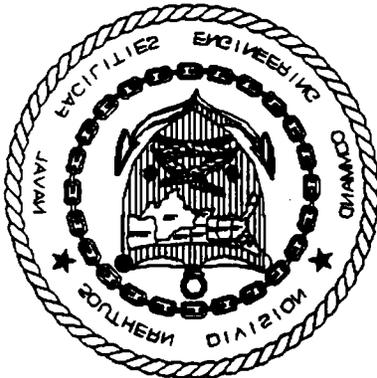


N00639.AR.001914  
NSA MID SOUTH  
5090.3a

FINAL PLAN OF ACTION NAVY EXCHANGE SERVICE STATION FACILITY ID #0-791718  
MILLINGTON SUPPACT TN  
7/7/2000  
ENSAFE

**FINAL PLAN OF ACTION  
NAVY EXCHANGE SERVICE STATION  
FACILITY ID #0-791718  
NAVY SUPPORT ACTIVITY MID-SOUTH  
MILLINGTON, TENNESSEE**



**SOUTHNAVFACENGCOM  
Contract Number: N62467-98-D-0937**

**Delivery Order: 0020**

**Prepared for:**

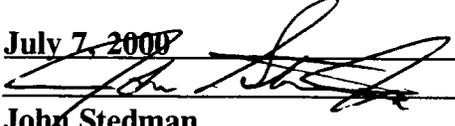
**Department of the Navy  
Southern Division  
Naval Facilities Engineering Command  
North Charleston, South Carolina**

**Prepared by:**

**EnSafe Inc.  
5724 Summer Trees Drive  
Memphis, Tennessee 38134  
(901) 372-7962**



**The Contractor, EnSafe, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-98-D-0937 are complete, accurate, and comply with all requirements of the contract.**

**Date:** July 7, 2000  
**Signature:**   
**Name:** John Stedman  
**Title:** Task Order Manager

## Table of Contents

List of Abbreviations . . . . .	v
1.0 INTRODUCTION . . . . .	1
2.0 SITE HISTORY AND PREVIOUS INVESTIGATIONS . . . . .	2
3.0 SOIL INVESTIGATION PROCEDURES . . . . .	4
3.1 Number and Location of DPT . . . . .	4
3.2 DPT Methods . . . . .	4
3.3 Procedures for Sample Collection . . . . .	4
3.3.1 Equipment and Collection . . . . .	4
3.3.2 Procedure for Selection of Soil Samples . . . . .	6
3.4 Analytical Methods . . . . .	8
3.4.1 Petroleum Analysis . . . . .	8
3.4.2 Fractional Organic Carbon Analysis . . . . .	8
3.4.3 Soil Property Analysis . . . . .	8
3.5 DPT Hole Abandonment . . . . .	9
3.6 Decontamination Procedures . . . . .	9
3.7 Investigation-Derived Waste . . . . .	10
4.0 GROUNDWATER INVESTIGATION PROCEDURES . . . . .	11
4.1 Groundwater Sampling . . . . .	11
4.1.1 Equipment and Collection . . . . .	11
4.2 Sample Containers and Preservation . . . . .	11
4.3 Analytical Methods . . . . .	12
4.4 Groundwater Classification . . . . .	12
4.5 Decontamination Procedures . . . . .	12
4.6 Investigation-Derived Waste . . . . .	12
5.0 HEALTH AND SAFETY PLAN . . . . .	13
5.1 Introduction . . . . .	13
5.2 Site Characterization . . . . .	13
5.2.1 Site Description . . . . .	13
5.2.2 Work Areas . . . . .	14
5.2.3 Work Area Access . . . . .	15
5.2.4 Work Zones . . . . .	15
5.3 Site Activities . . . . .	15
5.3.1 Soil Sampling . . . . .	15
5.3.2 Groundwater Sampling . . . . .	15
5.4 Chemical Hazards . . . . .	16
5.5 Operations and Physical Hazards . . . . .	16
5.6 Employee Protection . . . . .	17

5.6.1	Standard Safe Work Practices	17
5.6.2	NSA Mid-South General Rules of Conduct	17
5.6.3	Selection of Personal Protective Equipment	17
5.6.4	Air Monitoring	18
5.6.5	Procedures and Equipment for Extreme Hot or Cold Weather Conditions	20
5.7	Personal Decontamination	20
5.7.1	Personal Decontamination Procedures	20
5.7.2	Closure of the Personal Decontamination Station	21
5.8	Work Limitations	21
5.9	Exposure Evaluation	21
5.10	Medical Monitoring Program	21
5.11	Authorized Personnel	21
5.11.1	Responsibilities of Onsite Supervisor	22
5.11.2	Responsibilities of Site Health and Safety Officer	22
5.11.3	Responsibilities of Onsite Field Staff	22
5.12	Emergency Information	22
5.12.1	Site Resources	23
5.12.2	Emergency Procedures	23
5.13	Forms	25
6.0	QUALITY ASSURANCE PLAN	26
6.1	Introduction	26
6.2	Quality Assurance/Quality Control Objectives	26
6.2.1	Field Measurements	27
6.2.2	Laboratory Analyses	27
6.2.3	Representativeness	28
6.2.4	Completeness	28
6.2.5	Comparability	28
6.3	Project Organization and Responsibilities	29
6.3.1	Oversight	29
6.3.2	Investigation Performance	29
6.4	Decontamination Procedures	30
6.5	Soil Sample Documentation	30
6.6	Groundwater Sample Documentation	31
6.7	Sample Management	31
6.7.1	Sample Containers, Preservatives, Holding Times	31
6.7.2	Sample Preservation	32
6.7.3	Packaging Samples for Shipment	32
6.7.4	Sample Labels	34
6.7.5	Sample Chain-Of-Custody	37
6.8	Documentation	41
6.8.1	Field Records	41
6.8.2	Document Control	42

6.9	Analytical Procedures . . . . .	43
6.9.1	Field Analyses . . . . .	43
6.9.2	Laboratory Analyses . . . . .	44
6.9.3	Calibration Procedures and Frequency . . . . .	45
6.10	Data Reduction, Validation, and Reporting . . . . .	45
6.11	Field and Laboratory Quality Control Checks . . . . .	45
6.11.1	Field Data Quality . . . . .	45
6.11.2	Field Data Package . . . . .	47
6.11.3	Analytical Data Package . . . . .	47
6.12	Performance and System Audits . . . . .	48
6.12.1	Field System Audits . . . . .	49
6.12.2	Laboratory Systems Audit . . . . .	49
6.13	Preventive Maintenance . . . . .	49
6.14	Corrective Action . . . . .	49
6.15	Quality Assurance Reports . . . . .	50
7.0	REFERENCES . . . . .	51

## List of Figures

Figure 2-1	Site Map . . . . .	3
Figure 3-1	Proposed DPT Locations . . . . .	5
Figure 6-1	Sample Label . . . . .	35
Figure 6-2	Custody Seal . . . . .	38
Figure 6-3	Chain-of-Custody Form . . . . .	39

## List of Tables

Table 3-1	Procedure for Selection of Soil Samples for Laboratory Analyses . . . . .	6
Table 3-2	Soil Cleanup Levels . . . . .	9
Table 5-1	Exposure Guidelines for Site Chemical Hazards . . . . .	16
Table 6-1	Field Measurements QA Targets . . . . .	27
Table 6-2	Laboratory Measurement QA Objectives . . . . .	32
Table 6-3	Sample Containers and Preservatives . . . . .	44

## List of Appendices

Appendix A	Material Safety Data Sheets
Appendix B	Directions to the Nearest Hospital
Appendix C	Forms

## List of Acronymns and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
AQTESOLV	Aquifer Test Solver
BPA	Blanket Purchase Agreement
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CHASP	Comprehensive Health and Safety Plan
cm	Centimeter
COC	Chain of Custody
CTO	Contract Task Order
DPT	Direct-Push Technology
DQO	Data Quality Objective
EAR	Environmental Assessment Report
EIC	Engineer-in-Charge
EnSafe	EnSafe Inc.
FID	Flameionization Detector
$f_{oc}$	Fractional Organic Carbon
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
ID	Identification
IDW	Investigation-derived Waste
lbs	Pounds
LEL	Lower Explosive Limit
LQAC	Laboratory Quality Assurance Coordinator
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
msl	Mean Sea Level
MTBE	Methyl-tertiary-butyl-ether
NCR	NFESC Contract Representative
NEESA	Naval Energy and Environmental Support Activity

NEX	Navy Exchange
NFESC	Naval Facilities Engineering Support Center (formerly NEESA)
NIOSH	National Institute for Occupational Safety and Health
NSA Mid-South	Naval Support Activity Mid-South
OSHA	Occupational Safety and Health Administration
OVD	Organic Vapor Detector
PE	Performance Evaluation
PEL	Permissible Exposure Limit
PHSO	Project Health and Safety Officer
PID	Photoionization Detector
POA	Plan of Action
POTW	Publicly Owned Treatment Works
PPE	Personal Protective Equipment
ppm	Part per million
QA	Quality Assurance
QAP	Quality Assurance Plan
QC	Quality Control
REL	Recommended Exposure Limit
RPD	Relative Percent Difference
sec	Second
SHSO	Site Health and Safety Officer
SO	Service Order
SOP	Standard Operating Procedure
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SOW	Statement of Work
SSHSP	Site-Specific Health and Safety Plan
TCLP	Toxicity Characteristic Leaching Procedure
TDEC	Tennessee Department of Environment and Conservation
TLV	Threshold Limit Value
TN-GRO	Tennessee-Gasoline Range Organics
TPH-GRO	Total Petroleum Hydrocarbon-Gasoline Range Organics
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

## **1.0 INTRODUCTION**

At the request of the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), EnSafe Inc. (EnSafe) has prepared the following plan of action (POA) to determine the nature and extent of contamination at the Navy Exchange (NEX) service station (Facility ID #0-791718) at Naval Support Activity Mid-South (NSA Mid-South ). According to the Statement of Work (SOW) #198 submitted to EnSafe by SOUTHNAVFACENGCOM, the NEX service station includes two abandoned automotive service buildings, fuel pump islands, and underground storage tanks (USTs) containing leaded and unleaded regular gasoline, which have leaked in the past. Results from this investigation and previous groundwater monitoring will be presented in a Contamination Assessment Report Addendum. Evaluation of corrective actions for this site will be presented as an addendum to the 1993 Corrective Action Plan.

## **2.0 SITE HISTORY AND PREVIOUS INVESTIGATIONS**

According to documents provided by the Navy, three leaks/spills have occurred at the NEX service station. Previous studies were conducted by Harding Lawson Associates in 1987 and 1988 and ERC Environmental and Energy Services Company in 1989 and 1990. In February 1986, 5,000 gallons of regular unleaded gasoline leaked from a piping joint under pump island No. 4. In March 1987, another leak, 384 gallons, was discovered in the regular unleaded gasoline lines. During repair, a regular leaded line was ruptured and 24 gallons of leaded gasoline leaked. An estimated total of 5,400 gallons of unleaded and leaded regular gasoline were released into the subsurface (Harding Lawson Associates, 1988).

According to the Corrective Action Plan by the United States Geological Survey (USGS), there are hydrocarbon contaminated soil areas south of each building and in the area of the fuel pump islands (USGS, 1993). In addition, three areas exhibited substantial benzene and hydrocarbon contamination in the groundwater. The first area is in the center of the existing pump islands. The second is in the area of the USTs, and lastly, the third is near the oil-water separator. Figure 2-1 shows a site map of the NEX service station.



### **3.0 SOIL INVESTIGATION PROCEDURES**

The NEX service station site will be assessed using the direct-push technology (DPT). All utilities, lines, and storage tanks will be identified to prevent damage. Potential soil contamination will be evaluated using DPT, continuous soil sampling, field screening, and laboratory analyses of selected samples. In addition, a maximum of five groundwater samples will be collected from DPT locations outside the impacted area.

#### **3.1 Number and Location of DPT**

Initially, soil samples will be collected from 28 DPT locations spaced approximately 100 feet on center with the exception of two DPT locations that are near buildings. During the investigation, additional soil samples may be collected from up to 17 additional DPT locations to define the extent of petroleum contamination or at the discretion of the environmental coordinator. Proposed DPT locations shown on Figure 3-1 are approximate, and may be revised due to structural interferences or site conditions.

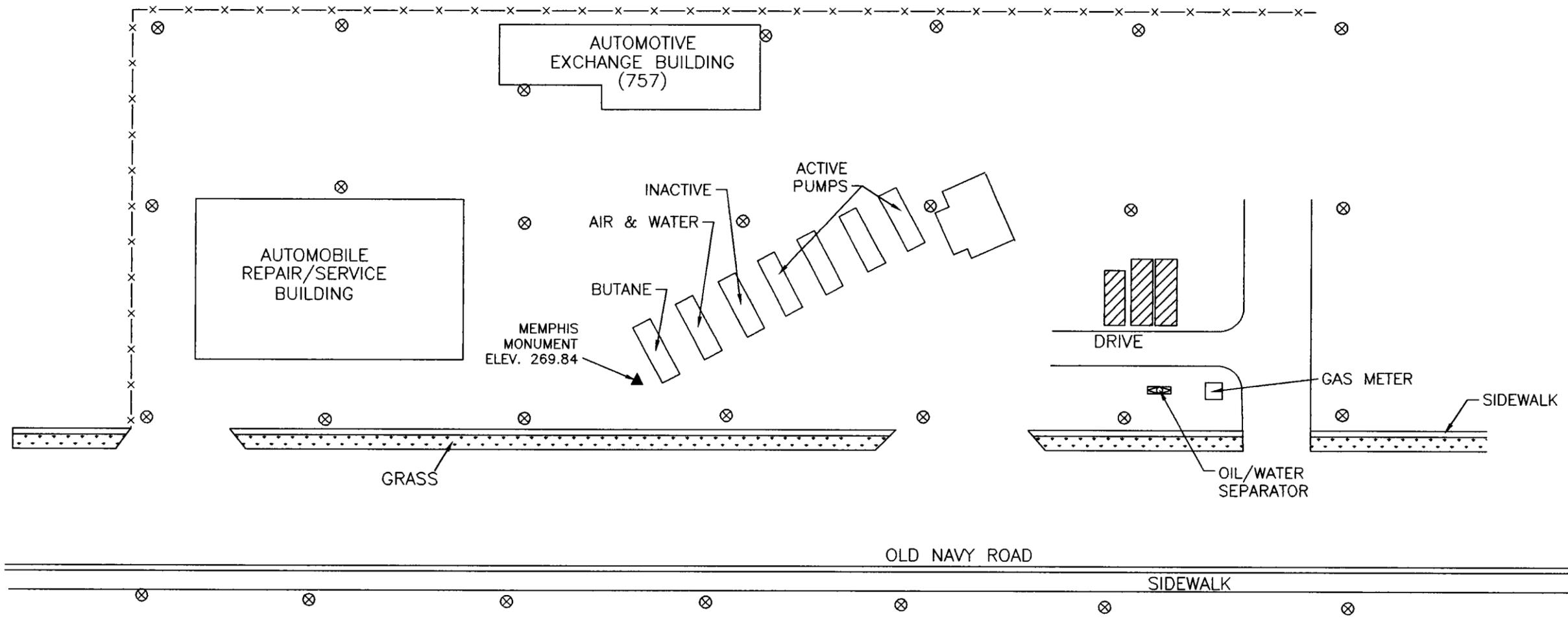
#### **3.2 DPT Methods**

Each DPT location will be completed to a maximum depth of 20 feet below land surface to adequately define the petroleum soil contamination. The pushes will be sampled continuously and field-screened with an organic vapor detector (OVD). Previous investigations indicated the soil contamination was limited to approximately 12 feet below land surface, and due to the existing site conditions, contamination migration beyond 20 feet below land surface is unlikely.

#### **3.3 Procedures for Sample Collection**

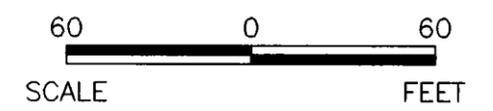
##### **3.3.1 Equipment and Collection**

Using a four-wheel-drive, truck-mounted, hydraulic probe, soil will be sampled from the ground surface to a depth of 20 feet at each of the locations. Each sample will be collected with



LEGEND

- ⊗ - PROPOSED DPT LOCATIONS
- x---x---x--- - FENCE
- ▨ - UNDERGROUND STORAGE TANKS



NAVAL SUPPORT ACTIVITY  
MID-SOUTH  
MILLINGTON, TENNESSEE

FIGURE 3-1  
PROPOSED DPT LOCATIONS  
NAVAL EXCHANGE SERVICE STATION SITE  
FACILITY ID NO: 0-791718

a 4-foot-long, 2-inch-diameter macro-core sampler with disposable liner or similar sampling tool that can provide similar sample volumes.

### 3.3.2 Procedure for Selection of Soil Samples

#### Petroleum Samples

From each location, soil samples from 3- to 4-foot intervals will be collected, visually logged, divided into two equal portions, and properly labeled. Each portion will be placed in a clean, air-tight container such as a sealable plastic bag. One portion will be immediately placed on ice for possible laboratory analysis. The other portion will be retained for headspace screening. This portion will be allowed to volatilize for at least of 15 minutes at a minimum temperature of 68° Fahrenheit. All samples will be allowed to volatilize for an approximately equal period of time before screening. After volatilization has occurred, the headspace will be screened using an OVD. The number of samples taken will be based on the procedure outlined in Table 3-1. Each sample is then placed in a jar that is properly labeled and stored at 4°C until it is delivered to a laboratory approved by the Tennessee Department of Environment and Conservation (TDEC). A chain-of-custody form will be completed for each soil sample collected and signed by the person collecting the sample and the laboratory receiving the sample. Sample security will be maintained during all phases of transport.

**Table 3-1  
 Procedure for Selection of Soil Samples for Laboratory Analyses**

Sample Condition	Number of Samples To Be Analyzed	Samples to be Analyzed
No indication of contamination from either organic vapor detector (OVD) field screening or olfactory/visual detection	1	1) The sample collected immediately above the water table or the bottom of the boring, whichever occurs first

**Table 3-1**  
**Procedure for Selection of Soil Samples for Laboratory Analyses**

Sample Condition	Number of Samples To Be Analyzed	Samples to be Analyzed
No indication of contamination from OVD field screening, but there is visual and/or olfactory observation of contamination	2	1) The sample which appears to have the highest concentration of contamination based on visual/olfactory detection  2) The sample collected immediately above the water table or the bottom of the boring, whichever occurs first
OVD readings indicate contamination in the soil	3*	1) The sample in which the OVD indicates the highest level of concentration  2) The deepest sample which the OVD indicates is contaminated  3) The sample collected immediately above the water table or the bottom of the boring, whichever occurs first

**Note:**

\* = If one soil sample meets more than one of the above-listed criteria, the sample with the second highest OVD screening will be submitted for analyses.

**Fractional Organic Carbon Analysis Samples**

A soil sample will be collected from the location at a depth equal to 1 foot below the bottom of the tank pit. The sample will be placed in a laboratory-prepared jar, properly labeled and submitted to a laboratory to determine the fractional organic carbon ( $f_{oc}$ ) content.

**Soil Properties Samples**

Two Shelby tube soil samples will be collected in the unsaturated zone, within or below the zone of suspected soil contamination. One sample will be collected at the depth anticipated to represent the zone of highest permeability; the second sample will be collected immediately above the water

table. If one of the Shelby tube samples meets both of these criteria, the other Shelby tube sample will be collected at a depth where the second highest permeability is expected.

### **3.4 Analytical Methods**

#### **3.4.1 Petroleum Analysis**

The NEX Service Station was documented in SOW #198 to have stored USTs containing gasoline; therefore, soil samples selected for laboratory analyses will be tested for benzene, toluene, ethylbenzene, xylene (BTEX); methyl-tertiary-butyl-ether (MTBE); and total petroleum hydrocarbons — gasoline range organic (TPH-GRO). In addition, a minimum of ten samples with the highest benzene concentrations will be analyzed for Toxicity Characteristic Leaching Procedure (TCLP) lead to help evaluate disposal alternatives. For laboratory analytical methods, refer to Section 6.9.

#### **3.4.2 Fractional Organic Carbon Analysis**

In determining the  $f_{oc}$  content of the soil, the laboratory will use one of the following methods: Walkey/Black, Lloyd Kahn, or ASTM Method D2974-87 (Nelson & Summers).

#### **3.4.3 Soil Property Analysis**

The two Shelby tube soil samples will be tested to determine the soil permeability in the unsaturated zone within any zone of suspected contamination and below it. Permeability testing will be in accordance with either Section 2.8 (Triaxial Cell) or 2.9 (Pressure-Chamber Permeameter) of Method 9100 of *Test Methods for Evaluating Solid Waste*, Third Edition (SW-846). The laboratory will be asked to select the most permeable section of the sample and to determine the following properties:

Permeability	centimeters (cm)/second (sec)
Volumetric Air Content	cm <sup>3</sup> -air/cm <sup>3</sup> -soil
Volumetric Water Content	cm <sup>3</sup> -H <sub>2</sub> O/cm <sup>3</sup> -soil
Total Soil Porosity	cm <sup>3</sup> /cm <sup>3</sup> -soil
Soil Bulk Density	g-soil/cm <sup>3</sup> -soil
Fractional Organic Carbon	g-carbon/g-soil

The laboratory will indicate whether the sample came from the vadose zone or the capillary fringe. The sample determined to have the highest permeability will indicate the applicable cleanup levels for the various test parameters. The cleanup levels are listed in Table 3-2.

**Table 3-2**  
**Soil Cleanup Levels (ppm)**

Soil Permeability	Benzene		TPH	
	Drinking Water	Non-Drinking Water	Drinking Water	Non-Drinking Water
> 10 <sup>-4</sup> cm/sec	5	25	100	250
10 <sup>-4</sup> to 10 <sup>-6</sup> cm/sec	25	50	250	500
< 10 <sup>-6</sup> cm/sec	50	100	500	1000

**Notes:**

All results are in parts per million or milligrams per kilogram.

cm/sec = centimeters per second

TPH = Total Petroleum Hydrocarbon

### 3.5 DPT Hole Abandonment

Upon completion, all holes will be sealed with bentonite.

### 3.6 Decontamination Procedures

The decontamination procedures to be used at this site are outlined in Section 6.4.

### **3.7 Investigation-Derived Waste (IDW)**

Soil samples not submitted to the lab for analysis will be containerized in 55-gallon steel drums. This material will be analyzed for TCLP benzene and TCLP lead. Analytical results from these tests will be used to facilitate disposal of this material as a special waste in a State-approved permitted landfill. The empty drums will be triple rinsed and turned over to the NSA Mid-South Public Works department.

## **4.0 GROUNDWATER INVESTIGATION PROCEDURES**

### **4.1 Groundwater Sampling**

A maximum of five groundwater samples will be collected from DPT locations. Because previous investigations concluded that the depth to water ranged from 6 to 8 feet and the monitoring wells were screened from approximately 4 to 20 feet below ground surface before reaching the water table, the 20-foot depth for the DPT locations should be sufficient. Groundwater will not be sampled from any DPT location containing 0.01 foot or more free product. The following procedures shall be used for groundwater sampling.

#### **4.1.1 Equipment and Collection**

Groundwater samples will be taken at locations outside the impacted area. A groundwater sampler will be pushed to the specified depth and the hydraulic probe disconnected. EnSafe personnel will then collect a groundwater sample from this interval with a peristaltic pump using clean, new, Teflon tubing. The tubing will be lowered through the rods to the groundwater sampling device and connected to the pump at the surface. A sustainable pumping rate will be established, but no water level or groundwater parameter measurements will be collected. Approximately one gallon of water will be purged and then a 4-liter transfer bottle will be connected between the groundwater sampler and the pump. Once the transfer bottle is full, sampling will be conducted by EnSafe personnel. For quality assurance, field measurements listed in Section 6.2.1 will also be taken.

Once collected, the sample will be properly labeled, documented in the field logbook, and prepared for transport to the analytical laboratory.

### **4.2 Sample Containers and Preservation**

Sample containers shall be pre-cleaned and sealed by the distributor or laboratory. Sample bottles for analytes will follow the parameters listed in Section 6.7.1.

Samples will be immediately labeled, placed on ice in a cooler and chilled to approximately 4°C. They will be maintained at this temperature until delivered to the state-approved laboratory. A chain-of-custody form completed for each groundwater sample collected, will be signed by the person collecting the sample and the laboratory receiving the sample. Sample security shall be maintained during all phases of transport.

#### **4.3 Analytical Methods**

Groundwater samples selected for laboratory analyses will be tested for BTEX, MTBE, and TPH-GRO. The analytical methods are discussed further in Section 6.9.

#### **4.4 Groundwater Classification**

The groundwater at this site is classified as non-drinking water (USGS, 1993).

#### **4.5 Decontamination Procedures**

The decontamination procedures are discussed in Section 6.4.

#### **4.6 Investigation-Derived Waste**

All decontamination water will be containerized in 55-gallon drums. This material will be sampled and analyzed for VOCs and ignitability. If concentrations are within discharge limits and if approved by the publicly owned treatment works (POTW) and NSA Public Works Department, EnSafe Inc. will pump this material to the POTW through the base's oil-water separator. The empty drums will be triple rinsed and turned over to the NSA Memphis Public Works Department. If concentrations exceed the discharge limits, this material will be turned over to the NSA Mid-South Public Works Department for disposal.

## **5.0 HEALTH AND SAFETY PLAN**

### **5.1 Introduction**

As part of the U.S. Navy's Installation Restoration Program, the following site-specific health and safety plan (SSHSP) has been prepared for the investigation of existing USTs and/or former USTs at the NEX service station.

This SSHSP is to be used in conjunction with the approved NSA Mid-South *Comprehensive Health and Safety Plan* (CHASP). Copies of both this plan and the CHASP will be onsite during all field operations.

#### **Applicability**

Current Hazardous Waste Operations and Emergency Response (HAZWOPER) training certificates for EnSafe employees and subcontractors anticipated to be conducting fieldwork will be filed onsite and available for review. Individuals whose certifications are not on file, or those who have more recent certificates (have attended a refresher course), will provide the Site Supervisor with copies of their certificates before being allowed to enter a work area.

Current Occupational Safety and Health Administration (OSHA) refresher training certificates will be available onsite for all employees involved in field activities. All subcontractors, Department of Defense oversight personnel, and any other site visitors must provide health and safety certification with appropriate refresher course documentation prior to site entry.

### **5.2 Site Characterization**

#### **5.2.1 Site Description**

The USTs at the NEX service station contained leaded and unleaded gasoline.

### **5.2.2 Work Areas**

Site control will be established and maintained around any ground-intrusive activities in accordance with the recommendations in the U.S. Environmental Protection Agency's *Interim Standard Operating Safety Guides*, revised September 1982. Three general zones of operation will be established in the field to reduce the potential for contaminant migration and risk of personnel exposure:

- The exclusion zone
- The contamination reduction zone
- The support zone

**The exclusion zone** is the area where contamination is identified. All personnel within it must use the prescribed levels of personal protective equipment (PPE). The exclusion zone boundary (hotline) is established based upon the suspected presence of contaminated materials. The boundary may be adjusted based on subsequent observations and/or measurements of the contaminant concentrations and/or level of effort. Gross decontamination of personnel (i.e., protective coveralls, gloves, etc.) will occur in the work area, as required, with most personnel decontamination activities occurring in a decontamination area. Only authorized personnel with at least of 40 hours health and safety training meeting the requirements of OSHA Title 29 Code of Federal Regulations (CFR) Part 1910.120 and three days of supervised field experience are permitted within the exclusion and contamination reduction zones.

The person entering the exclusion zone must be accompanied by a person who is able to:

- Assist his or her partner.
- Observe his or her partner for signs of chemical or heat/cold exposure.
- Periodically check the integrity of his or her partner's protective clothing.
- Notify the site manager, his representative, or others if emergency help is needed.

A decontamination area will serve as the **contamination reduction zone** for most site activities and will serve as a buffer between the primary exclusion zone and the support zone. It is intended to prevent the spread of contaminants from the work areas. All decontamination procedures will be conducted in this area. Personnel will leave the support zone and enter the contamination reduction zone through a controlled access point. They must wear the prescribed PPE. Exiting the contamination reduction zone requires the removal of all contaminants through compliance with established decontamination procedures (Section 5.7).

**The support zone** is the outermost area and is considered an uncontaminated or clean area. It contains the first-aid equipment and other supplies and equipment necessary to support, exclusion and contamination reduction zone activities. Normal street clothes can be worn here.

### **5.2.3 Work Area Access**

Authorized personnel will be allowed access to work areas as long as they follow the requirements of this SSHSP and the CHASP. See also Work Area Access, Section 7.1.2 of the CHASP.

### **5.2.4 Work Zones**

The actual work zone locations will be based on physical layout of the site, work task requirements, and current meteorological conditions.

## **5.3 Site Activities**

### **5.3.1 Soil Sampling**

Soil samples will be collected from DPT locations.

### **5.3.2 Groundwater Sampling**

Groundwater samples will be collected from DPT locations.

## 5.4 Chemical Hazards

Exposure guidelines for chemical hazards expected to be encountered at the site are listed in Table 5-1. The constituents that may be encountered include: BTEX and lead. Additional constituents identified during site activities will be incorporated in the health and safety plan addendum. Material Safety Data Sheets (MSDS) for the constituents listed below are included as Appendix A.

Table 5-1  
 Exposure Guidelines for Site Chemical Hazards

Chemical Name	Odor Threshold	OSHA PEL <sup>a</sup>	ACGIH TLV <sup>b</sup>	NIOSH REL <sup>c</sup>	Site Action Levels (ppm) <sup>d,e</sup>	Air Monitoring Device <sup>f</sup>
Benzene	61 ppm	1 ppm	10 ppm	0.1 ppm	0.05 ppm	PID or FID
Toluene	40 ppm	100	50	100	25	PID or FID
Ethyl Benzene	ppm	100	100	100	50	PID or FID
Xylene	Not Listed	100	100	100	50	PID or FID

**Notes:**

- <sup>a</sup> = 29 CFR 1910.1000, Table Z-1-A. Limits for Air Contaminants, as amended through 1/15/91.
- <sup>b</sup> = 1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGIH
- <sup>c</sup> = NIOSH Pocket Guide to Chemical Hazards, June 1990
- <sup>d</sup> = Site Action Levels calculated as 50% of TLV or PEL (as measured by NIOSH methods)-whichever is lower
- <sup>e</sup> = Site Action levels for unknown VOCs as measured by Real Time Photoionization detector = 1 ppm. Site Action levels (for upgrading from Level C to Level B) for unknown VOCs as measured by Real Time Photoionization detector = 5 ppm.
- <sup>f</sup> = A photoionization detector (PID) or a flame ionization detector (FID) will be used.
- mg/m<sup>3</sup> = milligram per cubic meter
- REL = Recommended Exposure Limit

## 5.5 Operations and Physical Hazards

Physical hazards typically encountered during environmental investigations will be present onsite. These hazards include heat-related illnesses, slippery surfaces, lifting, and use of heavy equipment. The Site Supervisor and Site Health and Safety Officer (SHSO) shall be aware of the

potential for heat stress and other weather-related illnesses, and as necessary, implement appropriate work regimens to minimize the likelihood of field personnel becoming ill.

Heavy equipment operations will be conducted in accordance with the procedures outlined in the CHASP, Attachment B. When conducting operations or survey work on foot, personnel will walk at all times. Running greatly increases the probability of slipping, tripping, and falling.

## **5.6 Employee Protection**

Employee protection for this project includes standard safe work practices, NSA Mid-South rules of conduct, PPE, personal decontamination procedures, and equipment for extreme weather conditions, work limitations, and exposure evaluation.

### **5.6.1 Standard Safe Work Practices**

See Section 7.5.1 of the CHASP for Standard Safe Work Practices.

### **5.6.2 NSA Mid-South General Rules of Conduct**

See Section 7.5.2 of the CHASP for NSA Mid-South General Rules of Conduct.

### **5.6.3 Selection of Personal Protective Equipment**

It is important that PPE be appropriate to protect against the potential or known hazards at each cleanup or investigation site. Protective equipment will be selected based on the types, concentrations, and routes of personal exposure that may be encountered. In situations where the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the PPE required, based on experience and sound safety practices.

The Project Health and Safety Officer (PHSO) will determine the appropriate level of PPE prior to the initial site entry based on the best available information. PPE requirements are subject to change as site information is updated or changes. **The decision to upgrade or downgrade levels of PPE shall be made by the PHSO.**

Field activities will be initiated in Modified Level D protection except when stated otherwise in this plan or when site conditions (e.g., sampling results from previous studies) indicate that modified Level D is inappropriate. Modified Level D protection consist of a hard hat, appropriate chemical-resistant gloves (vinyl or nitrile), eye protection, and chemical-resistant, steel-toed boots. Chemical protective coveralls (full length sleeves and pants) will be worn if free product or contaminants identified as skin irritants are encountered. This level of protection was selected because the concentrations of contaminants detected in previous studies were low and free product was not detected.

PPE upgrades to Level C will be initiated if airborne concentrations exceed 10 parts per million (ppm) above the background concentration in the breathing zone or if the concentration of any contaminant exceeds 50% of the OSHA Permissible Exposure Limit (See Section 5.6.4). See Table 7-1 in the CHASP for the specific criteria for use and equipment for each level of protection.

#### **5.6.4 Air Monitoring**

Previous site investigations indicate that workers may be exposed to low concentrations of chemicals including VOCs, combustible gases/vapors. Based on site history and existing sampling data, "worst case" contaminated areas will be identified before field activities begin.

Air monitoring using a photoionization detector (PID) and/or other appropriate sampling equipment will be conducted prior to beginning field activities at a new exclusion zone and during

ground-disturbing activities. The PID will be field calibrated to measure VOCs relative to a 100 ppm isobutylene standard. If VOCs are detected downhole, colorimetric detector tubes and/or other sampling media may be used to determine the identification and approximate concentration of these compounds.

A combustible gas indicator (CGI) will be used during all soil borings and well installations. The CGI will be field-calibrated to measure flammable gases relative to a 23% lower explosive limit (LEL) methane standard. Downhole CGI readings will be collected continuously during all soil-disturbing operations. Field activities will immediately cease if downhole readings exceed 10% LEL. If CGI readings do not subside, the area will be carefully investigated and mapped. Operations may not proceed until readings are below 10% LEL. The area will be immediately evacuated and the situation reevaluated to determine how to proceed.

If breathing zone levels exceed 10 ppm above background or site conditions indicate that additional health and safety precautions are needed, field activities in the area shall stop. Field staff shall notify the Site Supervisor of the situation and he/she shall contact both the Project Manager and the PHSO. The PHSO will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including upgraded PPE requirements, revised work schedules, and revised decontamination procedures. (Typically, PPE will be upgraded to Level C assuming that cartridge respirators are appropriate, otherwise Level B.) See Table 6-1 of the CHASP for specific criteria for each protection level. Work shall not proceed until breathing zone concentrations return to background levels and it is reasonably anticipated that breathing zone samples will stay approximately at background levels, or the chemical constituent(s) are identified and appropriate PPE is donned.

Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

PIDs, CGIs, and other monitoring equipment shall be calibrated daily their proper function verified before being used. Throughout the day this equipment shall be periodically checked to ensure it is working properly. A final calibration shall be conducted at the end of the workday, at which time each instrument will be checked to ensure it is free from surface contamination. Field staff shall note in their field notebooks that they conducted these calibrations and checks and note whether the equipment was functioning properly. When equipment is malfunctioning, it should be brought to the attention of the Site Supervisor or SHSO, who will arrange to repair or replace that equipment as needed.

#### **5.6.5 Procedures and Equipment for Extreme Hot or Cold Weather Conditions**

See CHASP Section 7.5.5.

#### **Severe Weather Conditions**

All fieldwork shall immediately cease at the first sign of thunder or lightning. Field personnel shall perform emergency personal and equipment decontamination (see Section 5.7) and seek immediate shelter.

#### **5.7 Personal Decontamination**

See Section 7.5.6 of the CHASP for information on personal decontamination.

##### **5.7.1 Personal Decontamination Procedures**

See Section 7.5.6.1 of the CHASP for information on personal decontamination procedures. All wastes (soil and water) generated during personal decontamination will be consolidated with the excavated soil and building debris.

### **5.7.2 Closure of the Personal Decontamination Station**

All disposable clothing and plastic sheeting used during site activities will be double-bagged and discarded in a labeled refuse container. Decontamination and rinse solutions will be placed in a 55-gallon barrel for later analysis and disposal. All washtubs, pails, buckets, etc. will be washed, rinsed, and dried at the end of each workday.

### **5.8 Work Limitations**

All site activities will be conducted during daylight only. All personnel scheduled for these activities will have completed initial health and safety training and actual field training as specified in 29 CFR 1910.120(e). All supervisors must complete an additional eight hours of training in site management. All personnel must complete an eight-hour refresher training course annually to continue working onsite.

### **5.9 Exposure Evaluation**

See Section 7.5.8 of the CHASP for information on exposure evaluation.

### **5.10 Medical Monitoring Program**

See CHASP Section 7.6.

### **5.11 Authorized Personnel**

Personnel anticipated to be onsite at various times during site activities include:

- Principal-in-Charge — Dr. James Speakman (EnSafe)
- Task Order Manager/Project Manager — Mr. John Stedman (EnSafe)
- Project Health and Safety Officer — Mr. Bill Bradshaw (EnSafe)
- Onsite Supervisor — Mr. John Stedman (EnSafe)
- Field Crew— To be determined

- Engineer-in-Charge — Mr. John Karlyk (SOUTHNAVFACENGCOM)
- NSA Mid-South Site Contact — Mr. Randy Wilson

#### **5.11.1 Responsibilities of Onsite Supervisor**

See Section 7.7.1 of the CHASP for responsibilities of the site manager.

#### **5.11.2 Responsibilities of Site Health and Safety Officer**

See Section 7.7.2 of the CHASP for responsibilities of SHSO.

#### **5.11.3 Responsibilities of Onsite Field Staff**

See Section 7.7.3 of the CHASP for responsibilities of onsite field staff.

### **5.12 Emergency Information**

All hazardous waste site activities present a risk to onsite personnel. Risk is minimized during routine operations by establishing good work practices, staying alert, and using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside or support service, Mr. Randy Wilson, the NSA Mid-South site contact, will be informed and the appropriate contact from the following list will be made:

<b>Contact</b>	<b>Agency or Organization</b>	<b>Telephone</b>
Randy Wilson	NSA Mid-South	(901) 874-5461
John Karlyk	SOUTHNAVFACENGCOM EIC	(843) 820-5624
Law Enforcement	NSA Mid-South Base Security	9-911

<b>Contact</b>	<b>Agency or Organization</b>	<b>Telephone</b>
Fire Department	NSA Mid-South	9-911
Ambulance Service	Hospital	9-911
Hospital	Methodist North Hospital 3960 Covington Pike	(901) 372-5211 or 9-911
Southern Poison Control Center	—	(901) 528-6048
Mr. John Stedman	EnSafe	(901) 372-7962
Bill Bradshaw	EnSafe	(901) 372-7962

John Karlyk, Southern Division Engineer-in-Charge (SOUTHNAVFACENGCOM EIC) will be contacted after appropriate emergency measures have been initiated onsite.

#### **5.12.1 Site Resources**

Cellular telephones may be used for emergencies and communication/coordination with NSA Mid-South. First-aid and eyewash equipment will be available at the work area.

#### **5.12.2 Emergency Procedures**

Conditions that may constitute an emergency include any member of the field crew being involved in an accident or experiencing any adverse effects or symptoms of exposure while onsite or if a condition is discovered that suggests the situation is more hazardous than anticipated.

The following emergency procedures should be followed:

- Site work area entrance and exit routes will be planned and emergency escape routes delineated by the Site Health and Safety Officer. Copies of the emergency contacts and routes will be posted onsite.
- If any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately stop work and act according to the SHSO's instruction.
- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the SHSO to indicate possible routes for upwind escape.
- The discovery of any conditions that would suggest the situation is more hazardous than anticipated will result in the suspension of work until the SHSO has evaluated the situation and provided the appropriate instructions to the field team.
- If an accident occurs, the Site Manager is to complete an Accident Report Form (see Attachment B of CHASP) for submittal to the managing principal-in-charge of the project.
- If a member of the field crew suffers a personal injury, the SHSO will call **(901) 372-5211 (Methodist North Hospital)** or **9-911** (serious injury) to alert appropriate emergency response agencies or administer onsite first aid (minor injury) as the situation dictates. An Accident Report Form will be completed for any such incident.

- If a member of the field crew suffers chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water, and if the situation dictates, the SHSO should alert appropriate emergency response agencies, or personally ensure that the exposed individual is transported to the nearest medical facility for prompt treatment. (See Appendix B for directions to the emergency medical facility.) An Accident Report Form will be completed for any such incident.

Additional information on appropriate chemical exposure treatment methods will be provided through the MSDSs, which are in the NSA Mid-South Field Trailer.

### **5.13 Forms**

The following forms will be used in implementing this SSHSP:

- Plan Acceptance Form
- Plan Feedback Form
- Exposure History Form
- Accident Report Form

The Plan Acceptance Form will be filled out by all employees working onsite before site activities begin. The Plan Feedback Form will be filled out by the Site Safety Officer and any other onsite employee who wishes to fill one out. The Exposure History Form will be completed by both the Site Manager and the individual(s) for whom the form is intended.

Examples of each form are provided in Appendix D. **All completed forms must be returned to the Project Manager at EnSafe, Memphis, Tennessee.**

## **6.0 QUALITY ASSURANCE PLAN**

### **6.1 Introduction**

This section presents policies, project organization, objectives, and functional activities along with quality assurance/quality control (QA/QC) measures intended to achieve the quality assurance goals of the POA at NSA Mid-South.

This document is intended to fulfill requirements for ensuring that all work be conducted in accordance with QA/QC protocols and field procedural protocols for environmental monitoring and measurement data as established in the following documents.

#### **Applicable Guidance Documents:**

- Environmental Protection Agency. (May 1996). *Standard Operating Procedures and Quality Assurance Manual*. Athens, Georgia.
  
- *Test Methods for Evaluation of Solid Waste (Physical/Chemical Methods)*, SW-846, Third Edition, Update III, December 1996.
  
- *Method for Determination of Gasoline Range Organics*. TDEC Division of Underground Storage Tanks. <http://www.state.tn.us/environment/ust/gro.htm>

### **6.2 Quality Assurance/Quality Control Objectives**

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, preventative maintenance of field equipment, and corrective action are described in this section.

In combination, QA/QC represent a set of procedures designed to produce analytical data of known and measurable quality. A useful distinction between QA and QC can be made as follows: QC represents the set of measurement procedures (spikes, blanks, replicates, calibration, etc.), used to provide overall evidence of the quality of a particular analytical batch; QA represents the set of procedures used to ensure that this evidence is available and used properly to evaluate and, if necessary, to qualify the data quality.

### 6.2.1 Field Measurements

Quality assurance objectives for parameters to be measured in the field by EnSafe Inc. personnel are presented in Table 6-1. Field measurements will include pH, temperature, specific conductance, and static groundwater level. Field equipment shall be calibrated daily in accordance with the manufacturer's specifications and recorded in the field logbook.

**Table 6-1**  
**Field Measurements QA Targets**

Field Measurements	Method #	Matrix	Precision	Accuracy	Completeness
Static Water Level	Manufacturer's SOP	Water	± 0.01 ft.	± 0.05 feet	90%
PID/FID	—	Air	± 10 ppm	± 2 ppm	90%
DPT Location	GPS		± 5%	± 3.0 cm	90%

**Notes:**

- = not applicable
- SOP = Standard Operating Procedure

### 6.2.2 Laboratory Analyses

Project QA objectives of analytical parameters for soil and groundwater will be as stipulated in their respective analytical methods, and as determined by the analytical laboratory's historical data quality evaluation for the methods. The NFESC laboratory approval process seeks to ensure that laboratory method QA/QC standards are appropriate to meet goals for intended

data uses. The laboratory establishes precision and accuracy goals based on historical data in accordance with the analytical methods.

### **6.2.3 Representativeness**

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the POA is followed and that proper sampling techniques are used. Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times and analyzing and assessing field duplicated samples.

### **6.2.4 Completeness**

The completeness goals for field and laboratory measurements take into consideration unavoidable non-attainment of QA goals which may occur over the course of the assessment. Efforts will be made to maintain soil and groundwater data completeness levels above the 95 percent level for this assessment.

### **6.2.5 Comparability**

Comparability expresses the confidence with which one data set can be compared to another. Comparability is dependent on similar QA objectives and upon the proper design of the sampling program and will be satisfied by ensuring that the POA is followed and that proper sampling techniques are used.

### **6.3 Project Organization and Responsibilities**

Project coordination responsibilities lie with the SOUTHNAVFACENCOM Engineer-In-Charge (EIC). The following sections describe the project chain-of-command.

#### **6.3.1 Oversight**

*Engineering Field Division* is responsible for providing the EIC who provides the site information and history, logistical assistance, assists in specifying the sites requiring investigation and reviews results and recommendations. The EIC is responsible for coordinating procurement, finance, and reporting; for communicating comments from other technical reviewers to the subcontractors; and for ensuring that the subcontractors address all the comments submitted and take appropriate corrective actions.

*State or Local Oversight* will be provided by TDEC for this investigation. The POA will be prepared in accordance with TDEC requirements and guidelines. The investigation results will be presented to the TDEC in the form of a Environmental Assessment Report (EAR). This field investigation has been requested in accordance with the requirements of the TDEC Division of Underground Storage Tanks *Environmental Assessment Guidelines* (August 1996).

#### **6.3.2 Investigation Performance**

The following individuals or firms will be responsible for the implementation of all work plan activities.

##### **Engineering Subcontractor**

EnSafe will serve as the Engineering Subcontractor for this project. As such, EnSafe is responsible for designing and implementing the field investigation. The EnSafe Task Order Manager is John Stedman.

### **Analytical Laboratory**

The analytical laboratory employed by EnSafe must be a State-approved laboratory. The laboratories are required to identify a Laboratory QA Coordinator (LQAC) responsible for overall QA. The LQAC must not be responsible for schedule, costs, or personnel other than QA assistants. It is preferred that the LQAC report directly to the Laboratory Director. The LQAC must have the authority to stop work on projects if QC problems arise which affect the quality of the data produced. Work will be performed in a manner consistent with other appropriate federal, state, and local guidelines, rules, regulations, and criteria.

#### **6.4 Decontamination Procedures**

Prior to any DPT, the probe rig and any other equipment to be used during the assessment shall be inspected for lubricant or other fluid leaks and repaired as necessary. All over-the-hole portions of the shall be steam cleaned before use and as necessary between DPT locations. All downhole equipment (rods, tools, etc.) shall be steam-cleaned prior to use and between all subsequent DPT locations.

All sampling equipment that is not pre-cleaned and disposable (stainless-steel scoops, split spoons, etc.), and all monitoring equipment, shall be properly decontaminated before each use by being: cleaned with a laboratory-grade detergent wash, triple-rinsed with distilled water, and allowed to air dry (if time permits).

#### **6.5 Soil Sample Documentation**

EnSafe personnel will use site-specific, bound logbooks for the maintenance of field records pertaining to the investigation. These records will document visual observations, calculations, and equipment calibrations. Entries will be dated and the time for each entry noted. The logbooks are accountable documents that will be properly maintained and retained as part of

the project files. Field logs will be retained in their original condition in the EnSafe project file.

## **6.6 Groundwater Sample Documentation**

EnSafe personnel will use site-specific, bound logbooks for the maintenance of field records pertaining to the investigation. These records will document visual observations, calculations, field measurements, and equipment calibrations. Entries will be dated and the time for each entry noted. The logbooks are accountable documents that will be properly maintained and retained as part of the project files.

## **6.7 Sample Management**

Refer to the procedures listed below to containerize, preserve, and package samples. Ship all samples to the selected laboratory via overnight delivery the day the samples are collected. Do not store samples overnight *unless* arrangements have been made with the laboratory. If samples *are* stored overnight, record the temperature of the storage container in the field logbook. Sample containers will be checked to ensure that proper preservatives have been added.

### **6.7.1 Sample Containers, Preservatives, Holding Times**

Appropriate numbers of sample containers, preservatives, and trip blank samples will be provided by the laboratory. All glass containers must have Teflon-lined caps. Sample containers shall be pre-cleaned and sealed by the distributor or laboratory. Sample bottles for analytes will follow the parameters listed in Table 6-3.

### 6.7.2 Sample Preservation

The sample containers will be pre-preserved by the laboratory or will be purchased pre-preserved. All samples requiring chemical preservation will be preserved immediately upon collection in the field.

**Table 6-2  
 Sample Containers and Preservatives**

Parameter	Container	Preservative (Pre-preserved)
<b>Water Samples</b>		
TN-GRO/BTEX/MTBE	two 40-ml glass vials with Teflon-lined septa	four drops of 1:1 hydrochloric acid, 4°C
Ignitability and Flashpoint	250-ml glass bottle with Teflon-lined lid	4°C
<b>Soil Samples</b>		
TN-GRO/BTEX/MTBE	100-ml glass jar with Teflon-lined lid	4°C
TCLP for Benzene	1-L glass jar with Teflon-lined lid	4°C
TCLP for Lead	500-ml glass jar with Teflon-lined lid	4°C

The following procedures will be followed when preserving samples.

- Care will be taken to ensure that the samples are not overpreserved. Overpreserved samples may be considered dangerous goods and will require shipment in accordance with procedures described in the current Dangerous Goods Regulations.

### 6.7.3 Packaging Samples for Shipment

Pack all samples for shipment to avoid breakage and to prevent cross-contamination.

**Sample Packaging Procedures:**

1. Select a cooler in good repair. Seal the drain plug on the inside and outside of the cooler with tape to prevent leakage.
  
2. Ensure that the cooler is clean and of sufficient quality for shipping purposes.

**While Packaging Samples:**

1. Place every sample container in a sealable plastic bag.
  
2. To prevent breakage, place 2 to 4 inches of inert packing material on the bottom of the cooler and *either*:
  - Wrap samples in bubble wrap packing material or other suitable material. Seal the protective wrap around the containers with tape. Protective wrap is not required for plastic containers, but take care when packing the coolers so that the containers do not directly touch each other.
  
  - or*
  
  - Place the bagged containers inside the cooler so the bottles do not touch each other. Place cooling material (e.g., bagged ice, blue ice) around and in between the samples. Completely fill any remaining space with inert packing material such as vermiculite or cellulose insulation.
  
3. Include a temperature blank or temperature strip in each sample cooler, if required by laboratory.

4. Place double-bagged ice inside the cooler to chill the samples to 4°C ( $\pm$  2°C).
5. Fasten the top of the cooler's large plastic bag with tape.
6. Place a chain-of-custody record describing the contents of each cooler in a plastic bag and seal it inside each cooler.
7. Seal the cooler with tape and custody seals so that the cooler cannot be opened without breaking the seal.

#### **Labeling the Package**

1. Clearly print the words "This End Up" or "This Side Up" on the top of the outer cooler. Place upward pointing arrows on the sides of the package.
2. Mark the cooler with the addresses of the shipper and receiver.
3. If more than one cooler is to be shipped, mark the coolers with the sequential number of the cooler and the total number of coolers (e.g., 1 of 3, 2 of 3, and 3 of 3).

#### **6.7.4 Sample Labels**

Samples will be identified by completing sample labels and affixing them to the outside of each sample container. Each sample will be logged in the field logbook at the time of collection. A sample label is provided in Figure 6-1. Labels will include site, sample identification, collection time and date, method of preservation, sampler identification, and the analyses to be conducted.

**Figure 6-1  
Sample Label**

<b>EnSafe Inc.</b> (901) 372-7962	
SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE
SAMPLE IDENTIFICATION	
PROJECT NUMBER	

*Samples* will be identified by applying a unique number to each sample using the following format and guidelines:

**FORMAT:**    1 2 3 4 5 6 7 8 9 0

**1 2 3**        —     The first three digits are for the site where the sample was collected: sites, plumes, buildings, background, etc.

**4**            —     This digit represents the matrix of the sample or the type of QC sample it is. Abbreviations for matrices and QC samples collected in this assessment are listed below:

- S — soil (surface and borings)
- C — soil duplicate sample
- G — groundwater
- H — groundwater duplicate sample

Z — liquid waste (including IDW drums)

V — solid waste (including IDW drums)

K — MS sample

X — MSD sample

T — trip blank

E — equipment rinsate blank

F — field blank

- 5 6 7 8 — These four digits correlate the QC sample with the field samples associated with it. A simple way to accomplish this is to use the sampling location, for example the boring or well number, of a sample collected on the same day as the QC sample. This also will help keep the QC samples blind to the laboratory.
- 5 6 7 8 — These four digits are for the sampling location: boring or well number, existing well ID, etc. For QC samples, these four digits correlate the QC sample with the field samples affected by it. An easy way to accomplish this is to use the sampling location, for example the boring or well number, of a sample collected on the same day as the QC sample. This will also help to keep the QC samples blind to the laboratory.
- 9 0 — The final two digits represent the sample-specific identification: depth to the nearest foot, depth interval, serial number for water and QC samples, etc.

All assigned sample numbers will be documented in the field logbooks to ensure that sample numbers are not duplicated.

### **6.7.5 Sample Chain-Of-Custody**

Instructions on maintaining chain-of-custody on samples are listed below.

- Sample containers will be labeled and placed in a cooler immediately following sample collection. All samples shall remain in the physical custody of the field personnel or in a designated secured area until sample shipment. An example of the sample label is provided in Figure 6-1.
- Custody seals will be affixed to sample coolers prior to shipment. An example of the custody seal is provided in Figure 6-2.

### **Chain-of-Custody Record**

The chain-of-custody form will be used to record the custody of the samples. An example of the chain-of-custody form is provided in Figure 6-3. The following information will be recorded in the appropriate spaces on the form.

**Figure 6-2  
Custody Seal**

**Figure 6-3**  
**Chain-of-Custody Form**

*Information about EnSafe Inc.:*

- Client name (EnSafe Inc.) and address
- Project Name/Number (NSAMEM/Contract Task Order [CTO] Number)
- Project Manager's Name
- Signature of Sampler(s)
- Chain-of-custody (COC) #
- Blanket Purchase Agreement/Service Order (BPA/SO) #

*Information about the Sample:*

- Field sample identification (as described in previous section)
- Date and time of collection (24-hour clock)
- Type of sample
- Type and size of sample containers
- Preservation temperature and chemical
- Number of sample containers/sample
- The type of laboratory analysis required
- Comments such as "strong odor" or "high concentration suspected" go in the remarks section

*Information about Shipment:*

- When sample custody is transferred, document it in the appropriate section of this form.
- The person relinquishing custody must print his or her name, company name, the reason for the transfer, date, time, and sign the form.

- Note the method of shipment and the air-bill number of the shipment on the chain-of-custody form.
- During shipment, the chain-of-custody form must be sealed in a plastic bag and placed inside the shipping cooler.
- Note any special instructions (e.g., priority turnaround) or comments in the comments section of the chain-of-custody form, and discuss them with the laboratory before sample collection and shipment.

Specific instructions on transferring custody and shipment of samples are listed below.

### **Transferring Custody**

1. Ship samples overnight to the selected analytical laboratory. Record the air-bill number in the appropriate section on the chain-of-custody record and in the field notebook.
2. When relinquishing custody to a shipper, advise the laboratory of any time constraints on analysis. Notify the laboratory as early in the week as possible regarding samples intended for Saturday delivery.
3. Fax a copy of the COC to laboratory before their receipt of cooler.

## **6.8 Documentation**

### **6.8.1 Field Records**

EnSafe personnel will maintain field records in permanently bound, waterproof field logbooks. Each logbook will be dedicated to an individual project. The names of the field sampling team leader and all team members, project name, and project code should be entered on the inside of

the front cover of the logbook. Entries should be dated and the time of each entry recorded. At the end of each day's activity, or entry of a particular event if appropriate, a sampling team member should initial and draw a diagonal line at the conclusion of the entry indicating the conclusion of the entry or the day's activity. Sample collection and handling procedures, as well as visual observations shall be documented in the field logbooks. Sample collection equipment (where appropriate), field analytical equipment, and equipment utilized to make physical measurements will be identified in the field logbooks. Calculations, results, and calibration data for field sampling, field analytical, and field physical measurement equipment will also be recorded in the field logbooks. Field analyses and measurements must be traceable to the specific piece of field equipment used and to the field sampling team member(s) collecting the sample, making the measurement, or analyses.

All entries in field logbooks shall be dated, legible, and contain accurate and inclusive documentation of an individual's project activities. Because field records are the basis for later written reports, language should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Once completed, these field logbooks become accountable documents and must be maintained as part of project files.

### **6.8.2 Document Control**

The term *document control* refers to the maintenance of investigation project files. Documents as outlined below shall be kept in project files.

#### **Contents of Project File:**

- A copy of the study plan.
  
- Original chain-of-custody records and bound field logbooks.

- A copy of the receipt for sample forms.
- All records obtained during the investigation.
- A complete copy of the analytical data and memos transmitting analytical data.
- All official correspondence received by or issued by EnSafe relating to the investigation including records of telephone calls.
- One copy of the draft report (without review comments).
- One copy of the final report and transmittal memorandum(s).
- Any other relevant documents related to the original investigation or follow up activities related to the investigation.

Under no circumstances are any personal observations or irrelevant information to be filed in the official project files.

## **6.9 Analytical Procedures**

This investigation will follow the analytical procedures described below.

### **6.9.1 Field Analyses**

All field measurements will be recorded in a dedicated field logbook and/or appropriate EnSafe field activity log (e.g., boring log, well construction log, etc.).

### 6.9.2 Laboratory Analyses

The NEX service station USTs were documented in the SOW #198 as containing gasoline; therefore, soil and groundwater samples selected for laboratory analyses will be tested for BTEX, MTBE, and TPH-GRO.

For BTEX and MTBE, the laboratory will use the *Test Methods for Evaluating Solid Waste*, SW-846 following the purge and trap procedures for the soil samples in Method 5030. The actual constituent analysis using gas chromatography with a photoionization detector shall follow Method 8021. TPH-GRO will be reported as described in the Tennessee-Gasoline Range Organics (TN-GRO) method. In accordance with the TN-GRO method, BTEX, MTBE, and GRO may be analyzed simultaneously.

#### Parameters and Analytical Methods to be Used:

The parameters and analytical methods are presented in Table 6-4. All samples will be analyzed in accordance with *Test Methods for Evaluation of Solid Waste (Physical/Chemical Methods)*, SW-846, 3<sup>rd</sup> Edition, Update III (USEPA, December 1996).

**Table 6-3  
 Analytical Methods**

Parameter	Soil Sample Methods	Water Sample Methods
BTEX/MTBE	5030 / 8021	5030 / 8021
TPH-GRO (TN-GRO)	TN-GRO	TN-GRO
TCLP for Benzene and Lead	1311/8021/6010B	—
Ignitability/Flashpoint	—	1010
Iron and Manganese	—	6010B

*Note:*

— = not analyzed

### **6.9.3 Calibration Procedures and Frequency**

The analytical laboratory will perform analytical instrument calibration in accordance with the analytical method.

EnSafe plans to calibrate field equipment such as pH, specific conductance, and temperature meters and OVDs according to their manufacturer's standard operating procedures. Field equipment for which SOPs are not in force will be calibrated and operated in accordance with the manufacturer's recommendations. All field instruments will be calibrated at the beginning and end of each work day.

### **6.10 Data Reduction, Validation, and Reporting**

The laboratory procedures for data reduction, validation, and reporting are included in the laboratory QAP which will be kept on reference in the EnSafe library. Data reduction, validation, and reporting by the laboratory will meet the criteria needed by EnSafe for internal data validation. For this project, analytical reporting requirements will be those specified by the analytical method employed.

### **6.11 Field and Laboratory Quality Control Checks**

Internal laboratory control checks used by the laboratory will be conducted in the laboratory by the laboratory staff. EnSafe will conduct internal quality control checks of sampling procedures and laboratory analyses. These checks will consist of preparing and submitting sampling equipment rinsate blanks, trip blanks, field blanks, and field duplicates for analysis, and evaluating the laboratory analytical package.

#### **6.11.1 Field Data Quality**

Field work will be conducted and/or supervised by EnSafe personnel to ensure that proper procedures are followed. Field records will be kept of all activities that take place during the investigation and these records will be maintained at the EnSafe office in Memphis, Tennessee. These records will include any obstacles that may be encountered during the investigation.

Field samples will be collected per the procedures outlined in Sections 6.5.1 and 6.8.3. Precision will be assessed by evaluating the results of duplicate and matrix spike duplicate samples. Accuracy will be assessed by evaluating the analyses of field blanks, trip blanks, laboratory matrix and surrogate spikes, and laboratory reagent blanks and blank spike samples.

*Duplicates* are samples identical to the original, collected from the same location (e.g., well) at the same time under identical conditions. Duplicate samples are analyzed along with the original sample to obtain sample procedure precision and inherent sample source variability. The same samples used for field duplicates shall be split by the laboratory and used as the matrix spike (MS) and matrix spike duplicate (MSD). Therefore, for the designated duplicate sample, there will be analyses of the original sample, the field duplicate, and the laboratory MS/MSD.

Field sampling personnel will need to coordinate with the laboratory in advance to ensure that sufficient QC sample volumes are collected and that QC samples are numbered in a manner that is compatible with the laboratory sample tracking system (to prevent misidentification of samples).

*Field blanks* are sample containers filled with the source water used in the decontamination of equipment in the field. They are prepared, preserved and stored in the same manner as the other field samples. The field blanks are analyzed along with the field samples for the parameters of interest to check for contamination imparted to the samples by the water, sample containers or other outside sources. One field blank per water source per sampling event will be prepared. One field blank will consist of potable water and one field blank will consist of deionized or distilled water.

*Rinsate (or equipment)* blanks are collected by retaining rinsate from sampling equipment. The equipment is rinsed with distilled water after full decontamination procedures have been performed. Rinsate samples are collected in the same type of container as the other field samples and preserved in the same manner. One rinsate sample will be collected and submitted for analysis. The rinsate blank is analyzed along with the field samples for the parameters of interest

to check for contamination imparted to the samples by the sampling equipment, containers, decontamination procedures or other outside source.

### **6.11.2 Field Data Package**

The package, including all field records and measurements obtained at the site by EnSafe sampling personnel, may be validated by the project QA officer utilizing the procedures outlined below.

#### **Review of Field Data:**

- A review of field data contained on water and soil sampling logs for completeness. Failure in this area may result in the data being invalidated for litigation or regulatory purposes.
  
- A verification that field blanks and sampling equipment rinsate blanks were properly prepared, identified, and analyzed. Failure in this area may compromise the analytical data package and result in some data being considered qualitative or invalid.
  
- A check on field analyses for equipment calibration and condition. Failure in this area may result in the field measurements being invalidated.
  
- A review of chain-of-custody forms for proper completion, signatures of field personnel and the laboratory sample custodian, and dates. Failure in this area may result in the data being invalidated for litigation or regulatory purposes.

### **6.11.3 Analytical Data Package**

Review of the analytical data package will be performed by the project QA Officer. The review steps will be performed by applying as guidance USEPA precision and accuracy statements for the analytical methods employed. The analytical data package review procedure includes the procedures below.

**Review of Analytical Data:**

- Comparison of the data package to the reporting level requirements designated for the project, to confirm completeness.
  
- Comparison of sampling dates, sample extraction dates, and analysis dates to check that samples were extracted and/or analyzed within the proper holding times. Failure in this area may render the data unusable.
  
- Review of analytical methods and required detection limits to verify that they agree with the quality assurance plan (QAP) and the laboratory contract. Failure in this area may render the data unusable.
  
- Review of field and laboratory blanks will be done to evaluate possible contamination sources. The preparation techniques and frequencies, and the analytical results (if appropriate) will be considered.
  
- Evaluation of all blanks (rinstate blanks, field blanks, reagent blanks, method blanks, and extraction blanks) must confirm freedom from contamination at the specified detection limit. All blank contaminants must be explained or the data applicable to those blanks labeled suspect and sufficient only for qualitative purposes.

**6.12 Performance and System Audits**

Audits may be performed before and during the work to evaluate the capability and performance of the entire system of measurement and reporting, i.e., experimental design, sampling (or data collection), analysis, and attendant quality control activities.

**6.12.1 Field System Audits**

The Site Project Manager is responsible for evaluating the performance of field personnel and general field operations and progress. The Site Project Manager will observe the performance of

the field operations personnel during each kind of activity such as water-level readings and sampling rounds.

#### **6.12.2 Laboratory Systems Audit**

A laboratory systems audit may be conducted by EnSafe or its designee. These audits test methodology and assure that systems and operational capability are maintained. They also verify that QC measures are being followed as specified in the analytical methods, laboratory written SOPs, and laboratory QAPP. The internal lab system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, adherence to written SOPs, records control, instrument operating records, etc. An audit will not be conducted if the laboratory can provide audit results which the QAO consider to be equivalent to an audit by EnSafe or its designee.

#### **6.13 Preventive Maintenance**

The field equipment for this project includes pH meters, thermometers, conductivity meters, turbidimeters, potentiometers, PIDs, and ferrous iron and sulfide test kits. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. Calibration checks will be documented in the field logbook. Critical spare parts such as tape, pH probes, and batteries will be kept on-site to reduce downtime. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field schedule. Preventive maintenance for laboratory equipment is outlined in the laboratory's QAPP.

#### **6.14 Corrective Action**

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out of quality control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented will be documented in the regular quality assurance reports to management. Corrective action should only

be implemented after approval by the project manager, or his designee, the site manager. If immediate corrective action is required, approvals secured by telephone from the project manager should be documented in an additional memorandum.

#### **6.15 Quality Assurance Reports**

The QAO will provide status reports to the project manager. The reports address items outlined below.

- QA activities and quality of collected data
- Results of data precision and accuracy calculations
- Evaluation of data completeness
- QA problems and recommended and/or implemented corrective actions and these results
- QA performance and system audit findings, if applicable.

## 7.0 REFERENCES

- EnSafe. (1997). *Draft Plan of Action, Underground Storage Tank N-12, Facility ID #0-791696, Naval Support Activity Memphis, Millington, Tennessee*. EnSafe: Memphis, Tennessee. September 11, 1997.
- EnSafe. (2000). *Statement of Work Cone Penetrometer Testing, Geoprobe Sampling, and Drilling, Naval Air Station Corpus Christi, Texas*. EnSafe: Memphis, Tennessee. April 2000.
- EnSafe/Allen and Hoshall. (1994). *Comprehensive RFI Work Plan—Naval Air Station Memphis*. E/A&H: Memphis, Tennessee. October 6, 1994.
- Harding Lawson Associates. (1988). *Final Remedial Action Plan, Naval Air Station Memphis, Navy Exchange Service Station, Millington, Tennessee*. Houston, TX. August 11, 1988.
- USGS. (1993). *Corrective Action Plan, Naval Exchange Service Station, Naval Air Station Memphis, Millington, Tennessee*. U. S. Geological Survey: Columbia, SC. November 1993.

**Appendix A**  
**MSDS**

Please reduce your browser font size for better viewing and printing.

# MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865

MALLINCKRODT



24 Hour Emergency Telephone: 908-859-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-996-6666

Outside U.S. and Canada  
Chemtrec: 202-483-7616

**NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.**

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

## METHYL TERT-BUTYL ETHER

MSDS Number: B7222 --- Effective Date: 02/18/99

### 1. Product Identification

**Synonyms:** 2-Methoxy-2-methylpropane; tert-Butyl methyl ether; Methyl 1,1-dimethyl ethyl ether; MTBE

**CAS No.:** 1634-04-4

**Molecular Weight:** 88.15

**Chemical Formula:** C<sub>5</sub>H<sub>12</sub>O

**Product Codes:**

J.T. Baker: 9034, 9042, 9043

Mallinckrodt: 5398

### 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl tert-butyl Ether	1634-04-4	99 - 100%	Yes

### 3. Hazards Identification

#### Emergency Overview

**DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY AFFECT CENTRAL NERVOUS SYSTEM, BLOOD, AND KIDNEYS. A CENTRAL NERVOUS SYSTEM DEPRESSANT. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.**

J.T. Baker SAF-T-DATA<sup>(tm)</sup> Ratings (Provided here for your convenience)

---

Health Rating: 2 - Moderate  
Flammability Rating: 4 - Extreme (Flammable)  
Reactivity Rating: 2 - Moderate  
Contact Rating: 2 - Moderate  
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;  
PROPER GLOVES; CLASS B EXTINGUISHER  
Storage Color Code: Red (Flammable)

---

### Potential Health Effects

---

**Inhalation:**

Inhalation of vapor can irritate respiratory tract. Causes central nervous system effects. Breathing high concentrations in air can cause lightheadedness, dizziness, weakness, nausea, headache.

**Ingestion:**

May cause nausea, vomiting. Other symptoms similar to inhalation may occur. Laryngeal, ocular, and respiratory muscles are affected in severe poisoning.

**Skin Contact:**

A mild skin irritant which causes loss of natural oils. May be a route of absorption into the body.

**Eye Contact:**

Vapors can irritate eyes; splashes may cause damage to eye tissue.

**Chronic Exposure:**

Symptoms noted above may be produced by cumulative exposure.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

---

## 4. First Aid Measures

**Inhalation:**

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

**Ingestion:**

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

**Skin Contact:**

Remove any contaminated clothing. Wash skin with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

## 5. Fire Fighting Measures

**Fire:**

Flash point: -27C (-17F)

Autoignition temperature: 435C (815F)

Flammable limits in air % by volume:

lcl: 1.6; uel: 8.4

Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.

**Explosion:**

Above the flash point, explosive vapor-air mixtures may be formed. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated. Sensitive to static discharge.

**Fire Extinguishing Media:**

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

---

## 7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

-ACGIH Threshold Limit Value (TLV): 40 ppm (TWA)

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation*,

*A Manual of Recommended Practices*, most recent edition, for details. Use explosion-proof equipment.

**Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear protective gloves and clean body-covering clothing.

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Characteristic ethereal odor.

**Solubility:**

4.8 g/100g of water.

**Specific Gravity:**

0.74

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

100

**Boiling Point:**

55C (131F)

**Melting Point:**

-110C (-166F)

**Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

245 @ 25C (77F)

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Unstable in acid solutions.

**Hazardous Decomposition Products:**

Carbon dioxide and carbon monoxide may form when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Oxidizers, acids.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

## 11. Toxicological Information

Oral rat LD50: 4 gm/kg; inhalation rat LC50: 23576 ppm/4H.

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Methyl tert-butyl Ether (1634-04-4)	No	No	None

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material is not expected to biodegrade. When released into the air, this material is expected to adversely affect the ozone layer. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is not expected to be degraded by photolysis. When released into the air, this material is expected to have a half-life between 1 and 10 days.

**Environmental Toxicity:**

No information found.

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

**Domestic (Land, D.O.T.)****Proper Shipping Name:** METHYL TERT-BUTYL ETHER**Hazard Class:** 3**UN/NA:** UN2398**Packing Group:** II**Information reported for product/size:** 335LB

**International (Water, I.M.O.)****Proper Shipping Name:** METHYL TERT-BUTYL ETHER**Hazard Class:** 3.1**UN/NA:** UN2398**Packing Group:** II**Information reported for product/size:** 335LB**15. Regulatory Information**

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Methyl tert-butyl Ether (1634-04-4)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	--Canada-- NDSL	Phil.
Methyl tert-butyl Ether (1634-04-4)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302- RQ	TPQ	-----SARA 313----- List	Chemical Catg.
Methyl tert-butyl Ether (1634-04-4)	No	No	Yes	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8 (d)
Methyl tert-butyl Ether (1634-04-4)	1000	No	No

Chemical Weapons Convention: No      TSCA 12(b): Yes      CDTA: No  
 SARA 311/312: Acute: Yes      Chronic: Yes      Fire: Yes      Pressure: No  
 Reactivity: No      (Pure / Liquid)

**Australian Hazchem Code:** 3[Y]E**Poison Schedule:** No information found.**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

**16. Other Information****NFPA Ratings:** Health: 2 Flammability: 4 Reactivity: 0**Label Hazard Warning:**

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. MAY AFFECT CENTRAL NERVOUS SYSTEM, BLOOD, AND KIDNEYS. A CENTRAL NERVOUS SYSTEM DEPRESSANT. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

**Label Precautions:**

Keep away from heat, sparks and flame.  
Avoid contact with eyes, skin and clothing.  
Avoid breathing vapor.  
Keep container closed.  
Use only with adequate ventilation.  
Wash thoroughly after handling.

**Label First Aid:**

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 3, 8.

**Disclaimer:**

\*\*\*\*\*

**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.**

\*\*\*\*\*

**Prepared by:** Strategic Services Division  
Phone Number: (314) 539-1600 (U.S.A.)

U.S. OIL CO., INC.  
EAST COAST MARKETING  
5 LAKE FANNY ROAD  
P.O. BOX 111  
BEL AIR, MD 21014  
PHONE: (301) 383-0253; (301) 879-7352  
EMERGENCY PHONE: (414) 739-6100  
CHEMTREC: (800) 424-9300

SECTION 1. PRODUCT IDENTIFICATION-----

PRODUCT: GASOLINE  
CHEMICAL NAME: GASOLINE, PETROL  
TRADE NAME & SYNONYMS: REGULAR LEADED, REGULAR NOLEAD, SUPER  
NOLEAD, PREMIUM LEADED, RACING GAS  
CHEMICAL FAMILY: PETROLEUM HYDROCARBON  
FORMULA: C3-C12  
CAS NUMBER: 8006-61-9

SECTION 2. HAZARDOUS COMPONENTS-----

INGREDIENT: GASOLINE  
PERCENT: 100  
OSHA LIMIT: N/A  
TLV: TWA = 300 PPM; STEL = 500 PPM

INGREDIENT: BENZENE  
PERCENT: UP TO 2  
OSHA LIMIT: TWA = 10 PPM; CEILING = 25 PPM  
TLV: TWA = 10 PPM; STEL = 25 PPM

INGREDIENT: TOLUENE  
PERCENT: UP TO 3  
OSHA LIMIT: TWA = 200 PPM; CEILING = 300 PPM  
TLV: TWA = 100 PPM; STEL = 150 PPM

INGREDIENT: XYLENE

PERCENT: UP TO 5

OSHA LIMIT: TWA: 100 PPM

TLV: TWA = 100 PPM; STEL = 150 PPM

TETRETHYL LEAD (REGULAR LEADED ONLY)

PERCENT: 0.1

OSHA LIMIT: TWA = 0.075 MG/M3 SKIN NOTATION

TLV: TWA = 0.1 MG/M3; STEL = 0.3 MG/M3 SKIN NOTATION

SECTION 3. PHYSICAL AND CHEMICAL PROPERTIES-----

BOILING POINT: 70-430 F

VAPOR PRESSURE: 325-525 MM HG @ 68 F

EVAPORATION: ESTIMATED 1.5

ODOR & THRESHOLD: GASOLINE 10 PPM

VAPOR DENSITY: 3-4 (AIR=1)

SPECIFIC GRAVITY: 0.70 - 0.73

PERCENT VOLATILE BY VOLUME: 100%

MOLECULAR WEIGHT: APPROX. 100

APPEARANCE: CLEAR, STRAW COLORED BRONZE, OR PINKISH IN COLOR

VISCOSITY: NOT APPLICABLE

SOLUBILITY: NEGLIGIBLE

SECTION 4. FIRE PROTECTION INFORMATION-----

FLASH POINT AND METHOD: ESTIMATED -45 F (CLOSED CUP ASTM D-56)

AUTOIGNITION TEMPERATURE: 536 F OR HIGHER

EXTINGUISHING MEDIA: CARBON DIOXIDE, DRY CHEMICAL, OR FOAM.

WATER STREAM MAY SPREAD FIRE; USE WATER SPRAY ONLY TO COOL

CONTAINERS EXPOSED TO FIRE. IF LEAK OR SPILL HAS NOT

IGNITED, USE WATER SPRAY TO DISPERSE THE VAPORS.

HAZARDOUS DECOMPOSITION PRODUCTS: INCOMPLETE COMBUSTION CAN

YIELD CARBON MONOXIDE, CARBON DIOXIDE, LEAD OXIDE AND

VARIOUS HYDROCARBONS.

FIRE AND EXPLOSION HAZARDS: CAN FORM FLAMMABLE MIXTURES WITH

AIR AND FLASH AT ROOM TEMPERATURES. EXPLOSION HAZARD IN FIRE

SITUATION. VAPOR IS HEAVIER THAN AIR AND MAY TRAVEL  
CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH  
BACK.

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

STABILITY: STABLE

CONDITIONS TO AVOID: HEAT, SPARKS, FLAME, AND STATIC  
ELECTRICITY.

SECTION 5. HEALTH INFORMATION-----

INHALATION: POSSIBLE EFFECTS INCLUDE HEADACHE, NASAL AND  
RESPIRATORY IRRITATION, DROWSINESS, FATIGUE, PNEUMONITIS,  
PULMONARY EDEMA, CENTRAL NERVOUS SYSTEM DEPRESSION AND  
KIDNEY DAMAGE. LONG-TERM EXPOSURE TO RATS HAS RESULTED IN  
KIDNEY CANCER.

EYE CONTACT: MILD EYE IRRITATION MAY RESULT FROM CONTACT  
WITH LIQUID, MIST, AND/OR VAPORS.

SKIN CONTACT: SKIN IRRITATION, DERMATITIS OR MORE SERIOUS  
DISORDERS MAY OCCUR UPON PROLONGED AND REPEATED CONTACT DUE  
TO SKIN DEFATTING. LIQUID CAN PENETRATE SKIN TO CAUSE  
CENTRAL NERVOUS SYSTEM DEPRESSION. VAPOR PENETRATION CAN  
ALSO CAUSE SYSTEMIC EFFECTS. REGULAR LEADED GASOLINE  
CONTAINS LEAD. LEAD CAN BE A CUMULATIVE POISON.

INGESTION: POSSIBLE EFFECTS INCLUDE HEADACHE, NASAL AND  
RESPIRATORY IRRITATION, NAUSEA, DROWSINESS, ASPHYXIA,  
FATIGUE, PNEUMONITIS, PULMONARY EDEMA, CENTRAL NERVOUS  
SYSTEM DEPRESSION AND KIDNEY DAMAGE. ASPIRATION INTO LUNGS  
WILL CAUSE CHEMICAL PNEUMONIA.

SECTION 6. FIRST AID PROCEDURES-----

INHALATION: IMMEDIATELY MOVE PERSONNEL TO AREA OF FRESH AIR.  
FOR RESPIRATORY DISTRESS, GIVE AIR, OXYGEN, OR ADMINISTER  
CPR (CARDIOPULMONARY RESUSCITATION). IF NECESSARY, OBTAIN  
MEDICAL ATTENTION IF BREATHING DIFFICULTIES CONTINUE.

EYE CONTACT: IMMEDIATELY FLUSH EYES WITH CLEAN, LOW-PRESSURE  
WATER FOR AT LEAST 15 MINUTES, OCCASIONALLY LIFTING LOWER

AND UPPER LIDS. IF IRRITATION PERSISTS, OBTAIN MEDICAL ATTENTION.

SKIN CONTACT: IF CLOTHING IS SOAKED, IMMEDIATELY REMOVE CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION. LAUNDRER CLOTHING BEFORE REUSE, BUT DISCARD CONTAMINATED LEATHER SHOES/GLOVES.

INGESTION: DO NOT INDUCE VOMITING, SINCE ASPIRATION INTO THE LUNGS WILL CAUSE CHEMICAL PNEUMONIA. PROMPTLY OBTAIN MEDICAL ATTENTION.

GENERAL: PERSONNEL WITH PRE-EXISTING SKIN DISORDERS, IMPAIRED LIVER OR KIDNEY FUNCTION, OR CENTRAL NERVOUS SYSTEM AND CHRONIC RESPIRATORY DISEASES SHOULD AVOID EXPOSURE TO THIS MATERIAL.

SECTION 7. EMPLOYEE PROTECTION-----

VENTILATION: MAINTAIN LOCAL OR DILUTION VENTILATION TO KEEP AIR CONCENTRATION BELOW 300 PPM. WHEN LOADING, UNLOADING, TANK GAUGING, ETC. REMAIN UPWIND.

RESPIRATORY PROTECTION: NONE NEEDED UNDER NORMAL CONDITIONS WITH ADEQUATE VENTILATION. USE NIOSH/MSHA APPROVED RESPIRATOR WHEN VAPOR LEVELS EXCEED EXPOSURE LIMITS. UP TO 1000 PPM, HALF-MASK ORGANIC VAPOR RESPIRATOR. UP TO 5000 PPM, FULL-FACE ORGANIC VAPOR RESPIRATOR OR FULL-FACED SUPPLIED AIR RESPIRATOR. GREATER THAN 5000 PPM, FIRE FIGHTING, OR UNKNOWN CONCENTRATION, SELF-CONTAINED BREATHING APPARATUS WITH POSITIVE PRESSURE.

PROTECTIVE CLOTHING - EYES: CHEMICAL GOGGLES WITH SIDE SHIELDS, FACE SHIELD.

PROTECTIVE CLOTHING - SKIN: AVOID PROLONGED AND/OR REPEATED SKIN CONTACT. IF CONDITIONS OR FREQUENCY OF USE MAKE CONTACT SIGNIFICANT, GLOVES, APRON, BOOTS AND FACIAL PROTECTION MADE OF NITRILE, NEOPRENE OR OTHER MATERIAL RESISTANT TO GASOLINE SHOULD BE WORN.

OTHER PROTECTIVE EQUIPMENT: USE ELECTRICAL GROUNDING ON HANDLING/TRANSPORTATION EQUIPMENT.

SECTION 8. TRANSPORTATION, HANDLING, AND STORAGE

INFORMATION-----

DOT HAZARDOUS MATERIAL: YES

DOT SHIPPING NAME AND NUMBER: GASOLINE, UN 1203

DOT HAZARD CLASS: FLAMMABLE LIQUID

HANDLING PRECAUTIONS: KEEP AWAY FROM HEAT, SPARKS AND OPEN FLAME! GROUND ALL DRUMS AND TRANSFER VESSELS WHEN HANDLING. EMPTY CONTAINERS RETAIN SOME LIQUID/VAPOR RESIDUES; HAZARD PRECAUTIONS MUST BE OBSERVED WHEN HANDLING EMPTIES. REFER TO 49 CFR 173.118 AND 173.119(A) FOR PACKAGING REFERENCES.

STORAGE PRECAUTIONS: KEEP CONTAINERS CLOSED AND DO NOT STORE IN A CLOSED VEHICLE. CONTAINERS SHOULD BE ABLE TO WITHSTAND PRESSURES EXPECTED FROM WARMING OR COOLING IN STORAGE. DO NOT STORE WITH STRONG ACIDS OR STRONG OXIDIZERS. STORE AS AN OSHA CLASS 1B FLAMMABLE LIQUID.

SECTION 9. ENVIRONMENTAL PROTECTION-----

SPIILLS, LEAKS OR RELEASE: NOTIFY EMERGENCY RESPONSE PERSONNEL. EVACUATE AREA AND REMOVE IGNITION SOURCES. BUILD A DIKE TO CONTAIN FLOW. REMOVE LIQUID OR USE WATER FOG TO DISPERSE VAPORS. PICK UP WITH PADS AND ABSORBENT MATERIAL. GASOLINE WILL FLOAT ON WATER AND RESULTING RUNOFF MAY CREATE AN EXPLOSION OR FIRE HAZARD. COMPLY WITH ALL APPLICABLE LAWS. SPILLS MAY NEED TO BE REPORTED TO THE NATIONAL RESPONSE CENTER (800/424-8802).

WASTE DISPOSAL METHOD: DISPOSE OF PRODUCT, CONTAMINATED MATERIAL, AND STORAGE TANK WATER BOTTOMS AS AN EPA "IGNITABLE HAZARDOUS WASTE" (D001) UNLESS PROVEN OTHERWISE. RCRA CLASSIFICATION FOR UNADULTERATED PRODUCT AS A WASTE - IGNITABLE, EP TOXIC. USE APPROVED TREATMENT, TRANSPORTERS, AND DISPOSAL STIES IN COMPLIANCE WITH ALL LAWS. IF SPILL IS INTRODUCED INTO A WASTEWATER SYSTEM, THE CHEMICAL AND

BIOLOGICAL OXYGEN DEMAND WILL LIKELY INCREASE. SPILL MATERIAL IS BIODEGRADABLE IF GRADUALLY EXPOSED TO MICROORGANISMS. A POTENTIAL DISPOSAL METHOD IS INCINERATION. INFORMATION SUPPLIED BY: WHOLESALE PETROLEUM - TERMINAL SALES

REVISION DATE: 05/01/86

DISCLAIMER\*\*\*\*\*

THE INFORMATION AND RECOMMENDATIONS CONTAINED IN THIS MSDS HAVE BEEN COMPILED FROM SOURCES BELIEVED TO BE RELIABLE AND TO PRESENT THE BEST CURRENT OPINION ON THE SUBJECT AT THE TIME OF PUBLICATION. NO WARRANTY OR MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE AS CONCERNS THE INFORMATION HEREIN PROVIDED. THIS INFORMATION RELATES ONLY TO THE SPECIFIC MATERIAL DESIGNATED AND MAY NOT BE VALID FOR SUCH MATERIAL USED IN COMBINATION WITH ANY OTHER MATERIALS OR IN ANY PROCESS. ALSO, SINCE THE CONDITIONS AND METHODS OF USE OF THE PRODUCT AND THE INFORMATION REFERRED TO HEREIN ARE BEYOND THE CONTROL OF U.S. OIL CO., INC., INCLUDING ITS DIVISIONS AND AFFILIATES, U.S. OIL COL, INC. EXPRESSLY DISCLAIMS ANY AND ALL LIABILITY AS TO ANY RESULTS OBTAINED OR ARISING FROM ANY USE OF THE PRODUCT OR SUCH INFORMATION. THE USER OF THE PRODUCT IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE PRODUCT FOR THEIR PARTICULAR PURPOSE AND THE COMPLETENESS OF THE INFORMATION PRESENTED IN THIS PUBLICATION.

=====

THIS INFORMATION IS INTENDED ONLY AS GUIDANCE FOR APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL AND IS BELIEVED TO BE ACCURATE. THE UNIVERSITY SYSTEM OF GEORGIA RIGHT TO KNOW PROGRAM PROVIDES NO GUARANTEE OF THE ACCURACY OR COMPLETENESS OF THE DATA AND SHALL NOT BE LIABLE FOR ANY

DAMAGES. USERS OF THIS PRODUCT ARE RESPONSIBLE FOR INVESTIGATING AND VERIFYING THE PRECAUTIONS AND DANGERS INVOLVED IN THE APPLICATION THAT THEY HAVE CHOSEN. FEDERAL, STATE, MUNICIPAL, AND INSURANCE REQUIREMENTS, AND NATIONAL SAFETY CODES MUST BE FOLLOWED AND ARE NOT TO BE CONFUSED WITH THE PRECAUTIONARY DATA.

LAST PAGE.

MSDS for XYLENES

Page 1

## 1 - PRODUCT IDENTIFICATION

PRODUCT NAME: XYLENES  
 FORMULA: C<sub>6</sub>H<sub>4</sub>(CH<sub>3</sub>)<sub>2</sub>  
 FORMULA WT: 106.17  
 CAS NO.: 1330-20-7  
 NIOSH/RTECS NO.: ZE2100000  
 COMMON SYNONYMS: DIMETHYLBENZENE; XYLOL  
 PRODUCT CODES: 9489, 9499, 5377, 9491, 9493, 9490, X516, 9492, 9516  
 EFFECTIVE: 09/11/86  
 REVISION #03

## PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 2 MODERATE  
 FLAMMABILITY - 3 SEVERE (FLAMMABLE)  
 REACTIVITY - 0 NONE  
 CONTACT - 2 MODERATE

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

## LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

## PRECAUTIONARY LABEL STATEMENTS

## WARNING

## FLAMMABLE

## CAUSES IRRITATION

## HARMFUL IF SWALLOWED OR INHALED

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.  
 AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH  
 ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,  
 USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.  
 FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

## 2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
M-XYLENE	40-65	108-38-3
O-XYLENE	15-20	95-47-6
P-XYLENE	0-20	106-42-3
ETHYL BENZENE	15-25	100-41-4

## 3 - PHYSICAL DATA

MSDS for XYLENES

Page 2

-----  
BOILING POINT: 137 C ( 279 F) VAPOR PRESSURE(MM HG): 5.1  
MELTING POINT: -48 C ( -54 F) VAPOR DENSITY(AIR=1): 3.7  
SPECIFIC GRAVITY: 0.87 EVAPORATION RATE: 0.7  
(H2O=1) (BUTYL ACETATE=1)  
SOLUBILITY(H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 100  
APPEARANCE & ODOR: COLORLESS LIQUID WITH SWEET PLEASANT ODOR.  
-----

-----  
4 - FIRE AND EXPLOSION HAZARD DATA  
-----

FLASH POINT (CLOSED CUP 27 C ( 80 F) NFPA 704M RATING: 2-3-0  
FLAMMABLE LIMITS: UPPER - 7.0 % LOWER - 1.1 %  
FIRE EXTINGUISHING MEDIA  
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.  
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

TOXIC GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE  
-----

5 - HEALTH HAZARD DATA  
-----

THRESHOLD LIMIT VALUE (TLV/TWA): 435 MG/M3 ( 100 PPM)  
SHORT-TERM EXPOSURE LIMIT (STEL): 655 MG/M3 ( 150 PPM)  
PERMISSIBLE EXPOSURE LIMIT (PEL): 435 MG/M3 ( 100 PPM)  
TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 4300  
LD50 (IPR-MOUSE) (MG/KG) - 1.6  
LD50 (SCU-RAT) (MG/KG) - 1700

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE  
-----

MSDS for XYLENES

Page 3  
-----

INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL.  
INHALATION OF VAPORS MAY CAUSE HEADACHE, NAUSEA, VOMITING, DIZZINESS,

DROWSINESS, IRRITATION OF RESPIRATORY TRACT, AND LOSS OF CONSCIOUSNESS.  
INHALATION OF VAPORS MAY CAUSE NARCOSIS.  
CONTACT WITH SKIN OR EYES MAY CAUSE IRRITATION.  
INGESTION MAY CAUSE NAUSEA, VOMITING, HEADACHES, DIZZINESS, GASTRO-  
INTESTINAL IRRITATION, BLURRED VISION, LOWERING OF BLOOD PRESSURE.  
CHRONIC EFFECTS OF OVEREXPOSURE MAY INCLUDE KIDNEY AND/OR LIVER DAMAGE.

## TARGET ORGANS

CENTRAL NERVOUS SYSTEM, EYES, SKIN, GI TRACT, BLOOD, LIVER AND KIDNEYS

## MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

NONE IDENTIFIED

## ROUTES OF ENTRY

INGESTION, INHALATION, SKIN CONTACT, EYE CONTACT, ABSORPTION

## EMERGENCY AND FIRST AID PROCEDURES

CALL A PHYSICIAN.

IF SWALLOWED, DO NOT INDUCE VOMITING.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL  
RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FOR  
AT LEAST 15 MINUTES.-----  
6 - REACTIVITY DATA  
-----

STABILITY: STABLE

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS

DECOMPOSITION PRODUCTS: CARBON MONOXIDE, CARBON DIOXIDE  
-----7 - SPILL AND DISPOSAL PROCEDURES  
-----

## STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING.

SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING OR FLAMES IN AREA. STOP LEAK  
IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP  
WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE INTO  
CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.J. T. BAKER SOLUSORB(R) SOLVENT ADSORBENT IS RECOMMENDED  
FOR SPILLS OF THIS PRODUCT.

## DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL  
ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER:

U239 (TOXIC WASTE)  
-----8 - PROTECTIVE EQUIPMENT  
-----

MSDS for XYLENES

Page 4  
-----

VENTILATION:

USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET

## TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 1000 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS RECOMMENDED.

EYE/SKIN PROTECTION: SAFETY GOGGLES, UNIFORM, APRON, NITRILE GLOVES ARE RECOMMENDED.

---

9 - STORAGE AND HANDLING PRECAUTIONS

---

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

## SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

---

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

---

## DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	XYLENE
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1307
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	1000 LBS.

## INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	XYLENES
HAZARD CLASS	3.3
UN/NA	UN1307
LABELS	FLAMMABLE LIQUID

-----  
MSDS for BENZENEPage 1  
----------  
1 - PRODUCT IDENTIFICATION  
-----

PRODUCT NAME: BENZENE  
FORMULA: C6H6  
FORMULA WT: 78.10  
CAS NO.: 71-43-2  
NIOSH/RTECS NO.: CY1400000  
COMMON SYNONYMS: BENZOL; PHENYL HYDRIDE; COAL NAPHTHA  
PRODUCT CODES: 9156, 9256, 9153, 9154, 9155, B717, 9149  
EFFECTIVE: 01/22/87  
REVISION #04

## PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 4 EXTREME (CANCER CAUSING)  
FLAMMABILITY - 3 SEVERE (FLAMMABLE)  
REACTIVITY - 0 NONE  
CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

## LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B  
EXTINGUISHER

## PRECAUTIONARY LABEL STATEMENTS

POISON DANGER  
EXTREMELY FLAMMABLE

CAUTION: CONTAINS BENZENE, CANCER HAZARD

HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN

EXCEPTIONAL HEALTH HAZARD - READ MATERIAL SAFETY DATA SHEET

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.  
AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH  
ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,  
USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.  
FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

-----  
2 - HAZARDOUS COMPONENTS  
-----

COMPONENT	%	CAS NO.
BENZENE	90-100	71-43-2

-----  
3 - PHYSICAL DATA  
----------  
MSDS for BENZENEPage 2  
-----

BOILING POINT: 80 C ( 176 F) VAPOR PRESSURE(MM HG): 74.6  
MELTING POINT: 6 C ( 43 F) VAPOR DENSITY(AIR=1): 2.77  
SPECIFIC GRAVITY: 0.88 EVAPORATION RATE: N/A  
(H2O=1) (BUTYL ACETATE=1)  
SOLUBILITY(H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 100  
APPEARANCE & ODOR: CLEAR COLORLESS LIQUID HAVING CHARACTERISTIC AROMATIC ODOR.

---

4 - FIRE AND EXPLOSION HAZARD DATA

---

FLASH POINT (CLOSED CUP: -11 C ( 12 F) NFPA 704M RATING: 2-3-0  
FLAMMABLE LIMITS: UPPER - 8.0 % LOWER - 1.3 %  
FIRE EXTINGUISHING MEDIA  
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.  
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES  
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED  
BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.  
MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER  
TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS  
VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK.  
CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG  
OXIDIZERS MAY CAUSE FIRE.

TOXIC GASES PRODUCED  
CARBON MONOXIDE, CARBON DIOXIDE

---

5 - HEALTH HAZARD DATA

---

THIS SUBSTANCE IS LISTED AS ACGIH SUSPECT HUMAN CARCINOGEN, NTP HUMAN  
CARCINOGEN, IARC HUMAN CARCINOGEN (GROUP 1). ACCEPTABLE MAXIMUM PEAK ABOVE  
THE ACCEPTANCE CEILING CONCENTRATION FOR AN EIGHT-HOUR SHIFT = 50 PPM FOR  
10 MINUTES; (PEL) CEILING = 25 PPM.

THRESHOLD LIMIT VALUE (TLV/TWA): 30 MG/M3 ( 10 PPM)  
SHORT-TERM EXPOSURE LIMIT (STEL): 75 MG/M3 ( 25 PPM)  
PERMISSIBLE EXPOSURE LIMIT (PEL): 30 MG/M3 ( 10 PPM)  
TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 4894  
LD50 (ORAL-MOUSE) (MG/KG) - 4700  
LD50 (IPR-RAT) (MG/KG) - 2.9  
LC50 (INHL-MOUSE-7H) (PPM) - 9980

---

MSDS for BENZENE

Page 3

---

CARCINOGENICITY: NTP: YES IARC: YES Z LIST: NO OSHA REG: NO



## DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: U019 (TOXIC WASTE)

-----  
8 - PROTECTIVE EQUIPMENT  
-----

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS ABOVE 10 PPM, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, POLYVINYL ALCOHOL GLOVES ARE RECOMMENDED.

-----  
9 - STORAGE AND HANDLING PRECAUTIONS  
-----

SAF-T-DATA(TM) STORAGE COLOR CODE: RED STRIPE (STORE SEPARATELY)

## SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

-----  
10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION  
-----

## DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	BENZENE (BENZOL)
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1114
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	1000 LBS.

## INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	BENZENE
HAZARD CLASS	3.2
UN/NA	UN1114
LABELS	FLAMMABLE LIQUID

MSDS for BENZENE

Page 5

-----  
MSDS for TOLUENE

Page 1

-----  
1 - PRODUCT IDENTIFICATION

PRODUCT NAME: TOLUENE  
FORMULA: C6H5CH3  
FORMULA WT: 92.14  
CAS NO.: 108-88-3  
NIOSH/RTECS NO.: XS5250000  
COMMON SYNONYMS: METHYLBENZENE; PHENYLMETHANE; TOLUOL  
PRODUCT CODES: 9472, 9456, 9466, 9462, V963, 9351, 9460, 9457, 9459, 9336, 5375, 9461  
EFFECTIVE: 09/08/86  
REVISION #02

## PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 2 MODERATE  
FLAMMABILITY - 3 SEVERE (FLAMMABLE)  
REACTIVITY - 0 NONE  
CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

## LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

## PRECAUTIONARY LABEL STATEMENTS

WARNING  
FLAMMABLE

## CAUSES IRRITATION

## MAY BE FATAL IF SWALLOWED OR INHALED

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.  
AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH  
ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,  
USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.  
FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

-----  
2 - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO.
TOLUENE	90-100	108-88-3

-----  
3 - PHYSICAL DATA

BOILING POINT: 111 C ( 232 F) VAPOR PRESSURE(MM HG): 22

-----  
MSDS for TOLUENE

Page 2

MELTING POINT: -95 C ( -139 F) VAPOR DENSITY(AIR=1): 3.2

SPECIFIC GRAVITY: 0.87 EVAPORATION RATE: 2.24  
(H2O=1) (BUTYL ACETATE=1)

SOLUBILITY(H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 100

APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID WITH BENZENE-LIKE ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP 4 C ( 40 F) NFPA 704M RATING: 2-3-0

FLAMMABLE LIMITS: UPPER - 7.1 % LOWER - 1.2 %

FIRE EXTINGUISHING MEDIA  
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.  
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

TOXIC GASES PRODUCED

CARBON MONOXIDE, CARBON DIOXIDE

5 - HEALTH HAZARD DATA

ACCEPTABLE MAXIMUM PEAK ABOVE THE ACCEPTANCE CEILING CONCENTRATION FOR AN EIGHT-HOUR SHIFT = 500 PPM FOR 10 MINUTES. (PEL) CEILING = 300 PPM.

THRESHOLD LIMIT VALUE (TLV/TWA): 375 MG/M3 ( 100 PPM)

SHORT-TERM EXPOSURE LIMIT (STEL): 560 MG/M3 ( 150 PPM)

PERMISSIBLE EXPOSURE LIMIT (PEL): MG/M3 ( 200 PPM)

TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 5000  
LD50 (IPR-MOUSE) (MG/KG) - 1.12  
LD50 (SKN-RABBIT) (G/KG) - 14  
LC50 (INHL-MOUSE-8H) (PPM) - 5320

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

MSDS for TOLUENE

Page 3

EFFECTS OF OVEREXPOSURE

INHALATION AND INGESTION ARE HARMFUL AND MAY BE FATAL.



EPA HAZARDOUS WASTE NUMBER: U220 (TOXIC WASTE)

-----  
8 - PROTECTIVE EQUIPMENT  
-----

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 1000 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS RECOMMENDED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, POLYVINYL ALCOHOL GLOVES ARE RECOMMENDED.

-----  
9 - STORAGE AND HANDLING PRECAUTIONS  
-----

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

## SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

-----  
10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION  
-----

## DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	TOLUENE
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1294
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	1000 LBS.

## INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	TOLUENE
HAZARD CLASS	3.2
UN/NA	UN1294
LABELS	FLAMMABLE LIQUID

-----  
MSDS for ACETONEPage 1  
----------  
1 - PRODUCT IDENTIFICATION  
-----

PRODUCT NAME: ACETONE  
 FORMULA: (CH<sub>3</sub>)<sub>2</sub>CO  
 FORMULA WT: 58.08  
 CAS NO.: 67-64-1  
 NIOSH/RTECS NO.: AL3150000  
 COMMON SYNONYMS: DIMETHYL KETONE; METHYL KETONE; 2-PROPANONE  
 PRODUCT CODES: 9010, 9006, 9002, 9254, 9009, 9001, 9004, 5356, A134, 9007, 9005, 9005  
 9008  
 EFFECTIVE: 08/27/86  
 REVISION #02

## PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 1 SLIGHT  
 FLAMMABILITY - 3 SEVERE (FLAMMABLE)  
 REACTIVITY - 2 MODERATE  
 CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

PRECAUTIONARY LABEL STATEMENTS

DANGER  
 CAUSES IRRITATION  
 EXTREMELY FLAMMABLE

HARMFUL IF SWALLOWED OR INHALED

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.  
 AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH  
 ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE,  
 USE ALCOHOL FOAM, DRY CHEMICAL, CARBON DIOXIDE - WATER MAY BE INEFFECTIVE.  
 FLUSH SPILL AREA WITH WATER SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

-----  
2 - HAZARDOUS COMPONENTS  
-----

COMPONENT	%	CAS NO.
ACETONE	90-100	67-64-1

-----  
3 - PHYSICAL DATA  
-----

BOILING POINT: 56 C ( 133 F)      VAPOR PRESSURE(MM HG): 181

-----  
MSDS for ACETONE

Page 2

MELTING POINT: -95 C ( -139 F) VAPOR DENSITY(AIR=1): 2.0  
SPECIFIC GRAVITY: 0.79 EVAPORATION RATE: ~10  
(H2O=1) (BUTYL ACETATE=1)  
SOLUBILITY(H2O): COMPLETE (IN ALL PROPORTIONS) % VOLATILES BY VOLUME: 100  
APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID WITH A FRAGRANT SWEET ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP: -18 C ( 0 F) NFPA 704M RATING: 1-3-0  
FLAMMABLE LIMITS: UPPER - 13.0 % LOWER - 2.6 %  
FIRE EXTINGUISHING MEDIA  
USE ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.  
(WATER MAY BE INEFFECTIVE.)

SPECIAL FIRE-FIGHTING PROCEDURES

FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS

VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

5 - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 1780 MG/M3 ( 750 PPM)  
SHORT-TERM EXPOSURE LIMIT (STEL): 2375 MG/M3 ( 1000 PPM)  
PERMISSIBLE EXPOSURE LIMIT (PEL): 2400 MG/M3 ( 1000 PPM)  
TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 9750  
LD50 (ORAL-MOUSE) (MG/KG) - 3000  
LD50 (IPR-MOUSE) (MG/KG) - 1297  
LD50 (SKN-RABBIT) (G/KG) - 20

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE

VAPORS MAY BE IRRITATING TO SKIN, EYES, NOSE AND THROAT.  
INHALATION OF VAPORS MAY CAUSE NAUSEA, VOMITING, HEADACHE, OR LOSS OF CONSCIOUSNESS.  
LIQUID MAY CAUSE PERMANENT EYE DAMAGE.  
CONTACT WITH SKIN HAS A DEFATTING EFFECT, CAUSING DRYING AND IRRITATION.

MSDS for ACETONE

Page 3

INGESTION MAY CAUSE NAUSEA, VOMITING, HEADACHES, DIZZINESS,  
GASTROINTESTINAL IRRITATION.



RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 5000 PPM, A GAS MASK WITH ORGANIC VAPOR CANNISTER IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS WITH FULL FACE SHIELD IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GLASSES WITH SIDESHIELDS, BUTYL RUBBER GLOVES ARE RECOMMENDED.

---

9 - STORAGE AND HANDLING PRECAUTIONS

---

SAF-T-DATA(TM) STORAGE COLOR CODE: RED (FLAMMABLE)

SPECIAL PRECAUTIONS

BOND AND GROUND CONTAINERS WHEN TRANSFERRING LIQUID. KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA.

---

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

---

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	ACETONE
HAZARD CLASS	FLAMMABLE LIQUID
UN/NA	UN1090
LABELS	FLAMMABLE LIQUID
REPORTABLE QUANTITY	5000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	ACETONE
HAZARD CLASS	3.1
UN/NA	UN1090
LABELS	FLAMMABLE LIQUID

-----  
MSDS for ETHYL BENZOATEPage 1  
----------  
1 - PRODUCT IDENTIFICATION  
-----

PRODUCT NAME: ETHYL BENZOATE  
FORMULA: C6H5COOC2H5  
FORMULA WT: 150.18  
CAS NO.: 93-89-0  
NIOSH/RTECS NO.: DH0200000  
COMMON SYNONYMS: BENZOIC ETHER; BENZOIC ACID, ETHYL ESTER  
PRODUCT CODES: L416  
EFFECTIVE: 06/09/86  
REVISION #01

## PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH - 1 SLIGHT  
FLAMMABILITY - 1 SLIGHT  
REACTIVITY - 0 NONE  
CONTACT - 1 SLIGHT

HAZARD RATINGS ARE 0 TO 4 (0 = NO HAZARD; 4 = EXTREME HAZARD).

LABORATORY PROTECTIVE EQUIPMENT

SAFETY GLASSES; LAB COAT

PRECAUTIONARY LABEL STATEMENTS

CAUTION  
COMBUSTIBLE

MAY CAUSE IRRITATION

KEEP AWAY FROM HEAT, SPARKS, FLAME. AVOID CONTACT WITH EYES, SKIN, CLOTHING.  
AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE  
VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE, USE WATER SPRAY,  
ALCOHOL FOAM, DRY CHEMICAL, OR CARBON DIOXIDE. FLUSH SPILL AREA WITH WATER  
SPRAY.

SAF-T-DATA(TM) STORAGE COLOR CODE: ORANGE (GENERAL STORAGE)

-----  
2 - HAZARDOUS COMPONENTS  
-----

COMPONENT	%	CAS NO.
NOT APPLICABLE		

-----  
3 - PHYSICAL DATA  
-----

BOILING POINT: 213 C ( 415 F) VAPOR PRESSURE(MM HG): N/A  
MELTING POINT: -34 C ( -29 F) VAPOR DENSITY(AIR=1): 5.17

-----  
MSDS for ETHYL BENZOATE

Page 2

SPECIFIC GRAVITY: 1.05 (H2O=1) EVAPORATION RATE: N/A (BUTYL ACETATE=1)  
SOLUBILITY(H2O): NEGLIGIBLE (LESS THAN 0.1 %) % VOLATILES BY VOLUME: 100  
APPEARANCE & ODOR: COLORLESS, CLEAR LIQUID WITH AN AROMATIC ODOR.

4 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP 88 C ( 190 F) NFPA 704M RATING: 1-1-0

FLAMMABLE LIMITS: UPPER - N/A % LOWER - N/A %

FIRE EXTINGUISHING MEDIA  
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES  
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

TOXIC GASES PRODUCED  
CARBON MONOXIDE, CARBON DIOXIDE

5 - HEALTH HAZARD DATA

TOXICITY: LD50 (ORAL-RAT) (MG/KG) - 2100  
LD50 (ORAL-RABBIT) (MG/KG) - 2630

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

EFFECTS OF OVEREXPOSURE  
VAPORS MAY BE IRRITATING TO EYES, NOSE AND THROAT.  
CONTACT WITH SKIN OR EYES MAY CAUSE IRRITATION.

TARGET ORGANS  
NONE IDENTIFIED

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE  
NONE IDENTIFIED

ROUTES OF ENTRY  
NONE INDICATED

EMERGENCY AND FIRST AID PROCEDURES  
INGESTION: IF SWALLOWED AND THE PERSON IS CONSCIOUS, IMMEDIATELY GIVE

MSDS for ETHYL BENZOATE

Page 3

INHALATION: LARGE AMOUNTS OF WATER. GET MEDICAL ATTENTION.  
IF A PERSON BREATHE IN LARGE AMOUNTS, MOVE THE EXPOSED



---

10 - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

---

## DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	COMBUSTIBLE LIQUID, N.O.S. (ETHYL BENZOATE)
HAZARD CLASS	COMBUSTIBLE LIQUID
UN/NA	NA1993
LABELS	NO LABEL REQUIRED UNDER 110 GALLONS

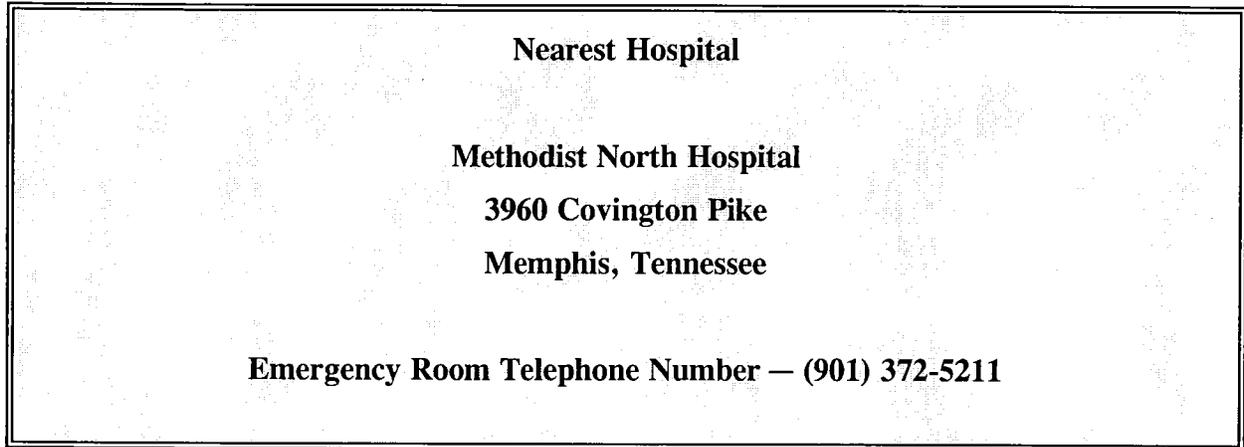
## INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	CHEMICALS, N.O.S. (NON-REGULATED)
----------------------	-----------------------------------

**Appendix B**  
**Directions to the Nearest Hospital**

## **DIRECTIONS TO THE NEAREST MEDICAL FACILITIES**

The nearest hospital **and** the nearest facility capable of treating chemical burns are the same facility, which is located at Methodist North Hospital. Therefore, there is only one set of directions.



### **Directions to Methodist North Hospital from NSA Mid-South Main Gate:**

- 1) Exit site through South Gate (Singleton Parkway).
- 2) Continue on Singleton Parkway through the stop signs.
- 3) Singleton Parkway and Covington Pike will intersect at a red light (about 5 miles).
- 4) You will see the entrance to the emergency room 700 feet past this light on the left.

**Appendix C**  
**Forms**

## PLAN ACCEPTANCE FORM

### SITE HEALTH AND SAFETY PLAN

**INSTRUCTIONS:** This form is to be completed by each person working on the project work site and returned to the Site Manager, EnSafe, Memphis, Tennessee.

**Job No:** 937

**Contract No:** N62467-98-D-0937

**Project:** Navy Exchange Service Station

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it. I certify I am in compliance with the applicable OSHA training requirements pertaining to the following:

**Check all that apply**

- 40-hour HAZWOPER training per 29 CFR 1910.120 (**required**)
- 8-hour HAZWOPER Refresher per 29 CFR 1910.120 (**required**; if applicable)
- 8-hour HAZWOPER Site Supervisor per 29 CFR 1910.120 (**required**; if applicable)
- First Aid (if applicable)
- CPR (if applicable)

---

Signed

---

Print Name

---

Company

---

Date

**EMPLOYEE EXPOSURE HISTORY FORM**

Employee:

---

Job Name:

---

Date(s) From/To:

---

Hours Onsite:

---

Contaminants (Suspected/Reported):

---

---

---

---

---

---

---

---

---

---

---

## PLAN FEEDBACK FORM

Problems with plan requirements:

---

---

---

Unexpected situations encountered:

---

---

---

---

Recommendations for revisions:

---

---

---

## ACCIDENT REPORT FORM

<b>This form is required by Public Law 91-596 and must be kept in the establishments for 5 years. Failure to maintain can result in the issuance of citations and assessment of penalties.</b>		Case of File No.										
<b>Location of Office:</b>												
1. Name												
2. Mail address ( <i>No. and street, city or town, State, and zip code</i> )												
3. Location if different from mail address												
<b>Injured or Ill Employee</b>												
4. Name ( <i>First, middle, and last</i> )		Social Security No. <table style="width: 100%; border-collapse: collapse; margin-top: 2px;"> <tr> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> </tr> </table>										
5. Home address ( <i>No. and street, city or town, State, and zip code</i> )												
6. Age	7. Sex ( <i>Check one</i> )	Male <input type="checkbox"/> Female <input type="checkbox"/>										
8. Occupation ( <i>Enter regular job title, not the specific activity he was performing at time of injury.</i> )												
9. Department ( <i>Enter name of department or division in which the injured person is regularly employed, even though he may have been temporarily working in another department at the time of injury.</i> )												
<b>The Accident or Exposure to Occupational Illness</b>												
If accident or exposure occurred on employer's premises, give address of plant or establishment in which it occurred. Do not indicate department or division within the plant or establishment. If accident occurred outside employer's premises at an identifiable address, give that address. If it occurred on a public highway or at any other place which cannot be identified by number and street, please provide place references locating the place of injury as accurately as possible.												
10. Place of accident or exposure ( <i>No. and street, city or town, State and zip code</i> )												
11. Was place of accident or exposure on employer's premises?      Yes <input type="checkbox"/> No <input type="checkbox"/>												
12. What was the employee doing when injured? ( <i>Be specific. If he was using tools or equipment or handling material, name them and tell what he was doing with them.</i> )												
13. How did the accident occur? ( <i>Describe fully the events which resulted in the injury or occupational illness. Tell what happened and how it happened. Name any objects or substances involved and tell how they were involved. Give full details on all factors which led or contributed to the accident. Use separate sheet for additional space.</i> )												
<b>Occupational Injury or Occupational Illness</b>												
14. Describe the injury or illness in detail and indicate the part of body affected. ( <i>E.g. amputation of right index finger at second joint; fracture of ribs; lead poisoning; dermatitis of left hand, etc.</i> )												
15. Name the object or substance which directly injured the employee. ( <i>For example, the machine or thing he struck against or which struck him; the vapor or poison he inhaled or swallowed; the chemical or radiation which irritated his skin; or in cases of strains, hernias, etc. the thing he has lifting, pulling, etc.</i> )												
16. Date of injury or initial diagnosis of occupational illness	17. Did employee die? ( <i>Check one</i> )											
	Yes <input type="checkbox"/> No <input type="checkbox"/>											
<b>Other</b>												
18. Name and address of physician												
19. If hospitalized, name and address of hospital												
Date of report	Prepared by ( <i>Print</i> )	Official position										