schedule is necessary or justified); and,
- The anticipated duration of treatment activities and an implementation schedule.

SOIL SAMPLING/ANALYSES

Excavated soils should be segregated and stockpiled according to the degree of evident contamination, and be sampled accordingly. Stockpiled contaminated soils should be placed on and covered with an impervious material (e.g., thick plastic sheeting), and bermed to prevent runoff.

Although the amount of samples to be taken vary with the quantity of soil to be disposed, one vertically composite sample (top portion, middle portion, bottom portion) should be collected for each ten (10) cubic yards of contaminated soil in each stockpile. However, for a very large quantity of soil (>100 cubic yards), the department will limit the total number of composite samples to ten (10) or more for the entire stockpile. This consideration will be on a case by case basis. Also, these samples are vertical composite samples and should not be combined and arranged for the best results.

Typically, samples should be analyzed for benzene, toluene, ethylbenzene, xylenes, and total petroleum hydrocarbons (as outlined in "Petroleum Hydrocarbons Analytical Methodology for Ground-Water and Soil Assessment"). Soils impacted by fuel oils should also be analyzed for polynuclear aromatic hydrocarbons and waste oils should also be analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, total halogens, and any other constituents (PCBs, etc.) believed to be present.

SOIL REMEDIATION

Certain types of contaminants can be addressed by on-site bioremediation and landfarming as a method for remediation. If a soil to be remediated is contaminated with virgin petroleum product (and is not classified as a hazardous waste), landfarming or bioremediation may be a viable method of corrective action. For example, soils contaminated by a gasoline release from a regulated petroleum underground storage tank may be appropriate for landfarming.

Soils impacted by used waste oils are not appropriate for bioremediation and/or landfarming. In addition, soils that exceed the toxicity characteristic leaching procedure (TCLP) regulatory limits set forth on pages 11845 and 11846 of the March 29 ,1990 Federal Register are considered to be a hazardous waste and must be dealt with as such.

ON-SITE BIOREMEDIATION

On-site remediation of excavated soils may be proposed as appropriate. Two methods, on-site bioremediation (where excavated soils are properly contained and biologically treated) and landfarming (land application/mixing of contaminated soils to promote biological degradation), are discussed below.

CAPs addressing planned on-site bioremediation of excavated soils should include the following items as appropriate:

- Laboratory (bench scale) studies to demonstrate the effectiveness of the proposed treatment, and justifications for the type, rate, and method of nutrient and/or microbial addition.

- Specifications for liners (over- and underlying) to contain excavated soils before and during treatment.

- Consideration, as necessary, for (of) containment of any leachate generated by the bioremediation process; e.g., system design collects generated leachate which is subsequently reapplied.

- Consideration, as necessary, of any air emissions generated during the bioremediation process. An Bureau of Air Quality Control (BAQC) modeling information sheet is enclosed in this document.

ON-SITE LANDFARMING

Excavated petroleum contaminated soils can be remediated by land-farming. This process involves the utilization of bioremediation in which natural occurring microorganisms break down petroleum products. Landfarming is the spreading of contaminated soil onto uncontaminated soil over a specified area followed by mixing or tilling the two together. This landfarming guidance information has been prepared to outline methods for determining site suitability, preparation, and monitoring.

This guidance document is for a one time landfarming effort and not intended to provide guidance for "high production" landfarming facilities.

The type of contamination and the degree of contamination of the soil should be quantified before application can begin (as outlined in the Sample Methodology Section of this document).

Site Suitability Study

A Site Suitability Study, as outlined below, should be conducted and submitted to SCDHEC as part of the CAP for approval prior to site improvement and/or to initiating landfarming.

A formula has been developed to determine the minimum acreage necessary for a known quantity of soil with a known contaminant level. The resulting acreage is the **minimum** land area required for that amount of impacted soil to be incorporated into upper 3 inches of soil. This value represents 1% of the total soil weight as contaminant hydrocarbons, following the recommendations of Overcash and Pal (1976). The minimum Acreage that is required to land farm a given amount of soil with a given TPH concentration utilizing the appropriate methods as outlined in "Petroleum Hydrocarbon Analytical Methodologies for Ground-Water and Soil Assessment".

Minimum Acreage = (tons of impacted soil) x (TPH in mg/kg) x
(conversion value = 909 kg/ton x 1kg/1,000,000 mg x

1 acre/454.4 kg)

For example, 150 tons of contaminated soil having an average TPH concentration of 1,300 mg/kg is stockpiled. The minimum needed acreage determined by filling in the above equation.

EX: 150 tons of soil, TPH is 1,300 mg/kg

(150 tons)(1,300 mg/kg)(909 kg/ton)(1kg/1,000,000 mg)

(1 Acre/454.4 kg) = 0.39 acres (minimum acreage needed)

Certain sites would be unsuitable for landfarming. The following characteristics would render a site unsuitable for landfarming:

- o Wetlands, quarries, gravel pits, and 10 year floodplain sites;
- o Excessive permeability (> 6 inches per hour);
- o Within 500 feet of lake, pond, river or potable water well;
- o Within 250 feet of a residence or commercial building;
- o Within 250 feet of a known underground cave or sinkhole;
- o On any land with slope greater than six percent (6%);
- o On any site where bedrock is less than five (5) feet below the surface;
- o On any site where the seasonally high water table is less than eight (8) feet below the surface. The depth to the water table must be greater than eight (8) feet to help insure that any leachate produced does not impact the ground-water;
- o On any site were there is a significant potential for ponding of rain water.

The purpose of the Site Suitability Study is to describe the soil column, determine depth to ground water, classify the soils, and determine the soil chemistry. The Site Suitability Study should be prepared by qualified personnel and should include, at a minimum:

- o Topographic map of the site;

- Analytical data for impacted soil as specified in the sampling/analyses section of this document;

- Soil profile and field tested permeability by ring infiltrometer, of the A and B horizons. Coarse sands, because of their large pores, do not hold water and tend to be more barren of bacteria colonies. Clays tend to retard infiltration, thereby encouraging runoff and erosion. The appropriate soils should contain more than 20%, but less than 35% clay and approximately 40% to 50% sand. One source for this information is the soil survey published by the U.S. Soil Conservation Service;

- The depth to the seasonal high ground-water table. This should be determined by installing a monitoring well in the middle of the proposed treatment area. The monitoring well should be installed in a manner to prohibit damage from future disking or site work, so that the well brackets the water table with a minimum ten (10) foot screen and meets the requirements of the South Carolina Well Standards and Regulations (R.61-71). If a monitoring well is damaged, it should immediately be properly abandoned and replaced (a damaged monitoring well could act as conduit for leachate to migrate to the water table).

- Slope of the proposed land farming site. The slope should not exceed six (6) degrees. By limiting the slope of the site, runoff and erosion are minimized. This information may also be obtained from the U.S. Soil Conservation Service Soil Survey.

- Soil chemistry. This should be determined to allow any adjustments to pH, nitrogen, and phosphorous contents of the soil needed to maximize microbacteriological breakdown of the hydrocarbon wastes. Nitrogen and phosphorous are the most likely chemical factors to effect the rate of bioremediation of the impacted soils. Therefore, the background levels of these elements present in the soils should be determined. A minimum of two (2) composite soil samples should be obtained from the proposed landfarm location to determine soil chemistry.

- Area calculations. Determine the minimum acreage required to landfarm the particular amount of impacted soil, as outlined above.

- o Step by step outline of pre-landfarming site improvements.

- o Step-by-step outline of proposed methods of contaminated soil application and application rates.

- o Landfarming treatment processes. Describe the proposed types and methods of nutrient addition, schematics of proposed site improvements and modifications, cover crop, minimum acreage necessary for landfarming, monitoring schedule, etc. (as outlined below in the implementation Section of this document).

Implementation

After the Department has approved a Soil CAP where landfarming was proposed, the site should be prepared in such a way to maximize the breakdown of the hydrocarbon contaminants and to monitor the progress of remediation. This includes the addition of nutrients, proper aeration, and run off control.

Site Improvement

The landfarming area should be designed in such a manner to insure that run off is contained within the area and that run on is avoided. Treatment and handling of stormwater run off may require appropriate permits from the SCDHEC Industial and Agriculture Wasterwater Division. Failure to do so could result in the spreading of contaminants into adjacent areas not previously impacted. If various contaminated soils are to be landfarmed at the same location, the different contaminated soils to be applied should be separated. Also, the landfarming plan should include soil sample locations, measures for storage of contaminated material during site preparation and during rainy weather.

The proposed site should be clearly marked so that the entire land-farming area is defined (borders, berms, etc.). Soil sampling locations should be marked and any monitoring well(s), if present, should be visible.

A cover crop is suggested in order to retard run off. The cover crop should not be used for consumption, animal food, or be a food-chain crop unless toxicological evidence is present showing its suitability. Certain types of vegetation are more appropriate than others for landfarming in certain soils, and some plants can withstand more contaminated soils than

others. Therefore, a crop or grass should be chosen that can survive the type of soils, climate, and root environment present.

Nutrient Addition

In general, soils in South Carolina are acidic. The addition of petroleum contaminated soils could lower the pH. Lime may be added to the landfarming site to maintain the pH at between 6.0-6.5 or at optimum for microbial decomposition of the contaminants. The pH should be monitored during landfarming to determine if the addition of lime is needed to maintain pH at the optimal level.

Information obtained from the initial site characterization should be used to determine if the soil's natural nutrient content should be supplemented. Nitrogen analysis measures, and the soil organic content reflects the nitrogen levels in the soils, while extractable phosphorous analysis indicates the amount of available phosphorous.

Nutrient addition may be necessary in the form of nitrogen and/or phosphorus. Application rates vary; the initial analysis of native soil (determined in the Site Suitability Study) will indicate what nutrients are lacking. The nutrients can be applied immediately before or after contaminated soil application. The ratio of carbon to nitrogen should be about even (1:1 ratio). The addition of petroleum contaminated soil will increase the carbon content; therefore, the addition of nitrogen may be necessary to restore the desired C:N (i.e 1:1) ratio. Phosphorus content of the soil should at least be 20 mg/kg, if not, phosphorus should be added.

Application

Non-Dedicated equipment used during soil application should be properly cleaned subsequent to use and the procedure should be outlined in the soil CAP.

Contaminated soil should be spread in an even application onto the site. Applied soils should then be incorporated into the native soil by either roto-tilling or disking within 24 hours. Mixing should occur within the upper six inches of native soil. If disking is used, several passes may be necessary to fully incorporate the contaminated soils.

The soils should be tilled approximately once a month. More frequent tilling could cause overdrying of soils; less tilling could result in less biodegradation due to reduced oxygen content in the soil. If a cover crop is utilized, it should be planted in such a manner as to allow adequate tilling of the soils.

Monitoring

Soil and ground-water monitoring is required before, during, and after completion of landfarming. Monitoring is necessary to confirm that the treatment process is effective and that contamination is not migrating to the water table. Ground-water samples should be taken on a quarterly basis until the analytical data from the soil samples are below detection for the contaminant in question and then an additional round of ground-water samples should be collected in the subsequent quarter.

A minimum of four (4) soil samples should be obtained from the landfarming location with an additional sample for every 5,000 square feet of landfarming area. Soil samples should be taken when the impacted soils are incorporated and every 30 days thereafter. Soil samples should be composite samples and should be taken in such a manner to be representative of the entire landfarming area.

All sampling and analytical methods must meet the relevant EPA and SCDHEC criteria. All laboratory work must be performed by laboratories certified by the SCDHEC.

All analytical data should be submitted to the SCDHEC program area responsible for the project within 30 days of receiving the results from the lab. Quarterly monitoring reports should include analytical data from the monitoring well, soil samples, depth to ground-water, reports of any possible run off events, and any other pertinent information. Additional sampling may be required by the SCDHEC on a site-specific basis, if necessary and will be identified in the Soil CAP approval.

Land to be used for landfarming must be the property of the responsible party or there must be a signed statement from the land owner giving approval to utilize that property in that manner. This information must be provided to SCDHEC prior to approval of on site activities.

IN-SITU SOIL REMEDIATION

If in-situ (treating in place) soil remediation such as bioremediation or soil venting is proposed, the CAP should include a technical pilot study that clearly outlines technical justification of the proposals effectiveness and the following items as appropriate:

- Soil and ground-water isoconcentration maps.

- o Construction details of the proposed system.

- o All proposed injection and/or venting locations on a scaled site map, including all piping and proposed air flow directions.

- o Discussion of ground-water flow rate and predicted rate of attenuation of contaminant concentrations in soils, groundwater, and air emissions through time.

- o A scaled site map showing predicted radius of influence in relation to existing wells, utilities, and structures, and technical justifications for the proposed effectiveness of the system:

    a) For in-situ soil venting include anticipated air emission rates of contaminants.

    b) For in-situ bioremediation, include all relevant information that demonstrates that the site hydrogeology, microbial activity, and the proposed nutrients and their application rates are appropriate for the proposed process.

- * **NOTE: Injection of any type (air, nutrients, potable water, etc.) will require an Underground Injection Control Permit in accordance with R.61-87.**

OFF-SITE DISPOSAL

Off-site disposal requires prior approval. A request for off-site disposal should be submitted to the program responsible for oversight of the project who will in turn forward to the appropriate SCDHEC personnel for action, and should include the following:

- o Analytical data (as specified in the soil sampling/analyses section of the document), with chain of custody forms.

- o A map showing the configuration of the stockpile along with the vertical sampling locations.

- o A cross-section drawing showing the locations of the vertical composite samples from

the stockpile.

Provide Site I.D. (e.g. GWPD #).

o Any other appropriate information.

GENERAL

Termination of in-situ soil treatment activities must receive prior approval from the SCDHEC, with the time to termination made on a site-by-site basis. When the excavated treated media is destined for off-site disposal, the termination of treatment of excavated soils is when the material is physically removed. When the excavated treated media is to remain on-site, treatment is complete when analytical results from representative soil samples indicate that the concentration of total petroleum hydrocarbons (TPH), and total benzene, toluene, ethylbenzene, and xylenes (BTEX) are below detection limits.

Acceptable analytical detection limits for TPH is 10 milligrams per kilogram (mg/kg), and for benzene, toluene, ethylbenzene, and xylenes 1 milligram per kilogram (mg/kg).

PERMITTING AIR POLLUTION SOURCES

Any person who plans to construct, alter, or add a source of contaminants to the atmosphere (i.e., through the construction of a bioremediation and/or soil venting system) must submit the attached Bureau of Air Quality Control (BAQC) modeling information form with the CAP before construction may begin, even for those operations which may emit less than 1000 pounds of air toxics per month.

WHO TO CONTACT

All documents, applications, reports, etc., should be submitted to the SCDHEC personnel providing oversight on the project. Pertinent information will then be distributed to other appropriate divisions or personnel as necessary. Three copies of the CAP, four copies of the engineering report, and two copies of the air pollution permit application will be required.

Questions should be directed to the appropriate SCDHEC project manager.

Attachments: BAQC Modeling Information Form

Petroleum Hydrocarbon Analytical Methodology for Ground-Water and Soil Assessment

tam/CAPNPDES.4

South Carolina
DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201

BAQC UST MODELING INFORMATION

PLEASE FILL OUT COMPLETELY

SITE/COMPANY NAME: _____ GWPD ID#: _____

CLEANUP LOCATION: _____

_____

TYPE OF OPERATION (i.e. AIR STRIPPER): _____

CONTACT: _____ PHONE: _____

SITE MAPS

Please include a scaled plot plan of the site location that clearly shows distances from the stack to the property boundaries. All buildings and/or structures within a radius of 5 stack heights (measured from the stack/vent) shall be incorporated on this plot plan and information on each building and/or structure's height, width, and length shall also be included.

STACK INFORMATION

HEIGHT ABOVE GROUND _____ FEET; DIAMETER _____ FEET

TEMPERATURE _____ F; VELOCITY _____ FEET/SECOND

AIR TOXIC INFORMATION

	AIR TOXIC EMITTED (i.e. BENZENE)	CHEMICAL ABSTRACT SERVICE (CAS) NUMBER	EMISSION RATE LB/HR
A)			
B)			
C)			
D)			

Please submit this completed sheet with scaled site maps to the appropriate SCDHEC project manager at the Ground-Water Protection Division, 2600 Bull Street, Columbia, SC 29201.

5090

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DR. P O BOX 10068
CHARLESTON, S.C 29411-0068
Autovon 563-0575

PLEASE ADDRESS REPLY TO THE COMMANDING OFFICER NOT TO THE SIGNER OF THIS LETTER REFER TO

5090
Code 1143/13

2 DEC 87

From: Commanding Officer, Southern Division, Naval Facilities Engineering Command
To: Commanding Officer, Naval Shipyard, Charleston, S.C.

Subj: UNDERGROUND STORAGE TANK EVALUATIONS

Ref: (a) 40 CFR 280, Underground Storage Tanks; Published 8 Nov 1985, Amended by Proposed Technical Standards 17 Apr 1987
(b) Section R.61-92, South Carolina Code of Laws, Underground Storage Tanks; Published 24 May 1985
(c) Section 101(14) of CERCLA 1980
(d) Open-End A&E Contract N62467-85-C-0064
(e) Activity Visit by Ms. Suzanne O. Sanborn of 28 August 1987

Encl: (1) SOUTHNAVFACENGCOM Tank Evaluation Approach
(2) Evaluation of Tanks Governed by 40 CFR 280 and Section R.61-92; High Priority
(3) Evaluation of Tanks Governed by 40 CFR 280 and Section R.61-92; Low Priority
(4) Corrective Project Documentation
(5) Funding Guidance for the UST Program

1. References (a) and (b) were promulgated governing underground storage tanks nationwide and in South Carolina which contain petroleum products or any chemical substance defined in reference (c). As a result, numerous underground storage tanks were required to be registered with the state, and new installation criteria and construction, operational and abandonment standards were promulgated.

W/Encl
(400)xc
FC

2. To comply with the new regulations, we obtained an A&E firm, Harding Lawson Associates, to conduct an inventory and an evaluation of all existing Navy petroleum underground storage facilities within the state of South Carolina. Under reference (d), the A&E produced the inventory necessary to complete the notification forms that were submitted to SCDHEC. Information contained on the notification forms included the approximate age, the total capacity, the materials of construction, and the utilization of each underground storage facility. Now that the notification procedure has been accomplished, actions are necessary to bring each Navy tank into compliance with both references (a) and (b). The A&E has evaluated all regulated underground storage tanks with respect to groundwater monitoring, leak detection, retrofitting, replacement, and abandonment or removal requirements.

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Code 1143/13

Subj: UNDERGROUND STORAGE TANK EVALUATIONS

3. Reference (e) was made to review the A&E's recommendations in the evaluation report with activity personnel and to determine the best long term alternative for both the activity and the Navy. Enclosure (1) is a brief explanation of SOUTHNAVFACENGCOM's views and tank evaluation approach that were used to determine the quickest and most cost effective solutions. Enclosure (2) contains our recommendations, as discussed with the activity, on those tanks governed by references (a) and (b). These tanks will require corrective action within the next three years and should be placed on a priority schedule. Enclosure (3) contains the recommendations on those additional tanks governed by references (a) and (b) which may be placed on a lower priority as corrective action may be scheduled over the next ten years.

4. Monitoring systems for leak detection required on existing tanks are fundable under the Navy's Pollution Abatement program. Accordingly, we have prepared and submitted project documentation for monitoring systems to NAVFACENGCOM for approval and funding. Tank retrofit, replacement and removal or abandonment projects are not Pollution Abatement fundable and must be implemented by the activity. To assist you in the development of project documentation, we have prepared Step II submissions and cost estimates as enclosure (4) for tank retrofit, replacement and removal or abandonment projects. This enclosure should be reviewed, modified and submitted through the appropriate chain of command. Enclosure (5) provides complete guidance on funding for the Underground Storage Tank (UST) program.

5. Action will continue to be taken at SOUTHNAVFACENGCOM to ensure that all corrective projects are implemented. Compliance with all UST's program and regulations is essential if the Navy is to protect the environment from leakage and contamination from underground storage tanks. Corrective projects and new tank installation plans should be forwarded for review to SOUTHNAVFACENGCOM Code 1143 to ensure that the regulations are being followed.

6. Any questions regarding the UST program should be directed to Ms. Suzanne O. Sanborn or Mr. John Albrecht at the above telephone number.

J. B. MALONE, JR.
By direction

SOUTHNAVFACENGCOM TANK EVALUATION APPROACH

Many of the latest nationwide studies published on underground storage tanks indicate one thing: tanks of certain ages constructed with certain materials have a high probability of leaking products into the environment. Today, tank manufacturers proclaim that tanks have a useable life of 15-20 years depending on construction specifications, installation standards, and geographic location. Harding Lawson Associates' study indicates that 71% of the underground storage tanks owned by the Navy in the state of South Carolina are at least 16 years old. Based on today's manufacturer's specifications, these tanks should be replaced.

Our main priority is to comply with EPA's 40 CFR 280, Underground Storage Tanks (UST) Regulations, and with R.61-92, South Carolina Code of Laws, by meeting specification requirements for leak prevention which requires state-of-the-art technology during installing, constructing, operating, and abandoning UST's and associated piping. Also of concern is ensuring that releases will be reported, monitored and that the appropriate remedial action will be taken to prevent or confine the contamination of the subsurface or the groundwater. These leak prevention requirements are to be met within a three to ten year period depending upon tank condition and the original date of installation.

Of the technical requirements in 40 CFR 280 and R.61-92, the first is to certify that all new underground storage tank systems are properly installed. These systems must be protected from corrosion. Bare steel underground storage tanks must be cathodically protected and coated with a corrosive-resistant material. Other systems must be made totally of a non-corrosive material or a steel and non-corrosive composite. These systems must be equipped with spill and overfill prevention devices and have a leak detection method with provisions for monitoring at least every 30 days.

Within a ten year period, existing underground petroleum tanks must meet the same requirements as new tanks for corrosive protection, leak detection, and prevention of spills an overfills. In most cases, fairly new existing tanks (0-5 years old and 6-10 years old), will require upgrading through retrofitting because these tanks partially comply with the requirements. Therefore, these tanks will be placed on a lower priority schedule for corrective action. Tanks on a higher priority schedule will be older existing tanks (15-20 years old and over 20 years old). These older existing tanks, in most cases, do not meet any of the requirements for corrosive protection, leak detection, and prevention of spills and overfills. Therefore, during the initial ten year period, older existing tanks will be on the following higher priority schedule:

CONDITION	SCHEDULE
Bare Steel Underground	Must meet requirements within three years for corrosive protection, leak detection, and prevention of spills and overfills.

CONDITION	SCHEDULE
Corrosion Protected Underground Tanks	Must meet requirements within five years for a leak detection method and prevention of spills and overfills.

Tanks not in compliance within the prescribed deadlines must either be closed or upgraded. During the ten year interim period, a combination of daily inventory control and periodic tank tightness testing (once every three years) should be used for security measures.

From the Navy's perspective, most of the tanks of concern are bare steel and already in excess of sixteen years old. They do not have cathodic protection, leak detection, or spill/overfill prevention devices. From a Navy-wide point of view, it is more economical to plan closure or replacement of these tanks now rather than to install leak detection systems now and have to replace the tanks in ten years in order to meet new tanks standards. Bulk storage facilities are an exception because MILCON projects are normally required for replacement.

EVALUATION OF TANKS GOVERNED BY 40 CFR 280 AND R.61-92
HIGH PRIORITY SCHEDULE

Below are our recommendations, as discussed with the activity personnel, along with the dates that action must be taken to comply with regulations.

Naval Shipyard, Charleston

Tanks 1279 A and B

These two steel tanks are over twenty years old. These tanks contain 2,500 and 3,000 gallons of unleaded and leaded gasoline, respectively. Each tank is equipped with a cathodic protection system. There has been no history of leaks/spills from these tanks. As long as the tanks show no major deterioration, they may continue to be used; however, it is required that a monitoring system be installed within the next five years.

Action for Installation of Monitoring Wells Required
to be Accomplished By: 31 December 1992
Funding: SOUTHNAVFACENGCOM

Tank 1279 C

This steel tank is fairly new and equipped with a cathodic protection system. It contains 3,500 gallons of unleaded gasoline. This tank was installed to replace a leaking tank. Incorporate this tank into the monitoring well system for tanks 1279 A and B. This should occur within the next five years.

Action for Installation of Monitoring Wells Required
to be Accomplished By: 31 December 1992
Funding: SOUTHNAVFACENGCOM

Tank 54

This 550 gallon diesel underground storage tank is over twenty years old. It is seldom used and has had no reported leakage; however, due to the age and condition of the tank, it will require replacement within the next three years. The tank should be replaced with a double-walled underground fiberglass tank equipped with an automatic between-wall monitoring system.

Action for Replacement Required By: 31 December 1990
Funding: Activity/Major Claimant

Tank NH 72

This 8,300 gallon fuel oil underground storage tank is over twenty years old and is located at the Organization Effectiveness Center. The soil around the tank shows evidence of minor spillage during refueling and gauging. This tank

is required to be replaced within the next three years with an underground double-walled fiberglass tank equipped with a between-wall automatic monitoring system. The contaminated soil is required to be excavated and properly disposed of.

Action For Replacement Required By: 31 December 1990
Funding: Activity/Major Claimant

Tank 590 A

This 2,000 gallon steel underground tank is located at the Radiation Control Office. It contains fuel oil and is over twenty years old. This tank does not meet new tank standards; therefore, it is required to be replaced with an underground double-walled fiberglass tank with between-wall automatic monitoring system within the next three years.

Action For Replacement Required By: 31 December 1990
Funding: Activity/Major Claimant

Tanks 6 A & B

These are two 2,500 gallon steel underground fuel oil tanks which are used to fire forging furnaces. These tanks are over twenty years old and do not meet the new tank standards. It is recommended that both tanks be replaced with one 5,000 gallon underground double-walled fiberglass tank equipped with automatic between-wall monitoring system within the next three years.

Action for Replacement Required By: 31 December 1990
Funding: Activity/Major Claimant

Tank 56

This 4,000 gallon steel underground tank is over twenty years old and stores fuel oil. It is located in a very congested area. It is recommended that this tank be replaced within three years by an underground double-walled fiberglass tank equipped with an automatic between-wall monitoring system.

Action for Replacement Required By: 31 December 1990
Funding: Activity/Major Claimant

EVALUATION OF TANKS GOVERNED BY 40 CFR 280 AND R.61-92
LOW PRIORITY SCHEDULE

Below are our recommendations, as discussed with the activity personnel, along with the dates that action must be taken to comply with regulations.

Naval Shipyard, Charleston

Tanks 13 A and B

There are two steel underground tanks each containing 560 gallons of calibrating fluid. They are fairly new tanks. These tanks will require replacement within ten years to insure full compliance with the regulations. They should be replaced with one 1,500 gallon underground double-walled fiberglass tank equipped with between-wall monitoring system. The tanks should be placed on long term routine maintenance program.

Action for Replacement Required By: 31 December 1997
Funding: Activity/Major Claimant

Tank Mechanical Section

This is a 550 gallon underground fiberglass tank which is used to store calibrating fluid. This tank is fairly new. At this time, there is no evidence of leakage or spillage. The tank should be placed on a routine maintenance program and inventory records kept daily by the activity. It is recommended to install a leak detection device within ten years.

Action for Retrofitting Required By: 31 December 1997
Funding: Activity/Major Claimant

Tank 240

This is a 5,000 gallon steel tank which is fairly new. At this time, the tank is not in use. It contains waste oil. Waste oil is classified as a hazardous waste in South Carolina; however, if the waste oil is recycled and burned on the premises, the tank will be regulated by 40 CFR 280 and R.61-92. It is recommended that this tank be replaced within ten years with an oil/water separator equipped with internal capacity to eliminate the external tank.

Action for Replacement Required By: 31 December 1997
Funding: Activity/Major Claimant

Tanks 1174 and 1169

These are two abandoned non-registered tanks that are over twenty years old. These tanks will need to be abandoned properly in accordance with API 1604 and R.61-92.12 within the next ten years.

Action for Removal/Abandonment Required By: 31 December 1997
Funding: Activity/Major Claimant

SPECIAL PROJECT REQUEST
NAVFAC 11014/64 (REV. 5-74)
Supersedes NAVFAC 9-11014/64 (11-68)
S/N 0105-LF-003-4230

STEP TWO SUBMISSION

TY SNDL NO	ACTIVITY NAME AND LOCATION	DATE SUBMITTED
	NAVAL SHIPYARD, Charleston, S.C.	16 Sep 87

NO	TITLE
	TANK RETROFIT/REPLACEMENT (INCLUDING PIPING)

3 TYPE
a. [ ] MAINT /REPAIR b. [ ] MINOR CONSTRUCTION/ ALTERATION c. [ ] AIR CONDITIONING [X] EQUIPMENT INSTALLATION

4 DESCRIBE AND STATE FUNCTION OF FACILITY

Underground storage tanks which supply fuels for automobiles, ships, aircraft, emergency generators, and heatings, and their associated piping.

a. PROPERTY RECORD CARD NO

b. NAVY CATEGORY CODE

c. BLDG OR STRUCTURE NO

5 WHAT IS THE EFFECT OF THIS PROJECT ON THE MISSION OF THE ACTIVITY?

Replacement/Retrofit of existing petroleum underground storage tanks and associated piping will prevent/halt environmental pollution. This will bring the activity into compliance with federal and state regulations.

6. THE REQUIREMENT FOR THE FACILITY IS BASED ON
a. [ ] A CHANGE IN MISSION b. [ ] FULL TIME CONTINUING NEED c. [ ] 3 TO 5 YEAR NEED d. [ ] LESS THAN 3 YEARS NEED e. [ ] CURRENTLY REQUIRED LESS THAN 50% OF TIME f. [X] RESERVED FOR FUTURE REQUIREMENTS

7a. EST. FUNDED COST	b. EST PROJECT COST	c. EST PLANNING COST	d TOTAL FUNDS REQUESTED	e EST. FACIL. REPL. COST
$ 161,379	$ 152,245	$ 9,134	$ 161,379	$

8. DATE FACILITY CONSTRUCTED
20+ years ago

9 IS FACILITY ON AN APPROVED BASIC FACILITY REQUIREMENTS LIST? *If NO, how was need determined?*
[ ] YES [ ] NO

JECT LISTED ON ANNUAL INSPECTION SUMMARY? *If answer is "NO, and AIS is applicable explain exclusion.*
S [ ] NO [X] N.A.

SCRIBE CONDITION TO BE CORRECTED OR PROBLEM TO BE SOLVED WITH PROPOSED SOLUTION *Attach additional description if necessary ONE PAGE ONLY*

Prevent loss of fuels and thereby protect the soils and groundwater.

12. WHY IS THE PROPOSED SOLUTION BEST – AND WHAT ALTERNATIVES WERE CONSIDERED?

EPA and SCDHEC regulations require that no leakage occurs. Tanks/piping 20 + years old are considered to be potential leakers and are out of compliance with new tank standards.

13. WERE ANY NON-NAVY EXPERTS INVITED TO REVIEW THIS PROBLEM AND THIS SOLUTION? *Explain effect on solution.*

a. [X] YES b. [ ] NO

14. HAS EFD DESIGN DIVISION REVIEWED SOLUTION? a. [ ] YES b. [X] NO

15. CAN ANOTHER FACILITY BE ECONOMICALLY ADAPTED FOR THIS FUNCTION? a. [ ] YES b. [X] NO

16. CAN PROJECT BE FUNDED IN PHASES? *How? How many?*
a. [ ] YES b. [X] NO

17. THIS PROJECT IS THE RESULT OF
[ ] INADEQUATE MAINTENANCE b. [X] FACILITY AGE c. [ ] DEFICIENT CONSTR d. [ ] DEFICIENT DESIGN e. [X] OTHER EPA Regulations

18 THIS SPECIFIC PROBLEM BEEN CORRECTED PREVIOUSLY?
a. [ ] YES b. [X] NO *When?*

HOW LONG WILL PROPOSED CORRECTIVE ACTION LAST? _____ YEARS

PE 577

19. ARE COMPONENTS BEING INCREASED IN SIZE OR CAPACITY? *Explain the difference, including cost*

a. [X] YES b. [ ] NO At facility 6, tanks 6A and 6B are to be combined, each having 2,500 gallon capacity to a one 5,000 gallon underground fiberglass tank.

20. ARE MATERIALS PROPOSED FOR USE THE SAME AS THOSE EXISTING? *If "NO," explain the difference, including cost*

a. [ ] YES b. [X] NO

21. PROJECT IS PLANNED TO BE ACCOMPLISHED BY

a. [ ] STATION LABOR b. [X] CONTRACT

22. HAS A PROJECT EVER BEEN SUBMITTED FOR THE REPLACEMENT OF THIS OR SIMILAR FACILITIES? *Check and explain if "YES."*

a. [ ] YES b. [X] NO *When?*

23. ANTICIPATED SAVINGS IF PROJECT IS DONE THIS YEAR AS COMPARED TO A DEFERRAL OF ONE YEAR

PROBABLE INCREASE IN PROJECT COST FOR ANY JUSTIFIABLE REASON	REDUCTION IN CURRENT MAINT COST	REDUCTION IN CURRENT OPERATIONS COST
$	$	$

JUSTIFY ANY SAVINGS INDICATED	WHAT IS PAY BACK PERIOD OF PROJECT? *(In years)*

WILL ACCOMPLISHMENT GENERATE REQUIREMENTS FOR ADDITIONAL M&O FUNDS OR PERSONNEL? a. [X] NO b. [ ] YES *Est. Ann.*

24. WHAT WOULD BE THE EFFECT OF DEFERRING THE PROJECT ONE YEAR?

Potential and liability for petroleum of the environment and violation of federal and state regulations.

*25. IF THE PROJECT IS NOT ACCOMPLISHED NOW, IN HOW MANY YEARS WILL THERE BE SERIOUS DAMAGE TO THE FACILITY AND/OR ITS CONTENTS OR IMPAIRMENT TO ESSENTIAL OPERATIONS? *Explain, include loss value to facility and/or contents.*

YEARS BEFORE SERIOUS DAMAGE OCCURS 3.

Bare steel tanks will be out of compliance by the end of December 1991. Protected steel tanks will be out of compliance by the end of December 1993. All tanks must meet new tank standards within a ten year period.

*26. HAS THE REDUCED UTILIZATION OF THIS SPECIFIC FACILITY AFFECTED A LARGE FACILITY SYSTEM OPERATION? *Explain.*

a. [ ] YES b. [X] NO BY HOW MUCH? _____%.

27. ARE THERE ANY OTHER FACTORS INVOLVED? *Check and explain.*

a. [ ] MORALE b. [X] HEALTH c. [X] PUBLIC RELATIONS d. [X] SAFETY e. [ ] FIRE PROTECTION f. [ ] SECURITY g. [ ] OTHER

All underground petroleum storage tanks must meet new tank standards within a ten year period. In order to meet these new tank standards, these tanks need retrofitting or replacement and thereby protecting the environment from contaminants. Violation of regulations will prevent a negative image to the public.

28. CERTIFICATION BY RESPONSIBLE OFFICER AT ACTIVITY: I am personally cognizant of the need for, the essentiality of, and the proposed method of accomplishment of this project and certify that the above information is correct, and that this project meets all criteria specified in OPNAVINST 11010.20 and subsequent changes thereto

SIGNATURE	TITLE	DATE

29. EFD TECHNICAL VALIDATION *(if required) (see para 7303, OPNAVINST 11010.20C)*

SIGNATURE	TITLE	DATE

ENCLOSURES

a. [X] ENGINEERING EST *(NAVFAC 2417)* b. [ ] LOCATION PLAN(S) c. [ ] DRAWINGS d. [ ] PHOTOGRAPHS

**NOT applicable to Minor Construction, Alterations, or Equipment Installation*

NAVFAC 181
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 18 Sep 87

SHEET 1 OF 1

ACTIVITY AND LOCATION: NAVAL SHIPYARD, Charleston, S.C.

CONSTRUCTION CONTRACT NO:

IDENTIFICATION NUMBER:

ESTIMATED BY: S. O. SANBORN

CATEGORY CODE NUMBER:

PROJECT TITLE: Tank Retrofit/Replacement (Including piping & detection leak

STATUS OF DESIGN: [ ] PCD [ ] 30% [X] 100% [ ] FINAL [ ] Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL
Replacement								
550 gallon double-wall FRP @ Bldg 54	1	EA	8100	8100	2750	2750	10850	10850
1,500 gallon double-wall FRP @ Bldg 13 (A&B)	1	EA	11341	11341	3190	3190	14531	14531
2,000 gallon double-wall FRP @ Bldg 590 A	1	EA	12650	12650	3300	3300	15950	15950
4,000 gallon double-wall FRP @ Bldg 56	1	EA	16280	16280	3700	3700	19980	19980
5,000 gallon double-wall FRP @ Bldg 6 (A&B)	2	EA	17820	35640	4180	8360	22000	44000
& Bldg. 240								
8,300 gallon double-wall FRP @ Bldg NH72	1	EA	22880	22880	8250	8250	31130	31130
							Subtotal	136441
Retrofit								
Bldg Mechanical Section w/leak detection device	1	SYS	2,000	2,000	160	160	2,160	2,160
Associated External piping @ 10 percent								
of total tank cost								13644
Design @ 6 percent of total tank & piping								9,134
cost & retrofit								
TOTAL								161,379

S/N 0105-LF-010-1335

DU S Government Printing Office 1979-683 874/0000 11

SPECIAL PROJECT REQUEST
NAVFAC 11014/64 (REV 5-74)
Supersedes NAVFAC 11014/64 (11-58),
S/N 0106-LF-003-4230

STEP TWO SUBMISSION

1. SNOL NO	ACTIVITY NAME AND LOCATION	DATE SUBMITTED
	Naval Shipyard, Charleston, S.C.	16 Sep 87

NO | TITLE: Installation of Monitoring/Leak Detection Systems

2. TYPE
a. [ ] MAINT REPAIR b. [ ] MINOR CONSTRUCTION/ ALTERATION c. [ ] AIR CONDITIONING [X] EQUIPMENT INSTALLATION

4. DESCRIBE AND STATE FUNCTION OF FACILITY
There are 6 petroleum tanks at this activity which must have monitoring/leak detection systems installed in order to comply with EPA 40 CFR 280 and SCDHEC R.61-92 regulations.

a. PROPERTY RECORD CARD NO
b. NAVY CATEGORY CODE
c. BLDG OR STRUCTURE NO

5. WHAT IS THE EFFECT OF THIS PROJECT ON THE MISSION OF THE ACTIVITY?
Will bring the mission into compliance with federal monitoring regulations eliminating the potential for fines and criminal actions.

6. THE REQUIREMENT FOR THE FACILITY IS BASED ON
a. [ ] A CHANGE IN MISSION b. [X] FULL TIME CONTINUING NEED c. [ ] 3 TO 5 YEAR NEED d. [ ] LESS THAN 3 YEARS NEED e. [ ] CURRENTLY REQUIRED LESS THAN 50% OF TIME f. [ ] RESERVED FOR FUTURE REQUIREMENTS

7a. EST. FUNDED COST	b. EST PROJECT COST	c. EST PLANNING COST	d. TOTAL FUNDS REQUESTED	e. EST. FACIL. REPL. COST
$ 29,760	$ 22,000	$ 7,760	$ 29,760	$

8. DATE FACILITY CONSTRUCTED

9. IS FACILITY ON AN APPROVED BASIC FACILITY REQUIREMENTS LIST? *If NO "how was need determined?*
[ ] YES [ ] NO

CT LISTED ON ANNUAL INSPECTION SUMMARY? *If answer is "NO," and AIS is applicable explain exclusion.*
a. [ ] NO [ ] N A

10. DESCRIBE CONDITION TO BE CORRECTED OR PROBLEM TO BE SOLVED WITH PROPOSED SOLUTION *Attach additional description if necessary.* (ONE PAGE ONLY)
In order to comply with EPA regulations: 40 CFR 280; monitoring systems must be installed on existing tanks to meet new tank standards.

12. WHY IS THE PROPOSED SOLUTION BEST – AND WHAT ALTERNATIVES WERE CONSIDERED?
An investigation was performed to determine the most cost-effective method of meeting new regulations. Alternatives evaluated for below-ground included tank replacement with double-walled tanks (with between-wall monitors).

13. WERE ANY NON-NAVY EXPERTS INVITED TO REVIEW THIS PROBLEM AND THIS SOLUTION? *Explain effect on solution.*
a. [X] YES b. [ ] NO

14. HAS EFD DESIGN DIVISION REVIEWED SOLUTION? a. [ ] YES b. [X] NO

15. CAN ANOTHER FACILITY BE ECONOMICALLY ADAPTED FOR THIS FUNCTION? a. [ ] YES b. [X] NO

16 CAN PROJECT BE FUNDED IN PHASES? *How? How many?*
a. [ ] YES b. [X] NO

17. THIS PROJECT IS THE RESULT OF
a. INADEQUATE MAINTENANCE b. [ ] FACILITY AGE c. [ ] DEFICIENT CONSTR. d. [ ] DEFICIENT DESIGN e. [X] OTHER EPA Regulations

18. HAS THIS SPECIFIC PROBLEM BEEN CORRECTED PREVIOUSLY?
a. [ ] YES b. [X] NO *When?*

HOW LONG WILL PROPOSED CORRECTIVE ACTION LAST? _____ YEARS

9. ARE COMPONENTS BEING INCREASED IN SIZE OR CAPACITY? *Explain the difference including cost.*

a. [ ] YES b. [X] NO

...TERIALS PROPOSED FOR USE THE SAME AS THOSE EXISTING? *If "NO," explain the difference including cost.*

...ES b. [X] NO N/A

... PROJECT IS PLANNED TO BE ACCOMPLISHED BY

a. [ ] STATION LABOR b. [X] CONTRACT

... HAS A PROJECT EVER BEEN SUBMITTED FOR THE REPLACEMENT OF THIS OR SIMILAR FACILITIES? *Check and explain if YES.*

a. [ ] YES b. [X] NO *When?*

23. ANTICIPATED SAVINGS IF PROJECT IS DONE THIS YEAR AS COMPARED TO A DEFERRAL OF ONE YEAR.

PROBABLE INCREASE IN PROJECT COST FOR ANY JUSTIFIABLE REASON	REDUCTION IN CURRENT MAINT COST	REDUCTION IN CURRENT OPERATIONS COST
$	$	$

JUSTIFY ANY SAVINGS INDICATED	WHAT IS PAY BACK PERIOD OF PROJECT? *(In years)*

WILL ACCOMPLISHMENT GENERATE REQUIREMENTS FOR ADDITIONAL M&O FUNDS OR PERSONNEL? a. [ ] NO b. [X] YES *Est. Ann.* 7,760

24. WHAT WOULD BE THE EFFECT OF DEFERRING THE PROJECT ONE YEAR?

Potential federal and state enforcement actions for illegal storage of petroleum in tank.

*25. IF THE PROJECT IS NOT ACCOMPLISHED NOW, IN HOW MANY YEARS WILL THERE BE SERIOUS DAMAGE TO THE FACILITY AND OR ITS CONTENTS OR IMPAIRMENT TO ESSENTIAL OPERATIONS? *Explain, include loss value to facility and/or contents.*

YEARS BEFORE SERIOUS DAMAGE OCCURS 3.

Tanks with bare steel will be out of compliance with federal regulations by the end of December 1991 and protected tanks will be out of compliance by the end of December 1993 unless monitoring systems are installed.

...IE REDUCED UTILIZATION OF THIS SPECIFIC FACILITY AFFECTED A LARGE FACILITY SYSTEM OPERATION? *Explain.*

... YES b. [X] NO BY HOW MUCH? _____%.

27. ARE THERE ANY OTHER FACTORS INVOLVED? *Check and explain.*

a. [ ] MORALE b. [X] HEALTH c. [X] PUBLIC RELATIONS d. [X] SAFETY e. [ ] FIRE PROTECTION f. [ ] SECURITY g. [ ] OTHER

Use of petroleum storage tanks with no monitoring system will be in violation of EPA regulations beginning in 1992 (for bare steel). All tanks must have monitoring/leak detection system within ten years (12-31-98). Violation of these regulations will present a negative image to the public.

28. CERTIFICATION BY RESPONSIBLE OFFICER AT ACTIVITY: I am personally cognizant of the need for, the essentiality of, and the proposed method of accomplishment of this project and certify that the above information is correct, and that this project meets all criteria specified in OPNAVINST 11010.20 and subsequent changes thereto.

SIGNATURE	TITLE	DATE

29. EFD TECHNICAL VALIDATION *(if required) (see para 7303, OPNAVINST 11010.20C)*

SIGNATURE	TITLE	DATE

ENCLOSURES:

a. [X] ENGINEERING EST. *(NAVFAC 2417)* b. [ ] LOCATION PLAN(S) c. [ ] DRAWINGS d. [ ] PHOTOGRAPHS

*NOT applicable to Minor Construction, Alterations, or Equipment Installation

NAVFAC 11013, 81
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 16 Sep 87

SHEET 1 OF 1

ACTIVITY AND LOCATION: NAVAL SHIPYARD, Charleston, S.C.

CONSTRUCTION CONTRACT NO:

IDENTIFICATION NUMBER:

ESTIMATED BY: S. O. Sanborn

CATEGORY CODE NUMBER:

PROJECT TITLE: INSTALLATION OF MONITORING/LEAK DETECTION SYSTEM

STATUS OF DESIGN: [X] PED [ ] 30% [ ] 100% [ ] FINAL [ ] Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL
(1) Monitoring Wells	8	EA					1,500	12,000
Site Investigation/Tank	5	EA					2,000	10,000
Monitoring Plan	2	SYS					3,000	6,000
A/E								1,760
Total								29,760

NAVFAC 11013, 81

GPO : Government Printing Office 1979 603-876/6681 21

NAVAL SHIPYARD, Charleston, S.C. 16 Sep 87

Underground Tank Abandonment (Removal or in-place abandonment)

3. TYPE
a. [ ] MAINT REPAIR b. [ ] MINOR CONSTRUCTION ALTERATION c. [ ] AIR CONDITIONING [ ] EQUIPMENT INSTALLATION N/A

4. DESCRIBE AND STATE FUNCTION OF FACILITY
There are two underground petroleum storage tanks which have been out of service for a long period of time. It is possible that these tanks have been abandoned improperly. In order for tanks to be properly abandoned, the following regulations will need to be applied. EPA 40 CFR 280, API 1604, and R.61-92.12.

a. PROPERTY RECORD CARD NO
b. NAVY CATEGORY CODE
c. BLDG OR STRUCTURE NO

5. WHAT IS THE EFFECT OF THIS PROJECT ON THE MISSION OF THE ACTIVITY?
Will bring the mission into compliance with federal and state regulations eliminating the potential for fines and criminal actions.

6. THE REQUIREMENT FOR THE FACILITY IS BASED ON
a. [ ] A CHANGE IN MISSION b. [ ] FULL-TIME CONTINUING NEED c. [ ] 3 TO 5 YEAR NEED d. [ ] LESS THAN 3 YEARS' NEED e. [ ] CURRENTLY REQUIRED LESS THAN 50% OF TIME f. [X] RESERVED FOR FUTURE REQUIREMENTS

7a. EST FUNDED COST	b. EST PROJECT COST	c. EST PLANNING COST	d. TOTAL FUNDS REQUESTED	e. EST FACIL. REPL. COST
$ 12,029	$ 10316	$ 1713	$ 12,029	$

8. DATE FACILITY CONSTRUCTED
20+ years ago

9. IS FACILITY ON AN APPROVED BASIC FACILITY REQUIREMENTS LIST? *If NO, how was need determined?*
[ ] YES [ ] NO

IS PROJECT LISTED ON ANNUAL INSPECTION SUMMARY? *If answer is "NO," and AIS is applicable, explain exclusion.*
[ ] YES [ ] NO [X] N.A.

11. DESCRIBE CONDITION TO BE CORRECTED OR PROBLEM TO BE SOLVED WITH PROPOSED SOLUTION. *Attach additional description if necessary, ONE PAGE ONLY.*
If tanks have been abandoned improperly, they may leak contaminants into the environment. In order to prevent loss of fuels and thereby protect the soils and groundwater, these tanks will be required to be abandoned properly.

12. WHY IS THE PROPOSED SOLUTION BEST – AND WHAT ALTERNATIVES WERE CONSIDERED?
EPA and SCDHEC regulations require that no leakage occurs from Underground Storage Tanks and piping abandoned improperly, could be potential leakers and are out of compliance.

13. WERE ANY NON-NAVY EXPERTS INVITED TO REVIEW THIS PROBLEM AND THIS SOLUTION? *Explain effect on solution.*
a. [X] YES b. [ ] NO

14. HAS EFD DESIGN DIVISION REVIEWED SOLUTION? a. [ ] YES b. [X] NO

15. CAN ANOTHER FACILITY BE ECONOMICALLY ADAPTED FOR THIS FUNCTION? a. [ ] YES b. [X] NO

*16. CAN PROJECT BE FUNDED IN PHASES? *How? How many?*
a. [ ] YES b. [X] NO

*17. THIS PROJECT IS THE RESULT OF
a. [ ] INADEQUATE MAINTENANCE b. [ ] FACILITY AGE c. [ ] DEFICIENT CONSTR d. [ ] DEFICIENT DESIGN e. [ ] OTHER: SCDHEC & EPA Regulations

*18. HAS THIS SPECIFIC PROBLEM BEEN CORRECTED PREVIOUSLY?
a. [ ] YES b. [X] NO *When?*

HOW LONG WILL PROPOSED CORRECTIVE ACTION LAST? _____ YEARS

PZ 977

19 ARE EMPLOYEES BE INCREASED/DECREASED DUE TO CAPACITY? *Explain, including #*

a. [ ] YES b. [X] NO

MATERIALS PROPOSED FOR USE THE SAME AS THOSE EXISTING? *If NO, explain the difference, including cost*

[ ] YES b. [X] NO

21 FED FOR IS PLANNED TO BE ACCOMPLISHED BY

a. [ ] STAT ON LABOR b. [X] CONTRACT

22 HAS A PROJECT EVER BEEN SUBMITTED FOR THE REPLACEMENT OF THIS OR SIMILAR FACILITIES? *Check and explain if "YES"*

a. [ ] YES b. [X] NO *When?*

23 ANTICIPATED SAVINGS IF PROJECT IS DONE THIS YEAR AS COMPARED TO A DEFERRAL OF ONE YEAR.

PROBABLE INCREASE IN PROJECT COST FOR ANY JUSTIFIABLE REASON	REDUCTION IN CURRENT MAINT COST	REDUCTION IN CURRENT OPERATIONS COST
$	$	$

JUSTIFY ANY SAVINGS INDICATED

WHAT IS PAY BACK PERIOD OF PROJECT? *(In years)*

WILL ACCOMPLISHMENT GENERATE REQUIREMENTS FOR ADDITIONAL M&O FUNDS OR PERSONNEL? a. [X] NO b. [ ] YES *Est. Ann.*

24 WHAT WOULD BE THE EFFECT OF DEFERRING THE PROJECT ONE YEAR?

*25 IF THE PROJECT IS NOT ACCOMPLISHED NOW, IN HOW MANY YEARS WILL THERE BE SERIOUS DAMAGE TO THE FACILITY AND/OR ITS CONTENTS OR IMPAIRMENT TO ESSENTIAL OPERATIONS? *Explain, include loss value to facility and/or contents.*

YEARS BEFORE SERIOUS DAMAGE OCCURS 10.

These tanks need investigations as to abandonment procedures and need to be abandoned properly if they have not already been done as soon as possible to prevent any damage to the environment.

26 WAS THE REDUCED UTILIZATION OF THIS SPECIFIC FACILITY AFFECTED A LARGE FACILITY SYSTEM OPERATION? *Explain.*

a. [ ] YES b. [X] NO BY HOW MUCH? _____%.

27 ARE THERE ANY OTHER FACTORS INVOLVED? *Check and explain.*

a. [ ] MORALE b. [X] HEALTH c. [X] PUBLIC RELATIONS d. [X] SAFETY e. [X] FIRE PROTECTION f. [X] SECURITY g. [ ] OTHER

Proper procedures for the closure and abandonment of underground storage tanks are necessary to protect the environment from contamination and to ensure the future safety of the site. It should be noted that when dealing with flammable substances during underground storage tank abandonment, adequate safety precautions should be applied to eliminate the possibility of explosion/fire.

28 CERTIFICATION BY RESPONSIBLE OFFICER AT ACTIVITY: I am personally cognizant of the need for, the essentiality of, and the proposed method of accomplishment of this project and certify that the above information is correct, and that this project meets all criteria specified in OPNAVINST 11010.20 and subsequent changes thereto.

SIGNATURE	TITLE	DATE

29. EFD TECHNICAL VALIDATION *(if required) (see para 7303, OPNAVINST 11010.20C)*

SIGNATURE	TITLE	DATE

ENCLOSURES

a. [X] ENGINEERING EST. *(NAVFAC 2417)* b. [ ] LOCATION PLAN(S) c. [ ] DRAWINGS d. [ ] PHOTOGRAPHS

*NOT applicable to Minor Construction Alterations, or Equipment Installation

NAVFAC (8)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 18 Sep 87

SHEET 1 OF 2

ACTIVITY AND LOCATION: NAVAL SHIPYARD, CHARLESTON, S.C.

CONSTRUCTION CONTRACT NO:

IDENTIFICATION NUMBER:

PROJECT TITLE: Underground Tank Abandonment/ Removal or in-place Abandonment

ESTIMATED BY: S.O. SANBORN

CATEGORY CODE NUMBER:

STATUS OF DESIGN: [ ] PCD [ ] 30% [ ] 100% [X] FINAL [ ] Other (Specify) ______

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY NUMBER	QUANTITY UNIT	MATERIAL COST UNIT COST	MATERIAL COST TOTAL	LABOR COST UNIT COST	LABOR COST TOTAL	ENGINEERING ESTIMATE UNIT COST	ENGINEERING ESTIMATE TOTAL
Removal of Tank #1174 1,000 gallon	1	EA	4200	4200	1336	1336	5536	5536
Removal of Tank #1169 550 gallon	1	EA	3500	3500	1280	1280	4780	4780
								10316
Associated piping 10 percent of total								
cost of tanks								1032
Design 6 percent of total cost of								
tanks and piping								681
TOTAL								12,029

ENVIRONMENTAL POLLUTION CONTROL REPORT (PCR)
PROPOSED PROJECT REPORT
EXHIBIT I INFORMATION

MEDIA: SOLID WASTE EFD: SOUTHDIV UIC: N00191
PROJECT NO.: S

+ PROJECT NAME: INSTALLATION OF MONITORING/LEAK DETECTION SYSTEMS +

FACILITY: NAVAL SHIPYARD
ADDRESS: CHARLESTON, S.C. 29408
AGENCY CONTACT: J.COOK, ENVIRONMENTAL SUPP. SPEC. A/V 563-0564--------

FUND CMD: NAVFAC APPN:-O&MN--
STATUS: PP NAVFAC

INTERNAL PROJECT NUMBER: ---------

+COST OF POLLUTION CONTROL MEASURES IN THOUSANDS OF DOLLARS: 30 +

FY	DESIGN	FUNDED	CONSTR	FUNDED
88	---8--	-NO--	--22---	---NO-
--	------	------	-------	---NO-
--	------	------	------	------

TOTAL COST: 30

+ AGENCY PROJECT SCHEDULE DATES +

DESIGN (START):	--	--
DESIGN (COMPLETION)	---	--
CONSTR (START):	---	--
CONSTR (COMPLETION):	---	--
FINAL COMPLIANCE:	---	--
REG FINAL COMPLIANCE:	DEC	93

+CONGRESSIONAL AUTHORITY DATES: MCON+

	(MO/YEAR)
SCHEDULED:	--- --
REQUESTED:	--- --
RECEIVED:	--- --
35% DESIGN COMPLETION	--- --

+ OTHER PCR DATES +

APPROVED:	---	--
PREPARED:	SEP	87
REVISED:	---	--

+ INFO FOR NEESA USE +

POLLUTANT CATEGORY
POLLUTANT SOURCE
CORRECTIVE ACTION
NAVFAC PROGRAM ELEMENT
EPA CODE NOP PCS
ACFS VFSB
PRIORITY ----
VARIOUS LOCATIONS ---
MAJOR REVISION ---
LEGAL ACTION CODE -
LEGAL CITATION--------

ENVIRONM. POLLUT. CONTROL R. (PCR)
PROPOSED PROJECT REPORT
EXHIBIT I INFORMATION

MEDIA: SOLID WASTE EFD: SOUTHDIV UIC: N00191
PROJECT NO.: S

+ PROJECT NAME: INSTALLATION OF MONITORING/LEAK DETECTION SYSTEMS +

1. PROBLEM STATEMENT

0001 UNDERGROUND PETROLEUM STORAGE TANKS THAT DO NOT HAVE
0002 MONITORING/LEAK DETECTION SYSTEM AS REQUESTED BY
0003 40 CFR 280 AND R.61-92
0010
0020 INSTALLATION OF MONITORING WELLS: TANKS #1279 (A,B,C)
0030 TANKS # 13 (A,B)
0040
0050

2. REMEDIAL ACTION

0001 INSTALL GROUNDWATER MONITORING WELLS OR LEAK
0002 DETECTION DEVICES ON TANKS SPECIFIED ACCORDING TO
0003 40 CFR 280 AND R.61-92
0010
0020
0030
0040
0050

3. APPLICABLE STANDARDS

0001 40 CFR 280 PROHIBITS THE USE OF UNDERGROUND
0002 PETROLEUM STORAGE TANKS WITHOUT ADEQUATE LEAK
0003 DETECTION.
0010
0020
0030
0040
0050

4. OTHER PCR INFORMATION

0001 MONITORING/LEAK DETECTION SYSTEMS MUST BE
0002 INSTALLED BY 12-31-98 ON TANKS THAT
0003 ARE OUT OF COMPLIANCE.
0010
0020
0030
0040
0050

UST PROGRAM ELEMENTS, RESPONSIBILITIES AND FUNDING

	Elements	Responsibility	Funding
1.	As needed, assist activities in conducting tank inventories and gathering required data.	EFD	PA
2.	Submit underground storage tank notifications to regulatory agencies with copy to EFD and NEESA; pay registration fees.	Activity	Activity O&MN
3.	Based on surveys, studies notifications or other information sources, prepare prioritized list of proposed Phase I activity assessments for only those tanks known or suspected to have leaks. Include cost estimate and schedule; submit PCR exhibits	EFD	PA
4.	Develop and maintain data base for underground storage tanks.	NEESA	PA
5.	Review federal, state and local regulations for impact on: design critiera, monitoring and treatment, remedial actions, unique R&D requirements, and tank testing.	NEESA	PA
6.	Perform assessment studies for known or suspected leaking tanks (Phase I). This includes the installation of monitoring systems, analysis of first round of monitoring, training or activity personnel to perform additional monitoring and determining the extent of soil or ground-water contamination.	EFD	ERD
7.	Provide assistance to EFDs on request.	NEESA	PA
8.	Manage remedial actions. Includes development of a corrective action plan, cleanup of contamination, interface with regulatory agencies, etc. (depending on magnitude and complexity of remedial actions, a central contract administered by NEESA may be used.)	EFD	ERD

	Elements	Responsibility	Funding
9.	Repair/replace tanks and/or associated piping as required.	Activity	Claimant MCON or O&MN
10.	Develop tank life estimates for activities on reimbursable basis.	NEESA	Activity O&MN
11.	Install monitoring systems, conduct initial tank testing, and develop initial tank management plan as required by state regulations (Phase II).	Activity	PA
12.	Long term routine monitoring sampling, periodic tank testing and record keeping.	Activity	Activity O&MN
13.	Complete technology assessment and conduct RTD&E on biodecontamination and other remedial actions.	NCEL	R&D/ERD
14.	Studies to locate underground tanks not used since January 1984 and activities to determine actual or potential contamination.	EFD	ERD
15.	Cleanup of contamination resulting from tanks not used since January 1974, unless such cleanup is incidental to tank replacement.	EFD	ERD
16.	Cleanup of contamination resulting from tank leaks which occurred prior to March 1, 1986 unless such cleanup is incidental to tank replacement.	EFD	ERD

DEPARTMENT OF THE NAVY
CHARLESTON NAVAL SHIPYARD
CHARLESTON, S.C. 29408-6100

5090
Ser 106.24/0771

06 NOV 1995

South Carolina Department of Health
and Environmental Control
Attn: Robert L. Hutchinson
UST Regulatory Section
Ground-Water Protection Division
2600 Bull Street Columbia, SC 29201

Re: USN Short Stay
Recreational Area
UST Permit #P-10-GF-12093
GWPD ID #16254

Gentlemen:

Charleston Naval Shipyard (CNSY) is the environmental permit holder for all naval activities located at Charleston Naval Base. As you are aware, Charleston Naval Base is undergoing base closure. Effective April 1, 1996, Charleston Naval Base will no longer exist. However, the Short Stay Naval Recreation facility located in Moncks Corner SC, will remain open. A separate Naval Command will accept responsibility and liability for the referenced Underground Storage Tank (UST) Permit and remediation efforts currently underway under Ground-Water Protection Division (GWPD) Site ID #16254.

As discussed during the telephone conversation between Mr. Karl Ray (CNSY) and Mr. Timothy A. Mettlen of your office (SCDHEC) on November 3, 1995, the owner will continue to be the U.S. Navy. Therefore, the requirements of R.61-92, Section 280.72 (assessing the referenced site and submitting a report at change-in-ownership) does not apply. The only actions that CNSY is required to take is to notify your office of the new permit holder for the navy.

As such, it is hereby formally requested that the above reference UST Permit #P-10-GF-12093/GWPD Site ID #16254 be transferred from Charleston Naval Shipyard to the following:

U.S. Navy, CINCLANTFLT
Attn: Tom Boyd, Facility Manager
Short Stay Naval Recreational Area
Rt. 5 Box 1192
Moncks Corner, SC 29461 Tel: (803) 743-5608

DEPARTMENT OF THE NAVY
CHARLESTON NAVAL SHIPYARD
CHARLESTON, S C 29408-6100

5090
Ser 106.24/0341
19 OCT 1994

South Carolina Department of Health
and Environmental Control
Ground Water Protection Division
Attn: Tim Mettlen
2600 Bull Street
Columbia, South Carolina 29201

Re: Fuel leak at Hobson Ave. and Viaduct Rd., Charleston Naval Base, Charleston, SC

Gentlemen:

This office is forwarding leak verification information on a leaking underground fuel line located near the intersection of Hobson Ave. and Viaduct Road on the Charleston Naval Base, Charleston, S.C. As required by South Carolina Law R.61-95, Section 280.50, verbal notification of the leak was made to Wayne Fanning of the Trident District Office on September 19, 1994.

Enclosure (1) contains the leak verification information and the initial abatement actions taken as required by S.C. Law R.61-95, Section 280.52, 62(b).

If there are any questions or if more information is needed, contact Karl Ray or Tim Martin, Code 106.24, at (803) 743-5519.

Sincerely,

R. L. Laney
Director, Occupational Safety,
Health and Environmental Office
By direction of the Commander

Encl:
(1) Leak Verification Information

Copy to:
Wayne Fanning, Trident EQC

South Carolina
DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201

January 30, 1995

R.L. Laney
Director, Occupational Safety,
Health and Environmental Office
Department of the Navy
Naval Station
Charleston, SC 29408-5000

RE: Charleston Naval Base
Fuel Leak, Hobson Avenue and Viaduct Road
GWPD Site #A-10-AA-16929
Leak Verification Report received October 26, 1994
Charleston County

Dear Mr. Laney:

The Ground-Water Protection Division (GWPD) of the South Carolina Department of Health and Environmental Control (SCDHEC) has reviewed the referenced Leak Verification Report and has the following comments:

1) The contaminant appears to be virgin fuel oil that was present in an abandoned pipeline from the Chicora Tank Farm. Since the contaminate is fuel oil, the GWPD of the SCDHEC will provide regulatory oversight for this project. Therefore, please address all future correspondence concerning this project directly to the GWPD.

2) Available information indicates fuel oil leaking from a corroded line has impacted soil and groundwater. The GWPD requests that an assessment plan, to determine the extent and severity of soil and ground-water impact to the environment, be submitted to the GWPD for approval. This plan should include the installation of, at a minimum, three permanent monitoring wells to determine ground-water flow direction. An assessment guidance document has been enclosed for your review.

GENERAL ENGINEERING LABORATORIES
Meeting today's needs with a vision for tomorrow.
General Engineering Laboratories, Inc.
Memorandum

Date: January 12, 1996

To: Mr. Richard Amy

From: Nina G. Marshtein, P.G.

Subject: Commercial Heating Oil and Generator Tanks

Per our telephone conversation of January 11, 1996, I have summarized the regulations concerning underground petroleum storage tanks (USTs) which are used to store heating oil for on-site consumption or to store fuel for generators.

1) It is a common misconception that petroleum USTs, which do not contain fuel for use in a vehicle, are not regulated. Although South Carolina law does not require the registration of these tanks, the state regulates any release of the contents of the tanks. Therefore, a release from one of these tanks will require assessment and, if necessary, clean up under the Pollution Control Act, Section 48-1-10 to 48-1-340 of the Code of Laws of South Carolina 1976.

2) The South Carolina Water Classifications and Standards (R.61-68) provides that all aquifers of the state will meet drinking water standards unless the state has reclassified the aquifer to a lower standard or has designated a portion of an aquifer as a mixing zone. To date, no aquifers have been reclassified. Mixing zones are issued for one property or group of properties at a time. Very few mixing zones (less than 5) have been issued since R. 61-58 was enacted. Therefore, if releases are detected at any of these tank sites, assessment and cleanup of soils and/or groundwater will be required unless a mixing zone is established.

3) If you choose to assess the tanks sites but not close them, understand that the tanks may leak in the future. Furthermore, the assessment may be considered inadequate by any lending institute if the property is to be sold more than 6 months after your assessment. In this case, additional assessment may have to be performed to confirm that the tank has not leaked since the earlier assessment. Of course, if the tank is permanently closed, it cannot release any more petroleum to the subsurface and the initial assessment would be adequate.

4) The following is an example for the liability associated with a commercial heating oil tank. A 500-gallon heating oil tank was closed by one of our clients (a commercial lending institution) at a former commercial facility. Since the site was to be sold, the lender had to assess the impact from the former tank to ready the property for sale. Free phase petroleum was floating on the water table and dissolved polynuclear aromatic hydrocarbons were detected in groundwater monitoring wells at the site. It took 5 years and over $95,000 to remove soils, analyze samples, remediate groundwater, and negotiate with the South Carolina Department of Health and Environmental Control (DHEC) to enable him to sell the site. Although this is not likely viewed as a significant liability to the US Navy, this property owner was unable to sell the site without a letter of "no further action" from DHEC because no lenders would finance the sale, even though the owner of the site was a commercial lending institution.

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29414
(803) 556-8171 • Fax (803) 766-1178

Chicora Tank Farm and Naval Supply Tank Farm at Naval Base Charleston

5 December 1995

B. D. Johnston

I conversed with Mr. Polite, an operator at the tank farm, today. He provided some insight re past operations of the tank farm He has been associated with the tank farm for at least eight years

He said that all the large tanks have been pumped down. He defined "pumped down" as to the level where the tank pumps loose suction. He said that this left approximately 18" in each tank. That's still a large volume of product remaining in each tank and the associated supply/sludge lines.

The fuel lines supplying the shipyard have not been used as long as he (Polite) has been associated with the tank farm Thus, the lines from the tank farm to Building 39 (Pump House), down to and around Dry Dock #5, and on to Pier F are basically abandoned in place

Note. I found documentation on a plan for Building 255 construction, that removed 168' of 6" and 14" Oil Line piping located approximately 9' bgs and capped both ends during foundation construction for this facility.

The JP-5 Facility (NS-3) was secured (pumps removed, pipe ends blanked, etc.) before he came to work at the tank farm. To his knowledge, the system has not been used since. Problems with fuel contamination (water, condensation, debris, etc.) during transmission from the tank to the facility resulted in closure of this facility Tank 14 was closed in conjunction with shut down of NS-3.

Fuel to fill the tanks was off-loaded at Naval Station Pier K and transferred either to Chicora or the tank farm via the underground 18" pipe lines. Sludge was pumped through the 12" lines. The materials that were handled include: Diesel Fuel, Navy Fuel Oil, Special Navy Fuel Oil, Oily Waste-Water, Lube Oil, Sludge.

Typical Operation: Oil was pumped into a tank. After hold time had elapsed, the tank was checked for water and sludge volumes. Water was drained/pumped from the fuel tank to the oily-waste tank. Sludge was pumped from the fuel tank to the sludge oil tank and allowed to separate again. The product remaining in the original fuel tank was then used for fueling purposes. Tanks where periodically checked for sludge build-up and water (in the form of condensation and rain seepage) and drained as needed to maintain product quality. Oily-waste water was allowed to separate over a week or so, and was then sampled. If the water at the bottom of the tank met discharge controls it was then pumped to the waste processing facility and on to NCW&SC via the sanitary sewer as waste water for treatment at the city's plant. Water was drained from the tank until oil was detected and then the flow was stopped and the separation process began again.

Sludge oil was allowed to separate in the same method, with the exception of usable oil being removed from the top portion of the tank's volume. This "good" sludge was mixed with Navy Fuel Oil to make Special Navy Fuel Oil. Very old naval vessels burned this stuff. When the sludge was no longer of use it was sold, loaded into tanker trucks and later burned by a vendor.

The retention pond was there to provide containment in the event of tank over-fill, tank or pipe rupture or other untimely catastrophe

Stripping connections are locations for attaching pumps to remove residual product in the transfer lines. Considering, there are only two fuel lines running back and forth from Chicora and three or four types of fuel oil, this makes sense. Remove the remaining type of oil before pumping a different type.

Removal and Disposal of Used Underground Petroleum Storage Tanks

Marketing Department

API RECOMMENDED PRACTICE 1604
SECOND EDITION, DECEMBER 1987

American
Petroleum
Institute

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FOREWORD

Underground storage tank systems that have held flammable or combustible liquids should be handled with extreme care during disposal in place, removal, storage, or disposal off site. This is particularly true of underground storage tanks at motor vehicle refueling facilities which are most frequently used for storage of motor fuel or other petroleum products.

The purpose of this recommended practice is to provide procedures for the disposal in place, removal, storage, and the off-site disposal or sale of used underground tanks that have contained flammable or combustible liquids. Although this guide specifically addresses underground storage tank systems at service station facilities, the principles outlined may be applied to similar systems used at other petroleum facilities.

At the time this recommended practice was written, legislation and regulations related to the operation, maintenance, disposal, and removal of underground petroleum storage systems were under development at the federal, state, and municipal levels. The appropriate government agencies should therefore be consulted about regulations that apply to the geographic area of interest before any action suggested in this recommended practice is taken. API will revise this recommended practice from time to time in an effort to ensure consistency with all applicable federal regulations. This edition of API Recommended Practice 1604 supersedes API Publication 1604, *Recommended Practice for the Abandonment and Removal of Used Underground Service Station Systems* (First Edition, 1981) in its entirety.

Suggested revisions are invited and should be submitted to the Director of the Marketing Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

CONTENTS

Removal and Disposal of Used Underground Petroleum Storage Tanks

SECTION 1—GENERAL

1.1 Introduction

Underground petroleum storage systems that are no longer needed or suitable for product storage must be properly disposed in place or removed in order to avoid future safety or environmental hazards. Because of the nature of the flammable or combustible liquids that are stored in these tanks, hazardous conditions may arise in the work area during disposal in place or removal and subsequent handling of tanks. For this reason, all personnel involved in the procedures outlined in this recommended practice should be familiar with the potential hazards, and be knowledgeable in the appropriate health and safety measures needed to ensure a safe working environment.

1.2 Scope and Purpose

1.2.1 This publication recommends procedures for the disposal in place, removal, storage, and off-site disposal of underground storage tank systems that have contained flammable or combustible fluids. In general, it outlines requirements, procedures, and operating conditions to be followed by contractors, engineers, or other individuals who may be involved in these practices. While this recommended practice specifically addresses underground petroleum storage tank systems at service station facilities, the principles outlined may be applied to similar systems used at other petroleum storage facilities. All such work must be accomplished in accordance with federal, state, and local requirements as well as accepted safety standards. Before initiating work, the appropriate government agencies should be consulted concerning applicable regulatory and permit requirements.

1.2.2 All applicable permits must be obtained prior to beginning any work. Where required, contractors must be approved by local authorities. Contractors, subcontractors, and their employees responsible for tank abandonment or removal should be familiar with: (a) all applicable safety rules and regulations, (b) the use of equipment and procedures for testing and vapor-freeing tanks, (c) the handling and disposal of the types of wastes likely to be encountered, and (d) the applicable sections of the publications referenced in 1.4.

1.2.3 The procedures outlined in this recommended practice can be carried out without the need to enter the tank. Should tank entry be desired, the procedures outlined in API Publications 2015, 2015A, and 2217 and Recommended Practice 1631 should be followed.

1.3 Special Precautions

During the course of underground storage tank removal or in place disposal, workers may be exposed to petroleum hydrocarbon liquids, vapors, or wastes. The precautions in 1.3.1 and 1.3.2 should be observed by all individuals engaged in the procedures discussed in this recommended practice.

1.3.1 TOXICITY CONSIDERATIONS: PETROLEUM SUBSTANCES

Users should be aware of appropriate health precautions. When high concentrations of petroleum hydrocarbon vapors are inhaled, symptoms of intoxication may result. These symptoms, ranging from simple dizziness to excitement or unconsciousness, are similar to those produced by alcohol or anesthetic gases. If such effects occur, the individual should be removed to fresh air. For minor effects of exposure, breathing fresh air or oxygen results in rapid recovery. If breathing has stopped, artificial respiration should be applied promptly. Medical attention should be obtained as soon as possible. Paragraphs 1.3.1.1 and 1.3.1.2 contain special toxicity considerations for benzene and tetraethyl lead, which may be present in petroleum products or wastes found in underground storage tanks. Care should be exercised to minimize exposure to these substances when they are present during the handling of used underground petroleum storage tanks.

WARNING: Tests have shown that prolonged or repeated exposure to some petroleum substances, in liquid or vapor form, may cause serious illness, including cancer, in laboratory animals. Although the significance of these test results to human health is not fully understood, exposure to petroleum substances should be minimized. The following health precautions are suggested:

a. Avoid skin contact and inhaling vapors.

b. Keep petroleum liquids away from eyes, skin, and mouth; they can be harmful or fatal if inhaled, absorbed through the skin, or ingested.
c. Use soap and water or waterless hand cleaner to remove any petroleum product that contacts skin. Do not use gasoline or similar solvents to remove oil and grease from skin.
d. Promptly wash petroleum-soaked clothes and avoid using soaked leather goods. Properly dispose of rags.
e. Keep work areas clean and well ventilated.
f. Clean up spills promptly.

1.3.1.1 Benzene

High occupational exposures to benzene have been associated with various human blood disorders, including an increased risk of leukemia. Very high levels have also been known to affect the central nervous system. Benzene administered by mouth has induced cancer in laboratory animals in long-term tests. Benzene is rapidly absorbed through the skin. The American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) for benzene is 1-part-per-million time-weighted average, with a short exposure limit of 25 parts-per-million (the latter is slated for deletion in 1986 or 1987). The Occupational Safety and Health Administration (OSHA) 8-hour time-weighted average for benzene is 10 parts-per-million with an acceptable ceiling concentration of 25 parts-per-million and an acceptable peak of 50 parts-per-million for 10 minutes (29 CFR 1910.1000, Table Z-2). OSHA conducted a rulemaking in 1986 with the intent to revise this standard. The latest OSHA *Occupational Safety and Health Standards* should be consulted to determine the current TLV.

1.3.1.2 Tetraethyl Lead

This organic form of lead can cause diseases of the central and peripheral nervous system, the kidney and the blood. Skin absorption of this compound is a major route of entry into the body. The ACGIH time-weighted average is 0.1 milligrams per cubic meter for general room air. The TLV in OSHA's *Occupational Safety and Health Standards* (29 CFR 1910.1000, Table Z-1) is 0.075 milligrams per cubic meter.

1.3.2 FLAMMABILITY AND COMBUSTIBILITY CONSIDERATIONS

1.3.2.1 Flammable or combustible vapors are likely to be present in the work area. The concentration of vapors in the tank, the excavation, or the work area may reach the flammable (explosive) range before venting is completed and a safe atmosphere is reached. Therefore, precautions must be taken to: (a) eliminate all potential sources of ignition from the area (for example, smoking materials, nonexplosion-proof electrical and internal combustion equipment), (b) prevent the discharge of static electricity during venting of flammable vapors, and (c) prevent the accumulation of vapors at ground level. Refer to API Publication 2015 and Recommended Practice 2003 for general precautionary measures to follow during the vapor-freeing procedure.

1.3.2.2 A combustible gas indicator (CGI) should be used to check for hazardous vapor concentrations (see 4.3). All open flame and spark-producing equipment within the vapor hazard area should be shut down. Electrical equipment (for example, pumps and portable hand tools) used in the area must be explosion-proof in accordance with NFPA 70B Class I, Division I, Group D or otherwise approved for use in potentially explosive atmospheres.

1.4 Referenced Publications

Portions of the following documents contain information regarding various engineering and safety procedures that may be applicable to underground storage tank removal or disposal.

API	
Bull 1628	*Underground Spill Cleanup Manual*
RP 1631	*Interior Lining of Underground Storage Tanks*
RP 2003	*Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*
Publ 2015	*Cleaning Petroleum Storage Tanks*
Publ 2015A	*A Guide for Controlling the Lead Hazard Associated with Tank Entry and Cleaning* (Supplement to API Publ 2015)
Publ 2217	*Guidelines for Confined Space Work in the Petroleum Industry*
Publ 2219	*Safe Operating Guidelines for Vacuum Trucks in Petroleum Service*
NFPA[1]	
327	*Standard Procedure for Cleaning or Safeguarding Small Tanks and Containers*
70B	*Electrical Equipment Maintenance*

[1]National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

OSHA[2]

Occupational Safety and Health Standards (29 CFR 1910.1000)

EPA[3]

General Regulations for Hazardous Waste Management (40 CFR 260)

Regulations for Identifying Hazardous Waste (40 CFR 261)

Regulations for Hazardous Waste Generators (40 CFR 262)

Underground Storage Tanks Regulations (40 CFR 280.11, 280.22)

SECTION 2—TEMPORARILY OUT OF SERVICE

2.1 Applicability

Underground petroleum storage tank systems are considered temporarily out of service if they are: (a) idle but will be returned to service within one year, (b) are awaiting abandonment in place, or (c) are awaiting removal.

2.2 Securing Tank Systems

Tanks temporarily out of service must be properly secured for the period they will be out of service. Tanks may be considered properly secured if processed as ollows:

a. Observe all special precautions described in 1.3 through 1.3.2.2.

b. Remove stored product from the tank using one of the following methods:

1. Drain all product lines into the tank, then remove all liquids from the tank.
2. Remove all flammable or combustible liquids with the exception of a sufficient quantity (approximately four inches) to assure a saturated vapor space.
3. When high water table or flooding conditions exist, remove all stored liquid and ballast the tank by filling with water.

c. Cap the fill pipe, gauge pipe, tank truck vapor recovery fitting, and vapor return. Secure the tank against tampering.

d. Cap the product lines at the service station island, or elsewhere if the pumps are removed, or leave the pumps connected and locked. Disconnect electric power to the pumps.

e. Leave the vent line open.

f. Consult the appropriate local, state, or federal agencies concerning regulatory notification requirements.

SECTION 3—DISPOSAL IN PLACE

3.1 Criteria for Disposal in Place

3.1.1 This section describes a safe method for the in place disposal of underground tanks. Removal of the tank is preferred (see Section 4). Disposal of the tank in place should be considered in the following circumstances: (a) because of the tank location adjacent equipment or structures may be damaged or weakened if the tank is removed, (b) removal may be physically impossible, or (c) removal may incur excessive costs: A determination of whether to dispose of a tank in place or to remove it will depend upon: (a) local regulations which may prohibit abandonment in place, (b) the location of the facility and tank, (c) the availability of equipment, and (d) cost. Additional considerations include the length of service the equipment has provided and its reuse or salvage value.

3.1.2 The federal *Resource Conservation and Recovery Act* (RCRA) (40 CFR 260-265) places restrictions on disposal of certain residues that may be present in some underground storage tanks. Residues from tanks that have held leaded gasoline should be treated with extreme caution. Lead compounds and other residues in the tank may be classified as hazardous wastes. All liquids and residues removed from the tank should be handled in accordance with appropriate federal, state, and local regulations. Product removed from the tank can usually be reused or recycled.

3.2 Procedures for Disposal In Place

3.2.1 Tanks may be effectively and safely disposed in place by using the procedures in 3.2.2 through 3.2.11.

[2]Occupational Safety and Health Administration, U.S. Department of Labor, Washington, D.C. 20402.
[3]U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460.

3.2.2 Observe the special precautions described in 1.3 through 1.3.2.2.

3.2.3 Drain product piping into the tank, being careful to avoid any spillage to the excavation area. Disconnect product piping from the tank, and cap or remove the piping.

3.2.4 Remove liquids and residues from the tank by using explosion-proof or air-driven pumps. Pump motors and suction hoses must be bonded to the tank or otherwise grounded to prevent electrostatic ignition hazards. It may be necessary to use a hand pump to remove the last few inches of liquid from the bottom of the tank. If a vacuum truck is used for removal of liquids or residues, the area of operation for the vacuum truck must be vapor-free. The truck should be located upwind from the tank and outside the path of probable vapor travel. The vacuum pump exhaust gases should be discharged through a hose of adequate size and length downwind of the truck and tank area. See API Publication 2219 for vacuum truck operating and safety practices.

Excavate to the top of the tank.

3.2.6 Remove the drop tube, fill pipe, gauge pipe, vapor recovery truck connection, submersible pumps, and other tank fixtures. Cap or remove all non-product lines, such as vapor recovery lines, except for the vent line. The vent line should remain connected until the tank is purged (see 4.2.2 through 4.2.7). Temporarily plug all other tank openings.

3.2.7 Purge the tank of flammable vapors. This may be accomplished using methods outlined in 4.2.2 through 4.2.7. Vent all vapors a minimum of 12 feet above grade and 3 feet above any adjacent roof lines. Monitor the tank for flammable vapor with a combustible gas indicator until the tank atmosphere has been brought to less than 20 percent of the lower flammable limit (see 4.3).

3.2.8 One or more holes may be cut in the tank top if existing tank openings are not adequate for introduction of the inert material to be used to fill the tank.

3.2.9 Proceed to introduce a suitable solid inert material through openings in the top of the tank. It is important to fill the tank as full as possible with the or other inert material. The procedures in 3.2.9.1 through 3.2.9.3 are intended to minimize any surface settling subsequent to disposal of the tank in place.

3.2.9.1 Sand will flow readily and is generally available. Any kind of sand is suitable if it is free of rocks, which might limit leveling-out in the tank. The sand may be introduced dry as long as it flows in freely. When the sand cone nears the top of the tank, the sand can be washed into the tank with a nominal amount of water and puddled to cause it to flow to the ends. The use of larger amounts of water should be avoided since the tank might be filled with water before it is filled with sand.

3.2.9.2 Almost complete filling of the tank can be achieved by using a combination of sand and earth. Fill the tank with sand to approximately 80 percent of calculated capacity. Mix soil and water to make a free-flowing mud and pour the mixture into the tank opening. Puddle the mixture until the tank is full and overflows the fill opening.

3.2.9.3 Other types of inert materials, slurries, or expandable materials such as polyurethane-type foams may be used when approved by regulatory officials.

3.2.10 After the tank is filled with an inert material, all tank openings should be plugged or capped unless it was necessary to cut open the tank top (see 3.2.8).

3.2.11 Disconnect and cap or remove the vent line.

3.3 Recordkeeping

3.3.1 When underground tanks are disposed in place, the owner of the tank should keep a permanent record of the tank location, the date of disposal in place, and the method of conditioning the tank for disposal. All local, state, and federal regulatory requirements for tank disposal/closure and notification must be observed.

3.3.2 It is recommended that the tank owner inform a potential buyer of the presence of abandoned underground tanks when properties are sold. A property owner should also be informed at the termination of the property lease. In some areas this may be a regulatory requirement. It may be desirable to obtain an acknowledgement or a release from the property owner.

SECTION 4—REMOVAL OF UNDERGROUND TANKS

4.1 Preparation

4.1.1 Observe the special safety precautions in 1.3 through 1.3.2.2.

4.1.2 Drain product piping into the tank, being careful to avoid any spillage. Cap or remove product piping.

4.1.3 Remove residues and liquids from the tank as described in 3.2.4. Also observe the restrictions in 3.1.2.

4.1.4 Excavate to the top of tank.

4.1.5 Remove the fill pipe, gauge pipe, vapor recovery truck connection, submersible pumps, and other tank fixtures. Remove the drop tube, except when it is planned to vapor-free the tank by using an eductor as in 4.2.5. Cap or remove all non-product lines, such as vapor recovery lines, except the vent line. The vent line should remain connected until the tank is purged. Temporarily plug all other tank openings so that all vapors will exit through the vent line during the vapor-freeing process.

4.2 Purging

4.2.1 Remove flammable vapors by one of the methods described in 4.2.2 through 4.2.7, or as required by local codes. These methods provide a means for temporary vapor-freeing of the tank atmosphere. However, it is important to recognize that the tank may continue to be a source of flammable vapors even after following the vapor-freeing procedures described in 4.2.2 through 4.2.7. For this reason, caution must always be exercised when handling or working around tanks that have stored flammable or combustible liquids. Before initiating work in the tank area or on the tank, a combustible gas indicator should be used to assess vapor concentrations in the tank and work area.

4.2.2 Vent all vapors from the tank at a minimum height of 12 feet above grade and 3 feet above any adjacent roof lines until the tank is purged of flammable vapors. The work area should be free from sources of ignition (see 1.3.2).

4.2.3 Flammable and combustible vapors may be purged with an inert gas such as carbon dioxide (CO_2) or nitrogen (N_2). This method should not be utilized if the tank is to be entered for any reason, as the tank atmosphere will be oxygen deficient. The inert gas should be introduced through a single tank opening at a point near the bottom of the tank at the end of the tank opposite the vent. When inert gases are used, they should be introduced under low pressure to avoid the generation of static electricity. When using CO_2 or N_2, pressures in the tank should not exceed 5 pounds per square inch gauge.

CAUTION: The process of introducing compressed gases into the tank may create a potential ignition hazard as the result of the development of static electrical charges. The discharging device must therefore be grounded. Explosions have resulted from the discharging of CO_2 fire extinguishers into tanks containing a flammable vapor-air mixture. CO_2 extinguishers should not be used for inerting flammable atmospheres.

4.2.4 If the method described in 4.2.3 is not practical, the vapors in the tank may be displaced by adding solid carbon dioxide (dry ice) to the tank in the amount of at least 1.5 pounds per 100 gallons of tank capacity. The dry ice should be crushed and distributed evenly over the greatest possible area in the tank to promote rapid evaporation. As the dry ice vaporizes, flammable vapors will flow out of the tank and may surround the area. Therefore, where practical, plug all tank openings except the vent after introducing the solid CO_2 and continue to observe all normal safety precautions regarding flammable or combustible vapors. Make sure that all of the dry ice has evaporated before proceeding.

CAUTION: Skin contact with dry ice may produce burns.

4.2.5 Flammable vapors may be exhausted from the tank by one of two methods of tank ventilation listed below:

a. Ventilation using an eductor-type air mover usually driven by compressed air is illustrated in Figure 1. The eductor-type air mover must be properly bonded to prevent the generation and discharge of static electricity. When using this method, the fill (drop) tube should remain in place to ensure ventilation at the bottom of the tank. Tanks equipped with fill (drop) tubes that are not removable should be purged by this method. An eductor extension shall be used to discharge vapors a minimum of 12 feet above grade.

b. Ventilation with a diffused air blower is illustrated in Figure 2. When using this purging method, it is imperative that the air-diffusing pipe is properly bonded to prevent the discharge of a spark. Fill (drop) tubes must be removed to allow proper diffusion of the air in the tank. Air supply should be from a compressor that has been checked to ensure a clean air supply and is free

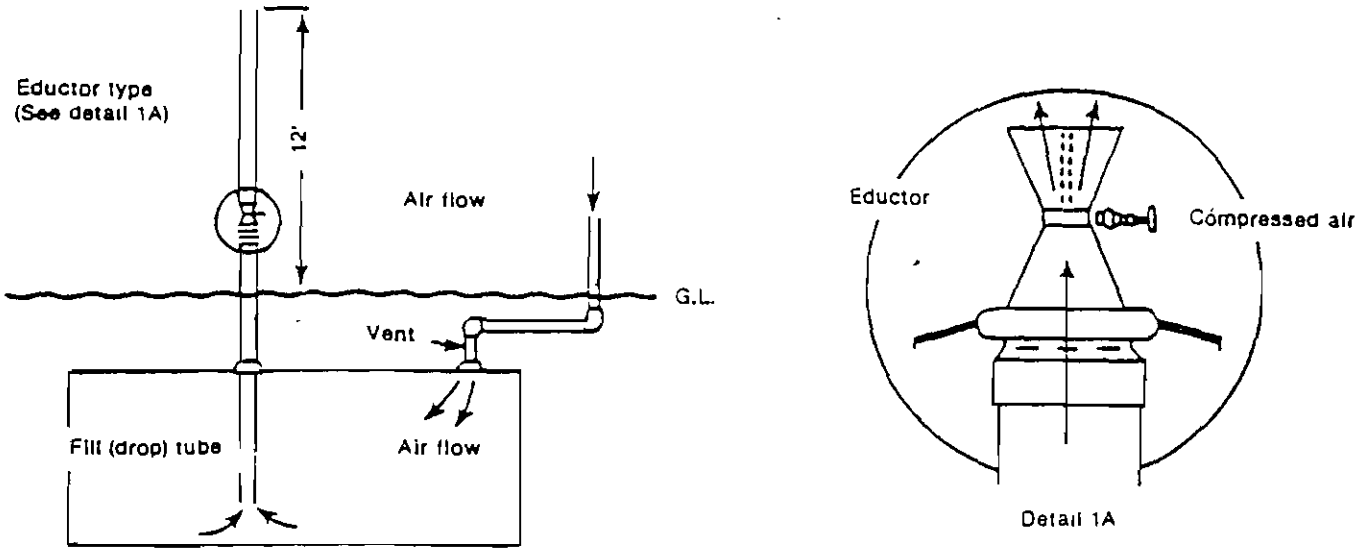
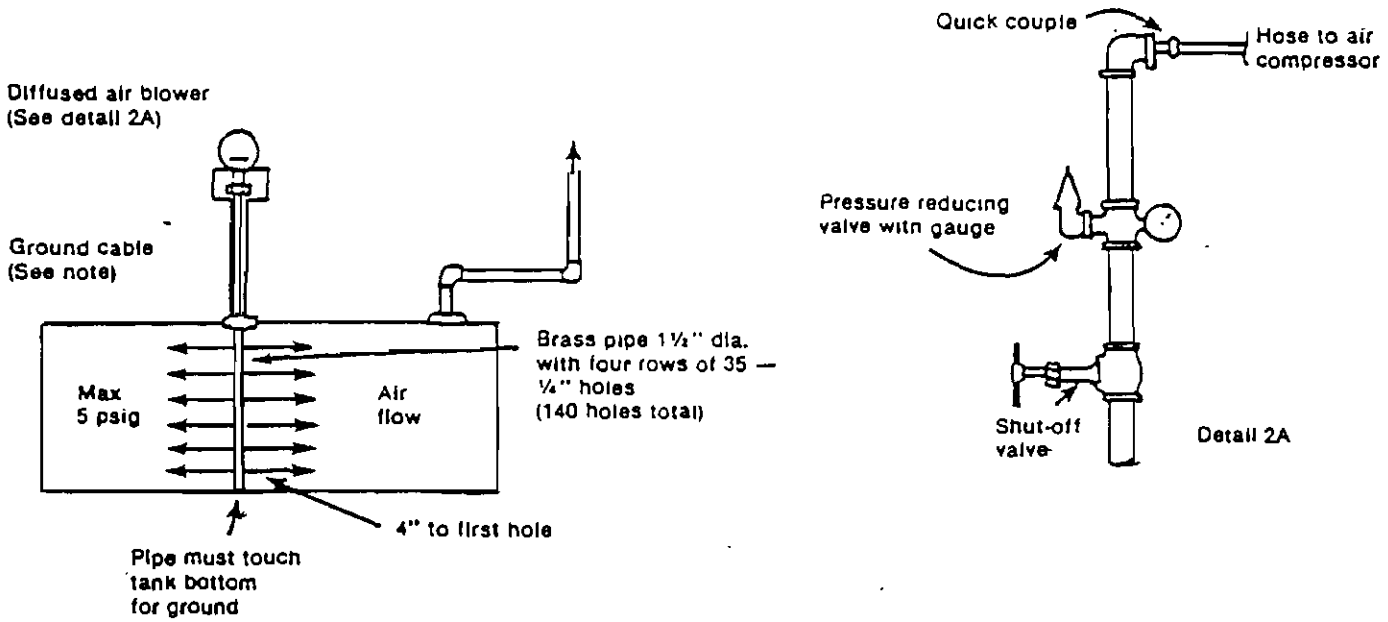


Figure 1—Eductor-Type Air Mover



Note: Ground cable brazed to pipe must be clamped to fill pipe. Use 12 gauge ground wire from fill pipe to water pipe or ground rod.

Figure 2—Diffused Air Blower

from volatile vapors. Air pressure in the tank must not exceed 5 pounds per square inch gauge.

4.2.6 One of the safest and simplest methods for vapor-freeing a tank is to fill the tank with water. However, in certain areas, regulatory requirements for treatment/disposal of water used in the vapor-freeing process may make this method cost-prohibitive. Before employing the method described in 4.2.6.1 through 4.2.6.3, consult local regulations.

4.2.6.1 Fill the tank with water until the floating product nears the fill opening. Remove the floating product and place it in a suitable container for proper disposal. Care should be exercised to ensure that neither product nor water is spilled into the tank excavation.

4.2.6.2 In the process of filling the tank with water, flammable vapors will be expelled through both the vent and fill openings, but primarily at the fill opening. Normal safety precautions should be observed. To minimize this escape of vapor through the fill opening, the opening may be temporarily capped.

4.2.6.3 When the tank is free of vapor, pump out the water and dispose of it in accordance with local regulations.

4.2.7 Steam can be used to clean and vapor-free a tank. However, a large static charge can build up on the nozzle of the steam jet. Insulated objects on which the steam impinges can also become charged. If steam is to be used for either purging or cleaning a tank or other equipment, the steam discharge nozzle and all conductive insulated objects subject to impingement or condensation should be bonded to the tank or be grounded. Steam purging of tanks should be avoided when suitable alternatives are available. Further reference to steam cleaning of tanks is found in NFPA 327.

4.3 Testing

4.3.1 The tank atmosphere and the excavation area should be regularly tested for flammable or combustible vapor concentrations until the tank is removed from both the excavation and the site. Such tests are to be made with a combustible gas indicator which is properly calibrated according to the manufacturer's instructions (typically on pentane or hexane in air), and which is thoroughly checked and maintained in accordance with the manufacturer's instructions. Persons responsible for testing must be completely familiar with the use of the instrument and the interpretation of the instrument's readings.

4.3.2 The tank vapor space is to be tested by placing the combustible gas indicator probe into the fill opening with the drop tube removed. Readings should be taken at the bottom, middle, and upper portions of the tank, and the instrument should be cleared after each reading. If the tank is equipped with a non-removable fill tube, readings should be taken through another opening. Liquid product must not enter the probe. Readings of 20 percent or less of the lower flammable limit must be obtained before the tank is considered safe for removal from the ground.

4.3.3 Combustible gas indicator readings may be misleading where the tank atmosphere contains less than 5 percent by volume oxygen, as in a tank vapor-freed with CO_2, N_2, or another inert gas. In general, readings in oxygen-deficient atmospheres will be on the high, or safe, side. It may be desirable to use an oxygen indicator to assess the oxygen concentration.

4.4 Removal

4.4.1 After the tank has been freed of vapors and before it is removed from the excavation, plug or cap all accessible holes. One plug should have a 1/8-inch vent hole to prevent the tank from being subjected to excessive differential pressure caused by temperature changes. The tank should always be positioned with this vent plug on top of the tank during subsequent transport and storage.

4.4.2 Excavate around the tank to uncover it for removal. Remove the tank from the excavation and place it on a level surface. Use wood blocks to prevent movement of the tank after removal and prior to loading on a truck for transportation. Use screwed (boiler) plugs to plug any corrosion holes in the tank shell.

4.4.3 When partially or totally removing an existing underground storage system, a small amount of contaminated backfill may be encountered. The contamination can be due to minor spills and drips during previous operation of the facility or from drips and minor spills that may occur during removal. Contaminated backfill may be a potential safety and environmental hazard. Spills or drips should be contained to minimize contamination during removal. If contamination is severe, consult local environmental officials, the fire marshal, or the USEPA for assistance and requirements. See API Bulletin 1628 for further information.

4.4.4 Tanks should be labeled after removal from the ground but prior to removal from the site. Regardless of the condition of the tank, the label should contain a

ng against certain types of reuse. The former contents and present vapor state of each tank, including vapor-freeing treatment and date should also be indicated. The label should be similar to the following in legible letters at least 2 inches high:

TANK HAS CONTAINED LEADED GASOLINE*

NOT VAPOR FREE

NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS INTENDED FOR HUMAN OR ANIMAL CONSUMPTION

DATE OF REMOVAL: MONTH/DAY/YEAR

*Or other flammable/combustible liquid. Use the applicable designation, for example, DIESEL.

4.4.5 Tanks that have held leaded motor fuels (or whose service history is unknown) should also be clearly labeled with the following information (see API Publication 2015A for additional guidelines):

TANK HAS CONTAINED LEADED GASOLINE
LEAD VAPORS MAY BE RELEASED IF HEAT IS APPLIED TO THE TANK SHELL

4.4.6 Tanks should be removed from the site as promptly as possible after vapor-freeing procedures have been completed, preferably on the day of tank removal from the excavation. If a tank remains at the site overnight or longer, additional vapor may be released from any liquid absorbed in the tank walls or residues remaining in the tank.

4.4.6.1 Before the tank is removed from the site, the tank atmosphere should be checked with a combustible gas indicator as specified in 4.3 to ensure that it does not exceed 20 percent of the lower flammable limit.

4.4.6.2 The tank should be secured on a truck for transportation to the storage or disposal site with the 1/8-inch vent hole located at the uppermost point on the tank. Tanks should be transported in accordance with all applicable local, state, and federal regulations.

SECTION 5—STORAGE OF USED TANKS

Storage Considerations

Even though used tanks that have contained flammable or combustible liquids have been vapor-freed at one time, they cannot be guaranteed to remain vapor-free. Hydrocarbons may be retained in crevices and under scale and may be released when disturbed or over a period of time. It is important, therefore, that appropriate safety precautions be observed at all times.

5.2 Storage Procedures

5.2.1 Tanks should be vapor-freed before being placed in storage (see 4.2). Tanks should also be free of all liquids and residues. All tank openings should be tightly plugged or capped, with one plug having a 1/8-inch vent hole to prevent the tank from being subjected to excessive differential pressure caused by temperature changes. Tanks should be stored with the vented plug at the highest point on the tank. All tanks should be labeled as described in 4.4.4 and 4.4.5.

5.2.2 Used tanks should be stored in secure areas on the premises of persons familiar with any attendant hazards and where the general public will not have access. A fenced yard, apart from other facilities, is desirable.

SECTION 6—SALE FOR REUSE

6.1 Considerations for Reuse

Careful consideration should be given to the reuse of tanks that have been in petroleum storage service. If a tank is sold for reuse, the purchaser should be given a very clear understanding of the former use and present condition of the tank. The seller of a tank to be returned service in an underground petroleum storage system must inform the purchaser of the tank of the owner's notification requirements under applicable federal regulations (40 CFR 280.11 and 40 CFR 280.22). There may also be similar state or local regulations. Buyers of such tanks should check with the original manufacturer of the tank to determine its suitability for reuse. It is advisable to test the tanks for flammable vapors (see 4.3) before they are transported.

CAUTION: Tanks that previously contained gasoline must not be used for the subsequent storage of food or liquids intended for animal or human consumption.

6.2 Conditions of Sale

A bill of sale should be used to transfer tank ownership. The bill of sale should include the purchaser's acknowledgement that he assumes all liability related to the tank. Bills of sale should indicate the former use of the tank and carry the following warning regardless of the former contents of the tank:

TANK HAS CONTAINED LEADED GASOLINE*

NOT VAPOR FREE

NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS INTENDED FOR HUMAN OR ANIMAL CONSUMPTION

*Or other flammable/combustible liquid. Use the applicable designation, for example, DIESEL.

SECTION 7—DISPOSAL

7.1 Disposal Criteria

7.1.1 Tanks should be disposed of when they are no longer fit for the storage of flammable or combustible liquids or any other appropriate use. Whether sold to a scrap dealer or disposed of at an acceptable facility, sufficient holes should be made in the tanks to render them unfit for further use.

7.1.2 Tanks that have been lined internally or coated externally with epoxy-based or similar materials may not be accepted by scrap processors. Prior inquiries should be made as to the requirements of the processor accepting the tank for scrap.

7.2 Disposal Procedures

7.2.1 After a tank has been vapor-freed, it should be rendered unsuitable for future use as a storage tank by puncturing, cutting, or drilling numerous holes in all sections of the tank.

7.2.2 All tanks should be labeled as described in 4.4.4 and 4.4.5.

7.2.3 A bill of sale should be used to transfer tank ownership (see 6.2).

7.2.4 Prior to disposal of used tanks, current federal, state, and local regulations should be checked to determine if special procedures or preparations are required.

Cleaning Petroleum Storage Tanks

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American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005

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SECTION 6—REPAIRS

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Cleaning Petroleum Storage Tanks

SECTION 1—GENERAL

1.1 Scope

This publication describes those procedures and precautions for gas freeing, entry into, cleaning, and exiting from nonportable atmospheric and pressurized petroleum storage tanks. The practices described in this publication are intended as a guide for personnel engaged in these activities. These are considered necessary for the safety and health of personnel and for the prevention of property damage. It is recognized that circumstances will determine the specific application of the procedures described. This publication does not apply to refrigerated storage.

Further information on floating roof tanks is available in API Publication 2015B.

1.2 Definitions

Flammable limits (see 2.2.1 for definition and discussion).

Sour stock is the type of crude oil and intermediate products obtained from it that contains quantities of hydrogen sulfide.

Threshold limit values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Because of wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some substances at concentrations at or below the threshold limit; a smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness. See the publications of the American Conference of Governmental Industrial Hygienists (1.3).

Vapor-freeing is the replacement of hydrocarbon vapors with fresh air in a tank.

Vapor indicators are instruments that detect or measure vapors, sometimes described elsewhere as combustible-gas indicators, gas indicators, and gasoline vapor indicators.

1.3 Referenced Publications

The latest editions of the following standards, codes, and specifications shall, to the extent specified herein, form a part of this publication:

API

Publ 2015A *A Guide for Controlling the Lead Hazard Associated with Tank Entry and Cleaning*

Publ 2015B *Cleaning Open Top and Covered Floating Roof Tanks*

Publ 2201 *Procedures for Welding or Hot Tapping on Equipment Containing Flammables*

Publ 2202 *Guidelines for Protecting Against the Lead Hazard When Dismantling and Disposing of Steel from Tanks Which Have Contained Leaded Gasoline*

Publ 2207 *Preparing Tank Bottoms for Hot Work*

Publ 2212 *Ignition Risks of Ordinary Flashlights*

Publ 2217 *Guidelines for Work in Confined Spaces in the Petroleum Industry*

Tech. Bull.(OH-8) *Medical Management of Chemical Exposures in the Petroleum Industry*

Audio-Visual Program

Safe Tank Cleaning

ANSI[1]

Z88.2 *Practices for Respiratory Protection*

Z117.1 *Safety Requirements for Working in Tanks and Other Confined Spaces*

ACGIH[2]

Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices and companion documents referenced therein

NFPA[3]

325M *Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids*

OSHA[4]

29 Code of Federal Regulations (CFR) 1910

NIOSH[5]

Recommended Standard for Occupational Exposure to Hydrogen Sulfide

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[1]American National Standards Institute, 1430 Broadway, New York, New York 10018.

[2]American Conference of Governmental Industrial Hygienists, Building D-5, 6500 Glenway Avenue, Cincinnati, Ohio 45211.

[3]National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

[4]Occupational Safety and Health Administration, U.S. Government Printing Office, Washington, D.C. 20402.

[5]National Institute for Occupational Safety and Health, 125 Bakers Drive, Morgantown, West Virginia 26505.

SECTION 2—PRELIMINARY PRECAUTIONS AND PREPARATIONS

2.1 Policies and Training

Each company should organize and maintain a system for tank entry and cleaning. Personnel employed to clean petroleum storage tanks should be adequately trained and thoroughly familiar with the safety precautions for controlling the hazards associated with tank cleaning. If the work is done by a contractor, a designated company representative should ensure that the contractor is made aware of the correct procedures to be followed. For additional information, see API Publications 2015A and 2015B, as well as the API-sponsored training program, *Safe Tank Cleaning*.

2.2 Hazards of Tank Cleaning

Petroleum storage tanks can be safely cleaned if proper procedures and adequate precautions are followed. Without such safeguards, injury or property damage may result from explosions, fire, oxygen deficiency, physical hazards, or the presence of toxic liquids, vapors, or dusts.

2.2.1 EXPLOSIONS OR FIRES

ıel (flammable vapors and gases), air (oxygen), and heat ource of ignition) are necessary for a fire. Fires and explosions cannot occur without the presence of all three of these elements. Mixtures of hydrocarbon vapor and air can be ignited only if the fuel-to-air ratio is within certain limits.

In the case of gases or vapors that form flammable mixtures with air or oxygen, there is a minimum concentration of vapor in air or oxygen below which propagation of flame does not occur on contact with a source of ignition. There is also a maximum proportion of vapor or gas in air above which propagation of flame does not occur. The boundary-line mixtures of vapor or gas in air, which if ignited will just propagate flame, are known as the *lower and upper flammable or explosive limits* and are usually expressed in terms of percentage by volume of gas or vapor in air. NFPA 325M, *Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids*, refers to the mixture below the lower flammable limit as too "lean" to burn or explode and a mixture above the upper flammable limit as too "rich" to burn or explode.

The lower and upper flammable limits (LFL and UFL) for most of those mixtures are between 1 percent and 10 percent hydrocarbon vapor by volume in air, respectively. Other vapors may have different limits. For precise values for various hydrocarbons, see NFPA 325M.

'apor indicators are calibrated to indicate the percentage ne lower flammable limit of vapors present in the mixture. Although a vapor indicator reading of zero is preferable, a concentration not exceeding 10 percent of the lower flammable limit will provide ample safety for performing hot work.

CAUTION: At 10 percent of the lower flammable limit, the hydrocarbon concentration will, in almost all cases, still exceed the threshold limit values of toxic materials, and appropriate personal protective equipment should be used. See 2.2, 2.3, and 4.7.

Ignition does not occur in petroleum vapor and air mixtures richer than the upper flammable limit. However, rich mixtures may be ignited and burn when diluted with outside air at tank openings such as hatches, manways, vents, or other openings. A rich mixture may remain in a tank after the liquid has been removed. When being vapor-freed by admission of air, tanks containing a rich vapor space will be in the flammable range sometime during the ventilation process. During the vapor-freeing operation, the presence of personnel on or adjacent to the tank should be minimized.

Vapors that issue from openings in a tank are usually heavier than air. If released near ground level, they may travel along the ground a considerable distance from the tank. During the tank vapor-freeing operation, all sources of ignition in the tank or in the vicinity of the tank should be eliminated.

Even after a tank has been freed of vapor, flammable mixtures may still be formed later from remaining residual liquids and sludges or from the entry of a liquid or vapor from an outside source. Petroleum vapors or liquids may enter a tank through unblinded lines or leaks in the bottom of the tank. Vapors may evolve within a supposedly empty and clean tank from flammables in overlooked places. Some of the more common sources are sludge, scale, hollow roof supports, unsealed sections of foam chambers, pontoons, heating coils, leaking bottoms, and internal wooden structures or other absorbent materials. Heat from the sun, steam tracing, or hot work may result in increasing the tank vapor content. Tank vapors should be checked frequently even if initial measurements indicate airborne quantities are within acceptable limits.

Flammable mixtures may be ignited by many ignition sources, including open flames, gasoline engines, diesel engines, lightning, electrical shorts in worn or defective extension cords, and sparks. Spark sources include electrical lamps, power tools, fixtures, switches, nonexplosionproof appliances, welding, and static electricity. Another source of ignition may be present in tanks that have been used for the storage of sour stocks or aromatic tars. Finely divided iron polysulfide deposits, which are pyrophoric on exposure to air, may form when sulfur compounds in sour stocks react with the iron of storage tanks. When these pyrophoric

deposits come in contact with air, a heat-generating chemical reaction takes place. If the heat is not dissipated, spot temperatures high enough to ignite a flammable mixture or residues can be reached.

Flammable deposits, such as condensed hydrocarbon or scale that may have formed on the underside of the tank roof or on rafters, can be ignited by cutting or welding operations on the roof. Such underside areas should be wetted down and kept wet while hot work is being performed on the roof.

The cleaning of jumbo size tanks may present special problems due to their very great volumes and large diameters. Special consideration will have to be given to ventilation and sludge removal. Special precautions and procedures, not included in this publication, should be established by the tank owner. Deviation from the guidelines in this publication may be necessary; however, the end objective of conducting cleaning safely must be achieved.

2.2.2 TOXIC LIQUIDS, VAPORS, AND DUSTS

2.2.2.1 Hydrogen Sulfide

Hydrogen sulfide is an extremely toxic, flammable gas encountered in the production and processing of high-sulfur-content crude oil and crude oil fractions. It is colorless and has a foul, rotten-egg odor. Since hydrogen sulfide is heavier than air, it will collect in low places. The atmosphere in all tanks that have contained sour stocks should be considered toxic, and special precautions are necessary for safe cleaning. Fortunately, hydrogen sulfide is gradually eliminated by refining processes and is virtually absent from most finished products. In low concentrations, it is detectable by its characteristic odor. However, smell cannot be relied upon to forewarn of dangerous concentrations because exposure to higher concentrations of the gas immediately paralyzes the sense of smell. A short exposure to lower concentrations has a similar desensitizing effect.

The Occupational Safety and Health Administration does not have an 8-hour time-weighted average (TWA) reference. The current OSHA standard for hydrogen sulfide is a ceiling level of 20 parts of hydrogen sulfide per million parts of air (ppm), or a maximum allowable peak of 50 ppm for 10 minutes once, if no other measurable exposure occurs. The National Institute for Occupational Safety and Health has recommended that the permissible exposure limit be reduced to 15 milligrams per cubic meter (10 ppm) averaged over a 10-minute period, and that work areas in which the concentration of hydrogen sulfide exceeds 70 milligrams per cubic meter be evacuated. The NIOSH *Recommended Standard for Occupational Exposure to Hydrogen Sulfide* should be consulted for more detailed information. In addition, the American Conference of Governmental Industrial Hygienists recommends a threshold limit value of 10 ppm (8-hour TWA). Check the latest edition and with your employer concerning exposure limits.

Tests for the concentration of this toxic gas in an atmosphere can be made with various hydrogen sulfide indicators. The accuracy and response times of such indicators will vary. Users should be informed of these and other limitations of the instrument being used.

Excess exposure to hydrogen sulfide causes death by paralysis of the respiratory system. There is some indication that the presence of alcohol in the blood aggravates the effects of hydrogen sulfide in acute poisoning cases. In mild doses, it is irritating to the eyes and respiratory tract. Repeated short accidental exposure may lead to chronic irritation of the eyes, nose, and throat. However, the effects of such exposure are not cumulative in action, and the symptoms usually disappear soon after removal from the mild exposure. It should be well understood that the sense of smell may be rendered ineffective by hydrogen sulfide, which can result in an individual failing to recognize the presence of dangerously high concentrations.

Hydrogen sulfide is a flammable gas that burns in air. Its flammable limits are 4.3 to 46 percent by volume in air. Therefore, the usual precautions against sources of ignition must also be observed when this hazard exists. A test for hydrogen sulfide should be made before any work is started on tanks that have contained sour stocks, and subsequent tests should be repeated at frequent intervals. Only after meeting the requirements specified in 4.7 Case I is it safe to enter tanks without respiratory equipment.

A tank that has contained leaded gasoline requires special precautions (see 2.2.2.2).

2.2.2.2 Lead Antiknock Compounds

NOTE: If the tank to be cleaned has ever contained leaded gasoline, Publication 2015A should be available for ready reference.

A tank that has been used for the mixing or storing of gasoline to which lead antiknock compounds have been added is a potential source of organic lead poisoning. Lead antiknock compounds are highly toxic. They are volatile and may enter the body through the respiratory system. In liquid form, they may be absorbed through the skin. Symptoms and effects vary considerably, depending on the degree of exposure and whether poisoning is due to a single massive exposure or to a relatively low level over a period of days or weeks. Effects range from subtle to serious central nervous system disorders and psychological symptoms. Exposure can be irritating to the eyes and there may be reproductive effects. Individuals should be in generally good physical and mental health. The presence of neurological disorders, alcoholism, or a history of gastrointestinal disorders may be reasons for disqualification. The effects of any toxic hazards can be ac-

cerbated by poor health, a cold, fatigue, overheating, skin abrasion, or lowered physical resistance. Exposure limits for the lead package, tetraethyl lead (TEL) and/or tetramethyl lead (TML), as pertinent, by the Occupational Safety and Health Administration, the American Conference of Governmental Industrial Hygienists, and the employer should be reviewed. For additional information, see the references in 1.3

Entering a tank that has contained leaded gasoline may be hazardous because of the presence of volatile organic lead compounds in the sludge and in the scale of the tank shell. A tank that has ever contained leaded gasoline and has been used to store other products without prior cleaning should always be considered lead-hazardous. The sludge in such a tank may contain organic lead for an indefinite period.

Other lead poisoning hazards may arise from decomposition products of lead antiknock compounds that have accumulated in the scale and sludge on the tank bottom or in the scale of the interior surfaces of the tank. Although some of these lead compounds may be nonvolatile, the application of intense heat, such as in torch cutting and welding, may create vapors that are dangerous if inhaled. The scaling and scraping of the dry internal surfaces of such a tank contaminate the atmosphere with dust containing hazardous quantities of organic lead.

A worker who enters a tank that has contained leaded gasoline should wear protective respiratory equipment and dress in prescribed clothing (see 2.3). Light-colored outer clothing is recommended so that persons working inside the tank may be more readily observed and contamination immediately recognized. At the end of the day or upon contamination, contaminated clothing should be removed and laundered before reuse. Each worker should thoroughly bathe, using soap, at the end of each day's work or before being reassigned to another job.

Sludge from tanks that have contained leaded gasoline should be kept wet until disposal. Sludge is hazardous to handle even after it has been removed from the tank. It should be disposed of as described in API Publication 2015A.

A tank cannot be considered lead-hazard free until:

1. It has been cleaned and all sludge has been removed.
2. Loosely adherent material has been scraped from all surfaces that have been in direct contact with the sludge and the material has been removed from the tank.
3. It is essentially dry and void of liquids and puddles.
4. It has been thoroughly ventilated after the foregoing operations.
5. A lead-in-air analyzer has been used to determine that the tank is lead-hazard-free (see API Publication 2015A).

CAUTION: Concrete tanks or tanks containing absorbent material cannot be rendered lead-hazard-free. Also, if there is apparent evidence of a leaky bottom, frequent lead-in-air analyses should be made to ensure that the atmosphere within the tank remains at a safe lead concentration.

It is unsafe to use steel from tanks that have contained leaded gasoline for the subsequent storage of food or liquids intended for animal or human consumption (see API Publication 2202).

2.2.2.3 Dusts

Where perceptible dusts are present, respiratory protection and protective clothing should be worn. The American Conference of Governmental Industrial Hygienists publication *Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment* discusses various types of dusts. See also, OSHA rules 29 CFR 1910.1000 and Table Z-3 regarding mineral and inert dusts.

2.2.2.4 Petroleum Substances

When high concentrations of petroleum hydrocarbon vapor are inhaled, symptoms of intoxication may result. These symptoms, ranging from simple dizziness to excitement or unconsciousness, are similar to those produced by alcohol or the anesthetic gases. If such effects occur, the individual should be removed to fresh air. For minor effects of exposure, fresh air and/or sniffing oxygen results in rapid recovery. If breathing has stopped, artificial respiration should be applied promptly. Medical attention should be obtained as soon as possible.

Tests have shown that prolonged or repeated exposure to some petroleum substances, in liquid or vapor form, may cause serious illness, including cancer, in laboratory animals. The significance of these results to human health is not fully understood because of the difficulty in translating to humans the data from animal tests. Nevertheless, everyone should minimize exposure to petroleum substances. The following health precautions are suggested:

1. Minimize skin contact and breathing of vapors.
2. Keep away from mouth; harmful or fatal if swallowed.
3. Keep work areas as clean as possible and well ventilated.
4. Clean up spills promptly.
5. Use soap and water or waterless hand cleaner to remove any petroleum product that contacts skin. Do not use gasoline or similar solvents to remove oil and grease from skin.
6. Promptly wash oil-soaked clothes, and avoid using oil-soaked leather goods.

Information concerning health risks with respect to particular materials should be obtained from the employer, the supplier of that material, or the Material Safety Data Sheet. Government health, safety, and environmental agencies are additional sources of information.

Obtain exposure limits and personal protection guidance from the employer and see 2.2.3.

2.2.2.5 Welding Fumes

The toxicity of welding fumes depends on their composition and concentration. The composition and quantity of fumes depends on the materials being welded, the composition of the rods and any coatings or paints, the process being used, and the circumstances of use. Toxic fumes are generated from welding on metals coated with or containing alloys of lead, zinc, cadmium, beryllium, and certain other metals. Some paints may produce toxic fumes when heated with the welding torch. The potential health effects range in type and severity depending on these factors, and some effects can be extremely serious.

Further detailed information on welding toxicity and appropriate protective measures such a respirators can be obtained from your employer and by consulting *Threshold Limits Values for Chemical Substances and Physical Agents in the Work Environment* (latest edition) by the American Conference of Govenmental Industrial Hygienists; OSHA regulations [see 29 Code of Federal Regulations Subpart Q (Welding, Cutting, and Brazing) 29 CFR 1910.251 and following, and Subpart Z (Toxic and Hazardous Substances) 29 CFR 1910.1000 and following]; API's *Medical Management of Chemical Exposures in the Petroleum Industry* (Technical Bulletin OH-8); and other references listed in 1.3 of this publication.

2.2.2.6 Other Chemical Hazards

Knowledgeable persons should be consulted when tanks containing materials such as acids, caustic high-boiling-point aromatics, and toxics not specifically referred to in this publication are to be cleaned.

2.2.3 OXYGEN CONTENT AND PETROLEUM AND CHEMICAL VAPORS

Work involving entry into an empty petroleum tank without the use of respiratory protective equipment must meet all the following requirements:

1. Oxygen content is no less than 19.5 percent measured by an oxygen analyzer instrument.
2. Toxic vapor concentrations are within their established exposure limit values, as specified by the employer. Also see the references listed in 1.3.
3. Hydrocarbon vapors are below 10 percent of the lower flammable limit.
4. The tank has been cleaned in accordance with API Publication 2015A if it has ever been in leaded gasoline service.

The threshold limit values or permissible exposure limits listed for most petroleum hydrocarbon vapors refer to time-weighted average concentrations for a normal 8-hour workday. Provided there are equivalent periods below the threshold limit value, exposures above the average threshold limit value concentration are generally permitted for many petroleum hydrocarbon vapors. However, in a few instances, such as in the case of benzene, the permissible variations above the threshold limit value are relatively small and are linked to corresponding maximum periods of exposure. When multiple hydrocarbon vapors are present, the combined effect of the various hydrocarbons in the product vapor must be considered as much as that of its individual components. These multiple hydrocarbon vapors occur in gasoline vapors, kerosine vapors, various motor fuel blending stocks, some solvents, and other petroleum distillates.

In the absence of information to the contrary, the effects of the different components should be considered as additive. The combined threshold limit value may be calculated. The threshold limit value of the mixture is exceeded if:

$$\frac{C_1}{TVL_1} + \frac{C_2}{TVL_2} + \cdots \frac{C_n}{TVL_n}$$

exceeds unity.

Where:

C = observed concentrations.
TLV = threshold limit value for any number of the mixture's different components, 1,2, ... n.

This formula applies only when the components in a mixture have similar toxicological effects; they should not be used for mixtures with widely differing reactivities. See the American Conference of Governmental Industrial Hygienists formula for independent effects (see 1.3).

Judgments on the extent to which the threshold limit value may be exceeded for short periods of unprotected exposure without risk of injury to health should be based on knowledge of the following factors: the chemical composition of the vapor, the effects of high concentrations for short exposure periods, the possible cumulative nature of repeated exposures, the duration of such exposures, the threshold limit value, and the oxygen content. Use of the expert guidance of medical or industrial hygiene personnel is always advisable.

Testing tank atmospheres for vapor concentrations in the range of 20 to 1000 parts per million for the petroleum hydrocarbons encountered in refining and producing operations can be performed accurately with a supersensitive-type vapor indicator. Other highly sensitive measuring procedures, such as gas chromatography, can also be used when such services are available. In the absence of such instruments, calibrated self-indicating detector tubes can be used to measure low concentrations of specific hydrocarbon vapors.

The oxygen content of the tank atmosphere can also be accurately measured by appropriate devices, which are

able from safety supply houses. To obtain a safe tank atmosphere, the space should be mechanically ventilated until the vapor concentration in the interior spaces and near the opening to the tank has been lowered to the appropriate exposure limit value. Because some hydrocarbon vapor may be released during tank cleaning procedures, mechanical ventilation should be continued and its effectiveness verified by periodically monitoring the tank atmosphere. If suitable vapor testing equipment is not available, tank entry must not be attempted under any circumstances.

Air within a tank that has been closed for an extended period, even though the tank has been previously cleaned and is empty, may become deficient in oxygen if the tank metal has rusted. If the oxygen content of the tank cannot be increased to at least 19.5 percent by mechanical ventilation, entry without approved air supplied respiratory protective equipment should not be permitted. If the oxygen content is below 16 percent, entry must not be made.

2.2.4 PHYSICAL HAZARDS

In addition to injury or property damage, which may result from fires, explosions, toxic conditions, or asphyxiation, trouble may result from other causes, such as:

1. Inadequate training of workmen or lack of competent supervision.
2. Structural failure of the tank shell, roof, roof support members, swing line cables, or other tank members. Certain types of roof panels on internal floating roofs will not support a worker's weight.
3. Tools or other objects dropping from overhead.
4. Falls through thin, corroded roofs or from scaffolds, stairs, and ladders.
5. Tripping over hose, pipes, tools, or equipment.
6. Slipping on wet, oily surfaces or colliding with objects in inadequately lighted interiors.
7. Accidental discharge of steam, high-pressure air, water, or oil, either into the tank or against personnel working outside, due to the omission of piping blinds.
8. Insufficient or faulty personal protection equipment.
9. Use of improper or poorly maintained tools, especially electrical tools or equipment.
10. Failure to disconnect or make inoperative electrical or mechanical equipment when not in use or failure to blind pipes connected to the tank.
11. Noise in excess of acceptable levels.
12. Inadequate lighting.
13. Inadequate working space.

2.3 Personal Protection

2.3.1 CLOTHING

Before entering a tank, each tank cleaner must be properly dressed for tank cleaning work. Clothing and equipment must provide for personal protection. Each day, tank cleaners should wear clean clothing, including fresh socks and underwear. A hard hat guards against head injuries. A long-sleeved shirt, long pants, and gloves help protect the skin against irritating materials. Gloves and either shoes or boots should be made of a material that the residues cannot penetrate.

Light-colored clothing is preferred. This makes it easier to see the cleaning crew members when they are working inside the tank, and splashes of sludge show up better on light-colored clothing.

If a tank cleaner's clothing becomes contaminated with tank sludge, the cleaner should immediately shower and change into clean work clothes. This practice is particularly important if the cleaner is working in a tank that has contained a toxic substance. Oil-contaminated clothing should not be kept in locker rooms, stored in lockers, or piled in bins. If not decontaminated immediately, the clothing should be placed in closed metal containers.

Tank cleaners should bathe with soap and water at the end of each day's work and when a tank-cleaning job has been completed. Hands and face should be washed thoroughly before meals.

2.3.2 BREATHING APPARATUS

Protective respiratory equipment for tank cleaners should provide a positive air pressure in a full-facepiece mask throughout the breathing cycle. Canister-type masks must not be used while working inside tanks because they do not provide proper protection against vapor concentrations even below 2 percent, nor do they protect against oxygen deficiency. Positive air pressure may be supplied to the full-facepiece mask in the following ways:

1. From a motor-driven positive-pressure blower, the discharge of which is connected to the full-facepiece mask by means of a low-pressure hose line from 0 to 25 pounds per square inch (0 to 1.76 kilograms per square centimeter). The blower air inlet should be located in an area where the air will remain free of contaminants, especially not near engine exhausts.
2. From equipment which supplies breathing air. The discharge of the equipment is connected by means of an intermediate-pressure air line to a reducing valve carried by the tank cleaner. The use of air from plant air lines is not recommended because the air from such sources is not reliably free of toxic contaminants or oil, nor is the supply under the control of the tank crew. The use of portable engine-driven compressors, of the type used to power air tools, to supply breathing air is not recommended. Reliance on such units is unwise because the continuity of operation is not highly reliable, the fuel supply may be depleted with

x attendance, and the air delivered could contain toxic substances.

3. From one or more high-pressure breathing-air cylinders, from 200 to 2000 pounds per square inch (14.06 to 140.6 kilograms per square centimeter), fitted with reducing valves to reduce to intermediate pressure. The discharge side of one reducing valve is connected by means of an intermediate-pressure air line to a second reducing valve carried by the tank cleaner. A low-pressure air line, carried by the tank cleaner, connects the low-pressure side of the second reducing valve to the full-facepiece mask.

4. From a high-pressure, breathing-air cylinder, complete with reducing valve, carried by the tank cleaner. The low-pressure outlet of the reducing valve is connected by means of a low-pressure air line, carried by the tank cleaner, to the full-facepiece mask. Because of the limited air supply, this self-contained equipment is recommended only for tank entries of short duration, such as for inspection, minor repairs or to provide emergency assistance.

CAUTION: Do not use oxygen cylinders or bottles for breathing-air purposes due to potential fire hazards and the risk of hyperventilation.

Breathing air equipment should be located on the upwind side of the tank opening so that only fresh, uncontaminated air will be supplied. The breathing air intake of a blower or compressor should not be placed near an internal-combustion engine exhaust. Where practical, the equipment should be provided with a vertical intake extension or be placed on a bench to elevate the intake above ground level. Where air is supplied from one or more high-pressure breathing-air cylinders, care must be exercised to properly locate and secure the cylinders to protect them from physical damage. An uninterrupted air supply to the full-facepiece masks must be maintained until all persons are out of the tank and have removed their facepieces.

Appropriate standby surveillance should be provided to monitor persons working inside the tank, the supply of breathing air, and conditions outside the tank. The type of rescue that might be necessary should be reviewed for each type of tank before entry.

Low- and intermediate-pressure hose connections should be inspected frequently and kept tight at all times. If the hose is pulled or twisted, a connection may be loosened while the hose is in use. Therefore, personnel should be instructed not to step on or twist hose lines. Air-supply hose lines should be inspected daily during use and tested frequently to guard against leaks. Defective hose should be replaced.

If a workman detects an odor such as gasoline while wearing a full-facepiece mask, he should leave the tank immediately. The source of the odor must be determined and eliminated before re-entry into the tank is permitted.

The user of the mask may remove his hat or cap to enable him to adjust the facepiece for a tight fit. It is essential that articles such as tobacco, snuff, and chewing gum be removed from the mouth before putting on the mask. Contact lenses should not be worn with respiratory protection masks.

After the facepiece has been adjusted and tightened, it should be tested for leaks. This is accomplished by inhaling while the end of the supply tube is closed with the palm of the hand. Modified self-contained breathing apparatus tube masks require that the coupling be plugged to accomplish the test. If the facepiece collapses against the face, the fit is satisfactory. If it does not, leaks should be located and eliminated. Leaks may be caused by temple bars on glasses, facial hair, absence of dentures, scars, certain facial shapes, or an incorrect respirator facepiece size for the wearer.

Persons should not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The local physician shall determine what health and physical conditions are pertinent. The respirator user's medical status should be reviewed periodically—annually, for instance.

Instructional written operating procedures for respiratory equipment should be available at the job site.

Under no circumstance should masks be removed inside the tank.

Facepieces should be cleaned frequently with soap and water, at least at the end of each day. Upon completion of the job, they should be properly stored in sealed plastic bags. The use of a mild disinfectant is recommended before storing the facepieces. The facepiece should be stored in a manner that will protect it from sunlight, dust, excessive heat or cold, moisture, and damaging chemicals.

Upon completion of the job, hoses should be thoroughly cleaned, dried, and capped before storing. Parts of mask sets, including the harness and lifelines, should be cleaned and dried to prevent deterioration and should be ready for reuse. Equipment should be protected against exposure to excessive heat. Any repairs or replacements should be made as soon as the need for them has been established.

2.3.3 MISCELLANEOUS

Full-coverage eye-protection equipment should be worn while scraping scale, cutting rivets, or spreading sawdust or other absorbents. Such equipment should be cleaned frequently and should be washed and sterilized upon completion of each job. Frequent or prolonged contact with oil may irritate or burn the skin and cause serious discomfort. Should such exposure become unavoidable, use gloves or, if necessary, the hands may be coated with commercial, nongreasy barrier creams which will provide partial protection.

Tools and equipment should be cleaned thoroughly at the

f each day and immediately after a job has been completed.

After a tank has been cleaned and closed for an extended period, the tank atmosphere should be checked for oxygen deficiency and tested for threshold limit value before re-entry. Only when the threshold limit value requirement has been met and the oxygen content in the tank atmosphere is above 19.5 percent by volume is it safe for men to enter a tank without respiratory equipment (see 4.7 Case I).

2.4 Emergency Plan and Standby Personnel

An emergency plan should be developed and available. Standby personnel should be provided where indicated. Means of alerting workmen to come out of the tank in the event of an external emergency should be considered.

SECTION 3—TANK-CLEANING OPERATIONS

3.1 General

Hazards encountered while cleaning petroleum storage tanks can be controlled by proper planning, inspection, and training. Tank-cleaning operations involve the following major steps:

1. Preliminary preparations, including external inspection of the tank and surveying the immediate area, training and indoctrination of the crew, and inspection of equipment.
2. Determining that the dike area is free of flammable or toxic materials before personnel are permitted to enter the tank.
3. Controlling sources of ignition in, around, and on the tank.
4. Emptying the tank by pumping and floating with water. This is probably the most commonly used procedure, but other methods may be employed.
5. Blinding off the tank and deenergizing electrical circuits after as much as the contents as possible have been removed.
6. Vapor-freeing the tank.
7. Testing the tank for oxygen, hydrocarbon vapors, and toxic gases.
8. Opening the tank for entry and removal and disposal of sludge.

3.2 Preparation for Cleaning

A supervisor who is competent to handle tank-cleaning operations should be placed in charge of the operation. He should first determine the type of product that the tank last contained and those contained in the past, as well as the indicated amount of sludge within the tank and the physical condition of the tank itself. He should make a survey of the surrounding area to determine whether it is safe to perform tank cleaning operations.

Equipment used for tank-cleaning operations should be inspected to ensure that it is free of defects and adequate for its intended purpose. Tank cleaners should be instructed in the proper use of all equipment, as well as safety precautions and rescue procedures.

Vigilance is required on the part of everyone engaged in tank cleaning. All persons involved in tank cleaning should be trained and well informed of the fire and health hazards of tank cleaning. Such a training and indoctrination program promotes efficiency and minimizes the possibility of injury and fire, which might result from error or misuse of equipment. Personal injury and property damage are less likely to occur when employees have a thorough knowledge of the operation, the proper use of protective equipment, and the hazards involved before the job begins.

Personal protective equipment should be inspected before each use to ensure that it is approved, in satisfactory condition, and suitable for the use intended.

3.3 Control of Sources of Ignition

Before any work is done that might involve release of vapors, roads in the tank vicinity should be barricaded and posted. All sources of ignition, including smoking, welding, or other work that might be a source of ignition, should be eliminated from the area where flammable vapors may be present or may travel. This area should be kept free of all sources of ignition, such as electrical and internal combustion engine equipment, from the time tank cleaning starts until the tank is vapor-free and the sludge has been removed. Then, if the equipment is used, it should be placed well away from the tank, preferably upwind to minimize the ignition hazard. No work should be done if the direction of the wind might carry vapors into areas where they might produce a hazardous condition, or when an electrical storm is either in progress or threatening. Even after as much oil as possible has been floated out of the tank and vapor-freeing has been completed, a hazardous condition may recur because of change in temperature, because of agitation of the sludge within the tank, or other reasons.

Vacuum trucks, if used to remove sludge from the tanks, should be located outside the dike where vapors will not reach

r internal-combustion engines. The vacuum pump exhaust ases should be discharged through hose of adequate size and length downwind of the truck.

No artificial lights except approved dry-cell-powered flashlights (see API Publication 2212), safety lanterns, cap lamps, or approved low-voltage lighting suitable for hazardous locations should be used inside the tank until the tank has been vapor-freed. Portable lights used outside the tank should be classified for hazardous locations, and extension cords should be equipped with connectors or switches approved for hazardous locations. Such equipment, when used, should be thoroughly inspected to ensure that it will not be a source of ignition.

Unexpected sources of ignition often occur, so it is not sufficient just to eliminate conditions known to be a possible source of ignition. Every effort must be made to avoid the release of vapors near ground level during ventilation and cleaning operations. Cleaning tanks at night should be discouraged because of limited visibility.

Fire extinguishers and fire hoses readily at hand are advisable.

To prevent spontaneous combustion, sludge removed from tanks that have contained sour stocks or aromatic tars should be kept wet until final disposal.

3.4 Emptying the Tank

Before the tank is opened, all residual product should be pumped or drained off to the lowest possible level through the water draw or pumpout connection. This pumping or draining may be augmented by adding water through existing piping connections, not through a roof opening, to float any remaining residual out of the tank.

3.5 Blinding Off and Electrically Isolating the Tank

After all possible residual oil has been removed, steam, foam, and all other piping connected to the tank should be blinded off as close as possible to the tank—on the tank side of tank valves. This will prevent hydrocarbon vapors or liquids from entering the tank from the lines. Blinding off is accomplished by first closing all the valves nearest the tank, then breaking the connections and placing blinds in all the lines. Blinds should be of sufficient strength and thickness to withstand the maximum pressure that might be exerted against the blind.

Before the blinds are installed, all lines between the tank and the blind location should be drained or flushed. In addition, valves in lines outside the dike and nearest to the tank should be closed, and caution tags should be attached to these valves. Foam chambers on the tank should be opened and inspected to ensure that the seal is intact and that oil is not trapped in an area open to the tank. Drains at the base of pipe risers to the chambers should be left open. Heating coils should be turned off and valves tagged or locked "closed."

Electrical connections to mixers and other electrical equipment should be disconnected, tagged, and locked out. If the tank bottom is protected from corrosion externally by an impressed current system, a bond wire should be used when disconnecting pipe flanges. All tank ground cables and cable clamps should be inspected to ensure grounding and bonding integrity.

3.6 Work on the Tank Roof and in Tank Vicinity During Vapor Freeing

CAUTION: Some tanks, on being emptied, may be in the flammable range. Work on the roof and adjacent to the tank should be limited to that which is essential. Workers should not be permitted on internal floating roofs during vapor freeing.

When it is necessary for workmen to go onto a tank roof, an inspection should be made to determine what safety measures are needed. Planks should be used to distribute workers' weight over a larger surface if the roof is in questionable condition. Safety belts and lifelines can be used, with a designated rescue worker standing by in the event of an accident.

When work is being performed on the outside of tanks that have contained sour stocks, in locations where exposure may occur, workers should wear protective respiratory equipment that provides an independent air supply.

3.7 Vapor-Freeing the Tank

Where conditions permit, it is preferable that the tank be freed of flammable vapors before other steps are undertaken. In the initial stage of vapor-freeing, while the tank still contains a flammable mixture, work in the area should be kept to a minimum.

A principal consideration in vapor-freeing a tank is the disposal of displaced vapor to minimize the possibility of a hazardous condition in the surrounding area. Effective disposal and the precautions required depend to a large extent on whether vapors are to be displaced by mechanical ventilation, steam ventilation, or natural ventilation.

3.7.1 MECHANICAL VENTILATION

Several methods of mechanical ventilation are quick and are considered safe. Vapors may be drawn from top manways by eductors or fans, or air may be forced through bottom shell manways by air, steam, or electric-motor driven fans suitable for hazardous locations. In each case, the air mover should be electrically bonded to the tank.

The time during which the vapor/air content in the tank will be flammable should be reduced to a minimum. One

sirable method of accomplishing this is to place an eductor in a top manway with a flexible tube attached to the eductor and extending it to near the tank bottom. The heavy vapors are thus drawn from near the bottom through the tube and eductor and discharged upward. The shell manway cover is left on, and the lighter air enters the tank through the top manway.

Discharging the vapors at the top of the tank allows maximum mixing with outside air and reduces the chances of flammable mixtures reaching a source of ignition. No work should be permitted on top of the tank while vapors are being educted.

Another method is to use an eductor or an air-, steam-, or electric motor-driven blower to draw vapors from the top manway and allow air to enter the tank from the bottom shell manway. Such an exhaust fan or eductor should be started at a low delivery rate to avoid a vacuum in the tank before the shell manway is opened. This will establish a pressure differential so that there will be no release of vapor at ground level when the shell manway cover is removed. After the shell manway cover has been removed, the exhaust eductor should be operated at full capacity.

Another mechanical method is to place the blower in the bottom manway and force air into the tank, allowing the vapor-air mixture to escape through the roof manway. The cover should be left on the roof manway until after the blower is installed in the shell manway. The roof manway cover is then removed and the blower started.

The blower may be air-, steam- or electric motor-driven. If an electric motor-driven blower is used, the motor and all electrical cables and connectors must be suitable for hazardous locations. If a gasoline engine-driven blower must be used, the engine is an additional source of ignition and must be located away from the tank, preferably outside the dike and on the upwind side of the tank.

A canvas duct may be used to carry air from the blower outlet to the manway. Care must be taken not to place the blower intake near other possible sources of vapor release, such as adjacent tanks, sewers, or loadings racks.

3.7.2 STEAM VENTILATION

Steam ventilation may prove advantageous in some cases, but its use introduces some special hazards. To be effective, it must be introduced at a rate high enough to raise the temperature inside the tank to at least 170 F (77 C). Often the available steam is insufficient to do this, particularly during cold weather or on large tanks. If the temperature in the tank reaches equilibrium below 170 F (77 C), the steam will condense as fast as it is introduced and no more vapors will be expelled.

The flow of steam into the tank may also generate static electricity, which can cause sparks and the ignition of flammable vapors. The pipe or nozzle of the steam hose, if one is used, must be bonded to the tank, but this will not prevent a charge from being generated by the steam after it leaves the nozzle or the end of the pipe. A charge may accumulate on an electrically insulated object inside the tank and result in sparking when the object comes close to any part of the tank at ground potential.

Steam should be introduced through a connection near the bottom of the tank, and either the roof manway or the gage hatch should be left open during the entire operation. This will avoid both the building of excessive pressure while steaming and the creation of a vacuum while cooling. When employing steam vapor-freeing, be certain that sufficient vacuum venting is provided to prevent any vacuum formation within the vessel from rapid steam condensation.

3.7.3 NATURAL VENTILATION

The least desirable method to vapor free a tank, since it could allow vapors to drift to a source of ignition, is to simply remove roof and shell manway covers and let the tank stand until natural ventilation makes the tank gas-free. This is also a slow process. At least at the start, the vapors will flow from the shell manway and, at times of little wind, may drift considerable distances. Wind or heat from the sun may cause the vapors to reverse and flow from the roof manway, particularly near the end of the operation. Sometimes wind sails can be used to increase the rate of ventilation.

Because drift and concentration of vapors are unpredictable, no work should be permitted in the vicinity of the ventilation and only the person, in proper protective clothing and equipment, making occasional gas tests should be allowed in the area.

3.8 Control of Pyrophoric Deposits in Sour Stock and Aromatic Tar Tanks

If the tank has contained sour stocks or aromatic tars, deposits in the tank may spontaneously generate heat and cause ignition if allowed to dry out and react with the oxygen of the air (see 2.2.1). This source of ignition can be controlled by isolating these deposits from air or by dissipating the heat to prevent a temperature rise until the atmosphere inside the tank is below the flammable range. This may be accomplished by wetting all interior surfaces of the tank with water. The wetting dissipates the heat of reaction and also tends to isolate these pyrophoric deposits from oxygen present during ventilation. Continuous wetting of the inside surfaces of a tank can be accomplished by positioning hoses with fog nozzles at open manways. The fog nozzles should be electrically bonded to the tank shell.

A suggested procedure for vapor-freeing and removal of

pyrophoric deposits from shell and roof surfaces involves the following steps:

1. Steam the tank until the interior surfaces are wet with condensate (see 3.7.2).
2. Install a high-capacity air mover in the roof manhole and one or more large fog nozzles in the neck of the shell manhole. Bond the air mover and nozzles to the tank.
3. Without delay, turn on the fog nozzles and immediately thereafter turn on the air mover. (The interior surfaces of the tank will be kept wet and the ingoing air will be thoroughly wetted by the moisture from the fog stream). The air mover and fog nozzles must be operated without interruption until the tank is vapor-free.
4. With the air mover still in operation after the fog nozzle has been removed, knock down all loose scale with a high-pressure water stream.

CAUTION: Workmen who enter the tank with the high-pressure water line must wear adequate protective equipment (see 2.3), and the requirements for entry must be met.

5. Proceed with the tank cleaning operation.

3.9 Vapor Testing

To determine the progress of vapor-freeing operations, the atmosphere in the tank and the surrounding area should be tested frequently throughout the operation with a vapor indicator. (For testing inside the tank, in the case of tanks which have contained leaded gasoline, the tester should be equipped as described in API Publication 2015A.) The tester should be thoroughly familiar with the reading and handling of the instrument. Before taking readings, the tester should determine that the instrument is in proper working condition and correctly calibrated. It is important that the tester adhere to the manufacturer's recommendations for checking and calibrating the instrument and use of the instrument in high humidity conditions.

Samples of vapor should be taken, preferably at the exhaust outlet.

Vapor indicator tests should not be performed during steam operations because the results may be erroneous.

To perform a vapor test following steaming operations, permit the atmosphere within the tank to stabilize for at least 15 minutes. When vapor concentration has been reduced to 50 percent of the lower flammable limit and air is entering the shell manways, personnel need not be restricted from around the tank. However, the introduction of potential ignition sources within the area should still be subject to rigorous control based on the vapor concentration tests, wind direction, and velocity.

When vapor concentration in the mixture leaving the tank is reduced to approximately 20 percent of the lower flammable limit, the first objective of removing the flammable atmosphere has essentially been accomplished. However, this condition is not necessarily permanent, and ventilation and vapor testing should be continued. The exact vapor concentration considered safe before proceeding with the next step in the work will depend upon the program set up for sludge removal. This, in turn, will depend on the size of the tank, the facilities available, the amount of sludge, and other factors.

CAUTION: The tester should wear respiratory equipment and protective clothing until it has been determined that:

1. Other toxic substances are not present at levels above the established exposure limit value, as specified by the employer.
2. The tank has not contained leaded gasoline or has previously been declared lead free.
3. The oxygen content is at least 19.5 percent.
4. The vapor indicator registers a reading not exceeding 10 percent of the lower flammable limit.

The ventilation should be shut down for 15 minutes prior to and while the tests are being made. Preferably no work should be started within the tank until it is vapor free. Any entry into the tank should follow the procedure outlined in 4.6 concerning the presence of an outside observer.

3.10 Initial Cleaning from Outside the Tank

After the foregoing steps have been completed in the order outlined, cleaning of the tank may be started.

The tank should now be temporarily vapor-free and ready for removal of remaining manway covers, riveted door sheets, or bolted cleanout cover plates.

Initial cleaning should be performed from outside the tank when the vapor concentration has been reduced to 50 percent or less of the lower flammable limit. A water-hose stream directed through open manways or rotating nozzles pointing inward from the tank shell and numerous similar devices have been successfully used to dislodge sludge and float it to a water draw or pumpout connection. All nozzles should be electrically bonded to the tank shell. Ventilation should be continued to maintain inflow of air at shell manways during this process. Occasional tests should be made for flammable vapors. The stirring of sludge may release vapors and increase vapor concentration. If the concentration rises to above 50 percent of the lower flammable limit, washing should be stopped until a safe concentration has been re-established.

Pumping equipment used for the removal of sludge and excess water from tanks preferably should be driven by air, steam, or an approved electrical drive suitable for the area classification. If it becomes necessary to use open type, electric-power or gasoline-engine driven equipment, the

'lowing special precautions are recommended to minimize ..e potential hazards:

1. Steps should be taken to ensure that an adequate flow of fresh air will enter the tank at the shell opening and be exhausted from the roof manway, thereby ensuring that flammable vapors will not flow out of the tank shell manway at ground level.
2. Equipment should be located on the upwind side of the tank and out of range of probable vapor travel preferably outside or on top of the dike.
3. The area around the tank should be tested for flammable vapors with a vapor indicator before any equipment, which may be a source of ignition, is started.
4. If a pump is used to remove residuals from the tank, it should be attended and properly maintained for continuous operation during the period of tank cleaning.

Each time the equipment is to be started, the area should first be tested for flammable vapors. A gasoline engine should always be stopped during refueling. Throughout the pumping period, close checks should be made to ensure that a flow of air is entering the shell manway. If at any time the inflow of air is stopped, the pump should be stopped immediately. The pumping operation should not be resumed until ventilation has been re-established and the area has been tested and found to be free of flammable vapors.

SECTION 4—TANK ENTRY

4.1 Testing for Entry

A tank that has not previously contained leaded gasoline may be regarded as safe for entry without respiratory equipment if it has been determined that:

1. Toxic substances are not present at levels above the established exposure limit value set by the employer (see 1.3, '.2.2, and 2.2.3).
.. The vapor indicator registers a reading not exceeding 10 percent of the lower flammable limit.
3. Oxygen content is at least 19.5 percent.

Entry may be made with approved supplied air respiratory equipment for cold work purposes provided that the flammable vapor concentration is not more than 20 percent of the lower flammable limit and the oxygen content is not less than 16 percent.

Prior to work, the interior of the tank should be inspected for physical hazards, such as loose rafters, angle irons, or columns and other materials that might fall. In addition, swing lines should be checked to ensure that they have been lowered to the tank bottom or are properly supported by angle frames.

4.2 Testing for Toxic Substances, Including Lead

Tests should be made to ensure that vapor concentrations are within established exposure limit values set by the employer (see 1.3, 2.2.2, and 2.2.3). Otherwise, workers should be required to wear respiratory equipment and protective clothing.

Tanks that have contained leaded gasoline may contain residues of lead antiknock compounds in sufficient quantities o present a serious health hazard even though the tank may ,e hydrocarbon-vapor free and contain sufficient oxygen. Before entry without protective equipment, tests should be made to ensure that the tank may be considered lead-hazard free as outlined in API Publication 2015A. The requirements of Case 1 in 4.7 must also be met.

4.3 Testing for Oxygen

After a tank has been cleaned and then closed for an extended period, the tank atmosphere should be checked for oxygen deficiency and gas-tested before re-entry. Only when the oxygen content in air is at least 19.5 percent by volume is it safe for workers to enter a tank without supplied air respiratory equipment (see 2.2).

4.4 Other Physical Hazards

See 2.2.4 for special physical hazard precautions.

4.5 Entry Permit

A qualified person, authorized to do so, should sign and issue an entry permit before workers enter a petroleum storage vessel. Persons entering the vessel should be sure that the permit has been correctly issued. The permit should be readily available for review and should attest that the provisions of Sections 2 and 4 of this publication have been carried out.

4.6 Additional Precautions

While workmen are inside a tank completing the cleaning process, a workman should be available outside the tank to assist those within the tank in the event of an emergency. When entrance into the tank is made, lifelines attached to the D-rings of the workmen's harnesses should be considered for added protection. The outside observer also should have adequate respiratory equipment available. Anyone who has inhaled hydrocarbon vapors should have immediate medical

ention if he appears weak or exhibits other unusual symptoms. Workmen should exercise caution to prevent skin contact with oil or sludge. In the event of such contact, the oil or sludge should be washed from the skin with soap and water as promptly as possible.

Safe and easy entrances and exits through manways should be provided. Tank-bottom sumps should be covered or guarded to prevent falls. Tools or other equipment should not be dropped or thrown from higher levels of the tank. Lighting should be provided, preferably by explosionproof lamps.

4.7 Protective Equipment Requirements and Permissible Personnel Activity for Various Tank Atmospheres

4.7.1 Case I—Entrance Not Requiring Full Respiratory Equipment or Protective Clothing

A tank can be entered by workers without respiratory protection if the tank atmosphere meets all of the conditions listed below and a permit for personnel entry has been issued.

1. Flammable vapors are at 10 percent of their lower flammable limit or less.
2. Oxygen in the tank atmosphere is 19.5 percent by volume, or greater.
3. Airborne concentrations of toxic substances are below established exposure limit values as specified by the employer (see 1.3, 2.2.2, and 2.2.3).
4. The tank has not contained organic lead or, if it has, it has been cleaned and a lead-in-air test shows that airborne concentrations of organic lead are at 2 micrograms of lead per cubic foot (0.075 milligrams of lead per cubic meter) or less.

Respiratory and other personal protection may be required for some tank repairs (see 6.4).

4.7.2 Case II—Entrance Requiring Respiratory Equipment and Protective Clothing

Workers wearing positive air pressure, full-facepiece respiratory equipment can enter the tank, provided that the tank atmosphere meets all the conditions listed below and a permit for entry has been issued. Protective clothing must be worn if toxic materials present can be absorbed through the skin. For entry into leaded gasoline storage tanks, see API Publication 2015A.

1. Flammable vapors are less than 20 percent of the lower flammable limit.
2. Oxygen in the tank atmosphere is 16 percent or more.
3. Hydrogen sulfide concentrations are less than 100 parts per million.
4. Airborne concentrations of other toxic vapors are below levels acceptable to the employer.

4.7.3 Case III—Entrance Prohibited

A tank must not be entered if any of the following conditions exist:

1. Flammable vapors are greater than 20 percent of the lower flammable limit.
2. Oxygen in the atmosphere is less than 16 percent.
3. Hydrogen sulfide concentrations are 100 parts per million or more.
4. Airborne concentrations of toxic vapors are above levels acceptable to the employer for entry.

SECTION 5—WORKING IN THE TANK

5.1 Ventilation

Flammable and toxic vapors may be present as long as oil or sludge remain within the tank. For this reason, ventilation should be continued, regardless of acceptable test results for flammable vapors, until oil and sludge have been removed.

5.2 Retesting

Tests for flammable and toxic vapors should be repeated at frequent intervals throughout the entire cleaning period. If the exposure limit and oxygen requirements are not met, workmen without respiratory equipment should leave the tank and ventilation should continue until the conditions specified in Section 4 are re-established. Such tests are especially important before re-entry into a tank following any extended interruption of work or after an overnight break in operations.

5.3 Removal of Sludge

5.3.1 REMOVAL AND DISPOSAL OF LEADED GASOLINE TANK SLUDGE

For tanks that have contained leaded gasoline it is essential that sludge removal be performed with the precautions specified in Publication 2015A. The disposal method must

mply with applicable federal and local waste disposal regulations.

5.3.2 METHODS FOR REMOVING SLUDGE

Sludge may be removed by various methods or by a combination of methods, depending on the construction of the tank and the number and size of shell openings. The simplest method is usually to:

1. Wash, brush, or sweep the sludge into piles.
2. Shovel the sludge into buckets or wheelbarrows to remove it from the tank.
3. Sweep and wash down the tank with a water-hose stream.
4. Remove remaining moisture from the tank by using an absorbent such as sawdust, spent clay, or rags.

While removing sludge by such methods, care must be taken to minimize release of vapors from the sludge.

If riveted or welded door sheets have been removed from the tank, or if the tank has floor-level cleanout manways, much of the sludge may be removed by flushing it from the tank with a high-pressure water stream. If such openings do not exist, self-priming pumps or steam- or water-operated ejectors may be useful. Any method of removing residual material that minimizes the time workers must spend inside the tank contributes to the safety of the tank-cleaning operations.

Vacuum tank trucks provide a fast and efficient method for removing and hauling sludge from tanks being cleaned. The area of operation for vacuum tank trucks must be proven to be vapor-free, and the truck should be located upwind from the tank and outside the path of probable vapor travel. In the area of discharge of sludge from the tank truck, vapor travel and sources of ignition must be considered.

SECTION 6—REPAIRS

6.1 Hot Work Permits

A hot work permit may be issued for work in or on the external surfaces of a tank only when the flammable vapor concentration is 10 percent or less of the lower flammable limit. The provisions of Sections 2 and 4 must also be met. Hot work permits may be issued only by a qualified and authorized person.

6.2 Additional Precautions for Doing Hot Work

If repairs involve hot work, surfaces to be heated, including roofs and structurals, should be free of liquid hydrocarbons, ignitable scale deposits, waxes, and other deposits that will evolve vapors. Such deposits are sometimes hidden on the upper surfaces of roof rafters. Vapor indicator tests will not indicate the presence of these materials. The application of heat from cutting and welding may produce flammable or toxic vapors. Frequent tests should be made, therefore, to ensure that the atmosphere in the tank is not in excess of 10 percent of the lower flammable limit and that the threshold limit value requirement is met. Wooden roof supports that emit vapors may be easily ignited. Flammable and toxic vapors may enter through leaks in the tank bottom or may evolve from pockets that exist in spaces such as pipe-column-type roof supports, chambers, swing lines, or pontoons. Continued ventilation will minimize any accumulation of flammable vapors emanating from such sources.

Surfaces of a tank that have been in contact with leaded gasoline should be scraped down to bare metal over any area that might be heated excessively by welding or by other operations. As an alternative to cleaning down to bare metal, welders may use supplied-air respiratory equipment or a welder's facepiece designed for use with a hose mask through which fresh air is supplied.

Repairs to original or false tank bottoms may be accomplished by drilling and tapping the bottom to provide connections by which carbon dioxide, water, or other purging agents may be introduced (see API Publication 2207). Some tank linings may be flammable. Internal floating-roof covers and seals and the seals of floating roof tanks may also be made of combustible plastics. These matters should be considered in determining the advisability of issuing a hot work permit.

Where hot work is to be performed, fire extinguishers should be available. Where available, standby pressured fire hose should also be considered. See 2.2.2.4 for additional information.

6.3 Cold Work In Tanks

Cold work may be performed at flammable vapor concentrations up to 20 percent of the lower flammable limit. The provisions of Sections 2 and 4 must also be met. Cold work permits may be issued only by a qualified and authorized person.

6.4 Other Work

Even if the tank complies with 4.7 Case I at the outset, some work operations thereafter, such as spraying or painting, may require the use of breathing apparatus or other protection. The type of equipment or respiratory apparatus that would be appropriate depends on the substances, concentrations, and circumstances involved and should be evaluated in planning the operation.

SECTION 7—GAS FREEING AND CLEANING LIQUEFIED PETROLEUM GAS STORAGE TANKS

7.1 Preliminary Precautions and Preparations

Many of the precautions and preparations for gas-freeing and cleaning atmospheric storage tanks are also applicable to liquefied hydrocarbon gas storage tanks. Personnel should familiarize themselves with these procedures as described in the preceding sections of this publication (see Section 2).

7.2 Type of Gas-Freeing Procedure to be Used

The procedure to be followed in gas-freeing liquefied petroleum gas storage tanks will vary with the type of installation, usually determined by the vessel's location. In bulk plants and installations having limited facilities, the procedure will be different from that in refineries and large installations. At large locations, flare systems and high volume water supplies are usually available. In the case of bulk plant and customer installations, the product being handled must be kept dry and is normally free from residue. Therefore, the -freeing procedure employing water flooding and washing ıot applicable.

7.3 Liquid Removal by Water Flooding

The tank should be blocked off from other equipment except for the pumpout line. Where the pumpout connection is above the bottom of the tank, water should be introduced under pressure into the bottom of the tank to float residual hydrocarbons to the pumpout connection while pumping continues. Water should not be introduced at a rate greater than the pumpout rate. A check valve should be provided to prevent back flow of hydrocarbons into the water line. When water flushing is completed, the water line should be disconnected, since the check valve may leak. When hydrocarbons have been flushed out, water should be drained through the water drawoff system. When the water is drained to a catch basin or other open systems, it is essential that attendance at the water-draw valve be maintained until vapor appears and the valve is closed.

7.4 Depressuring

After all liquid has been pumped out, the tank will contain gas under pressure. The method for venting this gas should remove it from the tank with a minimum possible concentration of gas in the surrounding atmosphere. Control of ignition sources, as discussed in 3.3, is also essential.

Flaring and venting to the atmosphere are the two preferred methods of depressuring tanks.

The venting method for a particular tank depends upon local conditions. Flare or gas collection systems should be used where they exist, since flaring at a safe location eliminates the possibility of flammable mixtures being formed in the area. At locations having no such systems, a simple flare can be constructed by connecting a pipe to the outlet of one of the valves on the tank. This pipe should be routed to an area safely clear of all combustible materials, including shrubs, weeds, and grass. The gas may be burned at the end of a horizontal pipe equipped with a flame arrester, or an elbow and nipple may be installed to direct the flow upward. In any event, the rate of burning must be controlled to prevent overheating of anything in the area.

On the other hand, venting at an elevation above the tank will disperse the vapors with a low probability of forming flammable mixtures in the surrounding area. To vent above the tank, use the following procedures:

1. Close a valve adjacent to a top outlet nozzle on the tank.
2. Disconnect the piping downstream of the valve.
3. Install a riser or vent stack on the valve approximately 8 feet above the top of the vessel.
4. Partially open the valve.
5. Slowly depressure the vessel.

7.5 Blinding

After the tank has been depressured, connections to other tanks, pumps, and facilities should be blinded off adjacent to the tank nozzles (see 3.5).

7.6 Vapor Freeing

When water flooding is not applicable or available, techniques similar to those described in 3.7 may be followed. It may also be feasible to purge the vessel with an inert gas, then purge the inert gas with air. Initially, flushing the pressure vessel out with air should be avoided because, at some stage in the process, the vessel atmosphere will be in the flammable range.

7.7 Gas Removal by Water Flooding

Some liquefied gas storage vessels or their foundations are not designed to be completely filled with water. This determination should be made before proceeding. Water flooding outlined in this publication does not apply to refrigerated storage tanks.

After all the liquid has been pumped out in accordance with 7.3 and the tank has been depressured (see 7.4), water should be pumped into the tank until it overflows through a top

ıdet. Gas should be dispersed to a closed system through a water knockout drum, as it does in a flare system.

However, overflowing the tank to the atmosphere is probably unavoidable in most instances. In those cases it should be ascertained that adequate wind or other means are available to disperse vapors in a safe direction.

In the case of noded tanks or other configurations which may result in gas being trapped as the water level rises, means of venting this gas should be provided. Washing should be continued until all hydrocarbons are displaced.

The gas collecting or flare system connection should be blinded off and water flushing continued overhead to the atmosphere until it is concluded that a satisfactory hydrocarbon gas test may be obtained.

The water level in the tank should be lowered several feet and a vapor indicator check made for gas content.

When the vapor indicator reading shows less than 10 percent of the lower flammable limit and the threshold limit value requirement is met, water flushing may be discontinued and water drained from the tank (see 3.9).

Adequate openings at the tank top and in trapped sections should be provided to ensure that a vacuum will not occur in the tank during water draining.

If pyrophoric iron sulfide could be present, a fog nozzle or piped spray system should be provided to wet down the interior surface frequently until scale has been removed (see 3.8).

7.8 Preparation for Entry

The vessel is now ready for entry if toxicity and oxygen checks are satisfactory (see Section 4).

Appendix B

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Tanks Containing Waste Oil or Unknowns

Tank I.D	UST #	Contents	Capacity (gals)	Sample Results
Naval Shipyard				
123-1	00059	Waste Oil	1,000	Yes
221-1	0001210	Waste Oil		Yes
226-1	00026	Waste Oil	Pass Through	Yes
236TK-1	00013	Lube/New	560	Yes
236TK-4	00014	Lube/New	560	Yes
236TK-5	00017	Lube/New	575	Yes
236TK-6	00018	Waste Oil	560	Yes
240	00022	Waste Oil	5,000	Yes
240A		Waste Oil		No
38-1	00042	Waste oil	1,500	Yes
1024	00063	Waste Oil	250	Yes
NS-2A	00062	Waste Oil	560	No (Still In Service)
NS3-1	00050	Waste Oil	280	Yes
NS44A	00061	Waste Oil	550	Yes
Naval Supply Center				
148		WasteOil		No
3901A		Waste Oil	103,000	No
3906O		Waste Oil	1,153,000	No
3911		Lube/New	50,000	No
3912		Lube/New	50,000	No

Appendix B

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Tanks Containing Waste Oil or Unknowns

Tank I.D.	UST #	Contents	Capacity (gals.)	Sample Results
Naval Supply Center (cont'd)				
3915		Lube/New	1,008,000	No
39A		Waste oil	741,000	No
39D		Waste Oil	741,000	No
Naval Station				
1346	NS037	Waste Oil	650	Yes
2505		Waste Oil	275	No
2513C		Lube/New	550	No
681-1	NS022	Waste Oil	100	Yes
NS26A	NS006	Waste Oil	200	Yes
NS26B		Unknown	Unknown	No
NS26C		Waste Oil	20,000	No
FBM61-2	NS031	Waste Oil	1,000	Yes
200-3	NS025	Waste Oil	250	Yes
680-3	NS038	Waste Oil	400	Yes

123-1

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MATERIALS TESTING LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, SC 29408-6100
SCDHEC ID# 10579

GENERAL LABORATORY REPORT

Date: 10 November 1995

To: Code 300C.9 Attn: Adkins

Subj: ANALYSIS OF WASTE OIL SAMPLE

Ref: (a) Job Order No. 37-160-05117: Building 123
(b) Report No. 95CH01766: C/N REM 494
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **Waste Oil, REM 494, UST 00059 (Tank 123-1)** was analyzed for METALS, PCB'S, Total Halogens and Flash Point in accordance with reference (c).

2. The results are as follows:

TEST	RESULTS
Arsenic, ppm	<0.5 ✓
Cadmium, ppm	2.5
Chromium, ppm	0.8 ✓
Lead, ppm	<0.5 ✓
Flash Point, F	>220 ✓
PCB, ppm	< 2 ✓
Total halogens, ppm	575 ✓
pH	7.95 ✓

EA Johnson 11/10/95 — Analyst

PA Bamick 11-13-95 — Head, LABORATORY DIVISION

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C221-1

To: J. T. Myers@C300C@CNSY
Cc: Karl Ray@C106@CNSY
B
F Joel T. Martin@c260@CNSY
Subject: Disposal of Water From UST Tank 221-1
Date: Thursday, October 13, 1994 11:12:24 EDT
Attach:
Certify: N
Forwarded by:

To: Code 300C.9

1. Lab analysis for sample taken from UST No. 221-1 has been reviewed IAW TGI UST0001210 Rev 00. The water is satisfactory for disposal into the sanitary sewer system using a slow bleed rate.

2. If any further information is needed, contact Tim Martin or Karl Ray at 3-5519.

10-13-94

J.T. Martin
Code 106.24

ANACON, INC.
959
[illegible]ON, TX 77034
(713) 922-7000

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

Charleston Naval SHYD
Environmental Office
Code 106.2, Bldg 76
Charleston, SC 29408

ANACON NO.	11284
DATE COLLECTED	9/26/94
DATE RECEIVED	9/27/94
DATE OF REPORT	10/10/94
DELIVERY ORDER	207
DOCUMENT NO	42693011
Contract No. N00612-93-D-T128	

Sample ID 4664

METALS

	Parameter	Result mg/l
1	Arsenic	<0.05
2	Barium	<0.05
3	Cadmium	<0.05
4	Chromium	<0.05
5	Lead	<0.05
6	Mercury	<0.001
7	Selenium	<0.05
8	Silver	<0.05
9	Zinc	<0.05
10	Nickel	<0.05
11	Copper	<0.05

Analyst Mark Bartosik

Lab Manager Ted Yen

LAB RESULTS DXB
SAT. K.B. Olsen 10/12/94
C/106C, 42970

ANACON, INC.

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LTON, TX 77034
(713) 922-7000

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

Charleston Naval SHYD
Environmental Office
Code 106.2, Bldg 76
Charleston, SC 29408

ANACON NO.	11284
DATE COLLECTED	9/27/94
DATE RECEIVED	9/29/94
DATE OF REPORT	10/10/94
DELIVERY ORDER	207
DOCUMENT NO	42693009
Contract No.: N00612-93-D-T128	

Sample ID 4664 Sample Matrix Aqueous Liquid

Parameter	EPA Method	MDL mg/l	Results mg/l	Date Analyzed	Analyst
BENZENE	5030/8020	0.005	<0.005	9/29/94	LG
TOLUENE	5030/8020	0.01	<0.01	9/29/94	LG
ETHYLBENZENE	5030/8020	0.01	<0.01	9/29/94	LG
XYLENE	5030/8020	0.01	<0.01	9/29/94	LG
Napthalene	5030/8240	0.01	<0.010	9/29/94	LG

Lab Manager
Ted Yen

ANACON, INC.

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ANALYTICAL AND CONSULTING LABORATORIES

Environmental, Chemical, and Petroleum

Charleston Naval SHYD
Environmental Office
Code 106.2, Bldg 76
Charleston, SC 29408

ANACON NO.	11284
DATE COLLECTED	9/26/94
DATE RECEIVED	9/27/94
DATE OF REPORT	10/10/94
DELIVERY ORDER	207
DOCUMENT NO	42693011

Contract No. N00612-93-D-T128

Sample ID 4664 Sample Matrix Aqueous Liquid

Parameter	Result mg/l
Oil & Grease	117.0
TOX	<1.0

Lab Manager
Ted Yen

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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 16 July 1995

To: Code 300C.9, Bldg.8

Subj: ANALYSIS OF WASTE OIL / UST 00026 LO

Ref: (a) Job Order: 37-160-05117
(b) Report NO: 95CH00785 : REM- 282
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **WASTE OIL / UST 00026 LO** was analyzed per reference (c).

2. The results follow :

TEST	RESULT
Arsenic, mg/l	0.1
Chromium, mg/l	0.7
Cadmium, mg/l	0.4
Lead, mg/l	2.4
PCB's, ppm	< 2
Flash Point, °F	> 230
Total Halogens, ppm	85
pH	6.67

R C Daley 7/16/95 — Analyst

P A Berwick 7-18-95 — Head, LABORATORY DIVISION

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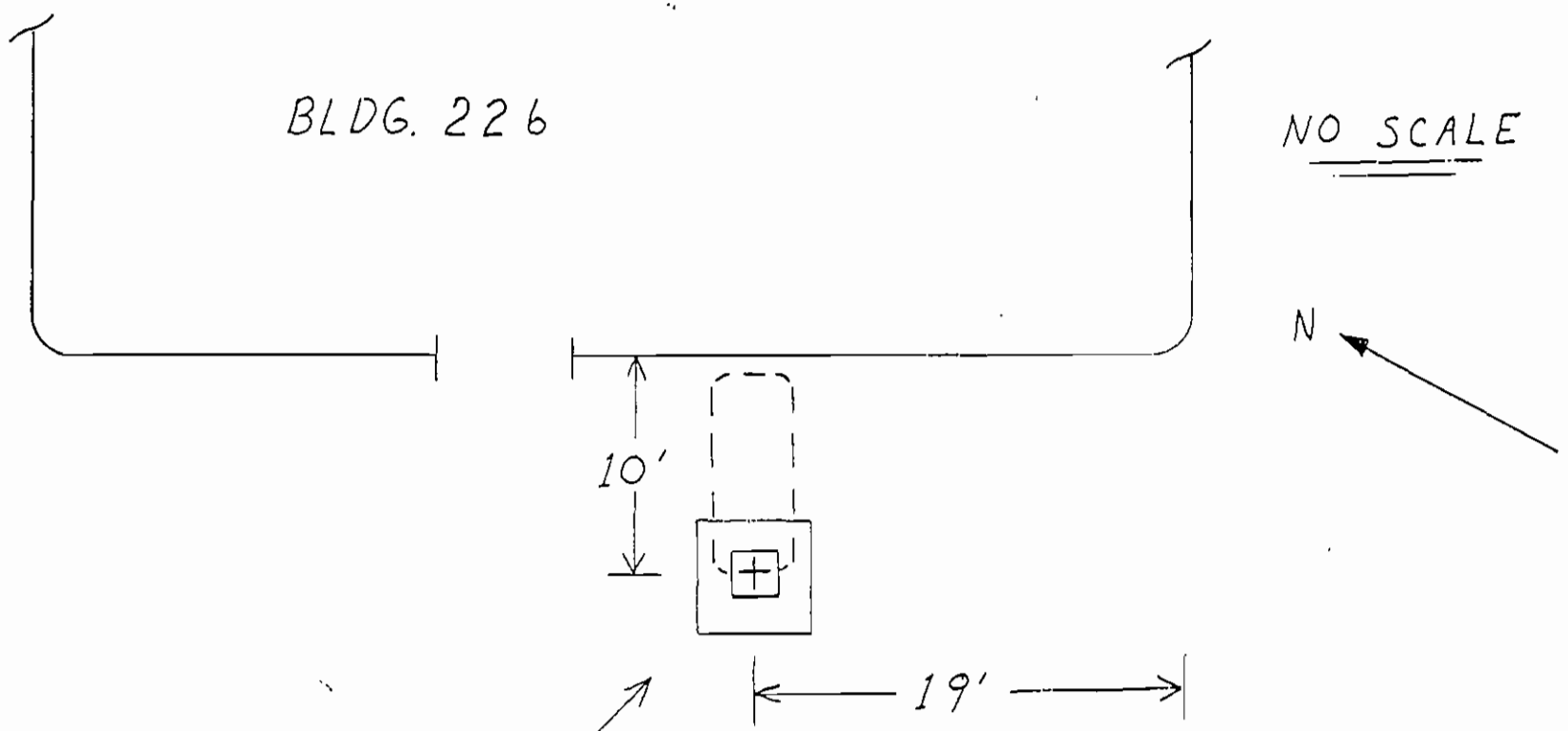
PLAN VIEW
TANK LOCATION



WASTE OIL TANK
TANK 226-1
UST 00026

K. J. Spoon 9/8/94

OFFICIAL COPY

~~236 TK-1~~

] ~~I~~CIAL USE ONLY

LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD

GENERAL LABORATORY REPORT (56) 28 JULY, 1994

File No: 10320

To: Code 106 & 106C Attn: Ross

Subj: Analysis of Oil from UST

Ref: (a) Job Order: 9163521000
(b) Report No: 94CH01100 Trace No.: REM 0001 - 0004
(c) EPA METHOD 600/04-81-045

1. Four (4) samples were analyzed by gas chromatographic methods per references (a) and (b) for Polychlorinated Biphenyl (PCB) content. The analysis was performed in accordance with reference (c). Detailed results of the analyses follow:

SAMPLED LOCATION	RESULTS, ppm
REM-0001 00018	< 2
1-0002 00017	< 2
.1-0003 00016	< 2
REM-0004 00013	< 2

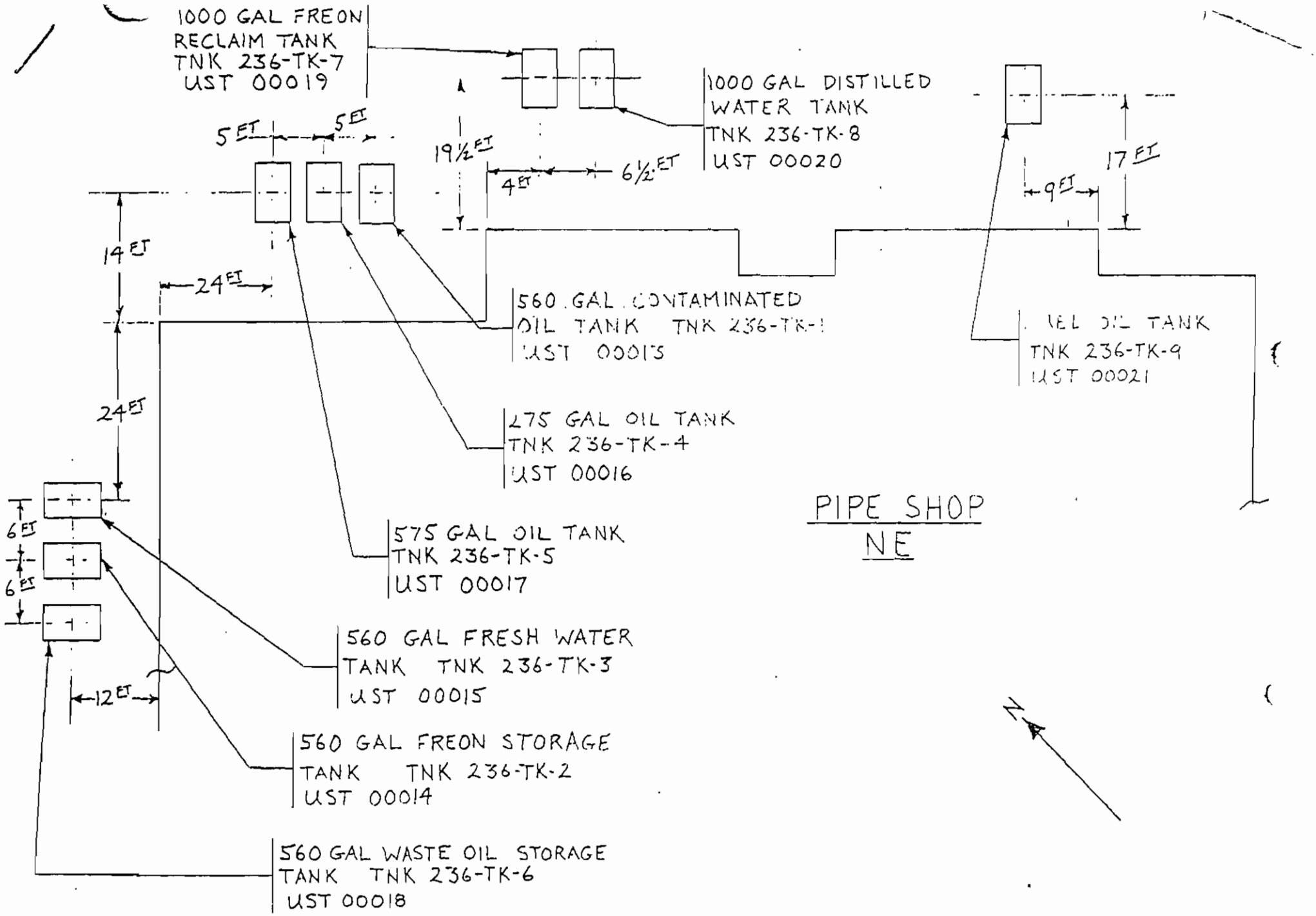
236TK-1 UST 00013
-4 UST 00016
-5 UST 00017
-6 UST 00018

6 '8 TEST PERFORMED AGAIN TO < 2 ppm K. [signature] 42970 C/106C 7/21/94

[signature] (43777) 7-28-94 [signature] 7/28/94

Analyst Head, Analytical and Applied Chemistry Branch

COPY TO: Code 134.1



NO SCALE

PLAN VIEW
TANK LOCATIONS

240

TNR 240-02-001

GENERAL ENGINEERING LABORATORIES

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Laboratory Certifications

STATE	GEL	EPI
FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	99988779	

CERTIFICATE OF ANALYSIS

UST00022

Client: Navy Public Works Center-Chas. Zone
Charleston Naval Shipyard
Code 106.24, Bldg.234
Charleston, South Carolina 29408-2020

Contact: Mr. Matt Cissel

Project Description: Code 106

cc: NPWC00195

Report Date: December 13, 1995

Sample ID	: TCG0194-6-1
Lab ID	: 9512082-01
Matrix	: Misc.-L
Date Collected	: 12/04/95
Date Received	: 12/05/95
Priority	: Routine
Collector	: Client

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	M
Extractable Organics											
PCB analysis - 7 items											
PCB-1016	U	0.00	0.0200	0.100	mg/l	1.0	MBB	12/12/95	0646	76954	1
PCB-1221	U	0.00	0.0200	0.100	mg/l	1.0					
PCB-1232	U	0.00	0.0200	0.100	mg/l	1.0					
PCB-1242	U	0.00	0.0200	0.100	mg/l	1.0					
PCB-1248	U	0.00	0.0200	0.100	mg/l	1.0					
PCB-1254	U	0.00	0.0200	0.100	mg/l	1.0					
PCB-1260	U	0.00	0.0200	0.100	mg/l	1.0					
Metals Analysis											
Arsenic	U	17.4	18.6	100	ug/l	1.0	WCC	12/07/95	1443	76967	2
Cadmium	U	0.643	0.970	50.0	ug/l	1.0					
Chromium	J	14.7	5.96	100	ug/l	1.0					
Lead		64.5	11.3	50.0	ug/l	1.0					
General Chemistry											
Flash Point, Setaflash (200F)	>	205	200	200	F	1.0	MCM	12/09/95	1600	76961	3
pH - 2 items											
pH		6.81	0.0100	0.0100	SU	1.0	JHM	12/05/95	2333	76942	4
pH Temperature		11.6	0.100	0.100	C	1.0					
Extractable Organic Halides	U	1.87	4.82	14.9	mg/l	1.0	SJ	12/11/95	1744	77191	5

Surrogate Recovery	Test	Percent%	Acceptable Limits
DCMX	PCB	134.*	(40.0 - 125.)

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Laboratory Certifications

STATE	GEL	EPI
FL	E87156/87294	E87472/87458
NC	233	
SC	10120	10582
TN	02934	
VA	00151	
WI	999887790	

CERTIFICATE OF ANALYSIS

Client: Navy Public Works Center-Chas. Zone
Charleston Naval Shipyard
Code 106.24, Bldg.234
Charleston, South Carolina 29408-2020
Contact: Mr. Matt Cissel
Project Description: Code 106

cc: NPWC00195 Report Date: December 13, 1995

Sample ID : TCG0194-6-1

M = Method	Method-Description
M 1	EPA 8080
M 2	EPA 6010A
M 3	SW 846 1020
M 4	EPA 9040
M 5	GEL

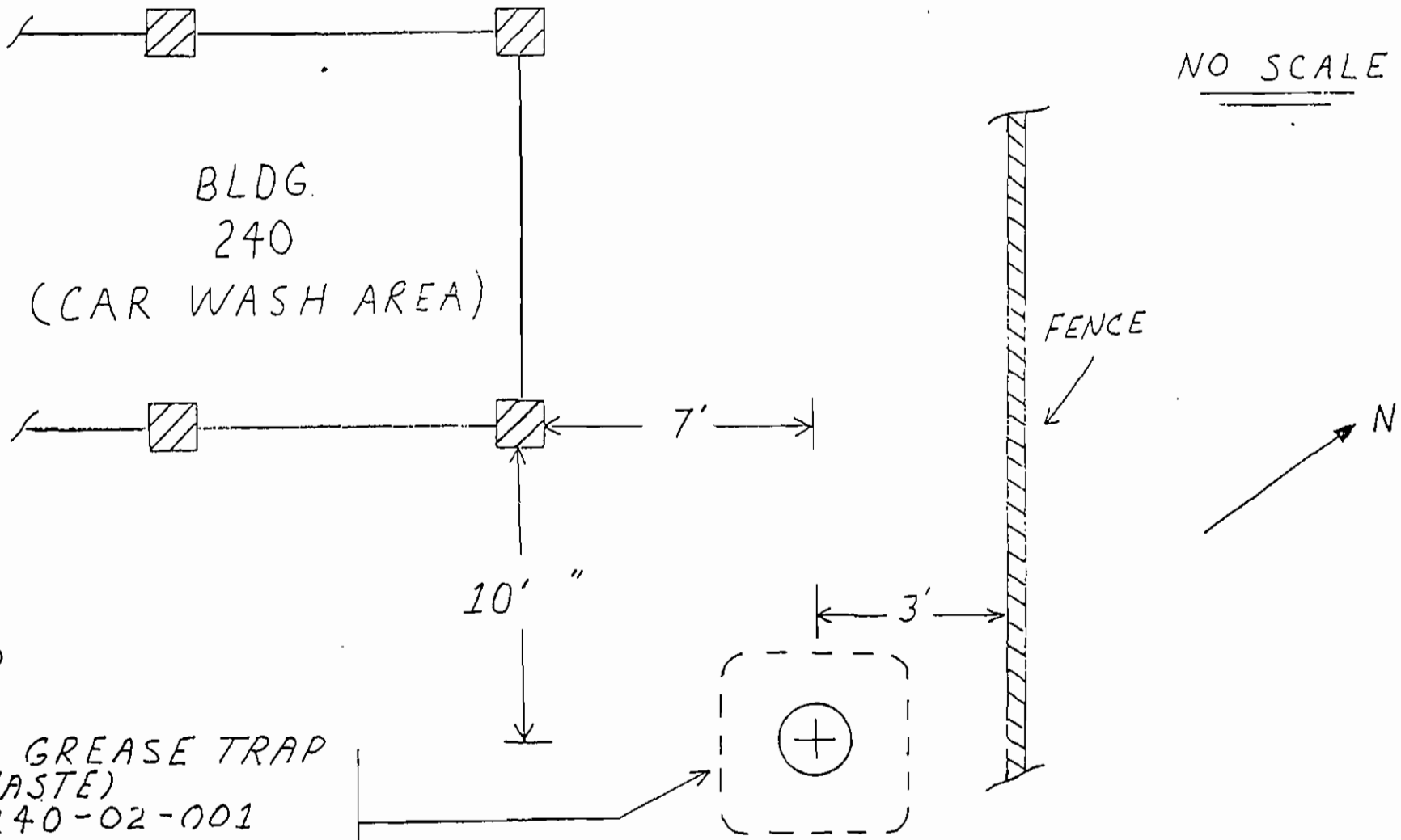
es:
ne qualifiers in this report are defined as follows:
J indicates presence of analyte at a concentration less than the reporting limit (RL) and greater than the detection limit (DL).
U indicates that the analyte was not detected at a concentration greater than the detection limit.
* indicate that a quality control analyte recovery is outside of specified acceptance criteria.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories standard operating procedures. Please direct any questions to your Project Manager, Karen Blakeney at (803) 769-7386.

Analytical Report Specialist

PLAN VIEW
TANK LOCATION

NO SCALE



K. Hyer 9/8/94 42970

5000 ⊗
~~100~~ GAL. GREASE TRAP
(OILY WASTE)
TANK 240-02-001
UST 00022

As Reported IN 1982 To Be 5000 GAL.
K.A. Hyer 9/106C 9/8/94
42970

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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 12 May 1995

To: Code 300C.9, Bldg. 8, Attn: Mr. R. E. Adkins

Subj: ANALYSIS OF WASTE OIL (UST 00042 LO)

Ref: (a) Job Order: 37-160-34121
(b) Report NO: 95CH00474 : **REM-195**
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **WASTE OIL (UST 00042 LO)** was analyzed per reference (c).

2. The results follow :

TEST	RESULT
Arsenic, mg/l	0.1 ✓
Cadmium, mg/l	0.2
Chromium, mg/l	1.2 ✓
Lead, mg/l	26 ✓
Total Halogens,ppm	45 ✓
pH	6.27 ✓
Flash Point, ^{0}F	>230
PCB's, ppm	< 2 ✓

R E Daley 5/12/95
Analyst

E A Moore 5/12/95
Head, LABORATORY DIVISION

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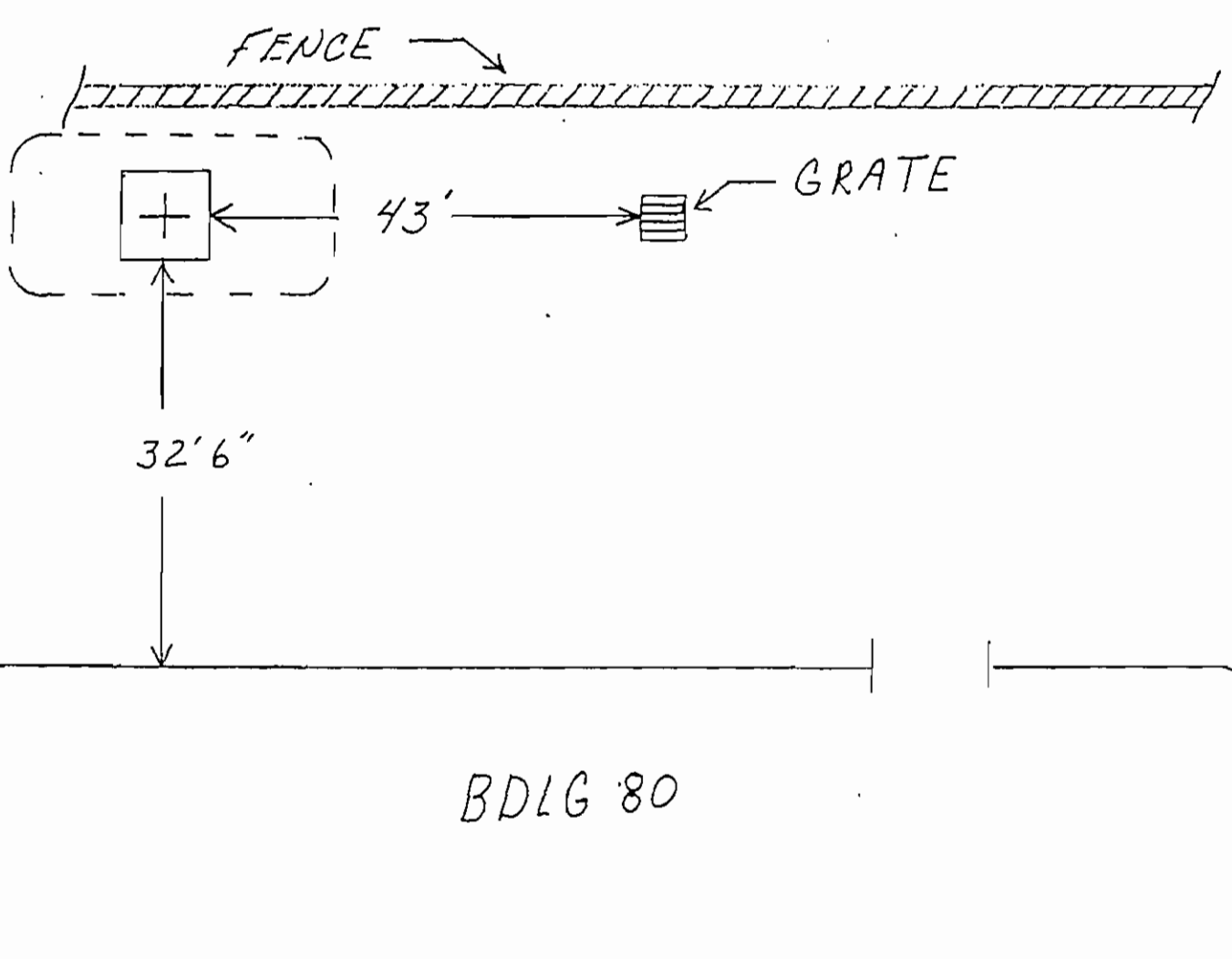
PLAN VIEW /
TANK LOCATION

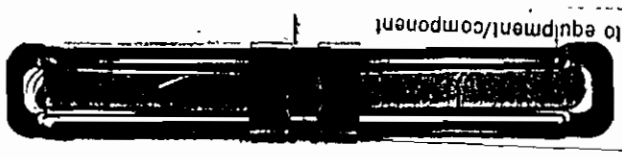
500 GAL WASTE OIL TANK
TVK 38-1
UST 00042

NO SCALE



Work Pack 2006

T. Hill
C1BGC
09/08/94



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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 30 September 1995

To: Code 300C.9, Bldg.1024

Subj: ANALYSIS OF WASTE OIL / UST 00063LO (TANK# 1024-1)

Ref: (a) Job Order: 37-160-05117
(b) Report NO: 95CH01448 : **REM- 425**
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **WASTE OIL / UST 00063LO (TANK# 1024-1)** was analyzed per reference (c).

2. The results follow :

TEST	RESULT
Arsenic, mg/l	< 1 ✓
Chromium, mg/l	< 1 ✓
Cadmium, mg/l	< 1 ✓
Lead, mg/l	1.2 ✓
PCB's, ppm	< 2 ✓
Flash Point, °F	> 230 ✓
Total Halogens, ppm	14 ✓
pH	7.26 ✓

334-3898

Jerry E Lewis 9/30/95 — Analyst

PB Bennett 10-3-95 — Head, LABORATORY DIVISION

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730 FM 1959
HOUSTON, TX 770...
(713) 922-7000 Tel.
(713) 481-0089 Fax

Chain of Custody Record

Document # 5103-3001/3001 Delivery order # 0295 Anacon Log Number: 1187

Client: Charleston Naval Shipyard
Code 106.2 Bldg 76
1351 First Street
Charleston, SC 29408-2020

Contact Person: Veronica Greene
Phone Number: (803) 743-5519
Fax Number: (803) 743-1475

Due Date: 4-21-95
Turn Around Time: 7 DAY

Delivered By:
Custody Seal (Y/N):
Sample Temperature:

Sampled By: Biel (Private Pilot)

Lab Number	Sample Matrix	Date/Time Collected	Number of Containers	Client Sample ID	Type of Analysis Requested: Arsenic, Cadmium, Chromium, Lead, (Tox) Total Halogens, PCB's, Flashpt, pH, TCLP Benzene, TCLP Arsenic, TCLP Barium, TCLP Cadmium, TCLP Chromium, TCLP Lead, TCLP Mercury, TCLP Silver	Remarks/ Preservatives
0171/0177	WATER	4-13-95/1020	2	5054 UST00052	✓ ✓ ✓ ✓ ✓ ✓	
0177	Oil	4-13-95/0830	2	5055 UST00049	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	
				No preservation added to samples for metal parameters Preservation added by Anacon P.M.D. 4-14-95		
		UST00050				

UST00050

	Relinquished By	Date	Time	Relinquished By	Date	Time
Anacon, Inc.	W.D. Vogel	4/13/95	1110		4-13-95	1615
730 FM 1959	Accepted By: P.M. Rogers	4-13-95	1110	Accepted By: P.M.D.	4/14/95	100
Houston, Tx 77034	Relinquished By:	4-13-95	1540	Relinquished By:	Date:	Time:
(713)922-7000	Accepted By:	4-13-95	1541	Accepted By:	Date:	Time:

ANACON, INC.
M 1959
STON, TX 77034
(713) 922-7000

5054.XLS

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

Charleston Naval SHYD
Environmental Office
Code 106.2, Bldg 76
Charleston, SC 29408

ANACON NO.	11878
DATE COLLECTED	4/13/95
DATE RECEIVED	4/14/95
DATE OF REPORT	4/28/95
DELIVERY ORDER	0295
DOCUMENT NO	5103-3001/3002
Contract No. N00612-93-D-T128	

Sample ID 5054 Sample Matrix Aqueous liquid

	Parameter	Method number	Date analyzed	Analyzed by	Reporting Limit mg/l	Result mg/l
1	Arsenic	200.7	4/19/95	MB	0.05	<0.05
2	Chromium	200.7	4/19/95	MB	0.05	<0.05
3	Cadmium	200.7	4/19/95	MB	0.05	<0.05
4	Lead	200.7	4/19/95	MB	0.05	<0.05
5	TOX	9040	4/27/95	SB	1.0	7.8

QA/QC Officer Tim Corum
Tim Corum

Lab Manager Ted Yen

ANACON, INC.
0 FM 1959
OUSTON, TX 77034
(713) 922-7000

5054-FL.XLS

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

Charleston Naval SHYD
Environmental Office
Code 106.2, Bldg 76
Charleston, SC 29408

ANACON NO.	11878
DATE COLLECTED	4/13/95
DATE RECEIVED	4/14/95
DATE OF REPORT	4/28/95
DELIVERY ORDER	0295
DOCUMENT NO	5103-3001/3002
Contract No. N00612-93-D-T128	
Sample ID 5054	Sample Matrix Aqueous liquid

FLASH POINT

Parameter	METHOD	Result degree F
Flash Point	1010	>200
pH	9040	9.5

QA/QC Officer Tim Corum
Tim Corum

Lab Manager
Ted Yen

ANACON, INC.
1959
ON, TX 77034
(713) 922-7000

5054-PCB.XLS

ANALYTICAL AND CONSULTING LABORATORIES
Environmental, Chemical, and Petroleum

Charleston Naval SHYD
Environmental Office
Code 106.2, Bldg 76
Charleston, SC 29408

ANACON NO.	11878
DATE COLLECTED	4/13/95
DATE RECEIVED	4/14/95
DATE OF REPORT	4/28/95
DELIVERY ORDER	0295
DOCUMENT NO	5103-3001/3002
Contract No. N00612-93-D-T128	

SAMPLE ID 5054 Sample Matrix Aqueous liquid

PCB ANALYSIS

Parameter	CAS #	Report limit, mg/l	Result, mg/l
AROCLOR-1016	12674-11-2	0.10	< 0.10
AROCLOR-1221	11104-28-2	0.10	< 0.10
AROCLOR-1232	11141-16-5	0.10	< 0.10
AROCLOR-1242	53469-21-9	0.10	< 0.10
AROCLOR-1248	12672-29-6	0.10	< 0.10
AROCLOR-1254	11097-69-1	0.10	< 0.10
AROCLOR-1260	11096-82-5	0.10	< 0.10

Method	608
Date Extracted	4/19/95
Date Concentrated	4/19/95
Date Analyzed	4/20/95
Analyzed by	LG

QA/QC Manager Tim Corum PhD. Tim Corum

Lab Manager Ted Yen

NS 44A

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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 30 September 1995

To: Code 300C.9, Bldg. NS 44

Subj: ANALYSIS OF WASTE OIL / UST 00061LO (TANK# NS 44A)

Ref: (a) Job Order: 37-160-05117
(b) Report NO: 95CH01472 : **REM- 427**
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **WASTE OIL / UST 00061LO (TANK# NS 44A)** was analyzed per reference (c).

2. The results follow :

TEST	RESULT
Arsenic, mg/l	< 1
Chromium, mg/l	3.2
Cadmium, mg/l	1.3
Lead, mg/l	92
PCB's, ppm	< 2
Flash Point, °F	215
Total Halogens, ppm	530
pH	< 1

334-38981
Jerry J. [signature] 9/30/95 Analyst

[signature] 10-3-95 Head, LABORATORY DIVISION

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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 30 September 1995

To: Code 300C.9, Bldg.1346

Subj: ANALYSIS OF WASTE OIL / USTNS 037LO

Ref: (a) Job Order: 71-002-16002
(b) Report NO: 95CH01446 : **REM- 426**
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **WASTE OIL / USTNS 037LO** was analyzed per reference (c).

2. The results follow :

TEST	RESULT
Arsenic, mg/l	2.5 ✓
Chromium, mg/l	1.8 ✓
Cadmium, mg/l	1.2 ✓
Lead, mg/l	89 ✓
PCB's, ppm	< 2 ✓
Flash Point, °F	> 230 ✓
Total Halogens, ppm	129 ✓
pH	7.06 ✓

334-38981

Jerry D. Lewis 9/30/95 — Analyst

P A Barrick 10-3-95 — Head, LABORATORY DIVISION

K9

681-1

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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 11 August 1995

To: Code 300C.9, Bldg.8

Subj: ANALYSIS OF WASTE OIL / USTNS 022 (LO)

Ref: (a) Job Order: 71-002-16002
(b) Report NO: 95CH00923 : REM- 333
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **WASTE OIL / USTNS 022 (LO)** was analyzed per reference (c).

2. The results follow :

TEST	RESULT
Arsenic, mg/l	< 1
Chromium, mg/l	46 10
Cadmium, mg/l	1.8
Lead, mg/l	95
PCB's, ppm	< 2
Flash Point, °F	> 230
Total Halogens, ppm	41
pH	7.18

R E Darley 8/11/95
Analyst

P R Bowick 8-11-95
Head, LABORATORY DIVISION

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10/ N526A

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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 11 August 1995

To: Code 300C.9, Bldg.8

Subj: ANALYSIS OF WASTE OIL / USTNS 006 (LO)

Ref: (a) Job Order: 71-002-16002
(b) Report NO: 95CH00924 : REM- 334
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of WASTE OIL / USTNS 006 (LO) was analyzed per reference (c).

2. The results follow :

TEST	RESULT
Arsenic, mg/l	< 1
Chromium, mg/l	6
Cadmium, mg/l	< 1
Lead, mg/l	28
PCB's, ppm	< 2
Flash Point, °F	> 230
Total Halogens, ppm	58
pH	5.63

OK

R E Worley 8/11/95 — Analyst

P M Bowers 8-11-95 — Head, LABORATORY DIVISION

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MATERIALS TESTING LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, SC 29408-6100
SCDHEC ID# 10579

GENERAL LABORATORY REPORT

Date: 10 November 1995

To: Code 300C.9 Attn: Adkins

Subj: ANALYSIS OF FUEL OIL SAMPLE

Ref: (a) Job Order No. 71-002-16002: Building 200
(b) Report No. 95CH01765: C/N REM 493
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of **Fuel Oil, REM 493, USTNS 025 (Tank 200-3)** was analyzed for Metals, PCB'S, Total Halogens and Flash Point in accordance with reference (c).

2. The results are as follows:

TEST	RESULTS
Arsenic, ppm	<0.5 ✓
Cadmium, ppm	(2.7)
Chromium, ppm	<0.5 ✓
Lead, ppm	4.9 ✓
Flash Point, F	>220 ✓
PCB, ppm	< 2 ✓
Total halogens, ppm	86 ✓
pH	6.7 ✓

EA Jonason 11/10/95 | CR Bennett 11-13-95

Analyst | Head, LABORATORY DIVISION

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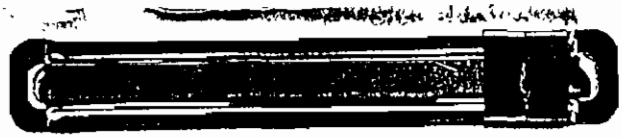

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LABORATORY DIVISION
CHARLESTON NAVAL SHIPYARD
CODE 134, BLDG 13
CHARLESTON, S.C. 29408-6100

GENERAL LABORATORY REPORT

Date: 11 August 1995

To: Code 300C.9, Bldg.8

Subj: ANALYSIS OF WASTE OIL / USTNS 038

Ref: (a) Job Order: 71-002-16002
(b) Report NO: 95CH01003 : REM- 352
(c) ECP #2

1. As authorized by reference (a) and requested by reference (b), one (1) sample of WASTE OIL /USTNS 038/ was analyzed per reference (c).

2. The results follow :

TEST	RESULT	
Arsenic, mg/l	< 1	
Chromium, mg/l	3.8	
Cadmium, mg/l	< 1	
Lead, mg/l	9.4	OK
PCB's, ppm	< 2	
Flash Point, °F	> 230	
Total Halogens, ppm	18	
pH	7.46	

R E Darley 8/11/95 eaj
Analyst

P A Barrick 8-11-95
Head, LABORATORY DIVISION

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N00191
NSY CHARLESTON SC

( ) -

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
02-241-001	/ /	HEAT/FUEL	6,000	STEEL	COPPER	TEMP OUT	No Test
02-241-002	/ /	DIESEL	500	STEEL	COPPER	ACTIVE	No Test
02-241-013	/ /	DIESEL	500	STEEL	UNKNOWN	TEMP OUT	No Test
1141A	/ /	LEAD GAS	10,000	STEEL	UNPRO. STL	CLOSED	No Test
1141B	/ /	LEAD GAS	4,000	STEEL	UNPRO. STL	CLOSED	No Test
1169	/ /	UNKNOWN	550	STEEL	UNPRO. STL	ABANDONED	No Test
1174	/ /	HEAT/FUEL	1,000	STEEL	UNPRO. STL	CLOSED	No Test
1175A	07/21/1988	UNLEAD	10,000	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
1175B	07/21/1988	UNLEAD	10,000	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
1175C	07/21/1988	DIESEL	10,000	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
123-1	08/25/1994	WASTE OIL	1,000	UNKNOWN	UNKNOWN	ACTIVE	No Test
1279A	02/04/1986	UNLEAD	2,500	STEEL	UNPRO. STL	REMOVED	No Test
1279B	02/04/1986	UNLEAD	3,000	STEEL	UNPRO. STL	REMOVED	No Test
1279C	02/04/1986	UNLEAD	3,500	STEEL	UNPRO. STL	REMOVED	No Test
13A	/ /	KEROSENE	560	STEEL	COATED STL	TEMP OUT	No Test
13B	/ /	KEROSENE	560	STEEL	COATED STL	TEMP OUT	No Test
177	/ /	DIESEL	300	PAINTED	COPPER	ACTIVE	No Test
2	/ /	KEROSENE	130	STEEL	UNKNOWN	ACTIVE	No Test
221-1	/ /	WASTE OIL	0	STEEL	UNPRO. STL	ACTIVE	No Test
226	/ /	HEAT/FUEL	700	STEEL	UNKNOWN	ACTIVE	No Test
226-1	/ /	WASTE OIL	0		UNKNOWN	ACTIVE	No Test
236-TK-1	02/03/1994	LUBE/NEW	560	STEEL	UNKNOWN	REMOVED	No Test
236-TK-4	02/03/1994	LUBE/NEW	275	STEEL	UNKNOWN	REMOVED	No Test
236-TK-5	02/03/1994	LUBE/NEW	275	STEEL	UNKNOWN	REMOVED	No Test
236-TK-6	02/03/1994	WASTE OIL	560	STEEL	UNKNOWN	REMOVED	No Test
236-TK-9	02/03/1994	HEAT/FUEL	1,000	STEEL	UNKNOWN	REMOVED	No Test
240	07/08/1991	WASTE OIL	5,000	STEEL	COATED STL	ACTIVE	No Test
242	02/02/1989	WASTE OIL	5,000	FIBERGLASS	UNKNOWN	ACTIVE	No Test
242A	/ /	WASTE OIL	5,000	STEEL	UNKNOWN	ACTIVE	No Test
25-1	/ /	HEAT/FUEL	0	UNKNOWN	UNKNOWN	TEMP OUT	No Test
32-1	/ /	DIESEL	350	STEEL	COATED STL	ACTIVE	No Test
32-2	/ /	DIESEL	350	STEEL	COATED STL	ACTIVE	No Test
32-3	/ /	DIESEL	500	PAINTED	COATED STL	ACTIVE	No Test
32-4	/ /	DIESEL	500	PAINTED	COATED STL	ACTIVE	No Test
32-501	/ /	DIESEL	114,000	STEEL	COATED STL	ACTIVE	No Test
32-D	/ /	DIESEL	5,000	PAINTED	COATED STL	ACTIVE	No Test
32-E	/ /	DIESEL	5,000	PAINTED	COATED STL	ACTIVE	No Test
38-1	08/25/1994	WASTE OIL	300	STEEL	UNPRO. STL	ACTIVE	No Test
3909	/ /	HEAT/FUEL	200,000	STEEL	UNPRO. STL	ACTIVE	No Test
42	/ /	HEAT/FUEL	560	STEEL	UNKNOWN	TEMP OUT	No Test
54	02/04/1986	DIESEL	560	STEEL	UNPRO. STL	ACTIVE	No Test
56	02/04/1986	DIESEL	4,000	STEEL	UNKNOWN	TEMP OUT	No Test
56B	/ /	HEAT/FUEL	4,000	STEEL	UNKNOWN	REMOVED	No Test
590A	/ /	HEAT/FUEL	576	STEEL	UNKNOWN	REMOVED	No Test
590A-1	/ /	HEAT/FUEL	2,260	STEEL	UNPRO. STL	ACTIVE	No Test
590A-2	/ /	HEAT/FUEL	576	STEEL	UNPRO. STL	ACTIVE	No Test
6A	02/04/1986	HEAT/FUEL	2,500	STEEL	UNPRO. STL	TEMP OUT	No Test
6B	02/04/1986	HEAT/FUEL	2,500	STEEL	UNPRO. STL	TEMP OUT	No Test
9B	/ /	HEAT/FUEL	586	STEEL	UNKNOWN	ACTIVE	No Test

N00191
NSY CHARLESTON SC

( ) -

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
9C	/ /	HEAT/FUEL	3,700	STEEL	UNPRO. STL	ACTIVE	No Test
NH72	/ /	HEAT/FUEL	8,300	STEEL	UNPRO. STL	ACTIVE	No Test
NS2A	/ /	WASTE OIL	560	STEEL	UNPRO. STL	ACTIVE	No Test
NS3-1	/ /	WASTE OIL	280	STEEL	UNKNOWN		No Test
NS4-TNK-1	/ /	HEAT/FUEL	25,000	STEEL	UNPRO. STL	ACTIVE	No Test
NS44A	/ /	WASTE OIL	550	STEEL	UNPRO. STL	ACTIVE	No Test
NS45-TNK-1	/ /	HEAT/FUEL	25,000	STEEL	UNPRO. STL	ACTIVE	No Test
NS6-1	/ /	DIESEL	100	STEEL	COPPER	ACTIVE	No Test

N00193
NAVAL WEAPONS STATION

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
701	/ /	HEAT/FUEL	280	STEEL	UNKNOWN	ACTIVE	No Test
705	/ /	HEAT/FUEL	280	STEEL	UNKNOWN	ACTIVE	No Test
708	/ /	HEAT/FUEL	280	STEEL	UNKNOWN	ACTIVE	No Test
717	/ /	HEAT/FUEL	280	STEEL	UNKNOWN	ACTIVE	No Test
718	/ /	HEAT/FUEL	280	STEEL	UNKNOWN	ACTIVE	No Test
719	/ /	HEAT/FUEL	280	STEEL	UNKNOWN	ACTIVE	No Test
758	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
759	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
760	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
761	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
762	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
763	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
765	/ /	HEAT/FUEL	280	STEEL	UNKNOWN	ACTIVE	No Test
A	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
AA	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
B	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
BB	/ /	HEAT/FUEL	I,000	STEEL	UNKNOWN	ACTIVE	No Test
C	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
D	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
DD	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
FF	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
G	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
H	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
HH	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
J	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
JJ	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
K	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
L	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
M	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
M5	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
M6	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
M8	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
N	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
O	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
P	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
Q	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
R	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
S-1	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
S-2	/ /	HEAT/FUEL	0	STEEL	UNKNOWN	ABANDONED	No Test
T-1	/ /	HEAT/FUEL	550	STEEL	UNKNOWN	ACTIVE	No Test
T-2	/ /	HEAT/FUEL	0	STEEL	UNKNOWN	ABANDONED	No Test
W	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
Y-1	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
Y-2	/ /	HEAT/FUEL	0	STEEL	UNKNOWN	ABANDONED	No Test
Y-3	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test

N00612
NSC CHARLESTON SC

( ) -

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
1136	/ /	HEAT/FUEL	375	STEEL	COPPER	ACTIVE	No Test
14	/ /	JP-5	215,460	STEEL	UNPRO. STL	TEMP OUT	No Test
148	/ /	WASTE OIL	0	STEEL	UNPRO. STL	ABANDONED	No Test
191	/ /	HEAT/FUEL	550	STEEL	COPPER	ACTIVE	No Test
191NW	02/04/1986	DIESEL	1,500	STEEL	GALVANIZED	ACTIVE	No Test
191SW	/ /	HEAT/FUEL	1,500	STEEL	UNKNOWN	ABANDONED	No Test
224	/ /	HEAT/FUEL	5,000	STEEL	UNPRO. STL	ACTIVE	No Test
3900E	/ /	DIESEL	2,350,000	UNKNOWN	UNKNOWN	ACTIVE	No Test
3900F	/ /	DIESEL	2,350,000	OTHER	UNKNOWN	ACTIVE	No Test
3901A	/ /	WASTE OIL	103,000	STEEL	UNKNOWN	ACTIVE	No Test
3906K	02/04/1986	DIESEL	2,130,000	CONCRETE	UNKNOWN		No Test
3906L	02/04/1986	DIESEL	2,128,000	CONCRETE	UNKNOWN	ACTIVE	No Test
3906M	02/04/1986	HEAT/FUEL	2,132,000	CONCRETE	UNKNOWN	ACTIVE	No Test
3906N	02/04/1986	HEAT/FUEL	2,126,000	CONCRETE	UNKNOWN	ACTIVE	No Test
3906O	02/04/1986	WASTE OIL	1,153,000	CONCRETE	UNKNOWN	ACTIVE	No Test
3906P	02/04/1986	DIESEL	2,128,000	CONCRETE	UNKNOWN	ACTIVE	No Test
3911	/ /	LUBE/NEW	50,000	UNKNOWN	UNKNOWN	ACTIVE	No Test
3912	/ /	LUBE/NEW	50,000	UNKNOWN	UNKNOWN	ACTIVE	No Test
3915	/ /	LUBE/NEW	1,008,000	UNKNOWN	UNKNOWN	ACTIVE	No Test
3916	/ /	DIESEL	4,200,000		UNKNOWN	ACTIVE	No Test
3917	/ /	DIESEL	4,200,000	UNKNOWN	UNKNOWN	ACTIVE	No Test
39A	/ /	WASTE OIL	741,000	OTHER	UNKNOWN	ACTIVE	No Test
39D	/ /	WASTE OIL	741,000	OTHER	UNKNOWN	ACTIVE	No Test
39L	/ /	DIESEL	6,500	STEEL	UNKNOWN	ACTIVE	No Test

N61165
NAVSTA CHARLESTON SC
BILL BRASEL
(803) 743-5519

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
1168-1	/ /	HEAT/FUEL	2,500	STEEL	UNKNOWN	ABANDONED	No Test
1177	/ /	DIESEL	560	STEEL	COPPER	ACTIVE	No Test
1346	07/08/1991	WASTE OIL	650	STEEL	GALVANIZED	ACTIVE	No Test
1346A	02/04/1986	NONE/EMPTY	10,000	STEEL	GALVANIZED	REMOVED	No Test
1346B	02/04/1986	NONE/EMPTY	10,000	STEEL	GALVANIZED	REMOVED	No Test
1346C	02/04/1986	NONE/EMPTY	10,000	STEEL	GALVANIZED	REMOVED	No Test
1346D	05/31/1990	NONE/EMPTY	4,000	STEEL	UNKNOWN	CLOSED	No Test
1346E	05/31/1990	NONE/EMPTY	4,000	STEEL	UNKNOWN	CLOSED	No Test
1346F	05/31/1990	NONE/EMPTY	4,000	STEEL	UNKNOWN	CLOSED	No Test
1346G	05/31/1990	NONE/EMPTY	4,000	STEEL	UNKNOWN	CLOSED	No Test
1346H	05/31/1990	NONE/EMPTY	10,000	STEEL	UNKNOWN	CLOSED	No Test
13461	06/24/1991	UNLEAD	10,000	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
1346J	01/24/1991	UNLEAD	10,000	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
1346K	06/24/1991	UNLEAD	10,000	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
1708-1	/ /	DIESEL	2,000	STEEL	UNKNOWN	TEMP OUT	No Test
220	/ /	HEAT/FUEL	275	STEEL	COPPER	CLOSED	No Test
2505	/ /	WASTE OIL	275	FIBERGLASS	COATED STL	ACTIVE	No Test
2508	/ /	HEAT/FUEL	10,000	STEEL	UNPRO. STL	ABANDONED	No Test
2509	/ /	HEAT/FUEL	1,000	STEEL	GALVANIZED	ABANDONED	No Test
2513A	/ /	HEAT/FUEL	42,000	STEEL	UNPRO. STL	ABANDONED	No Test
2513B	/ /	HEAT/FUEL	42,000	STEEL	UNPRO. STL	ABANDONED	No Test
2513C	/ /	LUBE/NEW	550	STEEL	UNPRO STL	ACTIVE	No Test
2517	/ /	HEAT/FUEL	2,000	STEEL	GALVANIZED	ABANDONED	No Test
2522	/ /	HEAT/FUEL	5,000	STEEL	UNPRO. STL	ABANDONED	No Test
2524A	/ /	HEAT/FUEL	1,000	STEEL	UNPRO. STL	ACTIVE	No Test
2524B	/ /	HEAT/FUEL	1,000	STEEL	UNPRO. STL	ACTIVE	No Test
2556	/ /	HEAT/FUEL	3,000	STEEL	UNPRO. STL	ACTIVE	No Test
601	/ /	HEAT/FUEL	12,000	STEEL	UNPRO. STL	ACTIVE	No Test
640	/ /	BOILER	1,000	STEEL	UNPRO. STL	ACTIVE	No Test
640B	/ /	HEAT/FUEL	3,000	STEEL	UNKNOWN	ABANDONED	No Test
641	/ /	HEAT/FUEL	560	STEEL	UNPRO. STL	ACTIVE	No Test
644	/ /	HEAT/FUEL	5,000	STEEL	UNPRO. STL	ACTIVE	No Test
646A	/ /	DIESEL	2,500	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
646B	05/16/1986	HEAT/FUEL	2,000	STEEL	UNKNOWN	REMOVED	No Test
648	/ /	HEAT/FUEL	1,000	STEEL	COPPER	ACTIVE	No Test
648B	/ /	HEAT/FUEL	2,000	STEEL	UNKNOWN	ABANDONED	No Test
650	/ /	HEAT/FUEL	1,000	STEEL	UNPRO STL	ACTIVE	No Test
653A	/ /	HEAT/FUEL	2,000	STEEL	UNKNOWN	ABANDONED	No Test
654	/ /	HEAT/FUEL	2,000	STEEL	UNKNOWN	ACTIVE	No Test
655	/ /	HEAT/FUEL	2,500	STEEL	UNPRO. STL	ACTIVE	No Test
655B	/ /	DIESEL	200	STEEL	COPPER	ACTIVE	No Test
656	/ /	HEAT/FUEL	5,800	STEEL	UNKNOWN	ACTIVE	No Test
657-1	/ /	HEAT/FUEL	5,000	STEEL	UNKNOWN	ACTIVE	No Test
657-2	/ /	HEAT/FUEL	2,000	STEEL	UNPRO. STL	ACTIVE	No Test
661	06/25/1992	HEAT/FUEL	4,000	FIBERGLASS	FIBERGLASS	ACTIVE	No Test
681-1	/ /	WASTE OIL	100	UNKNOWN	UNKNOWN	ACTIVE	No Test
681-2	/ /	HEAT/FUEL	20,000	UNKNOWN	UNKNOWN	ABANDONED	No Test
81-1	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
84	/ /	HEAT/FUEL	1,010	STEEL	UNKNOWN	ACTIVE	No Test

N61165
NAVSTA CHARLESTON SC
BILL BRASEL
(803) 743-5519

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
851A	01/08/1991	UNLEAD	500	STEEL	UNKNOWN	ACTIVE	No Test
851B	01/08/1991	DIESEL	500	UNKNOWN	UNKNOWN	ACTIVE	No Test
86	/ /	HEAT/FUEL	5,037	STEEL	COPPER	ACTIVE	No Test
M1123	/ /	HEAT/FUEL	270	STEEL	COPPER	ACTIVE	No Test
M82-1	/ /	DIESEL	155	STEEL	UNKNOWN	ACTIVE	No Test
NH1137-1	/ /	HEAT/FUEL	1,010	STEEL	UNKNOWN	ACTIVE	No Test
NH1137-2	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH1152	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH1153-1	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH1158	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH1159	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH1243	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH1244	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH21-1	/ /	HEAT/FUEL	0	STEEL	UNKNOWN	ABANDONED	No Test
NH23-1	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NH42-1	/ /	HEAT/FUEL	2,500	STEEL	UNPRO. STL	ABANDONED	No Test
NH46-1	/ /	HEAT/FUEL	2,500	STEEL	UNKNOWN	ABANDONED	No Test
NH46-2	/ /	HEAT/FUEL	2,500	STEEL	UNKNOWN	ABANDONED	No Test
NH46-3	/ /	HEAT/FUEL	2,500	STEEL	UNKNOWN	ABANDONED	No Test
NH46-4	/ /	HEAT/FUEL	2,500	STEEL	UNKNOWN	ABANDONED	No Test
NH46-5	/ /	HEAT/FUEL	0	STEEL	UNKNOWN	ABANDONED	No Test
NH62	/ /	HEAT/FUEL	1,010	STEEL	UNKNOWN	ACTIVE	No Test
NH62-1	/ /	HEAT/FUEL	2,500	STEEL	UNKNOWN	ABANDONED	No Test
NH62-2	/ /	HEAT/FUEL	1,000	STEEL	COPPER	ACTIVE	No Test
NH63-1	/ /	LEAD GAS	0	STEEL	UNKNOWN	ABANDONED	No Test
NH63-2	/ /	DIESEL	0	STEEL	UNKNOWN	ABANDONED	No Test
NH67-1	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ABANDONED	No Test
NS200	/ /	HEAT/FUEL	1,000	STEEL	UNKNOWN	ACTIVE	No Test
NS26A	/ /	WASTE OIL	200	UNKNOWN	UNKNOWN	ACTIVE	No Test
NS26B	/ /	UNKNOWN	0	UNKNOWN	UNKNOWN		No Test
NS26C	/ /	WASTE OIL	20,000	UNKNOWN	UNKNOWN		No Test
NS28A	/ /	HEAT/FUEL	10,000	STEEL	UNKNOWN	ACTIVE	No Test
NS28B	/ /	HEAT/FUEL	4,030	STEEL	UNKNOWN	ACTIVE	No Test
NS53	/ /	HEAT/FUEL	3,000	STEEL	UNKNOWN	ACTIVE	No Test
NS53B	/ /	DIESEL	800	STEEL		ABANDONED	No Test
NS54-1	/ /	LEAD GAS	10,000	STEEL	UNKNOWN	ABANDONED	No Test
NS54-2	/ /	LEAD GAS	10,000	STEEL	UNKNOWN	ABANDONED	No Test
NS71	/ /	HEAT/FUEL	2,000	STEEL	COATED STL	ACTIVE	No Test
NS79-1	/ /	HEAT/FUEL	500	STEEL	COPPER	TEMP OUT	No Test
NS79-2	/ /	HEAT/FUEL	10,000	STEEL	OTHER	ACTIVE	No Test

N62603
FLEMINEWARTRACEN CHARLESTON SC

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Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
202	/ /	BOILER	5,000	STEEL	UNKNOWN	ACTIVE	No Test
643A	/ /	HEAT/FUEL	6,000	STEEL	UNPRO. STL	ACTIVE	No Test
643B	02/04/1986	MOGAS	1,000	FIBERGLASS	UNKNOWN	REMOVED	No Test
643C	02/04/1986	DIESEL	550	UNKNOWN	UNKNOWN	REMOVED	No Test
647	/ /	HEAT/FUEL	4,000	STEEL	UNPRO. STL	ACTIVE	No Test
647A	/ /	HEAT/FUEL	4,000	STEEL	UNKNOWN	CLOSED	No Test

N63322
SUBTRAFAC CHARLESTN SC

( ) -

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
686	/ /	HEAT/FUEL	4,000	FIBERGLASS	GALVANIZED	ACTIVE	No Test
FBM61-1	08/17/1992	DIESEL	200	STEEL	UNKNOWN	ACTIVE	No Test
FBM61-2	/ /	BOILER	1,000	STEEL	UNPRO. STL	ACTIVE	No Test
FBM61-3	/ /	HEAT/FUEL	20,000	STEEL	UNPRO. STL	ACTIVE	No Test

N68084
NAVHOSP CHARLESTON SC
LT. SADLER
(803) 743-6020

Tank ID	Notification Form Date	Contents	Capacity (Gal)	Tank Construction Material	Pipe Construction Material	Status	Last Tightness Test Date
NH61-1	/ /	HEAT/FUEL	560	STEEL	COPPER	ABANDONED	No Test
NH61-2	/ /	HEAT/FUEL	1,000	STEEL	COPPER	ABANDONED	No Test
NH68	/ /	HEAT/FUEL	900	STEEL	UNKNOWN	REMOVED	No Test
NH68-1	/ /	HEAT/FUEL	3,000	STEEL	COPPER	ACTIVE	No Test
NH68-2	/ /	HEAT/FUEL	1,000	STEEL		ABANDONED	No Test

TABLE D-1
Above Ground And Underground Storage Tank Database

Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Year Remove	Facility	Tank Number	Above/ Under Ground	Tank Capacity	Tank Contents	Material	Tank Status	Year Tank Installed	Zone	Remarks
	FBMTF	FBM61-3	A	20000	HF	S	A	1961	H	
	NAVHOSP	NH68-1	A	3000	HF	S	A	1980	C	
	NAVSTA	1177	A	560	D	S	A		G	
	NAVSTA	1708-1	A	2000	D	S	TO	1966	I	
	NAVSTA	601	A	12000	HF	S	A	1963	H	
	NAVSTA	640	A	1000	HF	S	A	1963	H	
	NAVSTA	648	A	1000	HF	S	A		H	
	NAVSTA	655	A	2500	HF	S	A	1976	H	
	NAVSTA	655B	A	200	D	S	A		H	
	NAVSTA	84	A	1010	HF	S	A	1961	H	
	NAVSTA	86	A	5037	HF	S	A	1972	B	
	NAVSTA	M1123	A	270	HF	S	A		C	
	NAVSTA	M82-1	A	155	D	S	A	1990	C	
	NAVSTA	NH1137-1	A	1010	HF	S	A		C	
	NAVSTA	NH62	A	1010	HF	S	A		C	
	NAVSTA	NH62-2	A	1000	HF	S	A		C	
	NAVSTA	NS71	A	2000	HF	S	A	1986	H	
	NAVSTA	NS79-1	A	500	HF	S	TO		H	
	NSC	1136	A	375	HF	S	A	1977	C	
	NSC	14	A	215460	JP-5	S	TO	1957	H	
	NSC	191	A	550	HF	S	A		A	
	NSC	3901A	A	103000	WO	S	A	1945	G	
	NSC	39L	A	6500	D	S	A		G	
	NSY	02-241-002	A	500	D	S	A	1987	F	
	NSY	02-241-013	A	500	D	S	TO	1987	F	
	NSY	177	A	300	D	P	A		E	
	NSY	2	A	130	K	S	A		E	

* Tank requires further investigation
** Tank has been removed/closed by another contract
\# Tank are large field constructed tanks

Tank Contents
D = Diesel
E = Empty
HF = Heating Fuel
K = Kerosene
G = Leaded Gas
Lube = Lube Oil
LG = Leaded Gas
UNL = Unleaded Gas
WO = Waste Oil

Tank Status
A = Active
AB = Abandoned
CL = Closed
RM = Removed
TO = Temp Out Service

Tank Type
A = Aboveground Tank
U = Underground Tank
RU = Regulated Underground Tank

TABLE D-1
Above Ground And Underground Storage Tank Database

Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Year Remove	Facility	Tank Number	Above/ Under Ground	Tank Capacity	Tank Contents	Material	Tank Status	Year Tank Installed	Zone	Remarks
	NSY	226	A	700	HF	S	A		E	
	NSY	242A	A	5000	WO	S	A		F	
	NSY	32-1	A	350	D	S	A		E	
	NSY	32-2	A	350	D	S	A		E	
	NSY	32-3	A	500	D	P	A		E	
	NSY	32-4	A	500	D	P	A		E	
	NSY	32-501	A	114000	D	S	A	1988	E	
	NSY	32-D	A	5000	D	P	A		E	
	NSY	32-E	A	5000	D	P	A		E	
	NSY	3909	A	200000	HF	S	A	1962	G	
	NSY	NS6-1	A	100	D	S	A	1967	E	
	NWS	Y-3	A	1000	HF	S	AB	pre 1975	B	
#	NSC	3900E	F	2350000	D	UNK	A	1942	G	
#	NSC	3900F	F	2350000	D	OTHER	A	1942	G	
#	NSC	3906K	F	2130000	D	C	A	1942	G	
#	NSC	3906L	F	2128000	D	C	A	1968	G	
#	NSC	3906M	F	2132000	HF	C	A	1943	G	
#	NSC	3906N	F	2126000	HF	C	A	1968	G	
#	NSC	3906O	F	1153000	WO	C	A	1943	G	
#	NSC	3906P	F	2128000	D	C	A	1943	G	
#	NSC	3911	F	50000	LUBE	UNK	A		G	
#	NSC	3912	F	50000	LUBE	UNK	A		G	
#	NSC	3915	F	1008000	LUBE	UNK	A		G	
#	NSC	3916	F	4200000	D		A		G	
#	NSC	3917	F	4200000	D	UNK	A		G	
#	NSC	39A	F	741000	WO	OTHER	A	1942	G	
#	NSC	39D	F	741000	WO	OTHER	A	1942	G	

* Tank requires further investigation
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\# Tank are large field constructed tanks

Tank Contents
D = Diesel
E = Empty
HF = Heating Fuel
K = Kerosene
G = Leaded Gas
Lube = Lube Oil
LG = Leaded Gas
UNL = Unleaded Gas
WO = Waste Oil

Tank Status
A = Active
AB = Abandoned
CL = Closed
RM = Removed
TO = Temp Out Service

Tank Type
A = Aboveground Tank
U = Underground Tank
RU = Regulated Underground Tank

TABLE D-1
Above Ground And Underground Storage Tank Database

Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Year Remove	Facility	Tank Number	Above/ Under Ground	Tank Capacity	Tank Contents	Material	Tank Status	Year Tank Installed	Zone	Remarks
*	NAVHOSP	NH61-2	U	1000	HF	S	AB	1946	C	
*	NAVHOSP	NH68-2	U	1000	HF	S	AB	1950	C	
*	NAVSTA	1168-1	U	2500	HF	S	AB	1967	C	
*	NAVSTA	NH1152	U	1000	HF	S	AB	1941	C	
*	NAVSTA	NH1153-1	U	1000	HF	S	AB	1941	C	
*	NAVSTA	NH1158	U	1000	HF	S	AB	1941	C	
*	NAVSTA	NH1159	U	1000	HF	S	AB	1941	C	
*	NAVSTA	NH1243	U	1000	HF	S	AB	1941	C	
*	NAVSTA	NH1244	U	1000	HF	S	AB	1941	C	
*	NAVSTA	NH23-1	U	1000	HF	S	AB	1937	C	
*	NAVSTA	NH42-1	U	2500	HF	S	AB	1945	C	
*	NAVSTA	NH46-5	U		HF	S	AB	1941	C	
*	NAVSTA	NH67-1	U	1000	HF	S	AB	1946	C	AOC #508
*	NAVSTA	NS26B	U		UNK	UNK	AB		I	
*	NAVSTA	NS26C	U	20000	WO	UNK	AB		I	
*	NAVSTA	NS54-1	U	10000	LG	S	AB	1958	H	
*	NAVSTA	NS54-2	U	10000	LG	S	AB	1958	H	
*	NSY	1169	U	550	UNK	S	AB	1967	F	
*	NSY	226-1	U		WO		A		E	
**	FMWC	643B	RU	1000	MOGAS	FRP	RM	1982	H	
**	FMWC	643C	RU	550	D	UNK	RM		H	
**	FMWC	647A	U	4000	HF	S	CL	1967	H	
**	NAVHOSP	NH68	A	900	HF	S	RM	1961	C	
**	NAVSTA	220	A	275	HF	S	CL	1968	B	
**	NAVSTA	1346A	RU	10000	E	S	RM	1972	F	
**	NAVSTA	1346B	RU	10000	E	S	RM	1977	F	
**	NAVSTA	1346C	RU	10000	E	S	RM	1977	F	

* Tank requires further investigation
** Tank has been removed/closed by another contract
# Tank are large field constructed tanks

Tank Contents
D = Diesel
E = Empty
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K = Kerosene
G = Leaded Gas
Lube = Lube Oil
LG = Leaded Gas
UNL = Unleaded Gas
WO = Waste Oil

Tank Status
A = Active
AB = Abandoned
CL = Closed
RM = Removed
TO = Temp Out Service

Tank Type
A = Aboveground Tank
U = Underground Tank
RU = Regulated Underground Tank

COOPER RIVER

CENTERLINE CHANNEL PROJECT DEPTH 42'

INNER CHANNEL LINE

PROJECT DEPTH 35'

PROJECT DEPTH 30'

PROJECT DEPTH 15'

FLOOD EBB

WIND 3 KTS WEST

TWO MARK-17 DEPTH BOMBS JETTISONED 8 OCTOBER 1943

TWO MARK 47 TORPEX FILLED DEPTH BOMBS DROPPED IN THIS AREA 8 NOVEMBER 1943

SPOIL AREA

ABANDONED SUBSURFACE CHEMICAL DISPOSAL AREA

LONG TERM P.O.L. STORAGE

P.W. STORAGE

SHIPYARD

RIVER

BOUNDARY LINE

MATCH LINE

MARINA

NAVAL RECREATIONAL STATION

LOCATION MAP

NORTH CHARLESTON

NOISETTE CR.

COOPER RIVER

SHIPYARD CR.

DRUM S.

CHARLESTON

ASHLEY R.

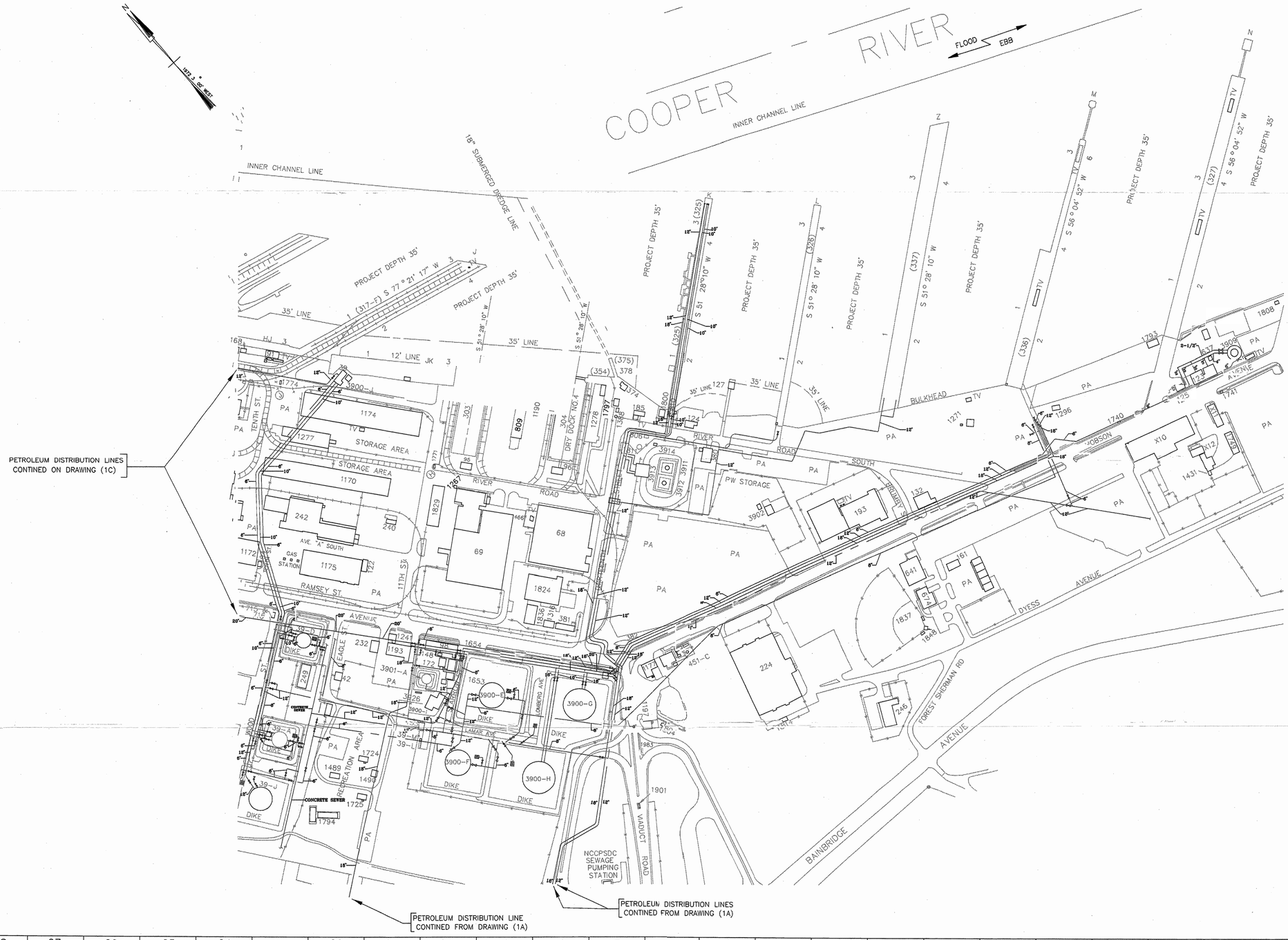
I-26

SCALE IN FEET 0 6000 12000

GRAPHIC SCALE 300 0 300 600 900

DRAWN: 03 JAN 96	CHARLESTON NAVAL SHIPYARD, CHARLESTON S.C.
	TANK MANAGEMENT PLAN STORAGE TANK LOCATIONS – CHARLESTON NAVAL SHIPYARD, NAVAL STATION AND CONTIGUOUS ACTIVITIES
SCALE	THIS DRAWING WAS DEVELOPED FROM P/W DRAWING # H606-272
SHEET 1 OF 1	

DRAWN: 03 JAN 96	CHARLESTON NAVAL SHIPYARD, CHARLESTON S.C.
	TANK MANAGEMENT PLAN PETROLEUM DISTRIBUTION LINES (1C) CHARLESTON NAVAL SHIPYARD, NAVAL STATION AND CONTIGUOUS ACTIVITIES
SCALE	THIS DRAWING WAS DEVELOPED FROM PW DRAWING # H606-272
SHEET 1 OF 1	



DRAWN: 03 JAN 96	CHARLESTON NAVAL SHIPYARD, CHARLESTON S.C.
	TANK MANAGEMENT PLAN PETROLEUM DISTRIBUTION LINES (1B) CHARLESTON NAVAL SHIPYARD, NAVAL STATION AND CONTIGUOUS ACTIVITIES
SCALE SHEET 1 OF 1	THIS DRAWING WAS DEVELOPED FROM PW DRAWING # H606-272

PETROLEUM DISTRIBUTION LINE
CONTINUED ON DRAWING (1B)

PETROLEUM DISTRIBUTION LINES
CONTINUED ON DRAWING (1B)

NCCPSDC
SEWAGE
PUMPING
STATION

PA

BOUNDARY LINE

BAXTER ST.

TOKEN ST.

NORWOOD ST.

SPRUILL AVE.

ENGLISH ST.

REDWOOD ST.

CLEMENTS AVE.

ROAD

OVERPASS

425

1906

BAINBRIDGE

BURTON LANE

CHICORA AVE.

3906-K

3906-L

3906-M

3906-N

3906-O

3906-P

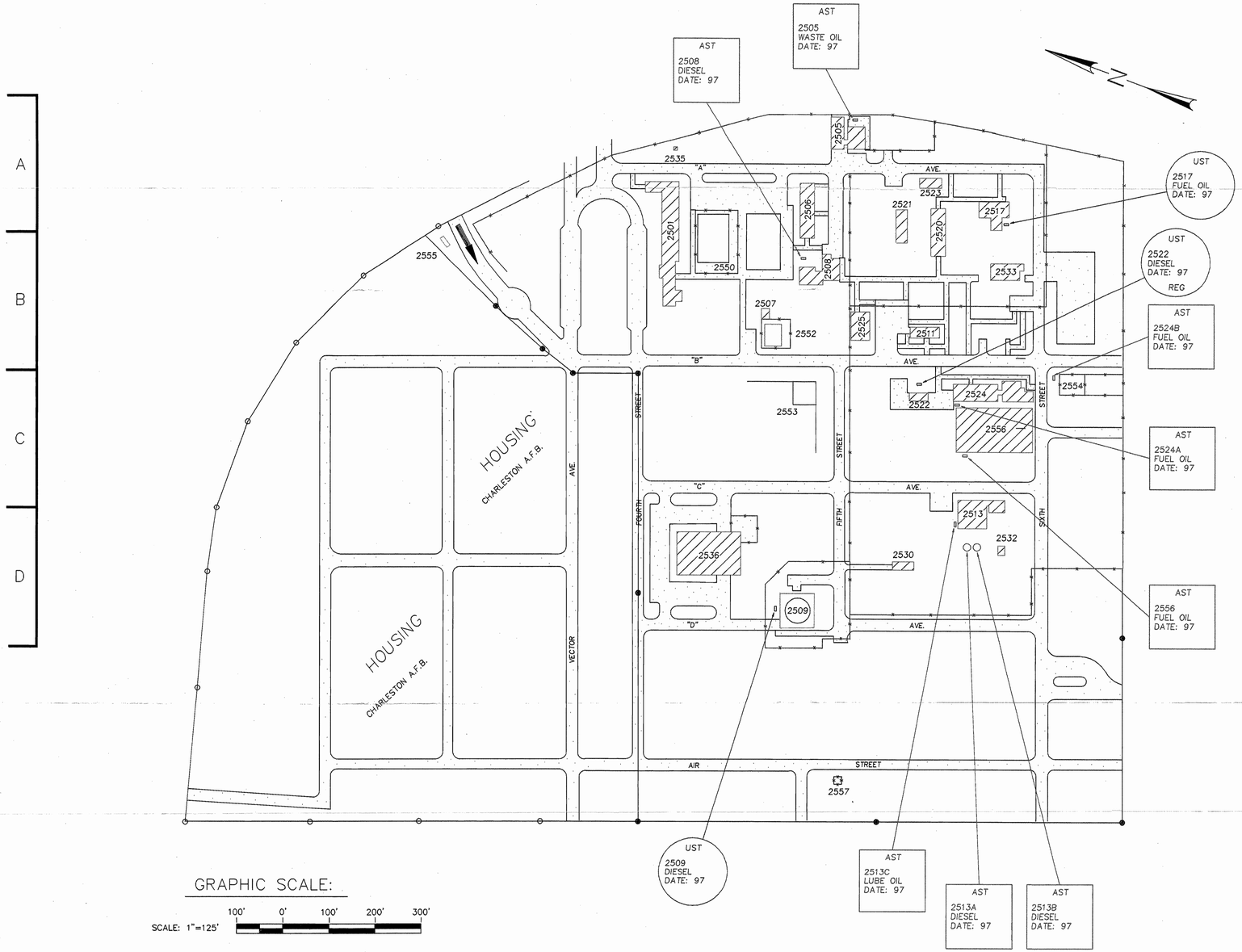
3906-Q

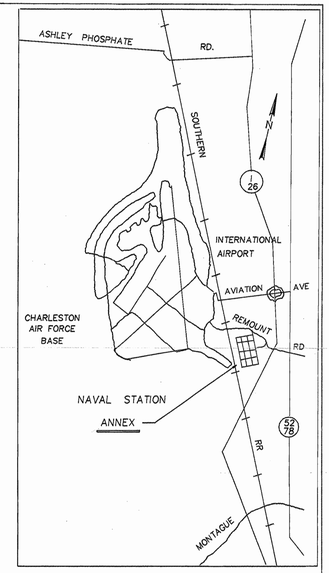
CHICORA TANK FARM

HIGHWAY NO. 52

DRAWN: 03 JAN 96	CHARLESTON NAVAL SHIPYARD, CHARLESTON S.C.
	TANK MANAGEMENT PLAN PETROLEUM DISTRIBUTION LINES (1A) CHARLESTON NAVAL SHIPYARD, NAVAL STATION AND CONTIGUOUS ACTIVITIES
SCALE SHEET 1 OF 1	THIS DRAWING WAS DEVELOPED FROM PW DRAWING # H606-272


03 JAN 96
CHARLESTON NAVAL SHIPYARD, CHARLESTON S.C.
TANK MANAGEMENT PLAN
STORAGE TANK LOCATIONS –
CHARLESTON NAVAL SHIPYARD, NAVAL
STATION AND CONTIGUOUS ACTIVITIES
SCALE
SHEET 1 OF 1
THIS DRAWING WAS DEVELOPED
FROM PW DRAWING # H606-272
GRAPHIC SCALE
ABBREVIATIONS
NH NAVAL HOSPITAL
UG UNDERGROUND
PA PARKING AREA
PW PUBLIC WORKS
NS NAVAL STATION
TV TRANSFORMER OR TRANSFORMER VAULT
LEGEND
BUILDINGS
CNSY BUILDINGS
FENCE
CIA FENCE
2 NAVAL BASE BOUNDARY FENCE GATE
AREA OF PROPERTY (IN ACRES)
TOTAL
NAVAL SHIPYARD 120.80
NAVAL BASE 1392.95
CLOUTER CREEK DREDGE AREA (EAST OF RIVER) 1397.00
TOTAL 2910.75
COOPER RIVER
CLOUTER CREEK
DREDGE AREA
CENTER LINE CHANNEL PROJECT DEPTH 42'
INNER CHANNEL LINE
NOISETTE CREEK
BOUNDARY LINE





LOCATION MAP

N.T.S.

INDEX OF EXISTING STRUCTURES

BLDG NO	LOCATION	DESCRIPTIVE TITLE (CURRENT USE)	QUANTITY	UNIT OF MEASURE
2501	B-2	NCO OPEN MESS	9,799	SF
2505	A-3	VEHICLE MAINTENANCE FAC.	4,620	SF
2506	B-3	BRKS - (VACANT)	3,125	SF
2507	B-2	BATH HOUSE	300	SF
2508	B-3	MAINTENANCE SHOP (CNSYD)	3,872	SF
2509	D-2	TOWER - INERT STORAGE	9,891	SF
2511	B-3	ADMIN BLDG	1,750	SF
2513	C-3	STORAGE	3,222	SF
2517	B-4	ADMIN - MCRC	4,850	SF
2520	B-3	CLASSROOM - MCRC	3,672	SF
2521	B-3	ARMORY - MCRC	2,667	SF
2522	C-3	GARAGE	1,008	SY
2523	B-3	ADMIN - MCRC	2,020	SF
2524	C-4	MINE ASSY PLANT	9,636	SF
2525	B-3	BUNKROOM	1,091	SF
2530	D-3	STORAGE	1,008	SY
2532	D-4	PAINT LOCKER	302	SF
2533	B-4	GALLEY (VACANT)	2,610	SF
2535	A-2	WATER TREATMENT FAC	35	SF
2536	D-2	COMOMAG FAC	19,136	SF
2550	B-2	TENNIS COURTS (2EA)	7,200	SF
2552	C-2	SWIMMING POOL	1	EA
2553	C-2	SOFTBALL FIELD	1	EA
2554	C-4	SUBSTA	311	SF
2555	B-1	ENTRANCE SIGN	1	EA
2556	C-4	MINE TRAINING CENTER	16,800	SF
2557	E-3	SEWAGE PUMPING STATION	224	SF

GRAPHIC SCALE:

SCALE: 1"=125'

100' 0' 100' 200' 300'

LEGEND:

- BLDG OR STRUCTURE
- ROADS, WALKS OR PAVED AREAS
- PROPERTY BOUNDARY
- PROPERTY BOUNDARY (BY OTHERS)
- SECURITY FENCE

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

P.W. DWG. NO.

DESIGNED:

DRAWN:

SECT. HD:

BR. MGR.

APPROVED:

DIRECTOR ENGR. DIVISION DATE

APPROVED:

OFFICER IN CHARGE DATE

SATISFACTORY TO

DATE

TANK MANAGEMENT PLAN

STORAGE TANK LOCATIONS -
NAVAL STATION ANNEX, CHARLESTON, S.C.
DEVELOPED FROM PW DWG NO 25713-48

REQUEST NO.

NAV. FAC. DRAWING NO.

CONSTR. CONTR. NO.

SCALE NOTED

SPEC.

SHEET 1 OF 1

TABLE D-1
Above Ground And Underground Storage Tank Database

Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Year Remove	Facility	Tank Number	Above/ Under Ground	Tank Capacity	Tank Contents	Material	Tank Status	Year Tank Installed	Zone	Remarks
**	NAVSTA	1346D	RU	4000	E	S	CL		F	
**	NAVSTA	1346E	RU	4000	E	S	CL		F	
**	NAVSTA	1346F	RU	4000	E	S	CL		F	
**	NAVSTA	1346G	RU	4000	E	S	CL		F	
**	NAVSTA	1346H	RU	10000	E	S	CL	1961	F	
**	NAVSTA	646B	RU	2000	HF	S	RM	1964	H	
**	NSY	1279A	RU	2500	UNL	S	RM	1967	E	AOC #569
**	NSY	1279B	RU	3000	UNL	S	RM	1967	E	AOC #569
**	NSY	1279C	RU	3500	UNL	S	RM	1982	E	AOC #569
**	NSY	236-TK-1	RU	560	LUBE	S	RM	1982	E	
**	NSY	236-TK-4	RU	275	LUBE	S	RM	1982	E	
**	NSY	236-TK-5	RU	275	LUBE	S	RM	1982	E	
**	NSY	236-TK-6	RU	560	WO	S	RM	1982	E	
**	NSY	236-TK-9	RU	1000	HF	S	RM	1982	E	
**	NSY	1141A	U	10000	LG	S	CL	1942	E	
**	NSY	1141B	U	4000	LG	S	CL	1942	E	
**	NSY	1174	U	1000	HF	S	CL	1947	E	
**	NSY	56B	U	4000	HF	S	RM	1967	E	
**	NSY	590A	U	576	HF	S	RM	1967	E	
96	FBMTF	FBM61-1	RU	200	D	S	A	1961	H	Removal Req'd by C/106 memo
96	FBMTF	FBM61-2	U	1000	WO	S	A	1978	H	
96	NAVSTA	1346	RU	650	WO	S	A	1967	F	Removal Req'd by C/106 memo
96	NAVSTA	851A	RU	500	UNL	S	A	~1980	H	
96	NAVSTA	851B	RU	500	D	UNK	A	~1980	H	
96	NAVSTA	NS200	U	1000	HF	S	A	1967	I	
96	NSC	148	U		WO	S	AB		G	
96	NSY	9B	A	586	D	S	A		E	AOC #574

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# Tank are large field constructed tanks

Tank Contents
D = Diesel
E = Empty
HF = Heating Fuel
K = Kerosene
G = Leaded Gas
Lube = Lube Oil
LG = Leaded Gas
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WO = Waste Oil

Tank Status
A = Active
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Charleston Naval Complex, Charleston, South Carolina

Year Remove	Facility	Tank Number	Above/ Under Ground	Tank Capacity	Tank Contents	Material	Tank Status	Year Tank Installed	Zone	Remarks
96	NSY	9C	A	3700	D	S	A		E	AOC #574
96	NSY	123-1	RU	1000	WO	UNK	A		G	Removal Req'd by C/106 memo
96	NSY	240	RU	5000	WO	S	A	1982	F	Removal Req'd by C/106 memo
96	NSY	242	RU	5000	WO	FRP	A	1989	F	
96	NSY	54	RU	560	D	S	A	1967	C	Removal Req'd by C/106 memo
96	NSY	56	RU	4000	D	S	TO	1989	E	Removal Req'd by C/106 memo
96	NSY	6A	RU	2500	HF	S	TO	1967	E	Removal Req'd by C/106 memo
96	NSY	6B	RU	2500	HF	S	TO	1967	E	Removal Req'd by C/106 memo
96	NSY	02-241-001	U	6000	HF	S	TO	1987	F	
96	NSY	221-1	U		WO	S	A		E	
96	NSY	NH72	U	8300	HF	S	A	1972	C	
96	NSY	NS2A	U	560	WO	S	A		I	
96	NSY	NS3-1	U	280	WO	S	AB		I	
96	NSY	NS4-TNK-1	U	25000	HF	S	A	1958	I	AOC #675
96	NSY	NS44A	U	550	WO	S	A	1958	H	
96	NWS	J	U	550	HF	S	A	pre 1975	B	
96	NWS	K	U	550	HF	S	A	pre 1975	B	
96	NWS	P	U	550	HF	S	A	pre 1975	B	
96	NWS	R	U	550	HF	S	A	pre 1975	B	
97	FBMTF	686	U	4000	HF	FRP	A	1967	H	
97	FMWC	202	U	5000	HF	S	A		H	
97	FMWC	643A	U	6000	HF	S	A		H	
97	FMWC	647	U	4000	HF	S	A	1964	H	
97	NAVHOSP	NH61-1	U	560	HF	S	AB	1946	C	
97	NAVSTA	2505	A	275	WO	FRP	A	1988	K	
97	NAVSTA	2508	A	10000	HF	S	AB	1955	K	
97	NAVSTA	2513A	A	42000	HF	S	AB	1964	K	

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D = Diesel
E = Empty
HF = Heating Fuel
K = Kerosene
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Lube = Lube Oil
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97	NAVSTA	2513B	A	42000	HF	S	AB	1964	K	
97	NAVSTA	2513C	A	550	LUBE	S	AB	1964	K	
97	NAVSTA	2524A	A	1000	HF	S	A	1954	K	
97	NAVSTA	2524B	A	1000	HF	S	A	1954	K	
97	NAVSTA	2556	A	3000	HF	S	A	1983	K	
97	NAVSTA	1346I	RU	10000	UNL	FRP	A	1988	F	Do not Remove
97	NAVSTA	1346J	RU	10000	UNL	FRP	A	1991	F	"
97	NAVSTA	1346K	RU	10000	UNL	FRP	A	1991	F	"
97	NAVSTA	2522	RU	5000	HF	S	AB	1954	K	
97	NAVSTA	646A	RU	2500	D	FRP	A	1991	H	
97	NAVSTA	661	RU	4000	HF	FRP	A	1992	H	
97	NAVSTA	2509	U	1000	HF	S	AB	1957	K	
97	NAVSTA	2517	U	2000	HF	S	AB	1957	K	
97	NAVSTA	640B	U	3000	HF	S	AB	1963	H	
97	NAVSTA	653A	U	2000	HF	S	AB	1969	H	
97	NAVSTA	654	U	2000	HF	S	A	1964	H	
97	NAVSTA	681-1	U	100	WO	UNK	A	1981	I	
97	NAVSTA	681-2	U	20000	HF	UNK	AB	1981	I	
97	NAVSTA	NS26A	U	200	WO	UNK	A	1981	I	
97	NAVSTA	NS28A	U	10000	HF	S	A	1958	I	
97	NAVSTA	NS28B	U	4030	HF	S	A	1982	I	
97	NAVSTA	NS53	U	3000	HF	S	A	1967	H	
97	NAVSTA	NS53B	U	800	D	S	AB	1967	H	
97	NSY	1175A	RU	10000	UNL	FRP	A	1988	F	Do not Remove
97	NSY	1175B	RU	10000	UNL	FRP	A	1988	F	"
97	NSY	1175C	RU	10000	D	FRP	A	1988	F	"
97	NSY	38-1	RU	300	WO	S	A	1967	E	Removal Req'd by C/106 memo

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Charleston Naval Complex, Charleston, South Carolina

Year Remove	Facility	Tank Number	Above/ Under Ground	Tank Capacity	Tank Contents	Material	Tank Status	Year Tank Installed	Zone	Remarks
97	NSY	13A	U	560	K	S	TO	1982	E	
97	NSY	13B	U	560	K	S	TO	1982	E	
97	NSY	25-1	U		HF	UNK	TO		E	
97	NSY	590A-1	U	2260	HF	S	A	1935	E	
97	NSY	590A-2	U	576	HF	S	A	1967	E	
97	NSY	NS45-TNK-1	U	25000	HF	S	A	1979	H	AOC #666
97	NWS	701	U	280	HF	S	A	pre 1975	B	
97	NWS	705	U	280	HF	S	A	pre 1975	B	
97	NWS	708	U	280	HF	S	A	pre 1975	B	
97	NWS	717	U	280	HF	S	A	pre 1975	B	
97	NWS	718	U	280	HF	S	A	pre 1975	B	
97	NWS	719	U	280	HF	S	A	pre 1975	B	
97	NWS	A	U	550	HF	S	A	pre 1975	B	
97	NWS	B	U	550	HF	S	A	pre 1975	B	
97	NWS	C	U	550	HF	S	A	pre 1975	B	
97	NWS	H	U	1000	HF	S	A	pre 1975	B	
97	NWS	L	U	550	HF	S	A	pre 1975	B	
97	NWS	M	U	550	HF	S	A	pre 1975	B	
97	NWS	N	U	550	HF	S	A	pre 1975	B	
97	NWS	Y-1	U	1000	HF	S	A	pre 1975	B	
97	NWS	Y-2	U		HF	S	AB	pre 1975	B	
98	NAVSTA	641	U	560	HF	S	A	1977	G	
98	NAVSTA	644	U	5000	HF	S	A	1977	H	
98	NAVSTA	648B	U	2000	HF	S	AB	1966	H	
98	NAVSTA	650	U	1000	HF	S	A	1969	H	
98	NAVSTA	656	U	5800	HF	S	A	1972	H	
98	NAVSTA	657-1	U	5000	HF	S	A	1968	H	

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98	NAVSTA	657-2	U	2000	HF	S	A	1978	H	
98	NAVSTA	81-1	U	1000	HF	S	A	1941	C	
98	NAVSTA	NH1137-2	U	1000	HF	S	AB	1940	C	
98	NAVSTA	NH21-1	U		HF	S	AB	1952	C	
98	NAVSTA	NH46-1	U	2500	HF	S	AB	1941	C	
98	NAVSTA	NH46-2	U	2500	HF	S	AB	1941	C	
98	NAVSTA	NH46-3	U	2500	HF	S	AB	1941	C	
98	NAVSTA	NH46-4	U	2500	HF	S	AB	1941	C	
98	NAVSTA	NH62-1	U	2500	HF	S	AB	1944	C	
98	NAVSTA	NH63-1	U		LG	S	AB	1944	C	
98	NAVSTA	NH63-2	U		D	S	AB	1944	C	
98	NAVSTA	NS79-2	U	10000	HF	S	A	1978	C	
98	NSC	191NW	RU	1500	D	S	A	1967	H	
98	NSC	191SW	U	1500	HF	S	AB	1967	A	
98	NSC	224	U	5000	HF	S	A	1967	~~A~~	
98	NSY	42	U	560	HF	S	TO		G	
98	NWS	758	U	550	HF	S	A	pre 1975	~~G~~ C	
98	NWS	759	U	550	HF	S	A	pre 1975	C	
98	NWS	760	U	550	HF	S	A	pre 1975	C	
98	NWS	761	U	550	HF	S	A	pre 1975	C	
98	NWS	762	U	1000	HF	S	A	pre 1975	C	
98	NWS	763	U	1000	HF	S	A	pre 1975	C	
98	NWS	765	U	280	HF	S	A	pre 1975	C	
98	NWS	AA	U	1000	HF	S	A	pre 1975	C	
98	NWS	BB	U	1000	HF	S	A	pre 1975	C	
98	NWS	D	U	550	HF	S	A	pre 1975	B	
98	NWS	DD	U	1000	HF	S	A	pre 1975	C	

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98	NWS	FF	U	1000	HF	S	A	pre 1975	C	
98	NWS	G	U	550	HF	S	A	pre 1975	B	
98	NWS	HH	U	1000	HF	S	A	pre 1975	C	
98	NWS	JJ	U	1000	HF	S	A	pre 1975	C	
98	NWS	M5	U	550	HF	S	A	pre 1975	C	
98	NWS	M6	U	1000	HF	S	A	pre 1975	C	
98	NWS	M8	U	1000	HF	S	A	pre 1975	C	
98	NWS	O	U	550	HF	S	A	pre 1975	B	
98	NWS	Q	U	550	HF	S	A	pre 1975	B	
98	NWS	S-1	U	550	HF	S	A	pre 1975	B	
98	NWS	S-2	U		HF	S	AB	pre 1975	B	
98	NWS	T-1	U	550	HF	S	A	pre 1975	B	
98	NWS	T-2	U		HF	S	AB	pre 1975	B	
98	NWS	W	U	1000	HF	S	A	pre 1975	B	

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BASE REALIGNMENT AND CLOSURE

TANK MANAGEMENT PLAN

CHARLESTON NAVAL COMPLEX
CHARLESTON, SOUTH CAROLINA

Facilities: **NSY**
NSC
NAVSTA
FLEMINEWARTRACEN
SUBTRAFAC

Prepared by:

Charleston Environmental Detachment
1899 North Hobson
North Charleston, SC 29404-2106

Authors:

J. A. Manzi
J. T. Amey

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29418
Gabriel Magwood, Code 1849, Engineer-in-Charge

Foreword

During the 90 year history of Charleston Naval Complex, the Navy has performed a variety of operations, involving handling, storage, and disposal of hazardous materials. Accidental spills and leaks have contributed to entrance of contaminants into the environment. Other contributions to environmental contamination occurred due to disposal or storage methods which were not environmentally sound by today's standards. In recent years, the Department of Defense has implemented numerous programs to investigate, evaluate, and remediate suspected past releases at DOD facilities.

The Comprehensive Long-Term Environmental Action, Navy Underground Storage Tank program is one of the programs used by DOD striving to achieve environmental cleanup goals. This program complies with Subtitle I of the Resource Conservation and Recovery Act (RCRA) and the Hazardous and Solid Waste Amendments of 1984 (HSWA). In addition, the program was established to insure compliance with State and Local regulations as the regulations pertain to each Naval Facility.

The UST program encompasses the following:

- Registration and management of Navy storage tank systems
- Contamination assessment planning
- Site field investigations
- Preparation of contamination assessment reports
- Remedial (corrective) action planning
- Implementation of remedial action plans
- Tank and pipeline closures

The UST program at the Charleston Naval Complex is overseen by the Southern Division of Naval Facilities Engineering Command (SDIV) and the South Carolina Department of Health and Environmental Control (DHEC).

Other programs address the implications and concerns of Base Realignment and Closure. A Closure Team (BCT) composed of representatives from the Naval Complex, SDIV, Federal and State regulation agencies has been established to discuss and resolve the multitude of problems and concerns surrounding base closure. Also, the BCT will tackle the tough environmental concerns associated with leasing government facilities to private organizations. The team approach is intended to foster partnering, accelerate the environmental cleanup process, and expedite timely, cost-effective, and environmentally responsible disposal and reuse decisions.

At the Charleston Naval Complex, the BRAC process includes the evaluation of the environmental condition of the property to ensure the suitability of transfer, reuse, or lease. Questions regarding the UST program at the Charleston Naval Complex should be addressed to Mr. Gabriel Magwood, Code 1849, at (803) 820-7307.

Executive Summary

The Charleston Environmental Detachment was contracted by SDIV to develop a Tank Management Plan (TMP) that facilitates identification and efficient closure of tanks and pipelines requiring remedial action. The scope of services for the work is described in the Statement of Work and the corresponding Proposal developed by the Charleston Environmental Detachment.

Charleston Naval Complex was placed on the 1993 Base Realignment and Closure Commission (BRAC) list by a bipartisan commission appointed by the President and confirmed by the Senate in accordance with the Defense Base Closure and Realignment Act of 1990. The primary goal of the BRAC is to effect an efficient transfer of areas suitable for property transfer and to identify and coordinate the necessary remedial actions for areas not suitable for immediate transfer.

This TMP only addresses those areas that require additional investigation under State petroleum storage tanks guidelines.

The scope of services developed to execute the TMP includes:

- Identification, classification, and location of existing storage tanks and pipelines at the Charleston Naval Complex and annexes
- Documentation of the locations of existing storage tanks and pipelines
- Develop guidelines and basic generic procedures for the proper closure of storage tanks and pipelines meeting the applicable requirements
- Development of outlines describing the management of investigative derived wastes (IDW) and management of initial removal action contaminated soils.

This TMP utilizes the Tank Inventory and Management System (TIMS) as a database that provides all the physical planning information for all petroleum storage tanks systems at the Charleston Naval Complex. Drawings and maps are included to provide pictorial representation of tank and pipeline locations. Other figures present schedules for tank removal and closure activities.

The investigative procedures for the tank closure and contamination assessment of petroleum contaminated sites are also provided. Flow charts describing the decision process and assessment activities have been developed and are included herein.

The TMP should serve to assist in planning and expediting tank closure and assessments for the Charleston Naval Complex through 1998.

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GLOSSARY

AST Aboveground Storage Tank

BCT	Base Closure Team
BEI	Bechtel Environmental, Inc.
BLS	Below Land Surface
BRAC	Base Realignment and Closure
CA	Contamination Assessment
CAR	Contamination Assessment Report
CED	Charleston Environmental Detachment
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action, Navy
DHEC	South Carolina Department of Health and Environmental Control
DOD	Department of Defense
DOT	US Department of Transportation
EBS	Environmental Baseline Survey
EPA	US Environmental Protection Agency
IDW	Investigation Derived Waste
IR	Installation Restoration Program
IRA	Initial Remedial Action
MOP	Monitoring Only Plan
NFA	No Further Action
NPDES	National Pollution Discharge Elimination System
OVA	Organic Vapor Analyzer
PID	Photo Ionization Detector
PPB	Parts per Billion
PPM	Parts per Million
QA/QC	Quality Assurance/Quality Control
RAC	Remedial Action Contract
RAM	Responsibility Assignment Matrix
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recover Act
RFA	RCRA Facility Assessment
SDIV	Southern Division, Naval Facilities Engineering Command
TIMS	Tank Inventory and Management System
TMP	Tank Management Plan
UST	Underground Storage Tank

1.0 INTRODUCTION

Charleston Environmental Detachment (CED) was contracted by SDIV to develop a Tank Management Plan (TMP) that facilitates the identification and efficient closure of tanks and pipelines requiring remedial action. The scope of services for the work is described in the Statement of Work and the corresponding proposal developed by the Charleston Environmental Detachment.

1.1 BACKGROUND AND PURPOSE

Charleston Naval Complex was placed on the 1993 Base Realignment and Closure Commission list by a bipartisan commission appointed by the President and confirmed by the Senate in accordance with the Defense Base Closure and Realignment Act of 1990. The primary goal is to effect an efficient transfer of areas suitable for property transfer and to identify and coordinate the necessary remedial actions for areas not suitable for immediate transfer. The recent Environmental Baseline Survey (EBS) divided the Charleston Naval Complex into twelve zones. The EBS was performed by Ensafe/Allen & Hoshall Inc. Petroleum sites at the base fall into three categories:

- Areas suitable for immediate transfer of property
- Areas requiring additional investigation under State petroleum storage tank guidelines
- Areas requiring additional investigation under the Navy's Installation Restoration Program (IR)

The primary goal of the BRAC effort is to assess and, if necessary, remediate sites at the base as quickly as possible to allow property transfer. The TMP will only address those areas that fall within State petroleum storage tank guidelines.

1.2 SCOPE

The scope of services:

- Identification, classification, and location of existing petroleum storage tank systems and pipelines at the Charleston Naval Complex and associated annexes
- Provide site maps of tanks and pipeline locations
- Develop generic procedures for the proper closure of existing petroleum storage tanks and pipelines
- Effective and efficient handling and disposal of IDW

1.3 TANK SITES NOT INCLUDED IN THE TANK MANAGEMENT PLAN (TMP)

Several tank sites at the Charleston Naval Complex and associated annexes are not included in the TMP as they will handled under other contracts. The storage tank systems that are not included in this plan are:

- Tanks associated with the new Naval Hospital
- Chicora Tank Farm
- Temporary Tanks

In addition, Tanks containing propane are not be addressed by this TMP. Propane is not considered a petroleum contamination risk because it is highly volatile and would be released as a gas, not a liquid or solid. The TMP addresses the removal and possible investigation of those tanks that contain petroleum products that may lead to soil, surface water, or groundwater contamination.

1.4 RESPONSIBILITY ASSIGNMENT MATRIX

The Responsibility Assignment Matrix (RAM), shown in Table 1-1, outlines the specific tasks associated with a project. Each member of the project team is assigned responsibility for a given task. A team member's responsibility can be designated as lead, support, review, approval, or information. The team member with the lead (L) responsibility is tasked with taking the lead in terms of project coordination, execution, and staffing. The support (S) role is one in which the team member will provide task support to the lead team member when called upon. Those members of the team responsible for review of a task or a task specific report are designated with an (R). Those team members who hold approval authority for a task completion or approval of a document are designated with an (A). In many instances, team members are tied into the loop for informational purposes. In these cases, the team members are designated with an (I).

The team members for the tasks associated with the TMP include SDIV, a CLEAN/RAC contractor, CED, and the South Carolina Department of Heath and Environmental Control (DHEC).

Table 1-1
Petroleum Assessment and Remediation Responsibility Assignment Matrix (RAM)

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

TASK	CED	Contractor	SDHEC	SDIV
Develop Tank Management Plan	L		I	A
Inventory Tanks	L			
Identify Removals	S			L
Prioritize Removal	S			L
Sample Unknown Tank Contents	L			
Removal Work Plan	L			A
Removal Health and Safety Plan	L			A
Removal Quality Control Plan	L			A
Removal Budget	L			A
Removal Schedule	L			A
Tank Removals	L		A/I	A
Remove Tank Contents	L			
Sample Tank Bottom Sludge	L			
Remove Tanks	L			
Perform Interim Soil Removals	L			
Waste Transport and Disposal	L			
Fill /Grade Excavation	L			
Contamination Assessment	L	S	A	A
Contamination Assessment Report	L	S	A	A
Monitoring	L	S	A	A
Monitoring Only Plan	L	S		
Install/Remove Monitoring Wells	L	S		
Perform Monitoring	L	S		
Closure Report	L	S	A	A

Notes CED = Charleston Environmental Detachment
BEI = Bechtel Environmental, Inc
DHEC = South Carolina Department of Health and Environmental Control
SDIV = Southern Division, Naval Facilities Engineering Command

I = Information
L = Lead Responsibility
S = Supporting Responsibility
R = Review Responsibility
A = Approval

2.0 REGULATORY REQUIREMENTS

South Carolina control regulations for underground storage tanks are contained in DHEC regulation R.61-92, Part 280, "Underground Storage Tank Control Regulations, March 23, 1990". In addition to the state's UST regulation, the following industry and regulatory guidance documents were used in developing the TMP and will be used in subsequent tank removal and assessment operations:

- DHEC, "UST Assessment Guidelines for Permanent Closure and Change-In-Service," June 1995;
- DHEC, "Soil/Groundwater Remediation Guidancc Document," March 3, 1992;
- DHEC, "Hydrogeologic Assessment Guidance Document," April 4, 1991;
- American Petroleum Institute Recommended Practice 1604, "Removal and Disposal of Used Underground Petroleum Storage Tanks";
- American Petroleum Institute Recommended Practice 2015, "Cleaning of Petroleum Storage Tanks";
- DHEC, "Standard Limited Assessment", June 1995;

For the most part, the main exemption under the UST regulations which pertains to the Charleston Naval Complex are USTs used for storing heating oil for consumptive use on the premises where stored. Also, there are no DHEC environmental regulations designed specifically to regulate the use of petroleum aboveground storage tanks (ASTs). Therefore, the ASTs and most of the USTs in the Charleston Naval Complex are exempt from the DHEC regulations governing use, transfer, and closure under the UST program. Although these storage tank systems are exempt from regulation, the possibility of previous releases to soil and groundwater must be considered; therefore, the UST recommendations and regulations are used in assessing both exempt and regulated USTs as well as ASTs and associated piping. Copies of these regulations, guidance documents, and recommended practices are presented in Appendix A.

3.0 STORAGE TANK DATA, INVENTORY AND LOCATIONS

3.1 DATA COLLECTION METHODS

The following section describes data collection methods for field screening and waste sampling.

3.1.1 Field Screening

Field Screening analysis was accomplished using a photo ionization detector (PID). Although the dependability of PID is questionable under different operating conditions, the purpose of field screening was to provide general knowledge of the site's contamination level. In addition to PID readings, the soil's odor was also used as a field screening tool.

A background level for volatile organics was measured by recording the PID readings of a soil sample at a similar depth in an area assumed to be free of contamination. PID readings were in the range of 2 - 3 ppm TPH. For the purpose of this report, PID readings above 10 ppm TPH were considered to be evidence of some level of contamination. PID readings below 10 ppm TPH were considered to be inconclusive and require further investigation to eliminate the site as a suspected source of contamination. Further investigation was beyond the scope of this report.

The methods used to accomplish PID field screening was the polypropylene bag method and a slightly modified bag method using a jar and plastic wrap. All field screening was accomplished using EPA document EPA/530/UST-90/003 *Field Measurements - Dependable Data When You Need it* - September 1990 as a guide. In general, the soil sample was collected and placed in a bag and sealed. The container was agitated for approximately two minutes and then scanned using a PID. Reading times varied and were terminated when readings started to decrease or stabilized.

Field sampling procedures involved augering a hole at each end of the tank and one at the approximate middle to a depth just at the water table. Subsurface interference could cause variations in the location of the holes and possible elimination of the hole completely. The depth of the hole varied from location to location and was based on the depth to ground water. As soon as a PID reading over 10 ppm TPH was recorded no further sampling was performed.

All of the USTs at the Charleston Naval Complex could not be field screened due to various difficulties.

- In many cases, subsurface obstructions were encountered at various depths even though preliminary probing was accomplished using a fiberglass rod. These obstructions required additional holes to be augered at a slightly different location. Subsurface obstructions could include piping, roots, construction debris, etc.

- Tanks totally covered by concrete or asphalt could not be screened. The hit and miss nature of manual augering of sampling holes was not conducive to concrete coring. In many cases, the facility drawings were not available or the drawings were not sufficiently detailed to determine the tanks orientation or exact location thus complicating the field screening effort.

Due to the difficulty in accomplishing field screening and the inconsistent/inconclusive nature of PID readings, field screening was discontinued. To aid in the closure of the USTs and ASTs covered by this report, CED is investigating the potential use of immunoassay analysis to facilitate more accurate soil screening during removal operations.

In the absence of field screening data, age, depth, material of construction, and known corrosion preventive measures were considered in determining the potential for tank leakage. Additionally, several other sources of information were used to developed tank removal determinations.

- The Navy's policy for tank closure is tank removal
- Industry's life expectancy "rule of thumb" for an unprotected UST is approximately 16 years
- A SDIV memo (Code 1143/13 dated 2 December 1987) states that all tanks older than 16 years should be removed.

3.1.2 Tanks Containing Unknowns/Waste Oil

Tanks containing waste oil or unknown substances will be sampled for the eight RCRA metals and F001-F005 solvents. In some cases, sampling could not be performed due to the efforts of a Charleston Naval Shipyard task team which cleaned and placed some tanks in a temporary closure status. Oil collected from these cleaning procedures was placed in the used oil recycling program. Unacceptable material was disposed of properly as hazardous waste. Additional sampling was not possible in these instances and the previous results of the sampling efforts were used in compilation of this report for the tanks involved. The results are provided in Appendix B.

3.1.3 Other Areas of Concern

In several instances, possible tank locations were identified which could not be confirmed due to past facility demolition. Site investigations and facility drawing searches were performed; however, the results were inconclusive and no record of removal could be found. These tanks are listed in the TIMS and annotated in the remarks section. Further investigation is recommended to appropriately address the possibility of contamination.

3.2 TANK INVENTORY MANAGEMENT SYSTEM (TIMS) DATABASE

The TIMS database was developed for SDIV in 1988 as part of the storage system management plan. The TIMS database was developed as a dynamic management tool to provide the activity and SDIV data on the physical information for the storage systems at the activity.

The TIMS database was developed to contain mainly the physical information on a single database with capabilities to query for specific storage system characteristics and to provide a user-friendly system for managing all the storage systems at each naval activity.

3.2.1 Description of the TIMS

TIMS was developed for SDIV on a personal computer using DBASE III Plus Software. Later, SDIV developed and incorporated a more user-friendly menu program into the system using the CLIPPER™ software package.

3.2.2 TIMS Information Sources

The information contained in TIMS was obtained from the following sources:

- Naval activity reports related to petroleum storage systems previously prepared for SDIV by Harding Lawson Associates (1986)
- Environmental Baseline Survey previously submitted by Ensafe/Allen & Hoshall (1994)
- RCRA Facility Assessment previously submitted by Ensafe/Allen & Hoshall (1995)

- RCRA Facility Investigation Work Plan for Zone H previously submitted by Ensafe/Allen & Hoshall (1995)
- Information including design drawings and contract specifications for storage tank systems, provided by naval activity personnel
- Information sources such as building inventory lists, and contract petroleum supplier lists
- Various Shipyard Correspondence
- Field investigations performed in conjunction with completion of the TMP by the Charleston Environmental Detachment personnel
- Tank list developed by the Charleston Naval Shipyard tank cleaning closure group

3.2.3 Information Contained in the TIMS Database

TIMS contains information on two areas of storage tank management. These two areas include naval activity information and physical information on the storage tank system.

As part of the TMP, the TIMS database was updated based on information obtained during the Environmental Baseline Survey and preliminary UST and AST surveillances the Charleston Environmental Detachment conducted at Charleston Naval Complex and its annexes in the Summer and Fall of 1995. In addition, other explanations and clarifications of the field findings were included. Appendix C contains a copy of the updated database in tabular form. The appendix includes Table C-1, physical information on storage systems. An electronic self extracting archive of the TIMS database for the Charleston Naval Complex is contained on a 3-1/2" computer diskette in Appendix C. Two copies are included.

3.3 TANK LOCATIONS AND SCHEDULE

This section discusses the number of USTs and ASTs at Charleston Naval Complex and its annexes and illustrates their locations on figures. Information presented in this section was compiled from the TIMS database, the Environmental Baseline Survey, and preliminary UST and AST location surveillance's conducted by the Charleston Environmental Detachment.

3.3.1 Site Location

The Charleston Naval Complex is located in and around Charleston, South Carolina. The Complex consists of five distinct areas. The main facility is the Naval Base. Four additional areas are located in various areas around the local commuting area. Figure 3-1 shows approximate locations of the facilities.

- Naval Base Charleston is comprised of 2,985.64 acres situated on the western bank of the Cooper River.
- The Naval Station Annex is comprised of 42 acres used for housing, small maintenance activities, and ancillary activities.
- The Naval Shipboard Electronic Systems Evaluation Facility (SESEF) is located on Sullivan's Island, South Carolina. The total area involved is 4.08 acres. (This facility was transferred to NISEEAST and will not be covered in this report).

- The Degaussing Station is comprised of a building and degaussing pier on 2.81 acres in downtown Charleston, South Carolina.

- The Short Stay Facility is a recreational facility in Berkeley County, South Carolina, used by naval station personnel and dependents. The facility is comprised of 56.6 acres leased from the South Carolina Public Service Authority. Recently, the facility was transferred to CINCLANTFLT.

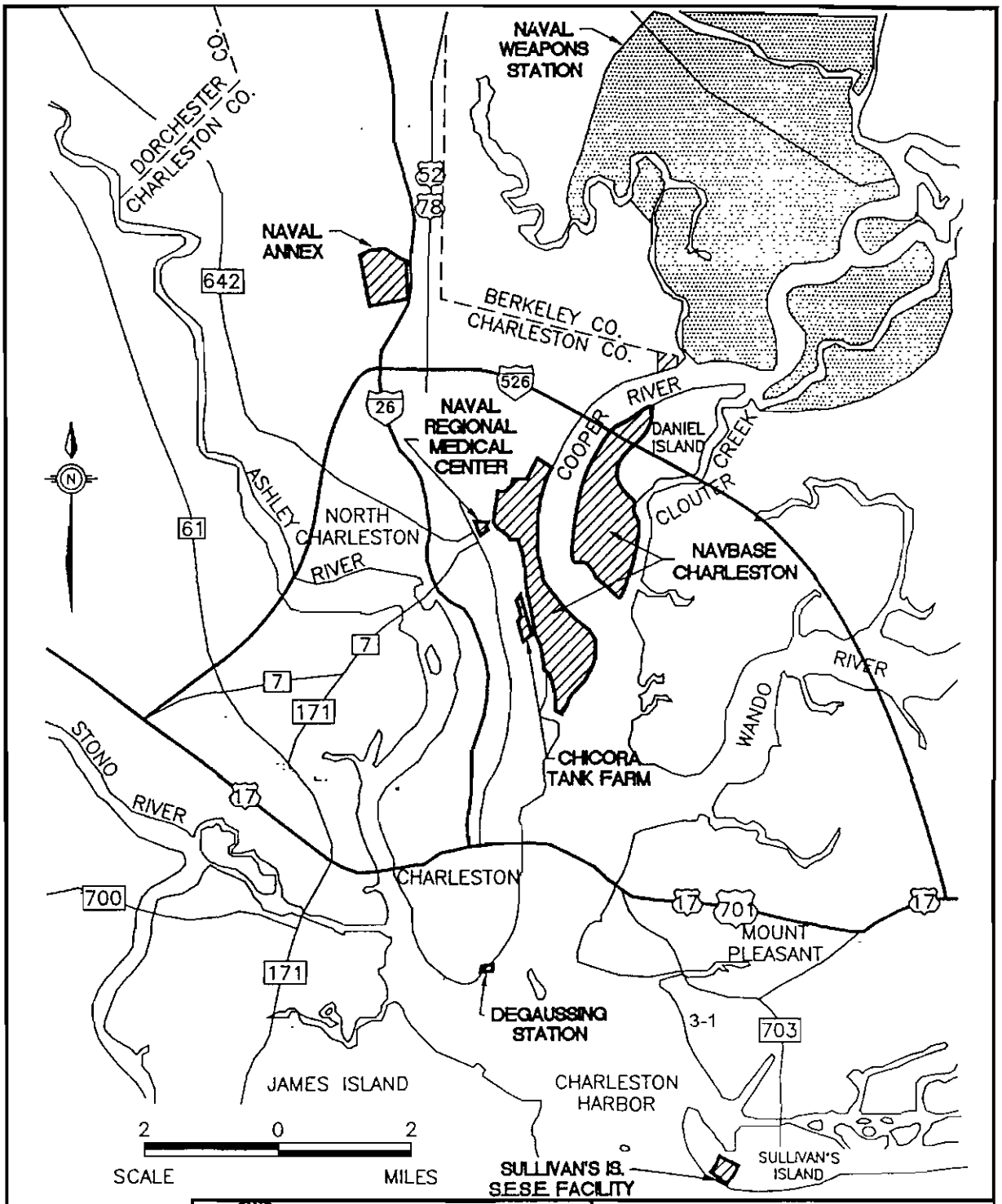
3.3.2 Tank Removal and Closure Schedule

Currently, there are 230 inventoried storage tank systems in the TIMS database at the Charleston Naval Complex. Of these 230 tanks, 27 have been removed/closed or have been scheduled for removal under separate contracts. A schedule, developed by the Charleston Naval Environmental Detachment, calls for the removal of 27 tanks in 1996, 56 tanks in 1997, and 47 tanks in 1998. Information showing the number and type of tanks at each of the Charleston Naval Complex facilities and the removal year is presented in Table 3-1. Maps showing tank locations, types, identification numbers, contents, removal dates, and regulatory status are contained in Appendix D.

In addition, 19 USTs will require further investigation due to demolition of the surrounding building and/or the inability to locate records describing tank removal. There are 39 ASTs which will require assessment in accordance with paragraph 4.3. These tank assessments and investigations will be accomplished and scheduled as needed.

The tank removal schedule was developed by the Charleston Environmental Detachment, and is based on the future use of the building, evidence of contamination, and the age and condition of the tank. All tank removals have been scheduled to occur after the official BRAC closure date (1 April 1996).

The Charleston Environmental Detachment will perform tank removal operations, initial remedial actions, and soil and groundwater assessments for this project. The Charleston Environmental Detachment will make every attempt to assess storage tank locations and retain a backlog of sites where IRAs will be conducted so that scheduling of sites in advance will be possible.



TANK MANAGEMENT PLAN
NAVAL BASE CHARLESTON

FIGURE 3-1
STUDY AREA
NAVAL BASE CHARLESTON
CHARLESTON, SOUTH CAROLINA

A total of 130 tanks are currently scheduled for removal from the Charleston Naval Complex. It is expected that most of the tanks will require soil and possibly groundwater assessment. Large field constructed tanks and ASTs require further assessment/investigation and then subsequent closure scheduling as applicable.

Table 3-1
Storage Tank Removal by Base Area and Year

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

Base Area	1996		1997		1998		Total	
	AST	UST	AST	UST	AST	UST	AST	UST
Shipyard	2	18	*	25	*	26	2	69
Naval Station	*	7	*	20	*	21	*	48
Naval Station Annex	0	0	8	3	0	0	8	3
Degaussing Facility	0	0	0	0	0	0	0	0
Total	2	25	8	48	0	47	10	120

Notes: AST = aboveground storage tanks
UST = underground storage tanks
* = disposition of ASTs pending assessment per paragraph 4.3

4.0 TANK CLOSURE AND ASSESSMENT PROCEDURES

The following chapter presents the tank closure and assessment procedures for tank removal operations, contaminated site assessment, and remediation associated with this project. Procedures contained in this TMP should be used in coordination, cooperation, and conjunction with the RAC contractor. This TMP provides guidance for development of tank removal workplans. These workplans will be developed prior to tank removal operations.

Procedures described in this chapter are designed to obtain the necessary information for the DHEC, Underground Storage Tank Assessment Guidelines and reach tank closure in an effective and efficient manner. A copy of these requirements are contained in Appendix A of this TMP.

Soil samples will be collected from borings and if contamination is present, a site assessment will be performed using DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.*

The success of this TMP and the tank removal project will depend on successful communication, cooperation, and coordination among all team members designated in the RAM. Because the schedule is ambitious and very important in this program, completing assigned tasks in the RAM, on schedule, is essential to the success of the program.

In some circumstances, facilities have been leased and the UST or AST provides the only means of heating the facility. In order to provide necessary heating for the facilities, a new or temporary AST will be installed in accordance with appropriate regulations to accommodate heating demands.

4.1 REGULATED UNDERGROUND STORAGE TANKS (USTs)

The decision making process for UST removal, contamination assessment, and, if necessary, remediation at the Charleston Naval Complex sites is presented in the flow chart shown on Figure 4-1 and discussed in the following sections.

Regulated USTs are defined as those USTs that are greater than 110 gallons in capacity and the volume of which (including the volume of underground pipes connected thereto) is 10 percent or more beneath the surface of the ground. USTs described in the exclusions and exceptions under DHEC Underground Storage Tank Control Regulations R.61-92, Part 280 are not classified as regulated USTs.

4.1.1 Tank Closure Assessment

Procedures for assessing regulated USTs with no visible evidence of contamination or prior history of releases will follow the UST system closure procedures established in DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.* The Charleston Environmental Detachment will collect and analyze all appropriate soil and groundwater samples associated with closure procedures. An EPA certified lab will be used in conjunction with Table 4-1. Each tank will have an Assessment Report form completed per DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.*

4.1.1.1 Tank Removal Operations

After a utility search, the Charleston Environmental Detachment will remove the USTs and perform all soil screening during the tank removal process. Soil samples will be collected during tank removal and will have headspace screening performed using an organic vapor analyzer (OVA) equipped with a PID in accordance with procedures describe in EPA Publication #530/UST-90-003, September 1990, *"Field Measurements , Dependable Data When You Need It"* . Alternative methods for field screening may be used, such as, immunoassays. At the

time of tank removal, if excessively contaminated soil is detected, the Charleston Environmental Detachment will remove soil exceeding readings of 100 parts per million (ppm) TPH and replace the excavated material with clean fill. Free product encountered in the excavation pit will also be removed using the best available method (i.e. vacuum truck, skimmer pump, sorbent pads, etc.). Contaminated soil will be removed to the assessed depth of contamination or to the water table, whichever comes first. Excavation limitation aspects include but are not limited to, the following: (1) jeopardizing the structural integrity of a building, or (2) exceeding the abilities of the Charleston Environmental Detachment. As a guide, excessively contaminated soil is described as soil that is saturated with petroleum or petroleum products and that exhibits a total petroleum hydrocarbon reading on an OVA/immunoassay of > 100 ppm. If the tank contained used oil, a PID reading will not yield reliable results; therefore, visual inspection of the soil for petroleum contamination or immunoassays will be required. Final confirmatory sampling will be done in accordance with DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.*

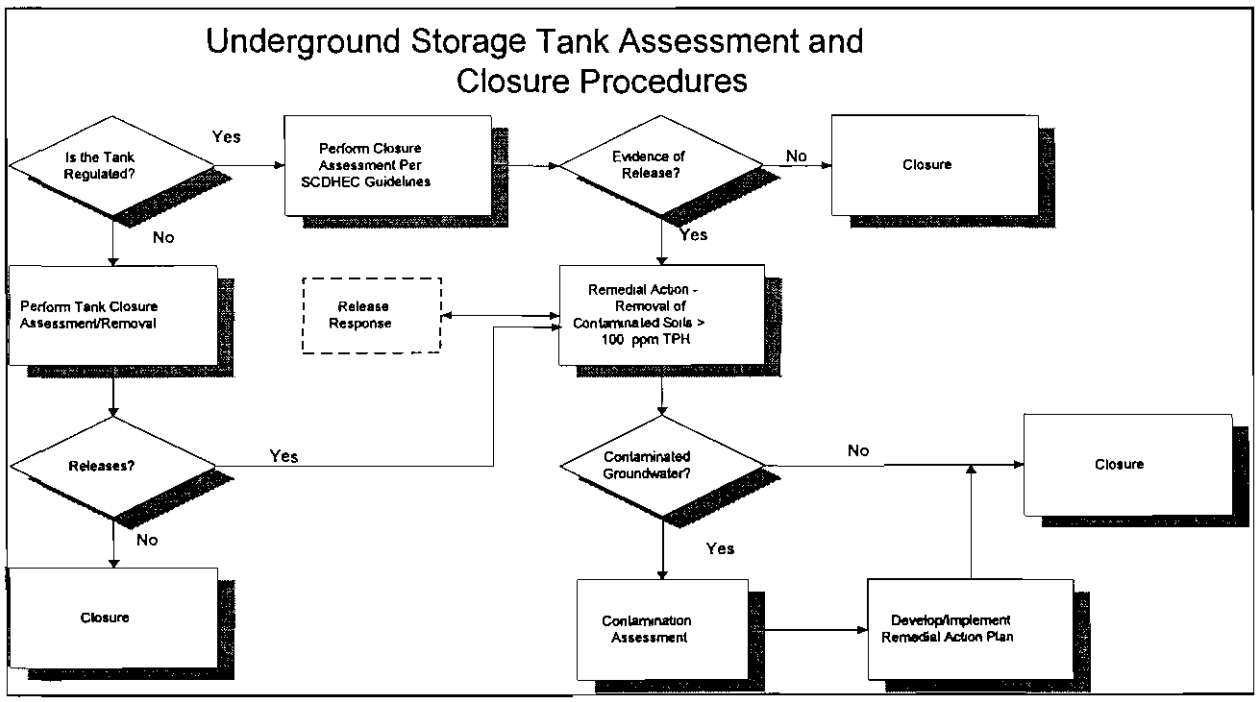


Figure 4 - 1

4.1.1.2 Assessment Program at Sites Where USTs Have Previously Been Removed

Although previously removed UST assessment does not fall under the scope of this document, it is recommended that investigations be performed to evaluate removal actions of tanks where a closure report does not exist. Some tanks were removed during a time period where, although not illegal, the methods of removal were not in compliance with today's strict standards. A contamination assessment is recommended.

4.1.2 Contamination Assessment and Initial Remedial Actions

If petroleum contamination remains either in the soil or groundwater after tank removal activities, a contamination assessment will be conducted. After development of an approved sampling plan, a soil boring program will be initiated to assess the horizontal and vertical extent of soil contamination. Soil borings will be advanced to the water table with samples being collected at 1 foot bls and every 2 feet thereafter until the water table is encountered. Samples collected from the soil borings will be field screened utilizing a PID or immunoassay analysis.

4.1.2.1 Initial Remedial Soil Removal Actions

After the horizontal and vertical extent of the contaminated soil has been assessed to the 100 ppm TPH concentration level, the Charleston Environmental Detachment will remove the contaminated soil from the site and replace it with clean fill. During the excavation process, soil borings will be advanced around the perimeter of the excavation and samples will be collected for OVA or immunoassay analysis to verify that petroleum contaminated soil has been removed from the site. Free product encountered in the excavation will be removed using the best available method (i.e., vacuum truck, skimmer pump, sorbent pads, etc.). Final determination of contaminant removal will be made using lab analysis and Table 4-1.

Table 4-1
Petroleum Analytical Groups
for Surface Water and Groundwater Samples
South Carolina Department of Health and Environmental Control

Base Realignment and Closure
Tank Management Plan
Charleston Naval Complex, Charleston, South Carolina

PRODUCT	SOIL SAMPLES			WATER SAMPLES		
	Analyate	**Method***	**RL****	**Analyate**	**Method***	**RL****
Gasoline Diesel Fuel Oil Kerosene	BTEX	8260	5ug/kg	BTEX	8260	5ug/l
	Naphthalene	8260	5ug/kg	Naphthalene	8260	5ug/l
	PAH	8270	660ug/kg	MTBE	8260	40ug/l
				PAH	8270	10ug/l
Used Oil	BTEX	8260	5ug/kg	BTEX	8260	5ug/l
	Naphthalene	8260	5ug/kg	Naphthalene	8260	5ug/l
	PAH	8270	660ug/kg	PAH	8270	660ug/l
	TPH	9071	10mg/kg	TPH	9070	10mg/l
	Metals	AA-ICP		Metals	AA-ICP	

BTEX	=	Benzene, Toluene, Ethyl-benzene, Xylene
PAH	=	Polynuclear Aromatic Hydrocarbons (Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene)
MTBE	=	Methyl Tertiary Butyl Ether
TPH	=	Total Petroleum Hydrocarbon
METALS	=	Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, Silver
AA-ICP	=	Atomic Absorption - Inductively Coupled Plasma
*	=	Or EPA equivalent method
**	=	Reporting Limit (RL)

4.1.2.2 Decision Process

If groundwater contamination exists at the site in significant amounts or soil contaminant levels continue to be above the levels for excessively contaminated soil, further contamination assessment will be conducted at the site to assess the horizontal and vertical extent of groundwater and soil contamination. If no or minimal groundwater contamination is detected at the site and soil contaminant levels are below the levels for excessively contaminated soil, a closure report will be prepared for the site.

Further contamination assessment will be performed for the site when groundwater contaminant concentrations exceed the target levels for clean closure or excessively contaminated soil is still present.

4.2 NON-REGULATED USTs

The decision making process for UST removal, assessment and, if necessary, remediation at non-regulated UST sites is presented in the flow chart shown on Figure 4-1 and discussed in the following sections.

Regulated USTs are defined as those USTs that are greater than 110 gallons in capacity and the volume of which (including the volume of underground pipes connected thereto) is 10 percent or more beneath the surface of the ground. USTs described in the exclusions and exceptions under DHEC Underground Storage Tank Control Regulations R.61-92, Part 280 are not classified as regulated USTs.

Non-regulated USTs that will be removed at the Charleston Naval Complex are predominantly heating oil storage tanks over 16 years old. Propane tanks have not been included in this TMP.

4.2.1 Tank Closure Assessment

Because the Charleston Naval Complex is being closed and base property transferred, non-regulated USTs on the base should undergo closure assessment similar to the requirements for regulated USTs. Therefore, the Charleston Environmental Detachment will collect and analyze appropriate soil and groundwater samples associated with UST closure procedures. Each tank will have an Assessment Report form per DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.*

4.2.1.1 Tank Removal Operations

After a utility search, the Charleston Environmental Detachment will remove the USTs. All UST soil screening during tank removal operations will be performed by Charleston Environmental Detachment. Soil samples will be collected during tank removal and will have headspace screening performed using an OVA equipped with a PID in accordance with procedures described in EPA Publication #530/UST-90-003, September 1990, *"Field Measurements , Dependable Data When You Need It"* . Alternative methods for field screening may be used, such as, immunoassays. At the time of tank removal, if excessively contaminated soil is detected the Charleston Environmental Detachment will remove soil exceeding the screening levels of 100 ppm TPH and replace the excavated material with clean fill. Free product encountered in the excavation will be removed to maximum extent possible using the best available method (i.e., vacuum truck, skimmer pump, sorbent pads, etc.). Contaminated soil will be removed to the assessed depth of contamination or to the water table, whichever comes first. Exeavation limitation aspects include, but are not limited to, (1) jeopardizing the structural integrity of a building, (2) exceeding the limitation of Charleston Environmental Detachment for soil removal. Excessively contaminated soil is described as soil that is saturated with petroleum or petroleum products and exhibits a total petroleum hydrocarbon reading on an OVA/immunoassay of > 100 ppm. If the tank contained used oil, a PID will not give reliable readings, therefore, visual inspection of the soil for petroleum contamination is required. Final confirmatory sampling will be done in accordance with DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.*

4.2.1.2 Soil Boring Program at Sites Where USTs Have Previously Been Removed

Although previously removed UST assessment does not fall under the scope of this document, it is recommended that investigations be performed to evaluate removal of tanks where a closure report does not exist. Some tanks were removed during a time period where, although not illegal, the methods of removal were not in compliance with today's strict standards. A contamination assessment is recommended.

4.2.2 Contamination Assessment and Initial Remedial Actions

A modified contamination assessment will be conducted at each site that continues to have contamination either in the soil or groundwater following tank removal. After development of an approved sampling plan, a soil boring program will be initiated to assess the horizontal and, perhaps, vertical extent of soil contamination. Soil borings will be advance to the water table and soil samples will be collected at 1 foot bls and every 2 feet thereafter, until the water table is reached. Soil samples collected from soil borings will be screened with a PID or immunoassay.

4.2.2.1 Initial Remedial Soil Removal Actions

After the horizontal and vertical extent of contaminated soil has been assessed to the 100 ppm TPH concentration level, the Charleston Environmental Detachment will remove the contaminated soil from the site and replace it with clean fill. During the excavation process, soil borings will be performed around the perimeter of the excavation and samples will be collected for OVA analysis to verify that petroleum contaminated soil has been removed from the site. In addition to the contaminated soil, if any free product is encountered in the excavation pit, it will be removed by the best available method (i.e., vacuum truck, skimmer pump, sorbent pads, etc.). Final determination of contamination removal will be made using lab analysis and Table 4-1.

4.2.2.2 Decision Process

If groundwater contamination exists at the site in significant amounts or soil contaminant levels continue to be above the levels for excessively contaminated soil, further contamination assessment will be conducted at the site to assess the horizontal and vertical extent of the groundwater and soil contamination. If no or minimal groundwater contamination is detected at the site and soil contaminant levels are below the levels for excessively contaminated soil, a closure report will be prepared for the site.

4.3 AST TANK CLOSURE ASSESSMENT

The decision making process for AST removal, assessment, and if necessary, remediation of AST sites is presented in the flow chart shown on Figure 4-2 and discussed in the following sections.

Currently, the state of South Carolina has no regulations governing the removal and closure of ASTs. In determination of how to close the applicable ASTs on the Charleston Naval Complex a conservative approach will be used. ASTs will undergo closure and assessment using procedures for regulated UST closure as a guide. The Charleston Environmental Detachment will collect and analyze appropriate soil and/or groundwater samples associated with AST closure procedures.

4.3.1 Tank Removal Operations

The Charleston Environmental Detachment will remove the ASTs, if necessary. Maps aecurately depicting the locations of the ASTs have been developed as part of the TMP; therefore, tank locations can be found after removal. Soil excavation is not expected to oecur during AST tank removal.

4.3.2 Soil Boring Program at AST Sites

The ASTs have been divided into two categories based on the tank size. For those ASTs with capacities greater than 550 gallons, five soil borings will be conducted. One soil boring will be placed directly beneath the area where the tank was located with four additional soil borings being placed around the tank perimeter at a maximum spacing of 20 feet. For ASTs of less than 500 gallon capacity, a minimum of one soil boring will be conducted. In each case, additional borings may be required based on piping configuration, visual evidence of a release, or if historical data on the tank system indicates that a release occurred at the site. The soil boring will be advanced to the water

table and soil samples will be collected at 1 foot bls and every 2 feet thereafter until the water table is encountered. Soil borings will be conducted via hand augering. It should be noted that a utility search will be performed for each site prior to soil boring.

Soil samples collected from the soil borings will have headspace screening performed using a PID in accordance with procedures described in EPA Publication #530/UST-90-003, September 1990, *"Field Measurements, Dependable Data When You Need It"*. Alternative methods for field screening may be used, such as, immunoassays.

If soil contamination is not detected during the soil boring program, no further assessment will be conducted at the site and a closure report will be prepared. If soil screening analyses indicate a discharge occurred at the site or there is soil contamination, an IRA will be initiated.

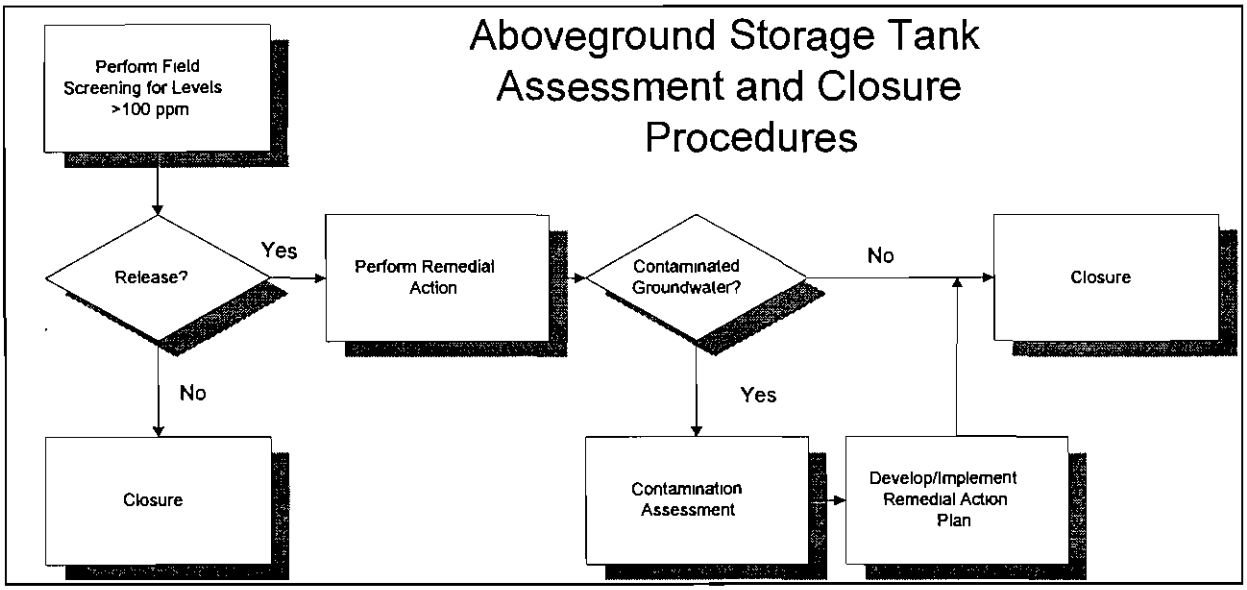


Figure 4 - 2

4.3.3 Initial Remedial Soil Removal Actions

The Charleston Environmental Detachment will assess the extent of soil contamination before performing IRA activities by conducting additional soil borings. Once the horizontal and vertical extent of contaminated soil has been assessed to the 100 ppm TPH concentration level, the contaminated soil will be removed and replaced with clean fill. The detachment will advance soil borings around the perimeter of the excavation and collect samples for OVA analysis or immunoassay to verify that petroleum contaminated soil has been removed from the site. Free product encountered in the excavation will be removed using the best available method (i.e., vacuum truck, skimmer pump, sorbent pads, etc.).

Contaminated soil will be removed to the assessed depth of contamination or to the water table, whichever comes first. Excavation limitations include but are not limited to, the following: (1) jeopardizing the structural integrity of a building, (2) exceeding the capabilities of the Charleston Environmental Detachment.

Generally, excessively contaminated soil is described as soil that is saturated with petroleum or petroleum products and that exhibits a total petroleum hydrocarbon reading on an OVA/immunoassay of >100 ppm. If the tank contained used oil, an OVA will not give reliable readings, therefore, visual inspection of the soil for petroleum contamination may be required.

4.3.4 Decision Process

If groundwater contamination exists at the site in significant amounts or soil contaminant levels continue to be above the levels for excessively contaminated soil, further contamination assessment will be conducted at the site to assess the horizontal and vertical extent of the groundwater and soil contamination. If no or minimal groundwater contamination is detected at the site and soil contaminant levels are below the levels for excessively contaminated soil, a closure report will be prepared for the site.

4.4 POST TANK REMOVAL PLANNING AND SCHEDULING

Upon completion of tank removal operations, additional assessment work will be conducted at those sites that have confirmed soil or groundwater contamination. Investigations and assessments will be coordinated to support the transfer of property as needed.

4.5 FIELD INVESTIGATION

Contamination Assessment (CA) phase of the project will continue at each site determined to require further assessment. The CA will continue with the placement and sampling of an appropriate number of groundwater monitoring wells at the site to adequately characterize the groundwater contaminant plume and to assess the horizontal and vertical extent of the plume. All monitoring wells, whether temporary or permanent, will have DHEC approval using the applicable request forms.

Monitoring wells will be constructed of 2-inch nominal, Schedule 40, flush-threaded, polyvinyl chloride (PVC) screen and casing. Screen length will be 10 feet with slot size openings of 0.010 inch. At least 1 foot of screen will be placed above the water table to allow free-floating petroleum product to enter the well. The screen will be surrounded with a quartz sand filter pack 20/30 gradation size (or an acceptable equivalent) to at least 2 feet above the top of the screen. A 1-foot bentonite seal will be placed above the filter pack. The remaining annulus will be grouted to the ground surface with Portland Type 1 cement. A locking, watertight cap will be installed on each well.

Twenty-four hours following well construetion, the well will be developed by pumping or bailing until purged water is clear and relatively free of sedünent assuring a good hydraulic connection with the surrounding aquifer.

4.6 CONTAMINATION ASSESSMENT REPORT

Upon completion of field investigation and receipt of the groundwater laboratory analytical results of the groundwater samples, a Contamination Assessment Report (CAR) will be prepared and submitted to SDIV for review.

A general CAR will be prepared for tank sites at the Charleston Naval Complex which exhibited soil/groundwater contamination. The general CAR will discuss procedures and methodologies used during the assessment and remedial actions performed. Information will inelude a description of the soil and hydrology in the immediate area, local receptors, etc. The DHEC Assessment Report Form will be included in each case.

4.7 FOLLOW-UP REPORTS AND POTENTIAL REMEDIAL ACTION

Based on the findings and conelusions of the CARs, a No Further Action (NFA) proposal, a Monitoring Only Plan (MOP), or a Remedial Action Plan (RAP) will be prepared for each site.

5.0 MANAGEMENT OF INVESTIGATIVE DERIVED WASTES (IDW)

This Section describes procedures for IDW management that will be implemented during BRAC field investigation and IRAs at the Charleston Naval Complex tank removal sites. Section 5.1 defines specific types of IDW expected to be generated at the facility and presents the disposal options available for each type of IDW. Section 5.2 describes equipment and logistics that will be used for IDW management. A list of options for disposal of petroleum contaminated solid earthen waste and other non hazardous IDW are presented in Section 5.3.

Procedures outlined in this section will be used at the Charleston Naval Complex to minimize the amount of IDW generated and to remove those wastes that pose an immediate threat to human health or the environment. While managing IDW, the goal of the project team is also to minimize disturbance of the site created by IDW handling, transportation, and management.

For the purposes of IDW management, a site is generally considered to be a discrete land area on or in which there is contiguous contamination. An example of such a site may include the area occupied by a UST or AST and the surrounding contaminated soil.

5.1 TYPE OF IDW

Three general types of IDW are expected to be generated during tank removal operations, field investigations, and IRAs: solid earthen wastes (e.g. dry drill cuttings), solid non-earthen wastes (e.g. personal protective equipment), and liquid wastes (e.g. purge water from monitoring wells and wash water from decontamination procedures). Subsections 5.1.1 through 5.1.3 provide general descriptions of solid and liquid IDW and the disposal options available for each. Figure 5-1 illustrates the steps in the solid IDW management decision making process. Figure 5-2 illustrates the steps in the liquid IDW management decision making process. IDW will be managed in accordance the Ensafe/Allen & Hoshall, *Final Comprehensive Sampling and Analysis Plan.*

Drilling mud and wet drill cuttings generated during mud rotary and hollow stem auger drilling activities are IDW that are composed of both liquids and solids; therefore, the strategies for liquid or solid waste management are, individually, not sufficient for these types of waste disposal. Specific procedures for the proper management of drilling mud and wet cuttings are presented in Subsection 5.1.3.

5.1.1 Earthen Waste

Contaminants of concern at UST program sites are assumed to be petroleum related products and, as such, are excluded from being classified as Resource Conservation and Recovery Act (RCRA) hazardous waste under the Code of Federal Regulations, Title 40, Part 261.4 (40 Code of Federal Regulation [CFR] 261.4). Petroleum contaminated earthen waste will be disposed using one or more of the approved disposal options. Options for disposal of petroleum contaminated soil are listed in Section 5.3.

All soils generated during investigations or UST removals will be appropriately containerized or stock piled until contamination levels can be determined. The following are possible disposal scenarios for the soils:

- Soil determined to be below 100 ppm TPH during field screening will be returned to the site.
- Soil determined to above 100 ppm TPH but not a hazardous waste will be treated/disposed of using an applicable method listed in paragraph 5.3.
- Soil determined to be a listed hazardous waste or characteristically hazardous will be managed and disposed of in accordance with applicable State and Federal Regulations.

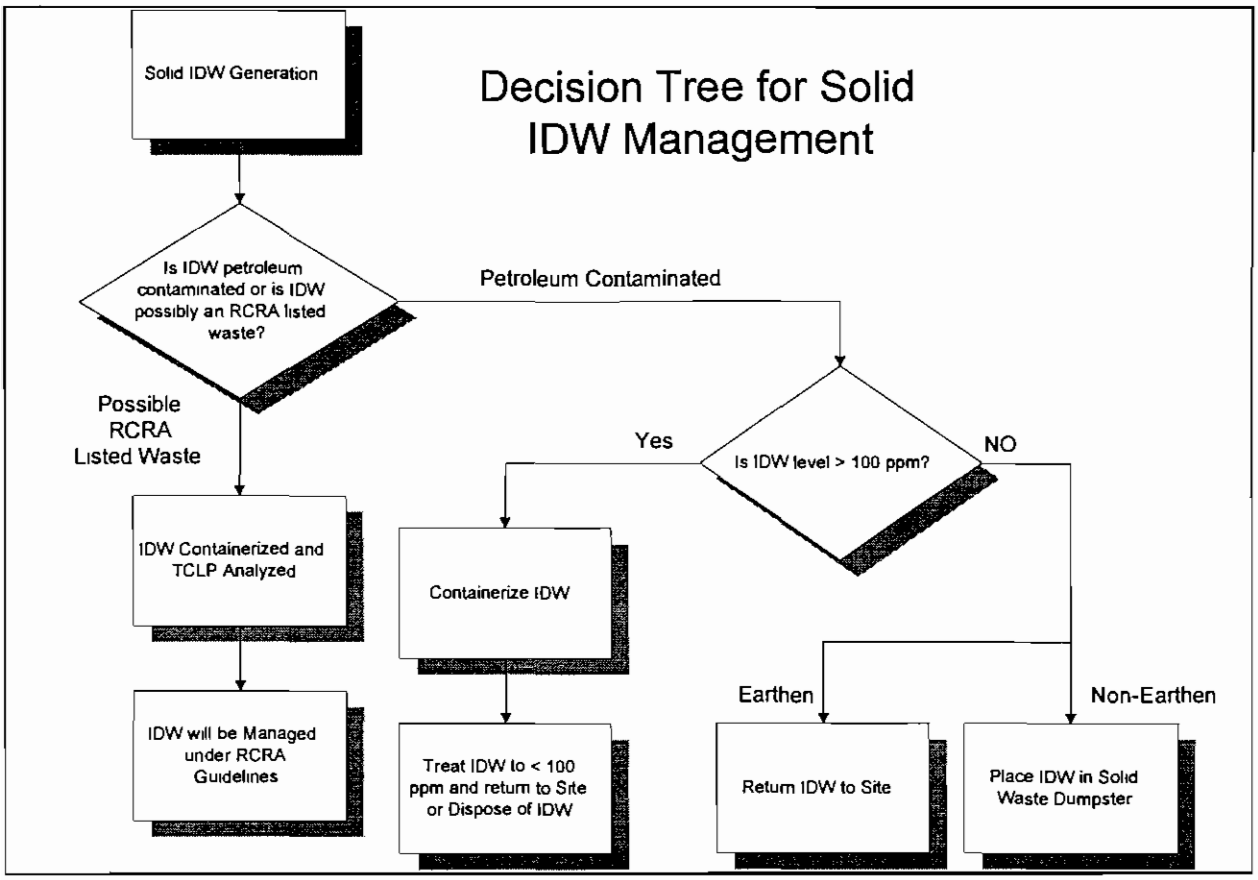


Figure 5 - 1

5.1.2 Liquid Waste

Liquid waste includes development or purge water from monitoring wells, decontamination fluids, and oily water from tank excavations. All liquid waste will be containerized until contamination levels are determined. The following are possible disposal scenarios for the liquids:

- Liquids meeting the NPDES discharge limits will be disposed of by discharging to a sanitary sewer.
- Liquid above NPDES limits for oily water will be processed through an oil water separator. The water will be discharged as described above. Resultant oily waste will be disposed of in accordance with applicable State and Federal regulations.
- Liquid containing listed RCRA wastes or is characterized as hazardous will be disposed of in accordance with the applicable state and Federal regulations.

5.1.3 Drilling Mud and Wet Drill Cuttings

Drilling mud and wet drill cuttings are characteristically slurries or sludge-like substances, consisting of both liquid and solid earthen constituents. Drilling mud should be containerized and temporarily stored at the location of

generation. The mud containers must remain undisturbed to facilitate gravity separation of solids and liquids. The liquid waste will then be decanted and treated as liquid IDW as described previously.

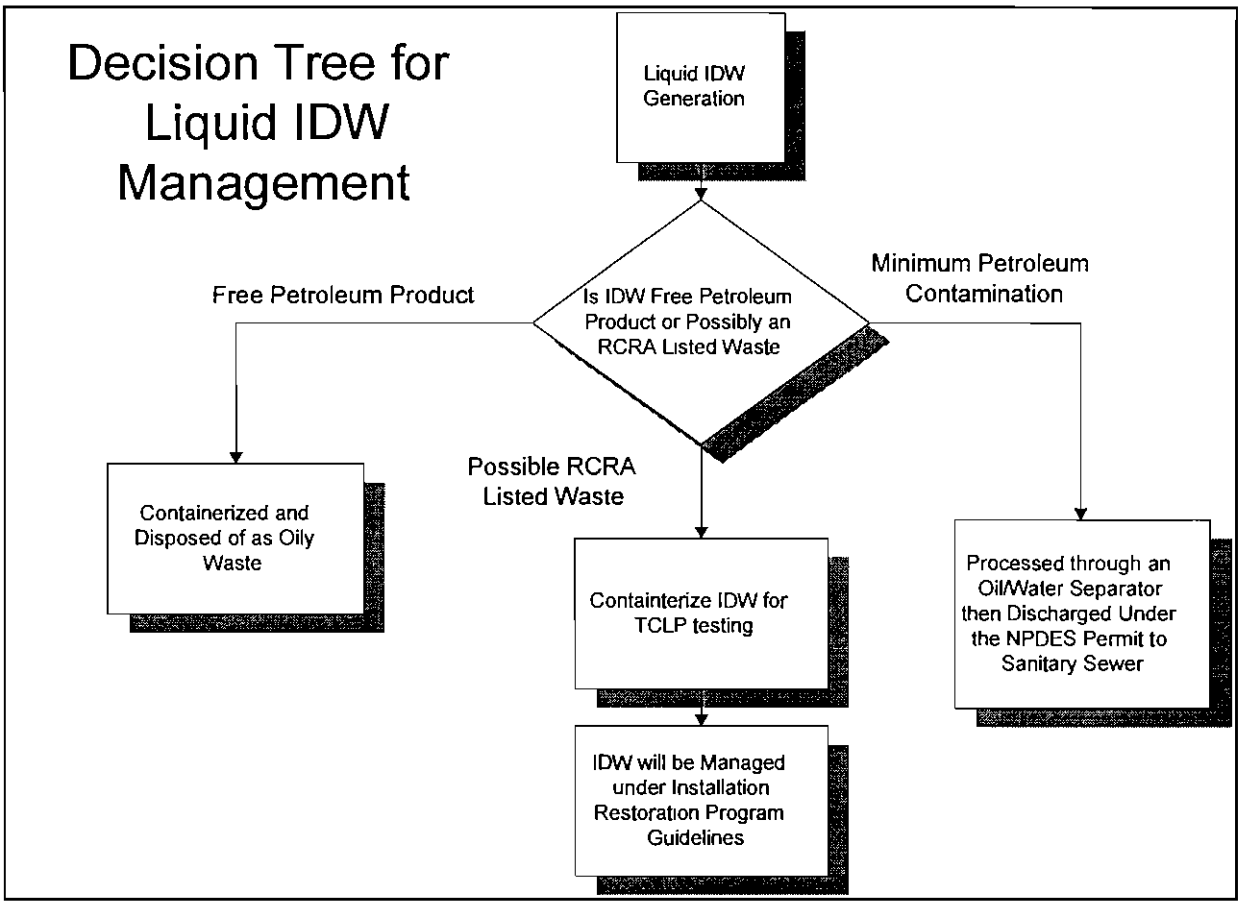


Figure 5 - 2

5.2 EQUIPMENT

5.2.1 Decontamination Pads

Equipment to be decontaminated during the project may include drilling rigs, tools, monitoring equipment, respirators, sample containers, trucks or trailers, and laboratory equipment. Decontamination will be accomplished using Ensafe/Allen and Hoshall's, *Final Comprehensive Sampling and Analysis Plan* which was developed for the Charleston Naval Complex and the EPA's *Standard Operating Procedures Quality Assurance Manual.*

Three types of decontamination pads may be used:

- Small temporary decontamination facilities may be established on site for tank removal and IRAs.
- A small decontamination station may be used to decontaminate field sampling equipment. Rinsate is captured in the bottom of the station and managed as liquid IDW.
- A large decontamination station located on base may be used to decontaminate heavy equipment. Decontamination fluids are collected in a drum and managed as a liquid IDW.

5.2.2 Containers

Most of the containers used on site will be H- type or F- type 55- gallon steel drums. The drums must be in compliance with US Department of Transportation (DOT), 49 CFR Part 173. Open head drums (H type) will be constructed of 16-gauge steel, top, bottom, and body, as a minimum. Tops will be secured with a 12 -gauge bolt ring, bolt, nut, and a sponge rubber gasket. Closed head drums (F type) will be constructed of 18- gauge steel, top, bottom, and body, as a minimum. F- type drums will have two fittings in the top, 2 -inch and 0.75- inch, one for filling and one for venting.

Other containers that may be used on site for storage of liquid IDW include: a water truck or tanker, 300- to 1,000-gallon high density polyethylene (HDPE) tanks, and Baker tanks. Other containers that may be used on site for solid IDW storage include a dump truck, dumpster, or roll -off container.

5.2.2.1 Labels

Drummed waste must be clearly marked with the contents, well number/site number, and date containerized. All containerized waste must have either a hazardous waste or nonhazardous waste label affixed to the drum. Labeling will be accomplished using Ensafe/Allen & Hoshall, *Final Comprehensive Sampling and Analysis Plan* as a guide.

5.2.2.2 Waste Storage and Management

All containerized earthen wastes left on site for management during pending remedial actions will be stored in a manner that is appropriately protected (e.g. roll-off bins will be covered to avoid potential exposure to personnel). Measures will be taken to prevent inadvertant access to stored waste where determined by the Navy to be necessary or otherwise appropriate. Empty drums must be rinsed to remove significant soil deposits and transported to a designated storage area. The drums must be stored in a manner that minimizes the area required while maintaining easy access. Drums must not be stacked greater than two in height. Lids must be secured on the drums to prevent rainfall intrusion.

5.3 DISPOSAL OPTIONS FOR PETROLEUM-CONTAMINATED SOIL

Contaminated soil excavated from a site during tank removal activities or IRAs will be treated or disposed of either on the Charleston Naval Base Complex or off site. Soil disposal at a thermal treatment facility, landfill, or ex-situ bio-remediation facility are the preferred options for soil remediation.

5.3.1 Site Considerations

The disposal option should be identified before excavation takes place.

- Contamination should not be spread into previously uncontaminated areas through untreated discharges or improper treatment/disposal techniques. Stockpiling soil on site indefinitely is unacceptable. Therefore, on site stockpiling should be limited to 1 month or less.

- Soil contaminated with waste oil will be segregated from other petroleum contaminated soils. Soils contaminated with waste oil require additional sampling in accordance with the DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service.*

- At sites where both gasoline and diesel contamination may exist, care must be taken in assessing the extent of contamination due to the differences in volatility.

6.0 SCHEDULE

The Charleston Naval Complex is scheduled for operational closure on 1 April 1996.

The schedule for tank removal is based on building use, function, and planning, whether the storage tank provides the only source of heat or hot water to building, and the age and condition of the tank. Storage tank removals have been scheduled for 1996, 1997, and 1998. A more detailed description on the tank removal schedule is contained in section 3.3.2.

7.0 REPORTS

The overall objective of the initiative that includes the TMP is to remove storage tank systems at the Charleston Naval Complex and to investigate and remediate any associated petroleum contamination resulting from operations of those storage tank systems. The primary reports generated for this program will be Tank Closure Reports. Other reports include Contamination Assessment Reports, No Further Action Proposals, Monitoring Only Plans, and Remedial Action Plans.

7.1 TANK CLOSURE REPORTS

Tank closure reports will consist of letter reports that include a discussion of the sample types, sample locations, and measurement methods; a site map; methods of maintaining QA/QC; and the results of all analyses of samples from the site. In addition, the Closure Assessment Form described in the DHEC *Assessment Guidelines for Permanent Closure Change-in-Owner and Change-in-Service* will be included.

At sites where contaminated soil is encountered during tank removal operations and an IRA is conducted, information on the OVA/immunoassay concentrations of contaminants in the soil, the amount of soil removed, and disposal of the contaminated soil will be included with the Tank Closure Assessment Form.

7.2 OTHER REPORTS

For those sites where there is a significant amount of soil or groundwater contamination such that an IRA cannot bring the contamination below target levels, a CAR will be prepared after additional field investigations obtain all necessary data. A discussion of the contents of the CAR is presented in Section 4.6. After the CAR has been submitted to and approved by DHEC, a follow-up report will be prepared. The follow-up report will depend on the amount and extent of the contamination and could include a No Further Action Request, a Monitoring Only Plan, or a Remedial Action Plan. A discussion of the follow-up reports is presented in Section 4.7.

Whichever report pathway is taken, the overall objective of the program is to reach tank closure in as short a time as possible. Follow-up report plans such as a MOP or RAP will contain alternatives that reflect the short schedule philosophy.

8.0 HEALTH AND SAFETY PLAN

Health and Safety precautions necessary while conducting the tasks outlined in the TMP are covered in the *Comprehensive Health and Safety Plan* written for the Charleston Naval Complex by Ensafe/Allen & Hoshall . More detailed information concerning site specific health and safety concerns will be addressed in the individual Work Plan as a Site Specific Health and Safety Plan.