

N00216.AR.000428
NAS CORPUS CHRISTI
5090.3a

AFFECTED PROPERTY ASSESSMENT WORK PLAN SITES 1, 3 AND BUILDING 8 NAS
CORPUS CHRISTI TX
5/9/2000
ENSAFE, INC

**AFFECTED PROPERTY ASSESSMENT WORK PLAN
INSTALLATION RESTORATION
SITES 1, 3, AND 4 AND BUILDING 8**



**NAS CORPUS CHRISTI
CORPUS CHRISTI, TEXAS**

**CONTRACT No.
N62467-89-D-0318
CTO-0152**

Submitted to:

SOUTHNAVFACENGCOM



Submitted by:

**EnSafe, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134**

May 9, 2000



**AFFECTED PROPERTY ASSESSMENT WORK PLAN
INSTALLATION RESTORATION
SITES 1, 3, AND 4 AND BUILDING 8**

**NAS CORPUS CHRISTI
CORPUS CHRISTI, TEXAS**

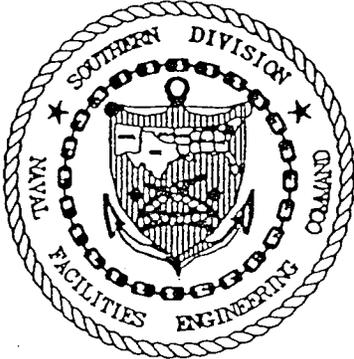
**CONTRACT No.
N62467-89-D-0318
CTO-0152**

Submitted to:

SOUTHNAVFACENGCOM

Submitted by:

**EnSafe, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134**



The Contractor, EnSafe Inc. hereby certifies that to the best of its knowledge and belief, the technical data delivered herewith is complete, accurate, and complies with all requirements of the contract.

Date: May 9, 2000
Signature: 
Name: Mark Henderson
Title: Task Order Manager

Table of Contents

1.0	INTRODUCTION	1
2.0	ADDITIONAL INVESTIGATIONS	3
2.1	Shallow Aquifer	3
2.2	Deeper Confined Aquifer	3
2.3	Drainage Ditch	7
2.4	Surface Soil Sampling	9
3.0	QUALITY ASSURANCE PLAN	11
3.1	Project Organization and Responsibilities	11
3.2	Quality Assurance Objectives	11
3.2.1	Analytical Data Deliverable Levels	11
3.2.2	Determining QA Objectives	14
3.2.3	Quantitative QA Objectives	14
3.2.4	Qualitative QA Objectives	17
3.3	Sampling Procedures	18
3.3.1	Referenced ASTM Standards For Sampling Procedures	18
3.3.2	General Sampling Procedures	19
3.3.3	Sample Processing	21
3.3.4	Developing Sampling Methods	22
3.3.5	Sample Custody	22
3.3.6	Analytical Procedures	24
3.3.7	Field QC Samples	30
3.4	Decontamination	31
3.4.1	Setting Up a Decontamination Area	31
3.4.2	Preventing Cross-Contamination	32
3.4.3	Non-Sampling Equipment	32
3.4.4	Sampling Equipment	32
3.4.5	Personnel Decontamination	33
4.0	HEALTH AND SAFETY PLAN	34
4.1	Introduction	34
4.2	Site Characterization	35
4.2.1	Work Areas	35
4.2.2	Work Area Access	36
4.2.3	Site Map and Work Zones	37
4.3	Site Activities	37
4.4	Hazards	37
4.4.1	Chemical Hazards	37
4.4.2	Heavy Equipment Operations	43
4.4.3	Physical Hazards During Operations	43
4.5	Employee Protection	44
4.5.1	Standard Safe Work Practices	44

4.5.2	NAS Corpus Christi General Rules of Conduct	45
4.5.3	Personal Protective Equipment (PPE)	46
4.5.4	Procedures and Equipment for Extreme Weather Conditions	52
4.5.5	Work Limitations	55
4.5.6	Exposure Evaluation	55
4.6	Monitoring Requirements	56
4.6.1	Medical Monitoring Program	56
4.7	Decontamination	60
4.7.1	Personnel Decontamination	60
4.7.2	Closure of the Personnel Decontamination Station	60
4.8	Authorized Personnel	61
4.8.1	Responsibilities of EnSafe Field Project Manager	61
4.8.2	Responsibilities of EnSafe Site Health and Safety Officer	62
4.8.3	Responsibilities of Onsite Field Personnel	63
4.9	Emergency Information	64
4.9.1	Site Resources	66
4.10	Emergency Procedures	66
4.11	Forms	67
5.0	AFFECTED PROPERTY ASSESSMENT REPORT	68

List of Figures

Figure 1-1	Site Vicinity Map	2
Figure 2-1	Proposed Monitoring Well Location	4
Figure 2-2	Proposed CPT Sampling Locations, Building 8	6
Figure 2-3	Proposed Drainage Ditch Sample Locations	8
Figure 2-4	Proposed Surface Soil Sample Locations	10

List of Tables

Table 3.1	Sample Containers, Preservation, and Holding Times	20
Table 3.2	Analytes Detected by Investigative Analytical Methods	25
Table 4.1	Exposure Guidelines For Expected Site Chemical Hazards	39
Table 4.2	Level of Protection and Criteria	47

List of Appendices

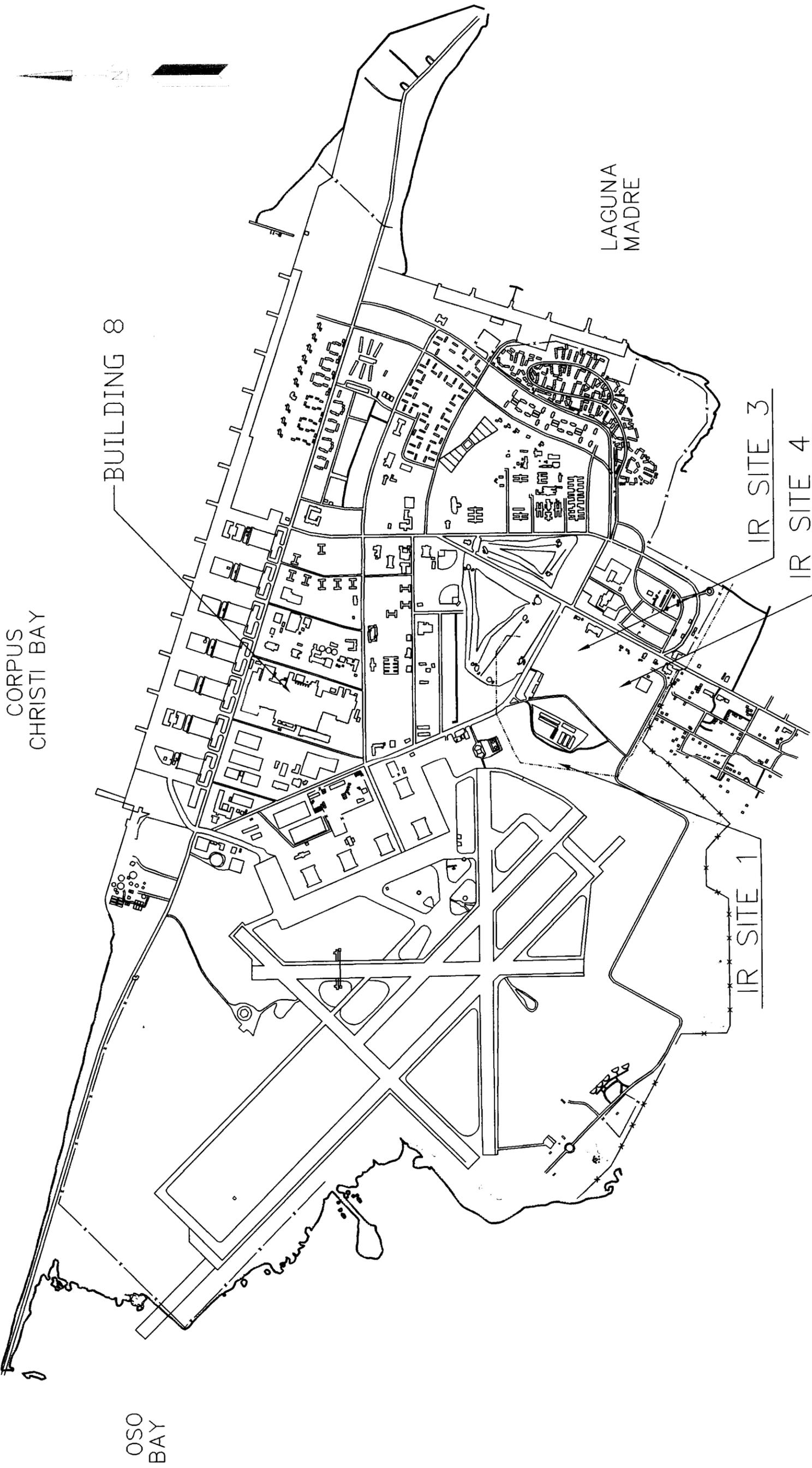
Appendix A	MSDS Sheets
Appendix B	EnSafe Corporate Health & Safety Manual/Drilling Safety Guide
Appendix C	Directions to the Nearest Emergency Medical Facility
Appendix D	Health and Safety Plan Forms

1.0 INTRODUCTION

In response to Texas Natural Resource Conservation Commission (TNRCC) comments on the *Addendum to Follow-up Facility Investigation Report, Installation Restoration Sites 1, 3 and 4*, dated July 8, 1999; *Response to Comments, Draft Final Follow-Up Facility Investigation Report, Building 8, Corpus Christi Army Depot*, dated October 21, 1999; and in order to conform to the new Texas Risk Reduction Program (TRRP) rules (Title 30 Texas Administrative Code chapter 350 [30 TAC 350]), additional investigations are planned for Naval Air Station (NAS) Corpus Christi. This work plan has been prepared by EnSafe on behalf of the Department of the Navy, through Contract Task Order 0152 to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), North Charleston, South Carolina, under contract N62467-89-D-0318.

The investigations described in this work plan will be conducted at Installation Restoration (IR) Sites 1, 3 and 4, also known as Solid Waste Management Units (SWMUs) 1, 2 and 4; and Building 8, Corpus Christi Army Depot (CCAD), SWMU 5. These sites are shown in Figure 1-1. This additional work is intended to fill data gaps and gather additional information required for completion of an Affected Property Assessment Report (APAR) as described in 30 TAC 350.

The original work plan *NAS Corpus Christi Facility Investigation Work Plan Revision 01 (FIWP)* dated August 17, 1992, is referenced for specific field activity methods and procedures. The Quality Assurance Plan (QAP) and Health and Safety Plan (HASP) from the above-described document have been updated and included in this work plan as Sections 3 and 4.



AFFECTED PROPERTY
 ASSESSMENT WORK PLAN
 IR SITES 1, 3, AND 4
 AND BUILDING 8
 NAS CORPUS CHRISTI
 CORPUS CHRISTI, TEXAS



FIGURE 1-1
 SITE VICINITY MAP

2.0 ADDITIONAL INVESTIGATIONS

Proposed additional investigations are described in the following sections.

2.1 Shallow Aquifer

Elevated concentrations of volatile organic compounds (VOCs) have been detected in groundwater samples from monitoring wells ES-18, ES-19, ES-28, and ES-29, north of Building 8. Wells north, west, and south of this group define the extent of contamination in these directions. The extent of contamination east of ES-28 and ES-29 has not yet been determined.

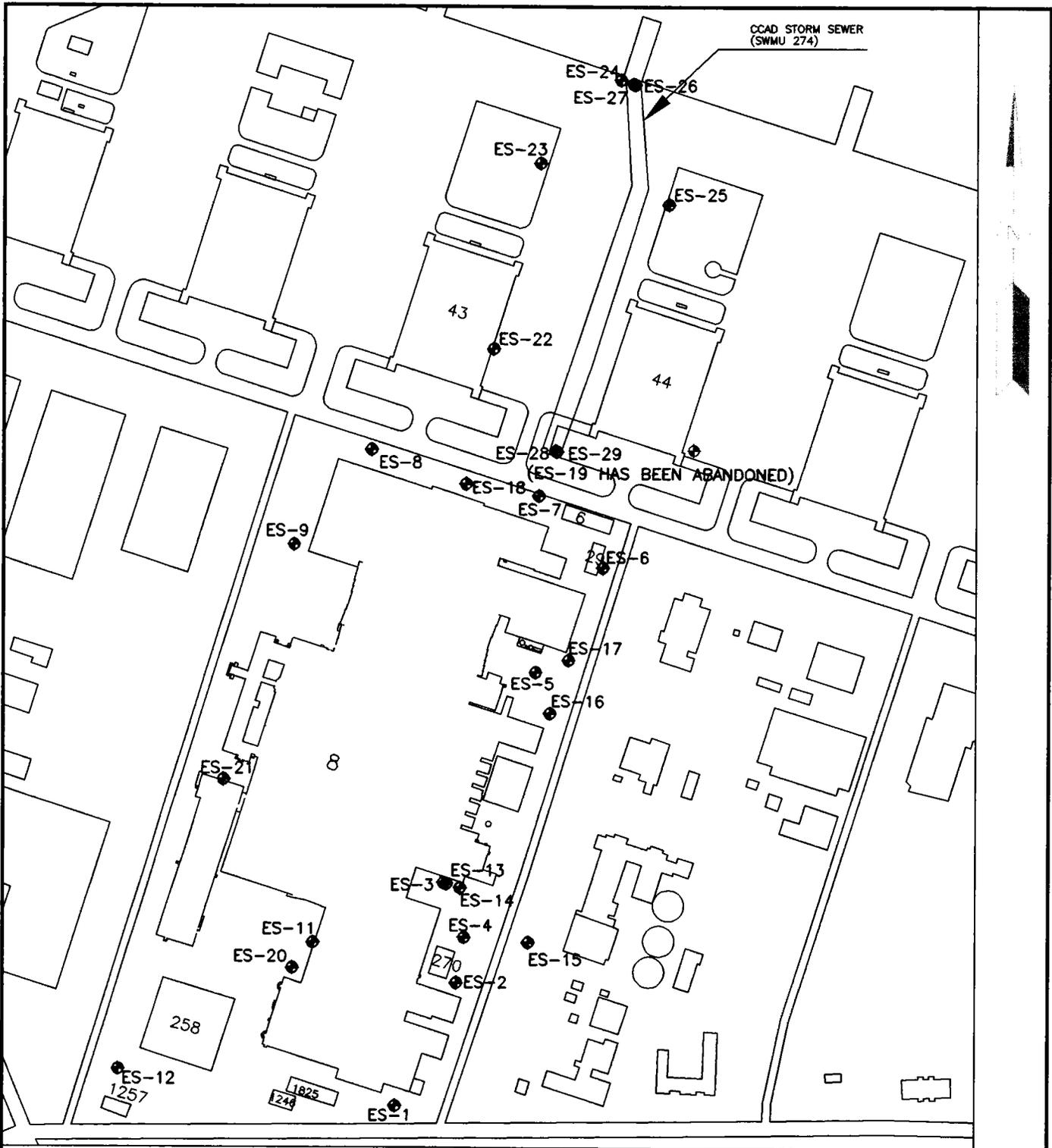
One monitoring well will be installed east of ES-29, near the southeastern corner of Building 44 (see Figure 2-1). Water level information from this well will also help to better define the direction of groundwater flow north of Building 8.

The monitoring well will be installed and developed in accordance with the FIWP. Soil samples will be collected from zero to two feet below ground surface (bgs) and from the 2-foot interval immediately above groundwater. Following installation and development, the well will be sampled with micropurging techniques. Both soil and groundwater samples will be analyzed using SW-846 methods for metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc) using U.S. Environmental Protection Agency (USEPA) 6000/7000 series methods, for VOCs by USEPA Method 8240, and for semi-volatile organic compounds (SVOCs) by USEPA Method 8270.

2.2 Deeper Confined Aquifer

Building 8

A clay layer has been confirmed at Building 8 at a depth similar to that encountered at sites 1, 3, and 4. The deeper confined aquifer beneath the clay in the vicinity of Building 8 has not been sampled. Section 350.51(e) of the TRRP requires that the vertical extent of chemicals of concern (COCs) in groundwater be defined to below the residential assessment level by collecting a representative



LEGEND

- ES-8 ● SHALLOW MONITORING WELL
- PROPOSED SHALLOW MONITORING WELL



AFFECTED PROPERTY
 ASSESSMENT WORK PLAN
 IR SITES 1, 3, AND 4
 AND BUILDING 8
 NAS CORPUS CHRISTI
 CORPUS CHRISTI, TEXAS

FIGURE 2-1
 PROPOSED MONITORING LOCATION
 BUILDING 8

DWG DATE:05/01/00

DWG NAME:APAWP2-1

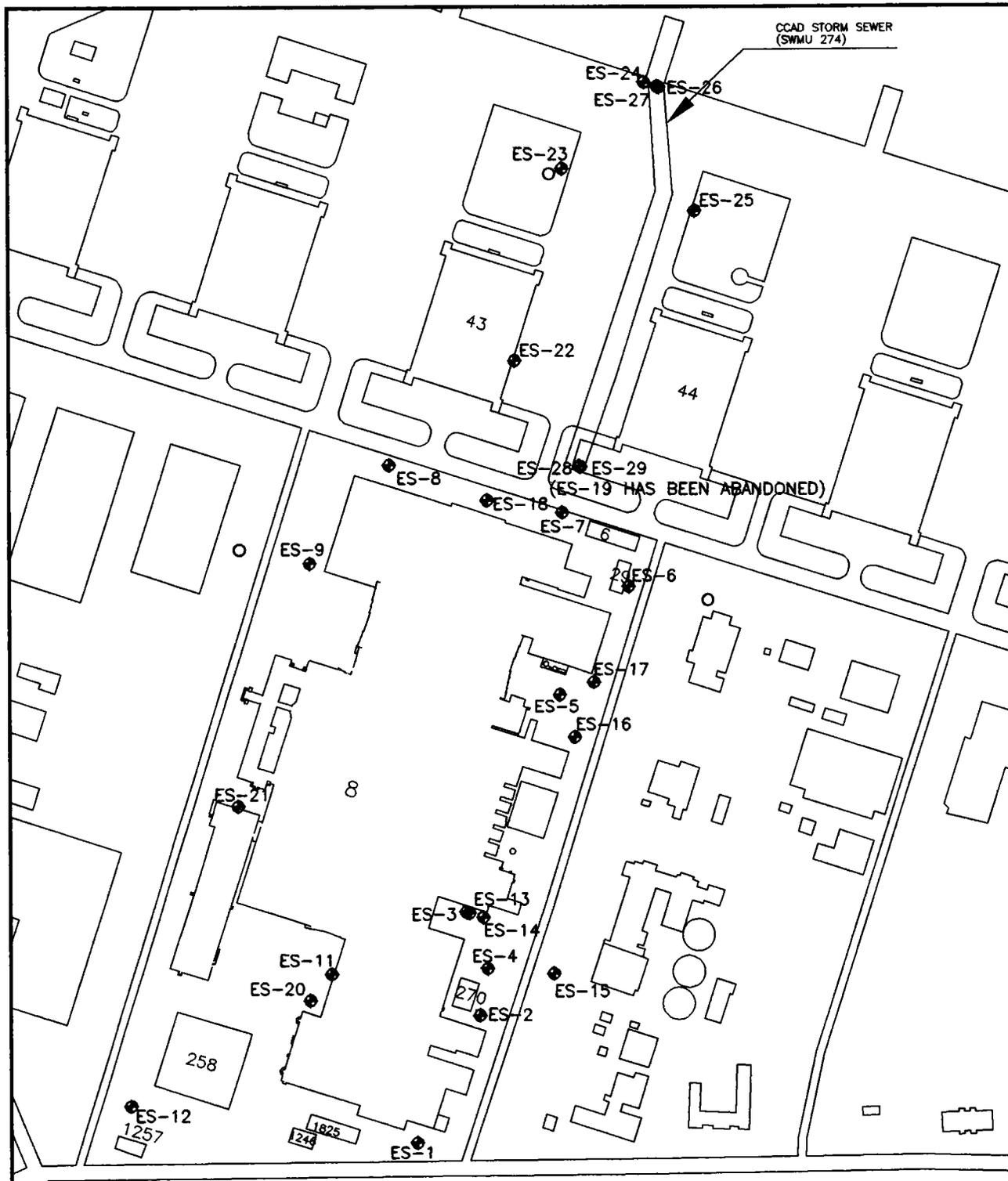
sample from a deeper groundwater-bearing unit. To satisfy this requirement, three samples from the deeper confined aquifer will be collected using a cone penetrometer testing (CPT) rig. The locations of the proposed CPT sample points are shown on Figure 2-2.

CPT provides a timely and efficient method for lithologically logging coastal unconsolidated deposits in order to identify the lower confining unit of the surficial aquifer. Once identified, a discrete groundwater sample can be collected from the base of the upper aquifer and/or the deeper confined aquifer.

The locations selected for CPT sampling are in areas where the upper aquifer is known to have no VOCs (near ES-23) or suspected to have no VOCs (west of ES-9 and east of ES-6). Groundwater samples will be collected from the base of the upper aquifer west of ES-9 and east of ES-6. A total of two groundwater samples will be collected from the CPT points west of ES-9 and East of ES-6, one from the base of the upper aquifer and one from the deeper confined aquifer. One groundwater sample will be collected from the CPT point near ES-23, from the deeper confined aquifer.

The selected locations form a triangle to accurately determine the direction of groundwater flow in the deeper aquifer. Once the groundwater sampling device is in position in the deeper aquifer, time will be allowed for stabilization of the water level within the sample rods, and the depth to water will be measured relative to ground surface. Based on existing survey data, the direction of groundwater flow will be estimated in the field. If it is determined that none of the three points is downgradient from ES-28 and ES-29, a fourth CPT sample location will be added.

Groundwater samples from these locations will be analyzed for VOCs by USEPA Method 8240.



LEGEND

- ES-8 ◆ SHALLOW MONITORING WELL
- PROPOSED CPT LOCATION



AFFECTED PROPERTY
ASSESSMENT WORK PLAN
IR SITES 1, 3, AND 4
AND BUILDING 8
NAS CORPUS CHRISTI
CORPUS CHRISTI, TEXAS

FIGURE 2-2
PROPOSED CPT LOCATION
BUILDING 8

DWG DATE:05/01/00

DWG NAME:APAWP2-2

IR Sites 1, 3, and 4

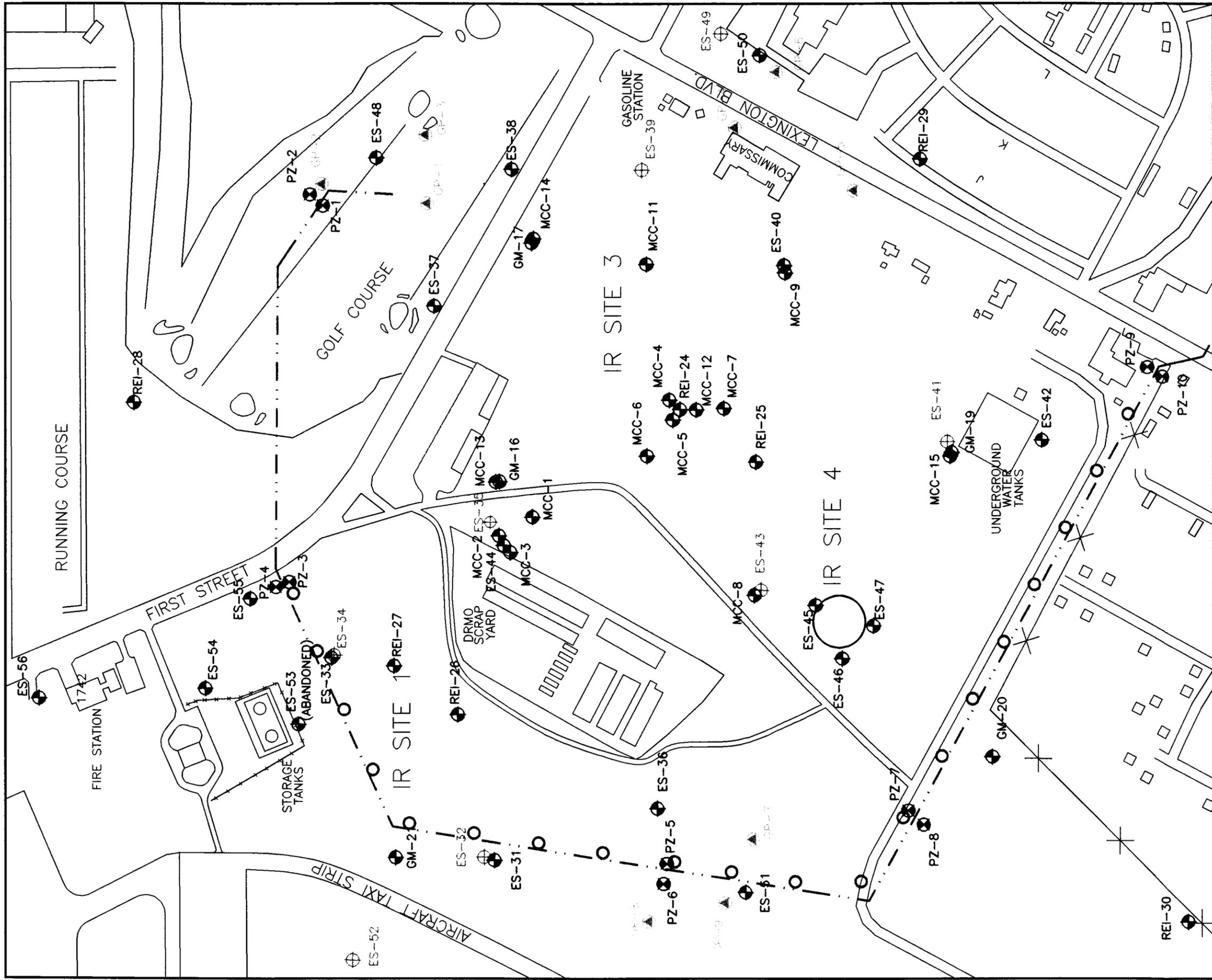
The deeper confined aquifer has been sampled at IR Sites 1, 3, and 4. With the exception of one sample from ES-52, the data show that the deeper aquifer has not been impacted by contaminants present in the upper aquifer. The duplicate sample from ES-52 collected in March 1997, contained 2.2 parts per billion (ppb) 1,1-dichloroethylene, 12 ppb trichloroethylene, and 32 ppb tetrachloroethylene. The original sample from ES-52, collected at the same time did not contain any VOCs. To confirm these anomalous detections in the duplicate sample, ES-52 will be resampled for VOCs and analyzed by USEPA Method 8240.

2.3 Drainage Ditch

30 TAC 350 requires that the concentration of COCs in groundwater at the point of discharge to surface water be below the surface water protective concentration levels. To determine the present concentrations, if any, of COCs in the groundwater adjacent to the drainage ditch, geoprobe sampling will be conducted at 200-foot intervals along the landfill side of the ditch. The proposed sample locations are shown on Figure 2-3.

Initially, each sample location will be lithologically logged by CPT as described in Section 2.2. Then the geoprobe rig will be used to collect a soil sample from 0 to 6 inches below ground surface (bgs) and from the 1-foot interval above the uppermost saturated zone. The geoprobe rig will also be used to collect groundwater samples from both the uppermost saturated zone and the base of the upper aquifer, at depths determined from CPT logging data.

Surface soil samples will be analyzed for SVOCs by USEPA Method 8270, PCBs by USEPA Method 8080, and metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc) by USEPA 6000/7000 series methods. Soil samples from the interval above the uppermost saturated zone will also be analyzed for VOCs by USEPA Method 8240.



LEGEND

- ES-33 ● SHALLOW MONITORING WELL
- ES-34 ⊕ DEEP MONITORING WELL
- ▲ GEOPROBE SAMPLE
- PROPOSED CPT/GEOPROBE SAMPLE LOCATIONS



AFFECTED PROPERTY
ASSESSMENT WORK PLAN
IR SITES 1, 3 AND 4, AND BUILDING 8
NAS CORPUS CHRISTI
CORPUS CHRISTI, TEXAS

FIGURE 2-3
PROPOSED CPT/GEOPROBE
SAMPLE LOCATIONS
IR SITES 1, 3 AND 4

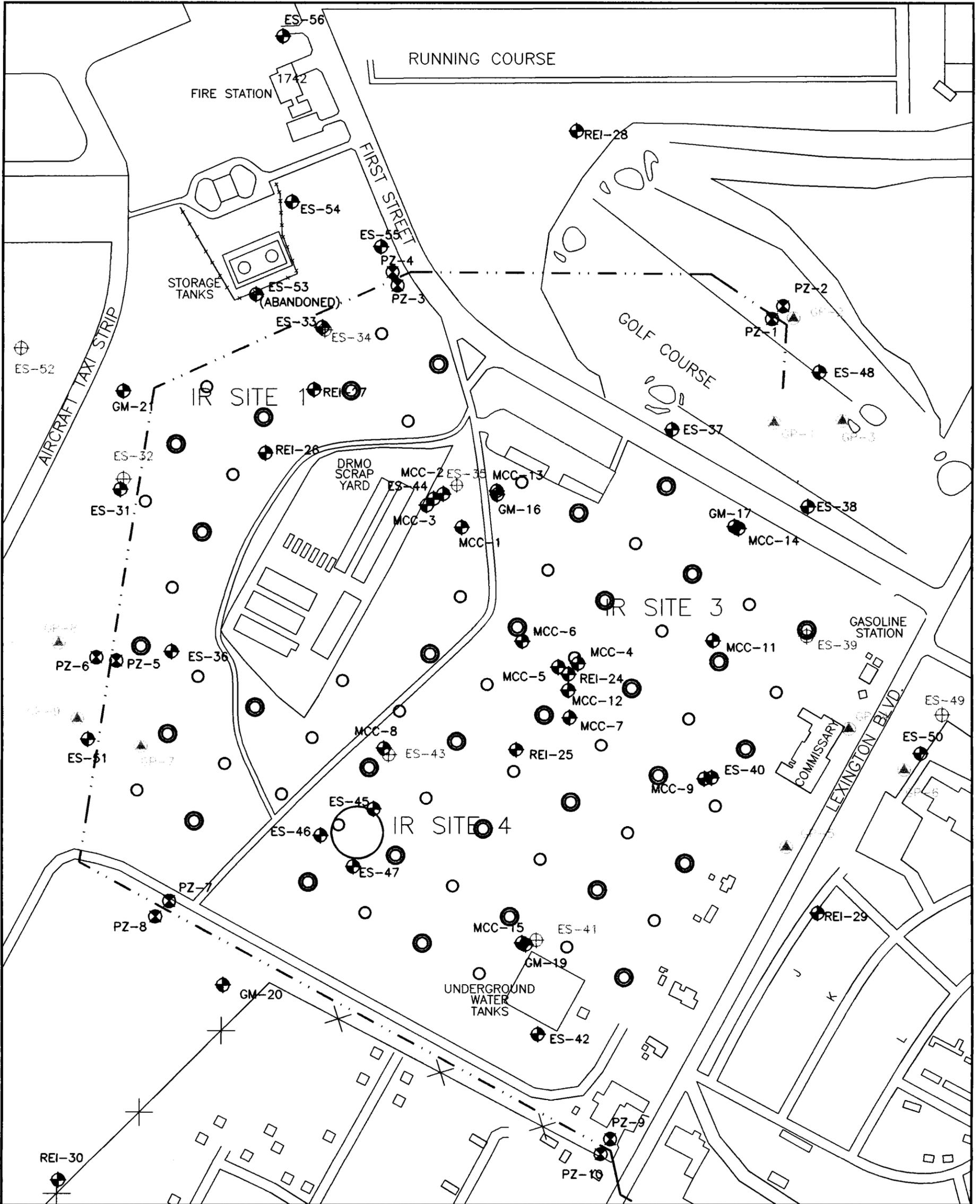
All groundwater samples from adjacent to the drainage ditch will be analyzed for VOCs by USEPA Method 8240, SVOCs by USEPA Method 8270, and PCBs by USEPA Method 8080.

2.4 Surface Soil Sampling

Section 350.4(a)(88) of TRRP defines surface soil for ecological pathways as the zone of soil extending from ground surface to 0.5 feet in depth. The existing surface soil data for IR Sites 1, 3, and 4 were collected from 0 to 2 feet bgs. To satisfy the TRRP requirement, surface soil samples will be collected on an approximate 200-foot grid from 0 to 0.5 feet bgs. A total of 67 surface soil samples will be collected.

All samples will be submitted to the laboratory, however samples collected on a 400-foot grid (32 samples) will be analyzed first, and the remainder (35 samples) held by the laboratory under documented chain of custody. If chemicals of concern (COCs) are detected in samples from the 400-foot grid, the additional samples will be analyzed as necessary to define the extent of COCs. The proposed sample grid is shown on Figure 2-4.

Surface soil samples will be analyzed for SVOCs by USEPA Method 8270, PCBs by USEPA Method 8080, and metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc) by USEPA 6000/7000 series methods.



LEGEND

- ES-33 ● SHALLOW MONITORING WELL
- ES-34 ⊕ DEEP MONITORING WELL
- GP-1 ▲ GEOPROBE SAMPLE
- PROPOSED 0-6 INCH SOIL SAMPLE (200-FOOT GRID)
- PROPOSED 0-6 INCH SOIL SAMPLE (400-FOOT GRID)



AFFECTED PROPERTY
ASSESSMENT WORK PLAN
IR SITES 1, 3 AND 4, AND BUILDING 8
NAS CORPUS CHRISTI
CORPUS CHRISTI, TEXAS

FIGURE 2-4
PROPOSED SURFACE SOIL
SAMPLE LOCATIONS
IR SITES 1, 3 AND 4

3.0 QUALITY ASSURANCE PLAN

This section presents the project-specific quality assurance and quality control (QA/QC) requirements; organization; procedures for laboratory analysis, field analysis, and data interpretation; and management goals established for the affected property assessment at NAS Corpus Christi.

3.1 Project Organization and Responsibilities

The Task Order Manager (TOM) will manage operations primarily from the home office. All other personnel are primarily dedicated to the field office. The Site Manager (SM) will be responsible for direct oversight of onsite operations.

The TOM and SM will provide overall project management for both field and office activities. The TOM is the official interface between the field investigation team and the Navy, the EnSafe administrative staff, subcontractors, and suppliers. The TOM will complete monthly status reports to the Navy, activity schedules, assessment of manpower demands, and approval of purchase requests.

3.2 Quality Assurance Objectives

The following sections contain QA objectives for the affected property assessment. These objectives include a description of the required data deliverables; QA objectives for these deliverables; and quantitative and qualitative evaluation of QA objectives.

3.2.1 Analytical Data Deliverable Levels

Quality criteria are outlined here to ensure that data from the affected property assessment are suitable for their intended use, and to meet goals established by USEPA. Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quantity of data required to support decisions made during investigative activities. They are based on the end uses for the data being collected and, as such, different uses may require different levels of data quality.

To acquire definitive data to meet the project QA objectives, the laboratory will supply QC information to assess data accuracy and precision. The USEPA document *Data Quality Objectives (DQOs) for Remedial Response Activities Development Process*, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, March 1987 (EPA 540/G-87/003) describes laboratory QC deliverable levels:

- **Screening** (DQO Level I): This level provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, initial site characterization to locate areas for subsequent and more accurate analysis, and for engineering screening of alternatives (bench scale tests). Data collected using DQO Level I include those generated onsite with photoionization meters, flame ionized detectors, conductivity and pH meters, and other real-time monitoring equipment.

- **Field Analysis** (DQO Level II): The objective of Level II data is to provide real-time results for ongoing activities or initial data which will ultimately be confirmed in an analytical laboratory. Level II results can be useful in phased projects as well. Other applications include determining contamination extent, screening, and developing baseline data. Analytical parameters and qualitative data available in USEPA Level II can be similar to those in Levels III or IV, although the use of portable instruments may produce qualitative results that are not as accurate or precise as those at the higher levels.

Level II is typically designated as the field screening level, although it may also be used for fixed laboratories when less stringent data deliverables are required for validation. The expected laboratory deliverables for this DQO level include sample results, method blanks, surrogate recoveries (organics), matrix spikes/matrix spike duplicates (MS/MSDs) (organics), and spike/duplicates (inorganics).

- **Laboratory Analysis** (DQO Level III): Level III analyses provides laboratory analysis using standard USEPA-approved procedures. This level applies to objectives such as site characterization, environmental monitoring, risk assessment, and/or confirmation of field-produced data. Level III data require QC forms to review data quality, but raw data are not submitted for full validation. Level III deliverables include (but are not limited to) all forms from the current Contract Laboratory Program (CLP) guidelines. These forms or similar laboratory QC summaries are required for evaluation purposes. For methods not defined by the CLP, the following will be summarized by the laboratory (as appropriate): sample results, case narratives, analytical sequences, preparation logs, GC/MS tuning data, calibration information (including percent relative standard deviation or percent difference from calibration), method blanks, organic MS/MSDs, GC/MS internal standard areas and retention times, inorganic spikes/duplicates, laboratory control samples, ICP check standards, ICP interference check samples, ICP serial dilutions, and atomic absorption spike recoveries.

- **Confirmational Laboratory Analysis** (DQO Level IV): Level IV is used when comprehensive documentation is required. As with Level III, Level IV requires QC forms to review data quality. In addition, all raw data are submitted by the laboratory for full validation. Level IV data may be used for site characterization, environmental monitoring, engineering purposes, risk assessment, and/or confirmation of the field-produced data. Typically, this level is needed for select samples at National Priority List (NPL) sites, or sites which may undergo litigation. Level IV deliverables include a full CLP equivalent including all QC forms/summaries produced for the Level III samples plus all raw data. For methods not defined by the CLP, all deliverables described for Level III will be produced and all raw data (bench sheets, instrument printouts, etc.) will be included.

- **Non-Standard** (DQO Level V): This refers to analyses by non-standard protocols, for example, when lower detection limits or analysis of an unusual chemical compound is required. These

analyses often require method development or adaptation.

It should be noted that in September 1993, USEPA replaced this guidance with an updated manual, *Data Quality Objectives for Superfund, Interim Final Guidance*, USEPA/540/G-93/071 (USEPA, September 1993) which states, "This guidance replaces the earlier guidance USEPA 540/G-87/003, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-7B, and the five analytical levels introduced in that document." As a result, the five analytical data levels were reduced to two – screening data and definitive data.

Definitive data (formerly Levels III and IV) are defined as data generated using rigorous analytical methods, such as approved USEPA reference methods. These data are analyte-specific, with confirmation of analyte identity and concentration. These approved methods produce tangible raw data (e.g., chromatograms, spectra, digital values, etc.) in paper printouts or computer-generated electronic files. Analytical or total measurement error (precision) must be determined for data to be definitive (USEPA, September 1993). As a result, data from this investigation are now defined as definitive data per the most recent USEPA guidance. However, during this project the five analytical levels will still serve as a description of laboratory data deliverables which are needed to assess data precision and accuracy.

3.2.2 Determining QA Objectives

The primary objective of this project is to determine the nature and extent of threats to human health and the environment, utilizing methods capable of detecting COCs at concentrations equal to or below residential assessment levels.

3.2.3 Quantitative QA Objectives

The four methods used to assess quantitative QA objectives are precision, accuracy, method detection limits, and completeness..

Precision

Precision measures the reproducibility of measurements and methods, and is defined for qualitative data as the variability of a group of values compared with its average value. To assess the precision of the measurement systems used in this project, field duplicates will be collected and analyzed along with the original samples. Precision of laboratory analysis will be assessed by comparing the analytical results between MS/MSDs and laboratory control sample/laboratory control sample duplicates (LCS/LCSDs) for organic analysis, and laboratory duplicate results for inorganic analysis. The relative percent difference (RPD) will be calculated for each pair of duplicate analyses using the following equation:

$$\% RPD = \frac{S - D}{(S + D) / 2} \times 100$$

Where:

S = sample result
D = duplicate result

Accuracy

Accuracy is the degree to which a given result agrees with the true value. Surrogate spike, MS/MSD, and LCS/LCSD percent recoveries (%Rs) are used to assess accuracy. Every organic sample is spiked with known quantities of nontarget surrogate compounds. Five percent of all samples analyzed are spiked with target chemicals for the MS/MSD. If the calculated %Rs for the known spike concentrations are within defined control limits set by each method, the reported sample concentrations are considered accurate.

$$\% R = \frac{(SSR - SR)}{SA} \times 100$$

Where:

SSR = spike sample recovery
SR = sample recovery
SA = concentration of spike added

Detection Limits

Detection limits are described in many different terms depending on the analysis being performed and the capabilities of the instrument. The following terms are important in describing detection limits:

- The Organic Method Detection Limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is determined from the analysis of a sample in a given matrix type which contains the analyte. It is the lowest concentration of an analyte a method can reliably detect taking into consideration the reagents and preparation steps applied to a sample.
- The Inorganic Instrument Detection Limit (IDL) is defined as the lowest amount of an element that can be detected above normal random background noise that can be reliably detected under ideal conditions. The IDL is established by determining three times the standard deviation of seven replicate analyses of the analyte at the lowest concentration that is statistically different from the blank. Inorganic IDLs are generally performed quarterly and are dependant on instrument sensitivity.
- The Practical Quantitation Limit (PQL) or Method Quantitation Limit (MQL) is used to determine the extent of contaminants in media. The organic PQL/MQL is the lowest non-zero standard concentration in the laboratory's initial calibration curve. Inorganic PQLs will be

demonstrated by analyzing a PQL standard at the beginning and end of the analytical sequence.

- The Sample Quantitation Limit (SQL) is the PQL/MQL adjusted for sample characteristics, sample preparation, dilutions, and/or laboratory adjustment. All undetected results will be reported at the SQL.

For this project all observed organic values below the SQL, but above the MDL will be reported as estimated values (flagged “J”) by the laboratory. Metals values will be reported down to the IDL adjusted for sample characteristics, sample preparation, dilutions, and/or laboratory adjustment. For metals, observed values below the PQL but above the IDL will be reported and flagged estimated (either “J” or “B”.)

Completeness

Completeness is defined as the percentage of measurements judged to be valid. It is calculated by dividing the number of valid results by the number of possible individual analyte results, expressed as a percentage. The analytical completeness goal for the affected property assessment is 95%.

The formula for calculating completeness is presented below:

$$\% \text{ completeness} = \frac{\text{Number of valid (i.e., non-R flagged) results}}{\text{Number of possible results}} \times 100$$

3.2.4 Qualitative QA Objectives

Comparability and representativeness are the two criteria used to qualitatively evaluate the QA objectives. Comparability is the degree to which one data set can be compared with another. Representativeness is the degree to which a sample or group of samples is indicative of the population being analyzed.

The objective of this QA/QC plan is to produce a high level of comparability between data sets. Heterogeneous investigative samples make it difficult to obtain consistently high comparability values. However, the use of standard methods for sampling and analysis (USEPA protocols), reporting data in standard units, and using standard and comprehensive reporting formats will optimize the potential for high levels of data comparability. Representative samples represent the characteristics of the population defined in the project objective. Sample locations have been selected based on historical data from previous investigations at NAS Corpus Christi.

3.3 Sampling Procedures

Specific sampling methods used in the field depend on conditions at the time of sampling and best professional judgment. EnSafe's objective in determining the appropriate sampling methods is to implement the required methods under current regulatory guidelines and employ the most current and applicable technology for sample collection.

3.3.1 Referenced ASTM Standards For Sampling Procedures

As stated above, many American Society of Testing and Materials (ASTM) standards have been used as guidance for development of sampling procedures. These standards, as well as the other documents referenced in this QAP, are housed in the EnSafe corporate library in Memphis, Tennessee. The following list provides ASTM standard designations and titles for evaluating field sampling procedures used in the affected property assessment.

ASTM Standards

<u>Designation</u>	<u>Title</u>
D 4448-85a (1992)	<i>Guide for Sampling Groundwater Monitoring Wells</i>
D 4700-91	<i>Guide for Soil Sampling from the Vadose Zone</i>
D 5314-92	<i>Guide for Soil Gas Monitoring in the Vadose Zone</i>
D 6169-97	<i>Guide for Selection of Soil and Rock Sampling Devices Used with Drill Rigs for Environmental Investigations</i>

3.3.2 General Sampling Procedures

General procedures for collecting environmental samples are designed to prevent cross-contamination and reduce the potential for human error during sample collection and processing. Such procedures include:

- Sampling in each medium will usually begin in the area of least known or presumed contamination and proceed to the area of most contamination.
- The preferred order of sample collection will be as follows (on a parameter basis): VOCs, SVOCs, PCBs, and metals. Following sample collection for the listed analytical parameters, samples for physical parameters will be collected.
- A clean pair of protective gloves will be worn while collecting of each sample.
- Samples for chemical analysis will be collected with either disposable sampling devices or decontaminated stainless-steel or Teflon devices. When composite samples are required, the sample will be homogenized in a stainless-steel or glass bowl. All sampling equipment will be decontaminated in accordance with the procedures outlined in Section 3.4 of this plan.
- Samples collected for VOC analysis will not be homogenized.
- Certified sample containers will be provided by the analytical laboratory. Table 3-1 contains a list of required sample containers for each analytical method.

Table 3-1
Sample Containers, Preservation, and Holding Times

Analytical Method	Sample Matrix ^a	Container Type ^b	Minimum Sample Volume	Sample Preservation	Holding Time
Total Metals SW-846 6010/7000	Soil	P, G	4 ounces	none required	180 days
	Water	P, G	500 ml	HNO ₃ to pH <2	180 days
Volatile Organic Compounds (VOCs) SW-846 8240	Soil	EnCore® sampler or equivalent ^c	2 samplers	4°C	laboratory preservation within 48 hrs. Analysis within 14 days for frozen preserved sample vial ^d
	Water	G (teflon-lined septum)	3 x 40 ml	4°C, HCl to pH <2	14 days; 7 days if unpreserved by acid.
Semivolatile Organic Compounds (SVOCs) SW-846-8270C	Soil	G (teflon-lined cap)	4 ounces	4°C	14 days until extraction and 40 days after extraction.
	Water	G (teflon-lined cap)	2 liters	4°C	7 days until extraction and 40 days after extraction.
Polychlorinated Biphenyls (PCBs) SW-846 8082	Soil	G (teflon-lined cap)	4 ounces	4°C	14 days until extraction and 40 days after extraction.
	Water	G (teflon-lined cap)	2 liters	4°C, pH 5-9	7 days until extraction and 40 days after extraction.

Notes:

- ^a No pH adjustment for soil.
- ^b Polyethylene (P); glass (G).
- ^c VOC soil preparation method SW-846 5035 using EnCore® samplers. A bulk soil jar will also be collected for soil moisture determination.
- ^d The holding time for method 5035 is currently under evaluation by several regulatory agencies and may be extended during the course of the investigation.

3.3.3 Sample Processing

Sample processing involves sample collection, labeling, preservation, chain-of-custody documentation, and shipping. The critical field procedures for these processes are outlined as follows:

- Clearly identify the chemical preservative on the sample label.
- Cool all samples to 4°C (\pm 2°C) immediately after collection and during shipment to the laboratory. Inside each cooler, include a 40 milliliter (ml) vial of tap water (temperature blank), or place a temperature strip on a sample bottle to measure sample receipt temperature.
- Handle the samples as infrequently as possible. Use extreme care to ensure that samples are not cross-contaminated.
- A trip blank, prepared by the laboratory, should be kept with the VOC sample containers at all times, and shipped along with each cooler containing samples to be analyzed for VOCs. Trip blanks do not need to be refrigerated before use, but should be stored in a dust-free, organic-free environment away from fuels, solvents, and volatile compounds. Discard any trip blanks with bubbles larger than a pinhead.
- Avoid headspace (bubbles) in all VOC samples. VOC samples that effervesce due to dissolved gases or high carbonate content may not be preserved with hydrochloric acid (HCl). Whether or not VOC samples are preserved will be documented on the chain-of-custody form.
- Identify and fully document all samples in the field logbook, on the chain-of-custody forms, and on the sample labels.
- Follow chain-of-custody procedures to assure that the sample custody is reliably maintained and that each step in transportation to the laboratory is documented. This process will be initiated

in the field and followed throughout the sampling process.

- Every effort will be made to ship all samples overnight on the day of collection to the laboratory via express air courier. Refer to Section 3.3.5 for sample shipment procedures.
- The laboratory will be notified in advance of a sample shipment, and will be notified of any shipments held overnight.

3.3.4 Developing Sampling Methods

This section addresses developing sampling procedures that are not currently required by the TNRCC; however, these procedures are emerging as the preferable sampling techniques and are likely to become requirements during the course of the affected property assessment.

On June 13, 1997, SW-846 Update III was promulgated. With this update, an important change was implemented for the collection and analysis of VOCs in soil. As a result of this update, the current practice of collecting soil in a glass jar without preservative is discouraged. The preferred VOC sampling method for the affected property assessment will be SW846 5035. For this method, soil VOC samples will be collected with the use of sample containers acceptable for low concentration soil analysis. In the event that this method cannot be used, soil samples will be collected as bulk samples containerized in brass or stainless steel sleeves.

3.3.5 Sample Custody

Samples collected for laboratory analysis are identified by a label printed with the following information:

- site name or location
- project number
- EnSafe sample identification number

- date and time of sample collection
- type of analysis to be performed
- preservative

Sample chain-of-custody procedures begin at the time the sample is containerized and labeled and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Sample custody records will be maintained in the field records, project files, and laboratory records. EnSafe will use the chain-of-custody forms for transferring sample shipments to the laboratory. Upon transfer of custody, the form will be signed by the EnSafe sampling team leader, who will note the date and time the samples were relinquished. Because common carriers will not sign chain-of-custody forms, these will be sealed inside each shipping container. All chain-of-custody forms received by the laboratory must be signed and dated by the laboratory sample custodian and returned to EnSafe following receipt, or as part of the data reporting package.

Shipping requirements specify that containers must be secure and custody-sealed. Once the container is secured, a custody seal will be affixed so that it must be destroyed in order to open the container. The field team member who packs and ships the samples must sign and date the custody seal.

Packaging Samples for Shipment

All samples must be packed for shipment in order to avoid breakage and prevent cross-contamination according to the following procedures:

1. Select a cooler in good condition. Seal the drain plug with tape on the inside and outside of the cooler to prevent leakage.
2. Ensure that the cooler is clean and of sufficient quality for shipping purposes.
3. In order to prevent breakage while packaging samples, *either*:

- Wrap samples in bubble wrap or other suitable packing 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 touch each other.

or

- Place 2 to 4 inches of inert packing material on the bottom of the cooler. Place the bagged containers inside the cooler so the bottles do not touch each other and place cooling material (e.g., bagged ice, blue ice) around and between the samples. Completely fill any remaining space with inert packing material such as vermiculite or cellulose insulation.

4. Include a temperature blank or strip in each sample cooler.
5. Place double-bagged ice inside the cooler to chill the samples to 4°C (\pm 2°C).
6. Place a chain-of-custody record describing the contents of each cooler in a plastic bag sealed it inside the cooler.
7. Seal the cooler with tape and custody seals so that the cooler cannot be opened without breaking the seal.

3.3.6 Analytical Procedures

The parameters being measured and analytical methods to be used are presented in Table 3-2. All samples analyzed by the laboratory will be reported using USEPA Level IV data deliverables. All

**Table 3-2
 Analytes Detected by Investigative Analytical Methods**

Parameter	Analytical Method	Analytes Quantitatively Evaluated By Method
Total Metals	SW-846 6010/7000	Arsenic (As) Barium (Ba) Cadmium (Cd) Chromium (Cr) Copper (Cu) Lead (Pb) Mercury (Hg) Nickel (Ni) Selenium (Se) Silver (Ag) Zinc (Zn)

**Table 3-2
Analytes Detected by Investigative Analytical Methods**

Parameter	Analytical Method	Analytes Quantitatively Evaluated By Method	
Volatile Organic Compounds (VOCs)	SW-846 8260B	Chloromethane	1,1,2,2-Tetrachloroethene
		Bromomethane	Toluene
		Vinyl Chloride	Chlorobenzene
		Chloroethane	Ethylbenzene
		Methylene Chloride	Stryene
		Acetone	Trichlorofluoromethane
		Carbon Disulfide	Vinyl acetate
		1,1-Dichloroethene	2-Chloroethyl vinyl ether
		1,1-Dichloroethane	Xylenes
		cis-1,2-Dichloroethene	1,3-Dichlorobenzene
		trans-1,2-Dichloroethene	1,4-Dichlorobenzene
		2-Butanone (MEK)	1,2-Dichlorobenzene
		1,1,1-Trichloroethane	
		Carbon tetrachloride	
		Bromodichloromethane	
		1,2-Dichloropropane	
		cis-1,3-Dichloropropene	
		Trichloroethene	
Dibromochloromethane			
1,1,2-Trichloroethane			

Table 3-2
Analytes Detected by Investigative Analytical Methods

Parameter	Analytical Method	Analytes Quantitatively Evaluated By Method	
Semivolatile Organic Compounds (SVOCs)	SW-846 8270C	Phenol	2-Methylnaphthalene
		bis(2-Chloroethyl)ether	Hexachlorocyclopentadiene
		2-Chlorophenol	2,4,6-Trichlorophenol
		1,3-Dichlorobenzene	2,4,5-Trichlorophenol
		1,4-Dichlorobenzene	2-Chloronaphthalene
		1,2-Dichlorobenzene	2-Nitroaniline
		2-Methylphenol (o-Cresol)	Dimethyl phthalate
		2,2'-oxybis (1-Chloropropane)	Acenaphthylene
		4-Methylphenol (p-Cresol)	2,6-Dinitrotoluene
		N-Nitroso-di-n-propylamine	Dimethylphthalate
		Hexachloroethane	Acenaphthylene
		Nitrobenzene	2,6-Dinitrotoluene
		Isophorone	3-Nitroaniline
		2-Nitrophenol	Acenaphthene
		2,4-Dimethylphenol	2,4-Dinitrophenol
		2,4-Dichlorophenol	4-Nitrophenol
		1,2,4-Trichlorobenzene	Dibenzofuran
		Naphthalene	2,4-Dinitrotoluene
		4-Chloroaniline	Diethylphthalate
		Hexachlorobutadiene	4-Chlorophenylphenylether

**Table 3-2
Analytes Detected by Investigative Analytical Methods**

Parameter	Analytical Method	Analytes Quantitatively Evaluated By Method	
Semi-Volatile Organic Compounds (SVOCs) continued	SW-846 8270C	2-Methyl-4,6-Dinitrophenol	bis(2-Ethylhexyl)phthalate (BEHP)
		N-Nitrosodiphenylamine	Di-n-octyl phthalate
		4-Bromophenyl-phenylether	Benzo(b)fluoranthene
		Hexachlorobenzene	Benzo(k)fluoranthene
		Pentachlorophenol	Benzo(a)pyrene
		Phenanthrene	Indeno(1,2,3-cd)pyrene
		Anthracene	Dibenz(a,h)anthracene
		Di-n-butylphthalate	Benzo(g,h,i)perylene
		Fluoranthene	Benzoic acid
		Pyrene	N-Nitrosodimethylamine
		Butylbenzylphthalate	Benzidine
		3,3'-Dichlorobenzidine	Benzyl alcohol
		Benzo(a)anthracene	Bis(2-Chloroisopropyl)Ether
		Chrysene	Pyridine

Table 3-2
Analytes Detected by Investigative Analytical Methods

Parameter	Analytical Method	Analytes Quantitatively Evaluated By Method
Polychlorinated	SW-846 8082	Aroclor-1016
Biphenyls (PCBs)		Aroclor-1221
		Aroclor-1232
		Aroclor-1242
		Aroclor-1248
		Aroclor-1254
		Aroclor-1260

samples will be analyzed in accordance with *Test Methods for Evaluation of Solid Waste (Physical/Chemical Methods)*, (SW-846), USEPA, OSWER, Third Edition.

3.3.7 Field QC Samples

Field measurements should be taken only by personnel trained to use the appropriate and available equipment. Field investigators must be trained and evaluated for overall knowledge of field measurement techniques by qualified staff before using the equipment. Sample collection should also be performed only by personnel knowledgeable of the QA objectives. The primary measurements of both field and laboratory QA/QC are derived from MS/MSDs, duplicate samples, field blanks, and rinsate blanks collected in the field. The following sections briefly describe the types of QC samples that will be used for the affected property assessment.

Duplicates

A duplicate is an identical sample collected from the same location, at the same time, under identical conditions as the original. Duplicate samples are analyzed along with the original to determine procedural precision and inherent source variability. For this project, field duplicates may be used to prepare laboratory MS/MSD samples. Soil duplicate samples will be collected to assess the heterogeneity of contaminant concentrations within the soil matrix (at a specific location). Duplicate samples (water and soil) will be collected at a 5 % frequency.

Field Blanks

A field blank is a sample container filled with the source water used to decontaminate field equipment. The field blank is prepared, preserved, and stored in the same manner as the other field samples. Field blanks are analyzed for contamination imparted by containers or other external sources. One field blank will be submitted during this sampling event.

Rinsate Blanks

Rinsate (or equipment) blanks are collected by retaining rinsate from sampling equipment. The

equipment is rinsed with potable water and deionized water after full decontamination procedures have been completed. Rinsate blanks are collected in containers of the same type and treatment as the sample containers. One rinsate blank will be submitted during this sampling event.

Trip Blanks

A trip blank is a sample container filled with organic-free water that is transported unopened with the sample bottles. It is opened in the laboratory and analyzed along with the field samples for volatile constituents of interest. One trip blank for volatile parameters will be prepared and submitted to the laboratory with each shipment.

3.4 Decontamination

Decontamination procedures will be performed in accordance with Appendix B and C of the USEPA SOP/QAM for sampling and drilling equipment, with the following exceptions. The detergent for use on this project will be Liquinox[®] which contains chelating agents to bind and remove trace metals from sampling equipment. The use of isopropanol as a solvent rinse during decontamination has been proven to cross-contaminate samples and will not be used during the affected property assessment. When available, hot tap water will be used for field decontamination. PVC well construction materials will not be rinsed with solvent or washed with hot water. Field reagent-grade water will be defined as ASTM Type II water for field use. The steam cleaner and/or high pressure hot water washer will be capable of generating adequate pressure and producing hot water and/or steam.

3.4.1 Setting Up a Decontamination Area

Cleaning and decontamination will usually be performed at a designated area onsite but downgradient and downwind of the clean equipment storage area. The decontamination area will be designed to collect runoff into a catch basin or pit. The waste/rinse water can then be containerized into 55-gallon drums. All cleaning of equipment will be performed on saw horses or auger racks above the ground. The Navy will be responsible for disposal of all decontamination wastes after they have been generated by EnSafe.

3.4.2 Preventing Cross-Contamination

The following procedures can reduce the risk of cross-contamination during the decontamination process:

1. Wear a new pair of disposable outer gloves before handling sampling equipment.
2. Use only Teflon, glass, or stainless-steel spray bottles/pressurized containers to apply rinsates. Keep each solution in a container designated and labeled specifically for that solution.
3. Decontaminate the appropriate amount of field equipment for each task to minimize the need for field cleaning.

3.4.3 Non-Sampling Equipment

Non-sampling equipment includes drill rigs and geoprobe rigs. Any paint or coatings (e.g., rust) that may come in contact with the sample will be removed from the equipment by sandblasting before being brought onsite. Non-sampling equipment will be decontaminated using the following procedure:

1. Decontaminate with high pressure wash.
2. If necessary, scrub with a laboratory-grade detergent and clean water wash solution.
3. Rinse with clean water as necessary.

3.4.4 Sampling Equipment

Sampling equipment includes any downhole equipment (e.g., augers, drill pipe, stainless-steel split barrel samplers, Teflon-coated stainless-steel leaders, stainless-steel liners, bailers), and any sampling utensils (e.g., stainless-steel spoons, spatulas, and bowls) that are not dedicated to the sample location. Downhole equipment that are hollow or have holes that transmit water or drilling fluids, will be cleaned on the inside and outside. Sampling equipment will be decontaminated using the following procedure:

1. Wear protective gloves prior to decontaminating the equipment.
2. Wash and scrub with a laboratory-grade detergent and clean water wash solution, or decontaminate with high pressure steam.
3. Rinse with clean water.
4. Rinse with deionized organic-free water.
5. Air dry.
6. Wrap in aluminum foil if the sampling equipment is to be stored or transported.
7. Augers and drill rods should be wrapped in clean plastic after decontamination.

3.4.5 Personnel Decontamination

Personnel decontamination procedures are outlined in the site-specific HASP in Section 4.

4.0 HEALTH AND SAFETY PLAN

4.1 Introduction

This Health and Safety Plan is written for field operations to be conducted at IR Sites 1, 3, and 4 and Building 8 at the Naval Air Station Corpus Christi, Texas. The affected property assessment is being conducted to assess the nature and extent of contamination at the site such that future remedial activities can be developed.

Applicability

The provisions of this plan are mandatory for all onsite personnel engaged in the affected property assessment who will be exposed or have the potential to be exposed to onsite hazardous substances. All personnel will operate in accordance with the most current requirements of 29 CFR 1910.120, *Standards for Hazardous Waste Workers and Emergency Responders*. These regulations include the following provisions for employees exposed to hazardous substances, health hazards or safety hazards: training as described in 120(e), medical surveillance as described in 120(f), and personal protective equipment described in 120(g). All field personnel assigned to field activities for the project must read this plan and sign the plan acceptance form before the start of site activities. Subcontractors will hold EnSafe harmless from, and indemnify it against all liability in the case of any injury. At a minimum, all provisions of the EnSafe health and safety plan will be followed.

EnSafe will suspend the site work and will instruct the subcontractor to evacuate the area if inadequate safety precautions are taken by the subcontractor or DOD oversight personnel or if it is believed that the subcontractor or DOD oversight personnel are or may be exposed to an immediate health hazard.

Health and Safety training certificates and current OSHA refresher training certificates, if necessary, will be available on site for all employees involved in field activities before the project begins. All subcontractors, DOD oversight personnel, and any other site visitors must provide Health and Safety certification with appropriate refresher course documentation prior to site entry.

4.2 Site Characterization

4.2.1 Work Areas

Site control will be established and maintained according to the recommendations in the EPA's *Interim Standard Operating Safety Guides*, Revised September, 1982. Three general zones of operation will be established 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 will be located so that the area between the decontamination station and the work area entrances will be included. The contamination reduction zone will include the decontamination station and the support zone will be located beyond the contamination reduction zone. Only authorized personnel with a minimum of 40 hours health and safety training meeting the requirements of OSHA 29 CFR 1910.120 are permitted within the exclusion and contamination reduction zones.

The exclusion zone is the area known or suspected to be contaminated with hazardous substances. The exclusion zone will be defined locally but is suggested to be within 20 feet of either side or the rear of the drill rig. All personnel within the exclusion zone must use the prescribed level of personal protection.

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

- Provide his or her partner with assistance.
- Observe his or her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his or her partner's protective clothing.
- Notify the shift supervisor, his representative or others if emergency help is needed.

Additionally, at least one person shall remain outside the exclusion zone and have available at least the same level of personal protective equipment (PPE) as the buddies who are entering the exclusion zone.

The person outside the exclusion zone will act as the safety observer and perform the security duties described in the section labeled Work Area Access/Egress of this section.

The contamination reduction zone serves as a buffer between the exclusion zone and the support zone and 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.

The support zone is the outermost area and is considered a non-contaminated or clean area. The support area will be equipped with an appropriate first-aid station and equipment to perform gross decontamination of equipment.

4.2.2 Work Area Access

All personnel entering the site exclusion zone must:

1. Check in with the EnSafe Field Project Manager or representative.
2. Provide the shift supervisor with the following information:
 - The names of individuals entering the site work area.
 - Destination in the site work area.
 - Activity to be performed at that location.
 - Duration of the planned activity.
3. The Field Project Manager will inform persons entering the site work area of the location of other activities taking place during the scheduled entry. If the Field Project Manager determines it is not safe for the scheduled entry, he or she can reschedule the entry or stop all other activities to perform the specific task.
4. When leaving the site work area, proceed directly to the decontamination station and check out with the Field Project Manager or his representative. All exits from the site work area must be

made through the contamination reduction zone.

5. Perform all necessary decontamination before leaving the contamination reduction zone.

4.2.3 Site Map and Work Zones

The specific locations of the work zones are shown on Figures 2-1, 2-2, and 2-3. The limit of the exclusion area and location and limit of the decontamination corridor and support area will be based on existing physical assets such as location of utilities, roads, and security assets.

4.3 Site Activities

The activities to be performed during the investigation include the drilling and sampling of 1 soil boring and the installation of one shallow groundwater monitoring well, installation of 26 CPTs, collection of 42 geoprobe groundwater samples, collection of 21 geoprobe soil samples, and the collection of 67 surface soil samples. Subsequent activities will include well purging, development, and sampling as required.

Boring/well installations and associated field work descriptions were provided in the Quality Assurance Plan by EnSafe.

4.4 Hazards

4.4.1 Chemical Hazards

Previous sampling operations reveal the potential for exposure to numerous chemical substances. Table 4.1 lists exposure guidelines for the expected site chemicals. Listed below are the potential chemical hazards posed by these materials and safety data associated with them.

Benzene is considered a human carcinogen by NIOSH (among others). As a result, all appropriate precautions should be taken to avoid or at the very least, limit exposure to benzene. Signs and symptoms of exposure include: dizziness; weakness; euphoria; headache; nausea; vomiting; tightness of the chest; staggering; and with more severe exposure, blurred vision; tremors; shallow and rapid respiration;

ventricular irregularities; paralysis; and unconsciousness.

Toluene is considered a moderate health hazard by the NFPA. Symptoms of exposure include: dizziness; exhilaration; and confusion at lower acute exposure levels, and incoordination; ataxia; unconsciousness; and death (eventually) may occur at high level acute exposures.

1,2-Dichlorobenzene (o-Dichlorobenzene) is considered a slight health hazard by NFPA. Short exposure at high concentrations may result in depression of the CNS. Vapors are irritating to eyes, nose and throat. It may cause burning pain in stomach, nausea, vomiting and diarrhea if ingested. Prolonged exposures may result in liver and kidney damage.

1,4-Dichlorobenzene is considered a moderate health hazard by NFPA. Signs of exposure include irritation of the eyes and upper respiratory tract; CNS depression; nausea, vomiting, diarrhea, and a burning pain in the stomach resulting from ingestion; and liver and kidney damage. Prolonged exposure may result in irritation of the skin.

**TABLE 4.1
EXPOSURE GUIDELINES FOR EXPECTED SITE CHEMICAL HAZARDS**

Chemical Name	Odor Threshold (ppm)	OSHA PEL (ppm) ^a	ACGIH TLV (ppm) ^b	NIOSH REL (ppm) ^c	Auto-ignition Temp.	Flammable range (% by volume)
Benzene	4.68 ppm	1 ppm (5ppm STEL)	10 ppm Suspect Human Carc.	Potential Occupational Carc.	1096 F	1.3 to 7.1%
Toluene	40 ppm	100 ppm (150ppm STEL)	100 ppm	100 ppm	996.5 F	1.3 to 7.1%
Trichloroethylene	N.A.	50 ppm (200ppm STEL)	50 ppm (200ppm STEL)	25 ppm Potential Occupational Carc.	770 F	11 to 41%
Vinyl Chloride	N.A.	1 ppm (5ppm Ceiling)	5 ppm Confirmed Occupational Carc.	Potential Occupational Carc.	881 F	3.6 to 33%
Carbon Disulfide	N.A.	4 ppm (12ppm Ceiling) Skin	10 ppm Skin	1 ppm 10 ppm Ceiling	212 F	1.3 to 50%
Chlorobenzene	N.A.	75 ppm	10 ppm	Not Listed	1184 F	1.3 to 9.6%
Ethyl Benzene	N.A.	100 ppm (125ppm STEL)	100 ppm (125ppm STEL)	Not Listed	860 F	1.0 to 6.7%
1,4-Dichlorobenzene	N.A.	75 ppm (110ppm STEL)	75 ppm (110ppm STEL)	Potential Occupational Carc.	N.A.	N.A.
1,2-Dichlorobenzene	N.A.	50 ppm Ceiling	50 ppm Ceiling Skin	Not Listed	1198 F	2.2 to 9.2%
Naphthalene	0.3 ppm	10 ppm (15ppm STEL)	10 ppm (15ppm STEL)	Not Listed	978 F	0.9 to 5.9%
Di-n-Butylphthalate	N.A.	5 mg/m3	5 mg/m3	Not Listed	N.A.	N.A.
Bromoform	N.A.	0.5 ppm Skin	0.5 ppm Skin	Not Listed	N.A.	N.A.

**TABLE 4.1
 EXPOSURE GUIDELINES FOR EXPECTED SITE CHEMICAL HAZARDS**

Chemical Name	Odor Threshold (ppm)	OSHA PEL (ppm) ^a	ACGIH TLV (ppm) ^b	NIOSH REL (ppm) ^c	Auto-ignition Temp.	Flammable range (% by volume)
1,2-Dichloroethene	N.A.	1 ppm (2ppm STEL)	10 ppm (15ppm STEL)	1 ppm 2 ppm Ceiling Potential Occupational Carc.	775 F	6.2 to 15%
Polychlorinatedbiphenyls (PCBs)	N.A.	Not Listed	2 ppm STEL	Not Listed	N.A.	N.A.
Lead	N.A.	0.05 mg/m ³	0.05 mg/m ³	0.1 mg/m ³	N.A.	N.A.
Chromium	N.A.	1 mg/m ³	0.5 mg/m ³	Not Listed	N.A.	N.A.
Cadmium	N.A.	0.6 mg/m ³ Ceiling	0.5 mg/m ³	Potential Occupational Carc.	N.A.	N.A.
Arsenic	N.A.	0.01 mg/m ³	0.2 mg/m ³	.002 mg/m ³ Ceiling Potential Occupational Carc.	N.A.	N.A.

Notes:

- ^a 29 CFR 1910.1000, Table Z-1-A. Limits For Air Contaminants, as amended through 1/15/91.
 - ^b 1990 - 1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGIH
 - ^c NIOSH Pocket Guide to Chemical Hazards, September 1985
- NA = Substance information not available, or substance unlisted.

Cadmium exposures may produce symptoms of nose and throat irritation, chest pain, sweating, chills, dyspnea, weakness, nausea, vomiting, diarrhea, abdominal cramps, and possible death. Prolonged exposures may result in loss of smell, nose ulceration, dyspnea, emphysema, kidney damage, and mild anemia.

Chromium dust exposure may cause irritation of the nose, throat, lungs, and eyes. Skin contact may result in irritation. Ingestion may produce mouth and throat irritation.

Lead exposure may result in insomnia, anorexia, low-weight, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, and trembling paralysis wrist (wrist-drop).

Arsenic is considered a human carcinogen by NIOSH (among others). As a result, all appropriate precautions should be taken to avoid or at the very least, limit exposure to arsenic. Signs and symptoms of exposure include: coughing; dyspnea; chest pains; irritation to skin and mucous membranes; fever; insomnia; liver swelling; melanosis; disturbed heart function; facial edema; and death.

Vinyl Chloride is considered a moderate health hazard by NFPA and a human carcinogen by NIOSH (among others). As a result, all appropriate precautions should be taken to avoid or at the very least, limit exposure to vinyl chloride. Signs and symptoms of exposure include: drowsiness; abdominal pains; numbness and tingling in fingers and toes; pains in joints; coughing; sneezing; irritability; and loss of appetite and weight. Contact with liquid may cause frostbite; contact with vapor may cause irritation and rash. Vinyl Chloride may be readily absorbed through the skin. Prolonged exposure may cause skin to become thickened and stiff with coarse, whitish patches; liver and spleen damage may occur.

1,2-Dichloroethane (Ethylene Dichloride) is considered a moderate health hazard by NFPA and a human carcinogen by NIOSH (among others). As a result, all appropriate precautions should be taken

to avoid or at the very least, limit exposure to 1,2-Dichloroethane. Signs and symptoms of exposure include: dizziness; nausea; vomiting; weakness; headaches; abdominal cramps; liver and kidney damage; fluid build up in the lungs; coma; and death. Ingestion of 2 ounces has resulted in nausea, faintness, drowsiness, difficult breathing, pale skin, internal bleeding, kidney damage, and death due to respiratory failure.

Trichloroethylene is considered a moderate health hazard by NFPA and a human carcinogen by NIOSH. As a result, all appropriate precautions should be taken to avoid or at the very least, limit exposure to trichloroethylene. Signs and symptoms of exposure include: headache, drowsiness; nausea; vomiting; dizziness; unconsciousness; and death. It may be absorbed through the skin and cause irritation, burning, or redness. Ingestion may result in abdominal pain, unconsciousness, liver or kidney damage, and death. Prolonged exposures may cause nervous exhaustion, sensitivity to alcohol, numbness in the fingers, and change in heart rate.

Carbon Disulfide is considered a moderate health hazard by NFPA. Signs and symptoms of exposure include sleep disturbances, fatigue, loss of appetite, nausea, diarrhea, depression, and extreme irritability. It may be absorbed through the skin causing or increasing symptoms listed above. Ingestion may result in loss of coordination, tremors, hallucinations, coma, and death.

Chlorobenzene is considered a moderate health hazard and a severe flammability hazard by NFPA. Symptoms of exposure include coughing, headache, loss of consciousness, loss of coordination, coma, and death. Chlorobenzene may be irritating to the skin.

Ethylbenzene is considered a moderate health hazard and a severe flammability hazard by NFPA. Symptoms of exposure include irritation of the nose and throat, dizziness, difficult breathing, depression, and unconsciousness. Skin contact may result in irritation, inflammation, blisters, and burns. Ingestion of ethylbenzene may produce headaches, drowsiness, and coma.

Naphthalene is considered a moderate health and flammability hazard by NFPA. Signs and symptoms of exposure include headache, excessive sweating and vomiting. Skin contact may result in irritation. Ingestion may result in nausea, vomiting, abdominal pain, and irritation of the bladder.

Bromoform is considered an extreme health hazard by NFPA. As a result, all appropriate precautions should be taken to avoid or at the very least, limit exposure to bromoform. Signs and symptoms of exposure include irritation of the nose and throat, tearing, reddening of the face, dizziness, and death. It may be readily absorbed through the skin to produce symptoms listed above. Ingestion may result in burning of the mouth and throat, headache, dizziness, difficult breathing, unconsciousness, and death.

Polychlorinatedbiphenyls (PCBs) is considered a human carcinogen by NIOSH, IARC, and NTP. As a result, all appropriate precautions should be taken to avoid or at the very least, limit exposure to PCBs.

Material Safety Data Sheets (MSDS) for the materials listed above are included in Appendix A.

4.4.2 Heavy Equipment Operations

Heavy equipment and drill rig operations will be conducted in accordance with the EnSafe Corporate Health & Safety Manual, Drilling Safety Guide. (Appendix B).

4.4.3 Physical Hazards During Operations

Personnel conducting drill rig operations shall keep clear of all moving parts. Loose clothing shall not be worn to prevent entanglement with the drill rig. When conducting operations or survey work on foot, personnel will walk at all times. Running greatly increases the probability of slipping, tripping, and falling. When working in areas that support habitat for poisonous snakes, personnel shall wear protective chaps made of a heavy material designed to prevent snake bites to the legs.

4.5 Employee Protection

Employee protection for this project includes standard safe work practices, personal protective equipment, procedures and equipment for extreme weather conditions, work limitations, and exposure evaluation.

4.5.1 Standard Safe Work Practices

Standard safe work practices that will be followed include:

- Eating, drinking, chewing gum or tobacco, smoking or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the Site Health and Safety Officer.
- Hands and face must be thoroughly washed upon leaving the work area.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate or discolored surfaces; or lean, sit, or place equipment on drums, containers, or on soil suspected of being contaminated.
- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages shall be avoided during operations.
- Due to the possible presence of overhead power lines, adequate side and overhead clearance should be maintained to insure that the drill rig boom does not touch or pass close to any overhead lines.
- Due to the possible presence of underground utilities (including electric, natural gas, water, sewer, telephone, etc.), the activity and local utility representatives should be contacted and requested to identify all lines at the ground surface using characteristic spray paint or labeled stakes. A 3-yard buffer zone should be maintained during all subsurface investigations.

- Due to the flammable properties of the potential chemical hazards, all spark or ignition sources should be bonded and/or grounded or mitigated before soil boring advancement or other site activities begin.

4.5.2 NAS Corpus Christi General Rules of Conduct

- Liquor, firearms, cameras, narcotics, tape recorders, and other contraband items are not permitted on the premises.
- Any violation of local, state, or federal laws, or conduct which is outside the generally accepted moral standards of the community is prohibited.
- Violation of the Espionage Act, willfully hindering or limiting production or sabotage is not permitted.
- Willfully damaging or destroying property, or removing government records is forbidden.
- Misappropriation or unauthorized altering of any government records is forbidden.
- Securing government tools in a personal or contractors tool box is forbidden.
- Gambling in any form, selling tickets, articles, taking orders, soliciting subscriptions, taking up collections, etc. is forbidden.
- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long distance telephone calls is forbidden.
- Compliance with posted signs and notices is required.
- Boisterousness and noisy or offensive work habits, abusive language, or any verbal, written, symbolic, or other communicative expression which tends to disrupt the work of others or morale is forbidden.
- Fighting or threatening bodily harm to another is forbidden.
- Defacing any government property is forbidden.
- Wearing shorts of any type and/or offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes and pants or slacks or coverall-type garments will be worn at all times on government property.
- All persons operating motor vehicles will obey all NAS Corpus Christi traffic regulations.

4.5.3 Personal Protective Equipment (PPE)

Field activities which disturb soils will be initiated in Level D protection. Level D protection consists of work coveralls (full length pants), hard hat, appropriate chemical resistant gloves, eye protection, and chemical resistant, steel toed and shank boots. This level of protection was chosen because petroleum contamination present at this site presents a significant skin absorption hazard.

Air monitoring for volatile organic compounds will be performed continuously during all sampling activities. Instruments will be continuous reading and intrinsically safe. Additional PPE upgrades to Level C will be initiated if airborne concentrations warrant respiratory protection. Level B will be initiated if concentrations of any contaminant exceeding 50 percent of the OSHA Permissible Exposure Limit (PEL) are encountered. See Table 4.2 for the specific criteria for use and equipment for each level of protection.

TABLE 4.2 LEVEL OF PROTECTION AND CRITERIA		
Level of Protection	Criteria for Use	Equipment
Level A	<ul style="list-style-type: none"> • When atmospheres are "immediately dangerous to life and health" (IDLH in the NIOSH/OSHA Pocket Guide to Chemical Hazards or other guides.) • When known atmospheres or potential situations exist that would affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes or mucous membranes. • Potential situations include those where immersion may occur, vapors may be generated or splashing may occur through site activities. • Where atmospheres are oxygen with the conditions above. • When the type(s) and or potential concentration of toxic substances are not known. 	<ul style="list-style-type: none"> • Positive pressure-demand full facepiece self-contained breathing apparatus or positive pressure-demand supplied air respirator with escape SCBA • Totally-encapsulating chemical protective suite • Chemical-resistant inner and outer gloves • Steel toe and shank chemical resistant boots • Hard hat under suit • Two-way radios worn inside suit • Optionally: coveralls, long cotton underwear, disposable protective suit, gloves and boots, work over fully encapsulating suit
Level B	<ul style="list-style-type: none"> • When work areas contain less than 19.5 percent oxygen • When concentrations of any contaminant exceed 50% of PEL 	<ul style="list-style-type: none"> • Chemical resistant clothes, long sleeves, hooded, one or two pieces • Full-faced positive-pressure supplied air breathing apparatus or airline system with a 30 minute escape bottle • Hard hat • Inner gloves and chemical resistant gloves • Steel toe and shank boots • Optionally: coveralls and disposable outer boots
Level C	<ul style="list-style-type: none"> • When airborne particulates (dust) warrant respiratory protection • When work areas contain at least 19.5 percent oxygen 	<ul style="list-style-type: none"> • Chemical resistant clothes, long sleeves, hood optional, one or two pieces • Full-faced piece, air purifying respirator equipped with cartridges suitable for the hazard • Hard hat • Inner gloves and chemical resistant gloves • Steel toe and shank boots • Coveralls and disposable outer boots
Level D	<ul style="list-style-type: none"> • When level B or C is not indicated • When airborne particulates do not warrant respiratory protection • When work areas contain at least 19.5 percent oxygen 	<ul style="list-style-type: none"> • Inner gloves and chemical-resistant gloves needed to handle soil or water samples • Steel toe and shank boots • Hard hat (ANSI Z891-1969 standard) • Eye protection (ANSI Z87.1-1968) standard • Optionally: coveralls and disposable outer boots

Notes:

Level A protection will be selected when the highest available level of respiratory, skin, and eye protection is needed. Level A protection will be required in Area A of the exclusion zone.

Contraindications for use of Level A:

- Environmental measures contiguous to the site indicate that air contaminants do not represent a serious dermal hazard.
- Reliable, accurate historical data do not indicate the presence of severe dermal hazards.
- Open, unconfined areas.
- Minimal probability of vapors or liquids (splash hazards) present which could affect or be absorbed through the skin.
- Total vapor readings indicate 500 ppm to 1,000 ppm.

Level B protection will be selected when the highest level of respiratory protection is needed, but cutaneous exposure to the small unprotected areas of the body, (neck and back of head) is unlikely, or where concentrations are not known to be within acceptable standards. Additionally, the permissible limit for exposure to mixtures of all site gases will be checked using the requirements of 1910.1000(d)(2)(i) to ensure that PEL is not exceeded. If the value calculated using this method exceeds 1.0, Level B PPE is required.

Level C protection will be selected when the types and concentrations of inseparable material is known, or reasonably assumed to be no greater than the protection factors associated with air-purifying respirators, and exposure to the unprotected areas of the body is unlikely to cause harm. Dust concentrations require Level C PPE, where the respirable fractions exceed the PEL of 5 mg/m³ or the total concentrations exceed the PEL of 15 mg/m³.

Level D protection will be chosen when measurements of atmospheric concentrations are at background levels and work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemicals.

Selection of Personal Protective Equipment

It is important that personal protective equipment 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 personal protective equipment required, based on past experiences and sound safety practices.

The appropriate level of protection will be determined before the initial entry based on the best available information. Subsequent information, (e.g., sampling results and site observations), may require changes in the original level selected.

The levels of personal protection were determined by the USEPA and are to be used in selecting equipment for onsite activities. The levels are designated as Level A, B, C, and D. They correspond with the work areas in the exclusion zone and are consistent with the levels of protection described in Appendix E of OSHA 1910.120.

Chemical-Protective Clothing (CPC)

Chemical-protective clothing is available in a variety of materials that offer a range of protection against different chemicals. The most appropriate material depends on the chemicals present and the tasks to be accomplished. Ideally, the material resists permeation, degradation, and penetration. Permeation is the process by which a chemical dissolves in and/or moves through a protective clothing material on a molecular level. Degradation is the loss of or change in the fabric's chemical resistance or physical properties due to exposure to chemicals, use or ambient conditions (e.g. sunlight). Penetration is the movement of chemicals through zippers, stitched seams or imperfections (e.g. pinholes) in a protective clothing material.

Selection of chemical-protective clothing is a complex task and should be performed by personnel with training and experience. Under all conditions, clothing is selected by evaluating the performance characteristics of the clothing against the requirements and limitations of the site and task-specific conditions. If possible, representative garments should be inspected before purchase and their use and performance discussed with someone who has experience with the clothing under consideration. In all cases, the employer is responsible for ensuring that the personal protective clothing (and all PPE) necessary to protect employees from injury or illness that may result from exposure to hazards at the work site is adequate and of safe design and construction for the work to be performed (see OSHA Standard 29 CFR Part 1910.132 - 1910.137).

Permeation and Degradation

The selection of chemical-protective clothing (CPC) depends greatly upon the type and physical state of the contaminants. This information is determined during site characterization. After the chemicals have been identified, available sources should be consulted to identify materials that are resistant to permeation and degradation by the known chemicals. One excellent reference, *Guidelines for the Selection of Chemical-Protective Clothing*, (ACGIH, 1985), provides a matrix of clothing material recommendations for approximately 300 chemicals based on an evaluation of permeation and

degradation data from independent tests, vendor literature, and raw material suppliers. Charts indicating the resistance of various clothing materials to permeation and degradation are also available from manufacturers and other sources. It is important to note, however, that no material protects against all chemicals and combinations of chemicals, and that no currently available material is an effective barrier to any prolonged chemical exposure.

In reviewing vendor literature, it is important to be aware that the data provided are of limited value. For example, the quality of vendor test methods is inconsistent. Vendors often rely on the raw material manufacturers for data rather than conducting their own tests, and the data may not be updated. In addition, vendor data cannot address the wide variety of used and challenges to which CPC may be subjected. Most vendors strongly emphasize this point in the descriptive text that accompanies their data.

Another factor to bear in mind when selecting CPC is that the rate of permeation is a function of several factors, including clothing material type and thickness, manufacturing method, the concentrations of the hazardous substances, temperature, pressure, humidity, the solubility of the chemical in the clothing material, and the diffusion coefficient of the permeating chemical in the clothing material. Thus permeation rates and breakthrough time may vary depending on these conditions. Breakthrough time is the time from initial exposure until hazardous material is detectable on the inside of the CPC.

Most hazardous wastes are mixtures for which specific data are not available to help make a good CPC selection. Due to a lack of testing, only limited permeation data for multi-component liquids are currently available.

Mixtures of chemicals can be significantly more aggressive towards CPC materials than can any single component. Even small amounts of a rapidly permeating chemical may provide a pathway that accelerates the permeation of other chemicals. Formal research is being conducted on these effects.

NIOSH is currently developing methods for evaluating CPC materials against mixtures of chemicals and unknowns in the field. For hazardous waste site operations, CPC should be selected that offers the widest range of protection against the chemicals expected onsite. Vendors are now providing CPC material composed of two or even three different materials laminated together that provide the best features of each material.

Heat Transfer Characteristics

The heat transfer characteristics of CPC may be an important factor in selection. Since most chemical-protective clothing is virtually impermeable to moisture, evaporative cooling is limited. The thermal insulation value, called the *clo* value, of chemical-protective clothing is a measure of the capacity of CPC to dissipate heat loss through means other than evaporation. The larger the *clo* value, the greater the insulating properties of the garment and, consequently, the lower the heat transfer. Given other equivalent protective properties, clothing with the lowest *clo* value should be selected in hot environments or for high work rates. Unfortunately, *clo* values for clothing are rarely available at present.

General Measures

A primary goal of EnSafe is the prevention of all occupationally related injuries and illnesses. The following practices are presented as general precautionary measures for reducing the risks associated with hazardous waste and spill operations. Failure to adhere to the measures will result in disciplinary action.

Personal Protection

- Be familiar with and knowledgeable about standard operating safety procedures.
- Be familiar with, knowledgeable about, and adhere to instructions in site safety plan.
- Identify and arrange for emergency medical assistance. The location, telephone number and transportation capabilities of the nearest emergency medical facilities should be known. For

particularly hazardous operations, onsite medical facility alerted.

- Consider fatigue, heat stress and other environmental factors influencing efficiency of personnel.

4.5.4 Procedures and Equipment for Extreme Weather Conditions

Field activities for this investigation are scheduled to last approximately 2 weeks. The seasonal climate can be expected to be hot. Heat stress will be of concern for the health and safety of personnel. Adverse weather conditions are important considerations in planning and conducting site operations. Extremes in hot weather can cause physical discomfort, loss of efficiency and personal injury.

Heat Stress

Heat stress can result when the protective clothing decreases natural body ventilation even when temperatures are moderate. Working under various levels of personal protection may require the wearing of low permeability disposable suits, gloves and boots. This clothing will prevent most natural body ventilation. Discomfort due to increased sweating and body temperature (heat stress) will be expected at the work site.

Heat stress is the metabolic and environmental heat to which an individual is exposed. The manifestations of heat strain are the adjustments made by an individual in response to the stress. The three most important categories of heat-induced illness are: heat exhaustion, heat cramps, and heat stroke. These disorders can occur when the normal responses to increased sweat production are not adequate to meet the needs for body heat loss or when the temperature regulating mechanisms fail to function properly.

Heat exhaustion is a state of collapse brought about by an insufficient blood supply to the cerebral cortex portion of the brain. The crucial event is low blood pressure caused by inadequate heart output and widespread expansion of blood vessels.

Heat Exhaustion Factors – Factors which can lead to heat exhaustion are as follows:

- Increased expansion of blood vessels which causes a decreased capacity of circulation to meet the demands for heat loss to the environment, exercise, and digestive activities.
- Decreased blood volume due to dehydration.
- Reduced blood volume due to lack of physical training, infection, intoxication (from industrial contaminants as well as from drinking alcohol), or heart failure.

Heat Exhaustion Symptoms – The symptoms include extreme weakness or fatigue, dizziness, nausea, or headache. More severe cases may also involve vomiting and possible unconsciousness. The skin becomes clammy and moist, the complexion pale, and the oral temperature stays normal or low but the rectal temperature is usually elevated (99.5°F - 101.3°F). Workers who are not acclimated run the highest risk.

Heat Exhaustion Treatment – In most cases, treatment of heat exhaustion is fairly simple. The victim will be moved to a cool place. If the victim is unconscious, medical assistance must be sought. Mild cases may experience immediate recovery; however, more severe cases may require several days care. No permanent effects have ever been reported.

Heat cramps result when the working muscles go into painful spasms. This may occur in those who perspire profusely in heat and who drink large quantities of water, but who fail to replace their bodies' low salt. It is the low salt content in the blood that causes the cramping. The abdominal muscles as well as the muscles in the arms and legs may be affected. The cramps may appear during or even after work hours. Persons on a "low sodium" diet should not be given salt. A physician must be consulted on the care of people with this condition.

Heat stroke is the most serious of the health problems that arise while working in hot environments. It is caused by the breakdown of the thermo-regulatory system under stress. When this happens,

perspiration stops and the body can no longer regulate its own temperature.

Heat Stroke Symptoms – A heat stroke victim may be identified by hot, dry, and usually red or spotted skin. The body core temperature can exceed 105°F. Mental confusion, irritability and chills are common. These are all early warning signs of heat stroke; if the sufferer is not removed from the hot environment at once, more severe symptoms can follow, including unconsciousness, delirium, and convulsions, possibly ending in death.

Heat Stroke Treatment – Heat stroke victims must be treated as a major medical emergency; medical assistance must be summoned immediately.

Additional treatment:

- First aid must be administered.
- Individual must be moved to a cool location.
- Individual must be cooled through wetting, fanning, or immersion.

Care should be taken to avoid over-cooling and treatment for shock by raising the legs. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

To reduce the potential for heat strokes:

- Drink plenty of fluids (to replace loss through sweating).
- Wear cotton undergarments to act as a wick to absorb moisture.
- Make adequate shelter available for taking rest breaks to cool off.

Additional Measures

In extremely warm weather, the Site Health and Safety Officer may also require these additional

measures:

- Shift working hours to early morning and early evening. Avoid the hottest time of the day.
- Frequently rotate crews wearing the protective clothing (if required).

4.5.5 Work Limitations

All site activities will be conducted during daylight hours 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 on an annual basis in order to continue working at the site.

4.5.6 Exposure Evaluation

All personnel scheduled for site activities have had a baseline physical examination which includes a stressing exam of the neurologic, cardiopulmonary, musculoskeletal and dermatological systems, pulmonary function testing, multi-chemistry panel and urinalysis and have been declared fit for duty. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated on an annual basis and upon termination of employment as required by 29 CFR 1910.120(f). The content of the annual or termination examination will be the same as the baseline physical. A qualified physician will review the results of the annual examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, there will be a medical examination to determine fitness for duty or any job restrictions. The site health and safety manager will review the results with the examining physician before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job related injury or illness requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30

years following the termination of employment.

4.6 Monitoring Requirements

Air monitoring will be accomplished using an HNu (or similar) photoionization detector (PID) and a MSA 361 combustible gas indicator (CGI) during all borings and ground water well installations. The PID will be field calibrated to measure volatile organic compounds relative to benzene using an isobutylene standard gas. Background (ambient) PID and CGI readings in the breathing zone will be collected before each day's field activities begin. This value will be recorded in the field log book. If volatile organic compounds concentrations (in the breathing zone) exceed background (ambient) readings by five ppm or more, or CGI readings exceed 20% of the LEL, field activities will immediately cease. Upon cessation of site activities, the Field Project Manager must contact the Health and Safety Officer. The Health and Safety Officer will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary including upgraded personal protective equipment requirements, revised work schedules, and revised decontamination procedures.

Field technicians will be made aware that they must report any unusual odors or soil discolorations. Each instrument shall be calibrated daily before site activities begin and operation checked during the day. At the end of each work day and before calibration, each instrument shall be checked to ensure that it is free from surface contamination.

4.6.1 Medical Monitoring Program

All EnSafe personnel who enter hazardous waste/spill sites or have the potential for exposure to hazardous materials from these sites must participate in the EnSafe Medical Monitoring Program. The program is conducted by the EnSafe's company doctor with the company Health and Safety Officer. The purpose of the program is to identify any pre-existing illnesses or problems that would put an employee at unusual risk from certain exposures or respirators, and to monitor and evaluate exposure-related events where workers are involved in the handling of hazardous materials. Project managers should

consult with the Health and Safety Officer and/or the company doctor concerning the scope of work and known or anticipated chemical hazards associated with each project.

EnSafe maintains the right to exclude certain individuals from particular jobs based on reports from the company doctor. The program will be reviewed on an annual basis to determine its effectiveness.

The company doctor has been employed as an independent contractor to provide medical monitoring for EnSafe.

The doctor is responsible for the following aspects of the medical monitoring program:

- Selection and quality assurance of medical and laboratory services involved in carrying out the monitoring program.
- Development of a uniform medical record.
- Record retention.
- Employee notification of examination results.
- Determination of content of the medical and biological monitoring programs.
- Record review and correlation between potential exposure and effect.
- Monitoring job related illness and injury for each employee.

Preplacement Examinations

Each EnSafe employee will be given a preplacement examination to identify any preexisting illness or problem that would put the employee at an unusual risk from certain exposures; to assure that each employee can safely use negative pressure respirators; and to develop a data base to assess any exposure related events detected during periodic medical monitoring. Data accumulation will include variables such as age, sex, race, smoking, prior employment history, and other conditions that might bear upon the occurrence of subsequent events once employment begins.

The preplacement examination includes:

- Occupational history including previous chemical and carcinogenic exposures.
- Medical history including demographic data, family history, personal habits, past medical history and a current symptomatic review of systems.
- Fertility history.
- Physical examination, stressing examination of the neurologic, cardio-pulmonary, musculoskeletal and dermatological systems.
- Physiological parameters including blood pressure and visual acuity testing.
- Pulmonary function testing including FVC, FEV1 and FEV 25-75.
- Electrocardiogram.
- PA and lateral chest X-ray.
- A multi-chemistry panel including tests of kidney and liver function.
- Red blood cell cholinesterase.
- Audiogram.

The history, physiological parameters, X-ray, screening tests and laboratory studies will be done before the physical examination. After the physical examination, the medical examiner will review the results of the examination and special studies with each employee and facilitate referral for further evaluation of abnormalities detected during this examination. The Health and Safety Officer will provide each employee with a written summary and detailed results of the examination along with treatment of any job restrictions. Additional medical testing procedures (e.g. ophthalmology/optometric assessment, specialized audiometric testing, etc.) may be required at the discretion of EnSafe's attending physician.

Periodic and Exit Examinations

An examination and updated occupational history will be repeated annually and include:

- Updated occupational and medical history
- Physical examination, stressing examination of the neurologic, cardio-pulmonary, musculoskeletal

and dermatological systems

- Pulmonary function testing including FVC, FEVI and FEV 25-75
- Multi-chemistry panel including tests of kidney and liver function
- Urinalysis

The company doctor will review the results of annual examination and exposure data, and request further tests or issue medical clearances as appropriate.

An examination will also be administered when an employee leaves the company. The company doctor will be consulted for the contents of the exam, except when the employee has had an exam within 6 months or when there has been no site work since the last examination.

Return-to-Work Examinations

After any job-related injury or illness, a medical examination is required to determine fitness for duty or to identify any job restrictions. The medical examiner will review the results of this back-to-work examination with Company doctor before releasing the employee for work. A similar examination will be performed if an employee has missed at least 3 days of work due to a non-job-related injury requiring medical attention.

Confidentiality

Medical records will be maintained in a confidential manner so that only authorized persons will have access to the records. The authorized personnel will include medical staff of the joint venture or contract medical personnel, the individual, the individual's personal physician or the individual's designated representative. Upon request, the individual may obtain a copy of the medical file, which will be provided within 15 days of the receipt of the written request. Information used for research, testing, statistical, or epidemiologic purposes will have all identifying data removed, including the identity of the individual. Any medical information or findings obtained which do not affect the individual's job

performance will not be made available to EnSafe to maintain the patient-physician confidentiality. Upon death, retirement, resignation, or other termination of services, the records will be retained by EnSafe or contracting physician.

4.7 Decontamination

A decontamination zone will be established and will include one area for sampling equipment and one area for personnel decontamination (if necessary).

4.7.1 Personnel Decontamination

The decontamination procedures, based on Level D protection, will consist of:

- Brushing heavily soiled boots and rinsing outer gloves and boots with soap and water.
- Removing outer gloves and depositing them in a plastic lined container.
- Hard hats and eye protection should also be washed thoroughly at the end of each work day with a soap and water solution.
- Disposable gloves and any disposable clothing will be disposed of in sealable bags and placed in a 55-gallon drum.
- All field personnel are to be instructed to shower as soon as possible after leaving the site.

Decontamination procedures will be conducted at the lunch break and at the end of each work day.

If higher levels of personal protection equipment are needed, adjustments will be made to these procedures and an amendment will be made to this health and safety plan.

4.7.2 Closure of the Personnel Decontamination Station

Decontamination and rinse solutions (soap and water solutions) from sampling tool decontamination will be collected in 55-gallon drums. All washtubs, pails, buckets, etc. will be washed, rinsed and dried at the end of each workday.

All contaminated soils produced during decontamination activities will be collected in 55-gallon drums along with drill cuttings, waste decontamination solutions, and any disposable gloves and clothing produced during site activities. All drums will be labeled by EnSafe personnel for final disposal by the Navy.

4.8 Authorized Personnel

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

- EnSafe Principal-In-Charge- Dr. James Speakman
- EnSafe Task Order Manager- Mr. Mark Henderson
- EnSafe Field Project Manager- Mr. Dave Felter
- EnSafe Field Personnel- to be determined
- SOUTHDIV, Engineer-in-Charge- Mr. B.K. Moring
- Naval Air Station Corpus Christi Site Contact- Ms. Lu Stevens
- Drilling Subcontractor- To Be Determined
- Laboratory Subcontractor- To Be Determined

4.8.1 Responsibilities of EnSafe Field Project Manager

The Project Manager will direct the site investigation and operation. The Project Manager has the primary responsibility for assuring that all personnel are aware of:

- Names of personnel and alternates responsible for site safety and health
- Safety, health and other hazards present on the site
- Use of personal protection equipment and assuring that the equipment is available
- Work practices by which the employee can minimize risks from hazards
- Safe use of engineering controls and equipment on the site
- Medical surveillance requirements including recognition of symptoms and signs which might indicate over exposure to hazards
- Site control measures, decontamination procedures, site standard operating procedures and the

contingency plan and responses to emergencies including the necessary PPE.

The Project Manager is also responsible for assuring that all employees have received at least 40 hours of health and safety instruction, off the site, and actual field experience under the direct supervision of a trained experienced supervisor. Workers who may be exposed to unique or special hazards shall be provided additional training.

The Project Manager also monitors the performance of personnel to ensure that mandatory health and safety procedures are being performed and corrects any performances that do not comply with the Health and Safety Plan. (Copies of health and safety training certificates must be available for review by the EnSafe Project Manager and Site Safety Officer.)

Additional responsibilities extend to ensuring that all field personnel employed on the site are covered by a medical surveillance program as required by 29 CFR 1910.120(f):

- Consulting with the Health and Safety Officer and/or other personnel
- Preparation and submittal of any and all project reports– includes progress, accident, incident, contractual, etc.
- Monitoring personnel decontamination to ensure that all personnel are complying with the established decontamination procedures.

4.8.2 Responsibilities of EnSafe Site Health and Safety Officer

The EnSafe Health and Safety Officer has the primary responsibility for:

- Assuring that a copy of the Health and Safety Plan is maintained onsite during all field activities.
- Advising the Field Project Manager on all health and safety related matters involved at the site.
- Directing and ensuring that the safety program is being correctly followed in the field, including the proper use of personal protective and site monitoring equipment.
- Ensuring that the field personnel observe the appropriate work zones and decontamination procedures.

- Reporting any safety violations to the Project Manager.
- Conducting safety briefings during field activities.

The Site Health and Safety Officer will be a person trained in safety and industrial hygiene. After the project begins and the Site Health and Safety Officer has had time to evaluate actual hazardous site conditions, he/she may determine that a member of the project team may assume the duties of the Site Health and Safety Officer.

The person responsible for daily health and safety will be trained to use the air monitoring equipment, interpret the data collected with the instruments, and be familiar with symptoms of heat stress and cold exposure and the location and use of safety equipment onsite. He will also be familiar with this health and safety plan.

4.8.3 Responsibilities of Onsite Field Personnel

All onsite field personnel will be responsible for the following:

- All personnel going onsite must be thoroughly briefed on anticipated hazards and trained on equipment to be worn, safety procedures to be followed, emergency procedures and communications.
- Required respiratory protective devices and clothing must be worn by all personnel going into areas designated for wearing protective equipment.
- Personnel must be fit-tested before using respirators.
- No facial hair which intrudes on the sealing surface of the respirator is allowed on personnel.
- Personnel on site must use the buddy system when wearing respiratory protective equipment. As a minimum, a third person, suitably equipped as a safety backup, is required during initial entries.
- Visual contact must be maintained between pairs onsite and site safety personnel. Field personnel should remain close together to assist each other during emergencies.
- All field personnel should make use of their senses to alert themselves to potentially dangerous situations which they should avoid, e.g., presence of strong and irritating or nauseating odors.

- Personnel should practice unfamiliar operations prior to doing the actual procedure in the field.
- Field personnel shall be familiar with the physical characteristics of the site, including:
 - wind direction in relation to contamination zones
 - accessibility to associates, equipment and vehicles
 - communications
 - operation zones
 - site access
 - nearest water sources
- The number of personnel and equipment in the contaminated area must be kept to a minimum, consistent with effective site operations.
- Procedures for leaving a contaminated area must be planned and implemented before going onsite in accordance with the Site Health and Safety Plan.
- All visitors to the job site must comply with the Health and Safety Plan procedures. Personal protection equipment may be modified for visitors depending on the situation. Modifications must be approved by the Site Health and Safety Officer.

4.9 Emergency Information

All hazardous waste site activities present a potential risk to onsite personnel. During routine operations, risk is minimized by establishing good work practices, staying alert and using proper personal protective equipment. 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, Lu Stevens, NAS Corpus Christi site contact, will be informed and the appropriate contact from the following list will be made:

Contact	Agency or Organization	Telephone
Lu Stevens	Naval Air Station Corpus Christi	(361) 961-3776

B.K. Moring	SOUTHDIV Engineer-in-Charge	(843) 820-5514
Law Enforcement	NAS Corpus Christi Base Security	(361) 961-2480
Fire Department	NAS Corpus Christi	(361) 961-3333
Ambulance Service	NAS Corpus Christi Base Hospital	(361) 961-2424 (361) 961-2735
Poison Control Center		(512) 881-4559
Mark Henderson	EnSafe 4545 Fuller Drive, STE 326 Irving, TX 75038	(972) 791-3222

B.K. Moring, SOUTHDIV Engineer-in-Charge will be contacted after appropriate emergency measures have been initiated onsite.

4.9.1 Site Resources

Cellular telephones will be used for emergency use and communication/coordination with NAS Corpus Christi. First aid and eye wash equipment will be available at the work area.

4.10 Emergency Procedures

If an emergency develops onsite, such as:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site; or
- A condition is discovered that suggests the existence of a situation 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 Safety Officer.
- If any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately halt work and act according to the instructions provided by the Site Safety Officer.
- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the Site Safety Officer to indicate possible routes for upwind escape.
- The discovery of any conditions that would suggest the existence of a situation more hazardous than anticipated will result in the suspension of work until the Safety Officer has evaluated the situation and provided the appropriate instructions to the field team.
- If an accident occurs, the Project Manager is to complete an accident report form for submittal to the managing principal-in-charge of the project.
- If a member of the field crew suffers a personal injury, the Site Health and Safety Officer will call (361) 961-2424 (serious injury) to alert appropriate emergency response agencies or administer on-site 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 a chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water, and if the situation dictates, the Site Health and Safety Officer should alert appropriate emergency response agencies, or personally ensure that the exposed individual is transported to the nearest medical treatment facility for prompt treatment. An Accident Report Form will be completed for any such incident.

Directions to the nearest emergency medical facility capable of providing general emergency medical assistance and treating chemical burns are provided in Appendix C.

Additional information on appropriate chemical exposure treatment methods is provided in MSDS in Appendix A.

4.11 Forms

The following forms will be used in implementing this Health and Safety Plan:

Plan Acceptance Form

Plan Feedback Form

Exposure History Form

The Plan Acceptance Form will be filled out by all employees working on the site prior to commencement of site activities. 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 Field Project 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 Task Order Manager at EnSafe.

5.0 AFFECTED PROPERTY ASSESSMENT REPORT

Following receipt of analytical data from this investigation, an affected property assessment report (APAR) will be prepared following the requirements specified in 30 TAC 350. This report will include:

- Groundwater Classification
- Land Use Classification
- Source Areas Characterization
- Local Geology and Hydrogeology
- COC Concentrations and Movement in Environmental Media
- Exposure Pathway Analysis
- Ecological Risk Assessment
- Summary of Sampling Methodology
- All Analytical Data
- Documentation of Data Adequacy
- Documentation of RBEL and PCL Calculations
- Comparison of COC concentrations to PCLs
- Graphical Representations of Soil and/or Groundwater PCLE zones
- Description of Notification Requirements

The APAR will be presented in a format compatible with guidance from the TNRCC. The guidance for the APAR report format is expected to be available in May 2000.



Appendix A
MSDS Sheets

POLYSCIENCE -- BENZENE, PRODUCT #: 251C-1 - BENZENE, ACS.
MATERIAL SAFETY DATA SHEET
NSN: 6810002815266
Manufacturer's CAGE: 58378
Part No. Indicator: A
Part Number/Trade Name: BENZENE, PRODUCT #: 251C-1

=====
General Information
=====

Item Name: BENZENE, ACS.
Company's Name: POLYSCIENCE
Company's Street: 7800 MERRIMAC AVE
Company's City: NILES
Company's State: IL
Company's Country: US
Company's Zip Code: 60648
Record No. For Safety Entry: 003
Tot Safety Entries This Stk#: 006
Status: SE
Date MSDS Prepared: 01MAR92
Safety Data Review Date: 05AUG94
Supply Item Manager: CX
MSDS Serial Number: BTSWC
Specification Number: 0-C-265C (RED SPEC)
Hazard Characteristic Code: F3
Unit Of Issue: CN
Unit Of Issue Container Qty: 20 LITERS
Type Of Container: METAL/PLASTIC
Net Unit Weight: 36.4 LBS

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: BENZENE (SARA III)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: CY1400000
CAS Number: 71-43-2
OSHA PEL: SEE 1910.1028
ACGIH TLV: 10 PPM; A2; 9394
Other Recommended Limit: NONE RECOMMENDED

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: COLORLESS LIQUID.
Boiling Point: 176F, 80C
Vapor Pressure (MM Hg/70 F): 7403 @20C
Vapor Density (Air=1): 2.77
Specific Gravity: 0.874
Autoignition Temperature: 928F

=====
Fire and Explosion Hazard Data
=====

Flash Point: 12F, -11C
Lower Explosive Limit: 1.3
Upper Explosive Limit: 7.1
Extinguishing Media: CARBON DIOXIDE, DRY CHEM POWDER OR APPROPRIATE FOAM.
WATER MAY BE EFFECTIVE FOR COOLING BUT MAY NOT EFFECT EXTINGUISHMENT
Special Fire Fighting Proc: WEAR SELF-CONTAINED BREATHING APPARATUS AND
PROTECTIVE CLOTHING TO PREVENT CONTACT W/SKIN & EYES. USE WATER SPRAY TO
COOL FIRE-EXPOSED CONTAINERS.
Unusual Fire And Expl Hazrds: EXTREMELY FLAMMABLE. VAPOR MAY TRAVEL
CONSIDERABLE DISTANCE TO SOURCE OF IGNITION AND FLASHBACK. CONTAINER
EXPLOSION MAY OCCUR UNDER FIRE CONDITIONS.

=====
Reactivity Data
=====

Cond To Avoid (Stability): HIGHT TEMPERATURES. SOURCES OF IGNITION.
Materials To Avoid: OXIDIZING AGENTS.

Hazardous Decomp Products: TOXIC FUMES OF CARBON MONOXIDE AND CARBON DIOXIDE.

=====
 Health Hazard Data
 =====

LD50-LC50 Mixture: LD50 (ORAL,RAT)=930 MG/KG
 Route Of Entry - Inhalation: YES
 Route Of Entry - Skin: YES
 Route Of Entry - Ingestion: NO
 Health Haz Acute And Chronic: ACUTE:HARMFUL IF SWALLOWED, INHALED, ABSORBED THRU SKIN. IRRIT TO MUC MEM & UPPER RESP TRACT. CAUSES SKIN & SEVERE EYE IRRIT. CHRONIC: CARCINOGEN. MAY ALTER GENETIC MATERIAL. BLOOD EFFECTS.
 Carcinogenicity - NTP: YES
 Carcinogenicity - IARC: YES
 Carcinogenicity - OSHA: YES
 Explanation Carcinogenicity: CONTAINS Benzene [71-43-2] WHICH IS LISTED BY NTP AND IARC AND REGULATED BY OSHA AS A CARCINOGEN.
 Signs/Symptoms Of Overexp: NAUSEA, DIZZ, HEAD, NARCOTIC EFFECT. CANCER. EXHILARATION, NERVOUS EXCITATION &/OR GIDD, DEPRESS, DROWSINESS, FATIGUE. TIGHTNESS IN CHEST, BREATHLESSNESS, LOSS OF CONSC, TREMORS, CONVULS, DEATH DUE TO RESP PARA OR CIRCULATORY COLLAPSE. DRYING, SCALING DERM, 2NSD SKIN INFECTIONS. BLEEDING FROM NOSE/GUMS/MUC MEM, SMALL BLISTERS, LEUKOPENIA.
 Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
 Emergency/First Aid Proc: IMMEDIATELY FLUSH EYES OR SKIN W/COPIOUS AMTS OF WATER FOR @ LEAST 15MINS WHILE REMOVING CONTAMINATED CLOTHING/SHOES. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT GIVE OXYGEN. IF SWALLOWED WASH OUT MOUTH W/WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.

=====
 Precautions for Safe Handling and Use
 =====

Steps If Matl Released/Spill: EVACUATE AREA. SHUT OFF ALL IGNITION SOURCES. WEAR SCBA, RUBBER BOOTS & HEAVY RUBBER GLOVES. COVER W/ACTIVATED CARBON ADSORBENT. TAKE UP & PLACE IN CLOSED CONTAINERS. TRANSPORT OUTDOORS. VENITLATE AREA & WASH SITE AFTER MATL PICKUP IS COMPLETE.
 Neutralizing Agent: NOT RELEVANT.
 Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS HIGHLY FLAMMABLE. OBSERVE ALL LOCAL, STATE AND FEDERAL LAWS.
 Precautions-Handling/Storing: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESP, CHEM-RESIST GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTH. USE ONLY IN CHEMICAL FUME HOOD. USE NONSPARKING TOOLS
 Other Precautions: DON'T BREATHE VAPOR. DON'T GET IN EYES, ON SKIN, ON CLOTHING. AVOID PROLONG/REPEAT EXPOSURE. KEEP TIGHTLY CLOSED. KEEP AWAY FROM HEAT, SPARKS, OPEN FLAME. STORE IN COOL DRY PLACE. IF FEEL UNWELL SEEK MED ADVICE (SHOW LABEL WHERE POSSIBLE).

=====
 Control Measures
 =====

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR.
 Ventilation: CHEMICAL FUME HOOD WHICH IS EXPLOSION PROOF.
 Protective Gloves: CHEMICAL RESISTANT GLOVES.
 Eye Protection: SAFETY GOGGLES.
 Other Protective Equipment: PROTECTIVE SUITABLE CLOTHING TO MINIMIZE SKIN CONTACT. SAFETY SHOWER & EYE BATH.
 Work Hygienic Practices: WASH CONTAMINATED CLOTHING PROMPTLY. WASH THOROUGHLY AFTER HANDLING.

=====
 Transportation Data
 =====

Trans Data Review Date: 94217
 DOT PSN Code: BRS
 DOT Proper Shipping Name: BENZENE
 DOT Class: 3
 DOT ID Number: UN1114
 DOT Pack Group: II
 DOT Label: FLAMMABLE LIQUID
 IMO PSN Code: BXB
 IMO Proper Shipping Name: BENZENE

IMO Regulations Page Number: 3185
IMO UN Number: 1114
IMO UN Class: 3.2
IMO Subsidiary Risk Label: -
IATA PSN Code: DBA
IATA UN ID Number: 1114
IATA Proper Shipping Name: BENZENE
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: DBA
AFI Symbols: 0
AFI Prop. Shipping Name: BENZENE
AFI Class: 3
AFI ID Number: UN1114
AFI Pack Group: II
AFI Basic Pac Ref: 7-7
N.O.S. Shipping Name: BENZENE.
Additional Trans Data: PER CTDF SHIPPING NAME: BENZENE, UNIT CAN CONTAINS
20 LITERS. FOR PALLETIZATION REQMTS: METAL OR PLASTIC 5 GALLON CONTAINER.

=====
Disposal Data
==========
Label Data
=====

Label Required: YES
Technical Review Date: 05AUG94
Label Status: F
Common Name: BENZENE, PRODUCT #: 251C-1
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-Moderate: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: HARMFUL IF SWALLOWED, INHALED, ABSORBED THRU
SKIN. IRRIT TO MUC MEM & UPPER RESP TRACT. CAUSES SKIN & SEVERE EYE IRRIT.
CHRONIC: CARCINOGEN. MAY ALTER GENETIC MATERIAL (MUTAGEN). BLOOD EFFECTS.
TARGET ORGANS: BLOOD/BLOOD MARROW/CNS. FIRST AID: IMMEDIATELY FLUSH EYES OR SKIN W/
COPIOUS AMTS OF WATER FOR @ LEAST 15MINS WHILE REMOVING CONTAMINATED
CLOTHING/SHOES. IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE
ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT GIVE OXYGEN. IF SWALLOWED
WASH OUT MOUTH W/WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: POLYSCIENCE
Label Street: 7800 MERRIMAC AVE
Label City: NILES
Label State: IL
Label Zip Code: 60648
Label Country: US

SCIENCE KIT -- TOLUENE - TOLUENE
MATERIAL SAFETY DATA SHEET
NSN: 681000D005045
Manufacturer's CAGE: 57020
Part No. Indicator: A
Part Number/Trade Name: TOLUENE

=====
General Information
=====

Item Name: TOLUENE
Company's Name: SCIENCE KIT INC
Company's Street: 777 E PARK DR
Company's City: TONAWANDA
Company's State: NY
Company's Country: US
Company's Zip Code: 14150-6708
Company's Emerg Ph #: 800-424-9300 (CHEMTREC)
Company's Info Ph #: 800-256-2586
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 01DEC94
Safety Data Review Date: 10JUN96
Supply Item Manager: CX
MSDS Preparer's Name: R.M.CARLSON
MSDS Serial Number: BZPCL
Specification Number: NONE
Spec Type, Grade, Class: NONE
Hazard Characteristic Code: F3
Unit Of Issue: NK
Unit Of Issue Container Qty: UNKNOWN
Type Of Container: UNKNOWN
Net Unit Weight: UNKNOWN

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: TOLUENE (SARA 313) (CERCLA)
Ingredient Sequence Number: 01
Percent: MAJOR
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM; Z-2
ACGIH TLV: S, 50 PPM; 9596
Other Recommended Limit: NONE RECOMMENDED

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: CLEAR COLORLESS LIQUID, AROMATIC BENZENE-LIKE ODOR.
Boiling Point: 232F, 111C
Melting Point: -139F, -95C
Vapor Pressure (MM Hg/70 F): 22
Vapor Density (Air=1): 3.14
Specific Gravity: 0.86
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: 4.5 ETHER=1
Solubility In Water: VIRTUALLY INSOLUBLE
Percent Volatiles By Volume: 100
Corrosion Rate (IPY): UNKNOWN
Autoignition Temperature: 896F

=====
Fire and Explosion Hazard Data
=====

Flash Point: 39.2F, 4.0C
Flash Point Method: CC
Lower Explosive Limit: 1.2
Upper Explosive Limit: 7.1
Extinguishing Media: DRY CHEMICAL, CARBON DIOXIDE, FOAM.
Special Fire Fighting Proc: USE A SELF-CONTAINED BREATHING APPARATUS AND

FULL PROTECTIVE EQUIPMENT. COOL FIRE EXPOSED CONTAINERS WITH WATER FOG.
Unusual Fire And Expl Hazrds: VAPORS ARE HEAVIER THAN AIR, CAN TRAVEL
DISTANCES ALONG THE GROUND, AND FLASHBACK AT THE SOURCE.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): HIGH HEAT, SOURCES OF IGNITION.
Materials To Avoid: STRONG OXIDIZERS, NITRIC AND SULFURIC ACIDS, STRONG
BASES, SOME PLASTICS, RUBBERS, COATING AND SOME AMINES.
Hazardous Decomp Products: CARBON DIOXIDE, CARBON MONOXIDE.
Hazardous Poly Occur: NO
=====

=====
Health Hazard Data
=====

LD50-LC50 Mixture: TLV IS 100PPM (TWA)
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: EYES: MAY CAUSE IRRITATION. SKIN: MAY CAUSE
IRRITATION. INGEST: MAY CAUSE GI TRACT IRRITATION. INHAL: MAY CAUSE RESPIRATORY
IRRITATION AND CNS DEPRESSION. CHRONIC: DERMATITIS, LIVER, KIDNEY AND BLOOD
DISORDERS.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: THERE ARE NO INGREDIENTS ABOVE 0.1% WHICH ARE
IDENTIFIED AS CARCINOGENS BY NTP, IARC OR OSHA.
Signs/Symptoms Of Overexp: NAUSEA, HEADACHE, DIZZINESS, DROWSINESS.
Med Cond Aggravated By Exp: PERSONS WITH PRE-EXISTING SKIN, EYE, KIDNEY,
LIVER AND RESPIRATORY AILMENTS MAY BE AT INCREASED RISK FROM EXPOSURE.
Emergency/First Aid Proc: SKIN: REMOVE CONTAMINATED CLOTHING; WASH WITH SOAP
OR MILD DETERGENT AND WATER. GET MEDICAL ATTENTION IF IRRITATION
PERSISTS. EYES: FLUSH WITH WATER FOR 15 MINUTES. GET IMMEDIATE MEDICAL
ATTENTION. INHAL: REMOVE TO FRESH AIR. GIVE OXYGEN OR ARTIFICIAL RESPIRATION
IF NEEDED. INGEST: DO NOT INDUCE VOMITING. GET PROMPT QUALIFIED MEDICAL
ATTENTION. IF CONSCIOUS, GIVE WATER OR MILK TO DRINK.
=====

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: ELIMINATE SOURCES OF IGNITION. USE PROPER
RESPIRATORY AND PROTECTIVE EQUIPMENT. SHUT OFF LEAK IF SAFE. DIKE. SOAK UP
WITH A NON-COMBUSTIBLE INERT ABSORBANT (CLAY, SAND); PLACE IN PROPER CONTAINER
FOR DISPOSAL. WASH SPILL AREA TO REMOVE SLIPPINESS.
Neutralizing Agent: NOT APPLICABLE.
Waste Disposal Method: DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE AND
LOCAL REGULATIONS. DO NOT FLUSH TO SEWER.
Precautions-Handling/Storing: STORE IN A COOL, DRY, WELL-VENTILATED PLACE.
KEEP CONTAINER CLOSED WHEN NOT IN USE. KEEP AWAY FROM HEAT, SPARKS, FLAMES AND
INCOMPATIBLE MATERIALS.
Other Precautions: FOLLOW LABEL DIRECTIONS. AVOID BREATHING VAPORS. AVOID
SKIN AND EYE CONTACT.
=====

=====
Control Measures
=====

Respiratory Protection: WHERE ENVIRONMENTAL CONTROLS ARE LACKING OR IN
ENCLOSED SPACES USE EITHER A SELF-CONTAINED BREATHING APPARATUS OR A NIOSH/
MSHA APPROVED RESPIRATOR FOR ORGANIC VAPORS, DEPENDING ON THE AIRBORN
CONCENTRATION.
Ventilation: LOCAL VENTILATION AT THE WORKSITE; MECHANICAL (GENERAL)
VENTILATION TO MAINTAIN TLV/PEL. USE NON-SPARKING EQUIPMENT.
Protective Gloves: VINYL OR RUBBER.
Eye Protection: CHEMICAL SPLASH GOGGLES
Other Protective Equipment: LAB COAT. PROVIDE A LOCAL EYE WASH STATION AND
SAFETY SHOWER.
Work Hygienic Practices: EXECISE GOOD LABORATORY PRACTICES. WASH HANDS
AFTER USE AND BEFORE EATING.
Suppl. Safety & Health Data: NONE
=====

Transportation Data

```
=====
Trans Data Review Date: 96162
DOT PSN Code: OJY
DOT Proper Shipping Name: TOLUENE
DOT Class: 3
DOT ID Number: UN1294
DOT Pack Group: II
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: OSR
IMO Proper Shipping Name: TOLUENE
IMO Regulations Page Number: 3285
IMO UN Number: 1294
IMO UN Class: 3.2
IMO Subsidiary Risk Label: -
IATA PSN Code: YEL
IATA UN ID Number: 1294
IATA Proper Shipping Name: TOLUENE
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: YEL
AFI Prop. Shipping Name: TOLUENE
AFI Class: 3
AFI ID Number: UN1294
AFI Pack Group: II
AFI Basic Pac Ref: A7.3
MMAC Code: NR
Additional Trans Data: NONE
=====
```

Disposal Data

Label Data

```
=====
Label Required: YES
Technical Review Date: 10JUN96
MFR Label Number: UNKNOWN
Label Status: F
Common Name: TOLUENE
Signal Word: WARNING!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-Moderate: X
Reactivity Hazard-None: X
Special Hazard Precautions: EYES:MAY CAUSE IRRITATION.SKIN:MAY CAUSE
IRRITATION.INGEST:MAY CAUSE GI TRACT IRRITATION.INHAL:MAY CAUSE RESPIRATORY
IRRITATION AND CNS DEPRESSION.CHRONIC:DERMATITIS,LIVER,KIDNEY AND BLOOD
DISORDERS. FIRST AID: SKIN:REMOVE CONTAMINATED CLOTHING;WASH WITH SOAP OR
DO NOT INDUCE VOMITING.GET PROMPT QUALIFIED MEDICAL ATTENTION.IF CONSCIOUS,
GIVE WATER OR MILK TO DRINK.
Protect Eye: Y
Protect Skin: Y
Label Name: SCIENCE KIT INC
Label Street: 777 E PARK DR
Label City: TONAWANDA
Label State: NY
Label Zip Code: 14150-6708
Label Country: US
Label Emergency Number: 800-424-9300 (CHEMTREC)
Year Procured: 1995
=====
```

PPG INDUSTRIES -- TRICHLOROETHYLENE - TRICHLOROETHYLENE, TECHNICAL
MATERIAL SAFETY DATA SHEET
NSN: 6810001844794
Manufacturer's CAGE: 47695
Part No. Indicator: A
Part Number/Trade Name: TRICHLOROETHYLENE

=====
General Information
=====

Item Name: TRICHLOROETHYLENE, TECHNICAL
Company's Name: PPG INDUSTRIES INC
Company's Street: 1 PPG PL
Company's City: PITTSBURGH
Company's State: PA
Company's Country: US
Company's Zip Code: 15272
Company's Emerg Ph #: 304-843-1300
Company's Info Ph #: 304-843-1300
Distributor/Vendor # 1: AMCO CHEMICAL CORP
Distributor/Vendor # 1 Cage: 97984
Distributor/Vendor # 2: C S D INC.
Distributor/Vendor # 2 Cage: 4N760
Record No. For Safety Entry: 002
Tot Safety Entries This Stk#: 010
Status: SE
Date MSDS Prepared: 31JUL90
Safety Data Review Date: 25FEB91
Supply Item Manager: CX
MSDS Preparer's Name: R. KENNETH LEE
MSDS Serial Number: BDGXX
Specification Number: O-T-634C
Spec Type, Grade, Class: TY II
Hazard Characteristic Code: T4
Unit Of Issue: CN
Unit Of Issue Container Qty: 5 GALLONS
Type Of Container: CAN
Net Unit Weight: 61.1 LBS

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: TRICHLOROETHYLENE (SARA III)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: KX4550000
CAS Number: 79-01-6
OSHA PEL: 100 PPM/100 STEL
ACGIH TLV: 50 PPM/100, A5STEL; 93
Other Recommended Limit: NONE SPECIFIED

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: CLEAR COLORLESS LIQUID, ETHER-LIKE ODOR
Boiling Point: 189F, 87C
Melting Point: UNKNOWN
Vapor Pressure (MM Hg/70 F): 57.8 MM
Vapor Density (Air=1): 4.54
Specific Gravity: 1.465
Decomposition Temperature: UNKNOWN
Evaporation Rate And Ref: 0.28 (ETHYL ETHER = 1)
Solubility In Water: 0.11%
Percent Volatiles By Volume: 100
Viscosity: UNKNOWN
Corrosion Rate (IPY): UNKNOWN

=====
Fire and Explosion Hazard Data
=====

Flash Point: NONE (DOT TEST)
Lower Explosive Limit: 7.8

Upper Explosive Limit: 52

Extinguishing Media: USE WATER FOG, CARBON DIOXIDE, OR DRY CHEMICAL.

Special Fire Fighting Proc: FIRE FIGHTERS SHOULD USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT WHEN FIGHTING CHEMICAL FIRE. USE WATER SPRAY TO COOL NEARBY CONTAINERS EXPOSED TO FIRE.

Unusual Fire And Expl Hazrds: VAPORS CONCENTRATED IN A CONFINED OR POORLY VENTILATED AREA CAN BE IGNITED BY A HIGH ENERGY SPARK FLAME OR HIGH INTENSITY SOURCE OF HEAT.

=====
 Reactivity Data
 =====

Stability: YES

Cond To Avoid (Stability): HIGH TEMPERATURES, SPARKS, AND OPEN FLAMES

Materials To Avoid: STRONG OXIDIZING AGENTS, CAUSTICS

Hazardous Decomp Products: HYDROGEN CHLORIDE GAS OR POSSIBLY SOME PHOSGENE

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT RELAVANT
 =====

Health Hazard Data
 =====

LD50-LC50 Mixture: ORAL RAT LD50 IS 4900 MG/KG

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: TRICHLOROETHYLENE IS IRRITATING TO BODY TISSUES. IF INHALED, IT DEPRESSES THE CENTRAL NERVOUS SYSTEM AND MAY EVEN IN EXTREME CASES CAUSE DEATH. CHRONIC OVEREXPOSURE MAY RESULT IN LIVER AND/OR KIDNEY DAMAGE.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: IARC REPORTS TRICHLOROETHYLENE AS CLASS 3; INSUFFICIENT EVIDENCE. CALIFORNIA 'KNOWS' TRICHLOROETHYLENE CAUSES CANCER.

Signs/Symptoms Of Overexp: EYE:IRRITATION SKIN:IRRITATION,DERMITITIS.

INHALED:RESPIRATORY IRRITATION, DIZZINESS, NAUSEA, HEAD ACHE, LOSS OF EQUILIBRIUM, POSSIBLE CENTRAL NERVOUS SYSTEM DAMAGE. INGESTED:G/I IRRITATION,EFFECTS SIMILAR TO INHALED, ASPIRATION INTO THE LUNGS DURING VOMITING MAY CAUSE PULMONARY EDEMA.

Med Cond Aggravated By Exp: NONE GIVEN BY MANUFACTURER (SUPPLIER).

Emergency/First Aid Proc: EYE:FLUSH W/WATER 15 MIN, HOLD LIDS OPEN.

SKIN:WASH WITH SOAP & WATER. REMOVE CONTAMINATED CLOTHING AND LAUNDRER

BEFORE REUSE. INHALED:REMOVE TO FRESH AIR. RESTORE BREATHING IF NECESSARY.

INGESTED:DO NOT INDUCE VOMITING. GIVE 2 LARGE GLASSES WATER AND GET IMMEDIATE MEDICAL CARE. GIVE NOTHING BY MOUTH IF UNCONSCIOUS. IF IRRITATION PERSISTS OR IS SEVERE,SEE A DOCTOR.
 =====

Precautions for Safe Handling and Use
 =====

Steps If Matl Released/Spill: EVACUATE AND VENTILATE AREA. ADSORB ON INERT MATERIAL SUCH AS SAWDUST OR VERMICULITE. SHOVEL INTO CLOSED CONTAINERS FOR DISPOSAL. DO NOT ALLOW TO ENTER SEWER OR DRAIN.

Neutralizing Agent: NONE

Waste Disposal Method: DISPOSE I/A/W ALL FEDERAL, STATE AND LOCAL REGULATIONS. MANUFACTURER SUGGESTS THAT DISPOSAL MAY BE DONE BY REPROCESSING OR INCINERATION.

Precautions-Handling/Storing: STORE IN A COOL, DRY AREA. KEEP TIGHTLY COLSED WHEN NOT IN USE. USE ONLY IN A WELL VENTILATED AREA. VAPORS ARE HEAVIER THAN AIR AND WILL COLLECT.

Other Precautions: 'EMPTY' CONTAINERS MAY CONTAIN RESIDUE OR VAPOR. TREAT THEM WITH THE RESPECT DUE FULL ONES. DO NOT CUT,WELD,ETC. ON THEM.
 =====

Control Measures
 =====

Respiratory Protection: RESPIRATOR WILL NOT NORMALLY BE NECESSARY. USE NIOSH/MSHA APPROVED AIR SUPPLIED RESPIRATOR OR RESPIRATOR FOR ORGANIC MIST/VAPOR IF EXPOSURE IS ABOVE THE TLV/PEL. SEE 29 CFR 1910.134 FOR REGULATIONS PERTAINING TO RESPIRATOR USE.

Ventilation: NORMAL ROOM VENTILATION MAY BE SUFFICIENT (CHECK PEL TO BE SURE). SUPPLEMENT WITH LOCAL EXHAUST IF PEL/TLV IS EXCEEDED.

Protective Gloves: VITON, POLY VINYL ALCOHOL
 Eye Protection: SAFETY GLASSES OR SPLASH GOGGLES
 Other Protective Equipment: BOOTS, APRONS, ETC. AS NEEDED TO PREVENT SKIN CONTACT
 Work Hygienic Practices: USE GOOD CHEMICAL HYGIENE PRACTICE. AVOID UNNECESSARY CONTACT. WASH THOROUGHLY BEFORE EATING OR DRINKING.
 Suppl. Safety & Health Data: NEW JERSEY RIGHT-TO-KNOW: ALSO CONTAINS BUTYLENE OXIDE.

=====
 Transportation Data
 =====

Trans Data Review Date: 91056
 DOT PSN Code: OQK
 DOT Proper Shipping Name: TRICHLOROETHYLENE
 DOT Class: 6.1
 DOT ID Number: UN1710
 DOT Pack Group: III
 DOT Label: KEEP AWAY FROM FOOD
 IMO PSN Code: OVL
 IMO Proper Shipping Name: TRICHLOROETHYLENE
 IMO Regulations Page Number: 6273
 IMO UN Number: 1710
 IMO UN Class: 6.1
 IMO Subsidiary Risk Label: -
 IATA PSN Code: YMD
 IATA UN ID Number: 1710
 IATA Proper Shipping Name: TRICHLOROETHYLENE
 IATA UN Class: 6.1
 IATA Label: TOXIC
 AFI PSN Code: YMD
 AFI Prop. Shipping Name: TRICHLOROETHYLENE
 AFI Class: 6.1
 AFI ID Number: UN1710
 AFI Pack Group: III
 AFI Special Prov: N36
 AFI Basic Pac Ref: 10-10
 Additional Trans Data: RQ = 100 POUNDS; EXCEEDED IF 2 CONTAINERS ARE SPILLED.

=====
 Disposal Data
 =====

Disposal Data Review Date: 88077
 Rec # For This Disp Entry: 01
 Tot Disp Entries Per NSN: 003
 Landfill Ban Item: YES
 Disposal Supplemental Data: MSDS DATED DECEMBER, 1977. MATERIAL IS TYPE II OF FEDERAL SPEC O-T-634B. EFFECTS OF OVER EXPO; CHRONIC: MAY DAMAGE THE LIVER AND KIDNEYS. CAUSE CANCER IN EXP. LAB ANIMALS. IN CASE OF ACCIDENTAL EXPOSURE OR DISCHARGE, CONSULT HEALTH AND SAFETY FILE FOR PRECAUTIONS.
 1st EPA Haz Wst Code New: U228
 1st EPA Haz Wst Name New: TRICHLOROETHYLENE; TRICHLOROETHENE
 1st EPA Haz Wst Char New: TOXIC (T)
 1st EPA Acute Hazard New: NO

=====
 Label Data
 =====

Label Required: YES
 Technical Review Date: 25FEB91
 Label Status: F
 Common Name: TRICHLOROETHYLENE
 Chronic Hazard: NO
 Signal Word: CAUTION!
 Acute Health Hazard-Slight: X
 Contact Hazard-Slight: X
 Fire Hazard-Slight: X
 Reactivity Hazard-None: X
 Special Hazard Precautions: MAY CAUSE RESPIRATORY TRACT IRRITATION. AVOID BREATHING DUST, VAPOR, MIST OR GAS. KEEP CONTAINER CLOSED. USE WITH ADEQUATE VENTILATION. FIRST AID: IF INHALED, REMOVE TO FRESH AIR. IF NOT

BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. GET MEDICAL ATTENTION IMMEDIATELY. TRICHLOROETHYLENE IS IRRITATING TO BODY TISSUES. IF INHALED, IT DEPRESSES THE CENTRAL NERVOUS SYSTEM AND MAY EVEN IN EXTREME CASES CAUSE DEATH. CHRONIC OVEREXPOSURE MAY RESULT IN LIVER AND/OR KIDNEY DAMAGE. STORE IN A COOL, DRY AREA. KEEP TIGHTLY CLOSED WHEN NOT IN USE. USE ONLY IN A WELL VENTILATED AREA.

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: PPG INDUSTRIES INC

Label Street: 1 PPG PL

Label City: PITTSBURGH

Label State: PA

Label Zip Code: 15272

Label Country: US

Label Emergency Number: 304-843-1300

Year Procured: 1989

SCIENTIFIC POLYMER PRODUCTS -- VINYL CHLORIDE-VINYL ACETATE COPOLYMER, 070
MATERIAL SAFETY DATA SHEET
NSN: 681000N050027
Manufacturer's CAGE: 0MWG0
Part No. Indicator: A
Part Number/Trade Name: VINYL CHLORIDE/VINYL ACETATE COPOLYMER, 070

=====
General Information
=====

Company's Name: SCIENTIFIC POLYMER PRODUCTS INC
Company's Street: 6265 DEAN PARKWAY
Company's City: ONTARIO
Company's State: NY
Company's Country: US
Company's Zip Code: 14519
Company's Emerg Ph #: 716-265-0413
Company's Info Ph #: 716-265-0413
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 01NOV91
Safety Data Review Date: 23MAR94
MSDS Serial Number: BVJHB
Hazard Characteristic Code: NK

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: ACETIC ACID, VINYL ESTER, POLYMER WITH CHLOROETHYLENE; (VINYL
CHLORIDE/VINYL ACETATE/COPOLYMER)
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: AK0950000
CAS Number: 9003-22-9
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: FINE, WHITE POWDER; SLIGHT PLEASANT ODOR.
Boiling Point: N/A
Melting Point: SUPDAT
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: N/A
Evaporation Rate And Ref: N/A
Solubility In Water: NIL
Percent Volatiles By Volume: SUPDAT

=====
Fire and Explosion Hazard Data
=====

Flash Point: N/A
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL, ALCOHOL
FOAM.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA AND FULL
PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: AVOID DISPERSION OF DUST IN AIR TO REDUCE
POTENTIAL FOR DUST IGNITION/EXPLOSION.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): NOT APPLICABLE
Materials To Avoid: NOT APPLICABLE

=====
Health Hazard Data
=====

=====

Precautions for Safe Handling and Use

=====

Control Measures

=====

Transportation Data

=====

Disposal Data

=====

Label Data

=====

Label Required: YES
Technical Review Date: 06APR94
Label Date: 06APR94
Label Status: G
Common Name: VINYL CHLORIDE/VINYL ACETATE COPOLYMER, 422
Chronic Hazard: NO
Signal Word: WARNING!
Acute Health Hazard-Slight: X
Contact Hazard-Moderate: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: STORE IN DRY, COOL PLACE. ACUTE: BRIEF SKIN CONTACT IS NOT IRRITATING. PROLONGED CONTACT OR COVERED CONTACT MAY CAUSE LOCAL IRRITATION. EYE CONTACT WILL CAUSE MODERATE CONJUNCTIVITIS AND POSSIBLY MILD CORNEAL INJURY. CHRONIC: NONE LISTED BY MANUFACTURER.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: SCIENTIFIC POLYMER PRODUCTS INC
Label Street: 6265 DEAN PARKWAY
Label City: ONTARIO
Label State: NY
Label Zip Code: 14519
Label Country: US
Label Emergency Number: 716-265-0413

ULTRA SCIENTIFIC -- EPA-1012, CARBON DISULFIDE SOLUTION AT (SUPP DATA)
MATERIAL SAFETY DATA SHEET
NSN: 684000N058060
Manufacturer's CAGE: 0MU35
Part No. Indicator: A
Part Number/Trade Name: EPA-1012, CARBON DISULFIDE SOLUTION AT (SUPP DATA)

=====
General Information
=====

Company's Name: ULTRA SCIENTIFIC
Company's Street: 250 SMITH ST
Company's City: N KINGSTOWN
Company's State: RI
Company's Country: US
Company's Zip Code: 02852
Company's Emerg Ph #: 401-294-9400
Company's Info Ph #: 401-294-9400
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 13SEP93
Safety Data Review Date: 09MAR95
MSDS Serial Number: BWZfq

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: METHYL ALCOHOL; (METHANOL) (SARA 313) (CERCLA). LD50:(ORAL,
RAT) 12,900 MG/KG.
Ingredient Sequence Number: 01
Percent: 99.37
NIOSH (RTECS) Number: PC1400000
CAS Number: 67-56-1
OSHA PEL: 200 PPM, S
ACGIH TLV: 200 PPM;250 STEL, S

Proprietary: NO
Ingredient: CARBON DISULFIDE (SARA 302/313) (CERCLA)
Ingredient Sequence Number: 02
Percent: 0.63
NIOSH (RTECS) Number: FF6650000
CAS Number: 75-15-0
OSHA PEL: 20 PPM
ACGIH TLV: 10 PPM, S

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: LIQUID.
=====

=====
Fire and Explosion Hazard Data
=====

Flash Point: NOT APPLICABLE
Extinguishing Media: CARBON DIOXIDE, DRY CHEMICAL POWDER OR WATER SPRAY.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE
EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: COMBUSTIBLE.
=====

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: STRONG OXIDIZERS.
Hazardous Decomp Products: NOT APPLICABLE
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT
=====

=====
Health Hazard Data
=====

LD50-LC50 Mixture: SEE INGREDIENT 1.
=====

Route Of Entry - Inhalation: NO
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: TOXIC; IRRITANT. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS - DIRECT PHYSICAL CONTACT SHOULD BE AVOIDED.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INGEST:CALL MD IMMEDIATELY (FP N). SKIN: FLUSH W/COPIOUS AMOUNTS OF WATER. EYES:FLUSH W/COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. INHAL:REMOVE TO FRESH AIR - GIVE OXYGEN, IF NECESSARY. CONTACT MD.

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: DUE TO THE SMALL QUANTITY INVOLVED, SPILLS OR LEAKS SHOULD NOT POSE A SIGNIFICANT PROBLEM. A LEAKING BOTTLE MAY BE PLACED IN A PLASTIC BAG & NORMAL DISPOSAL PROCEDURES FOLLOWED. LIQUID SAMPLES MAY BE ABSORBED ON VERMICULITE OR SAND.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AFTERBURNER & SCRUBBER. OBSERVE ALL FEDERAL, STATE & LOCAL LAWS CONCERNING DISPOSAL.
Precautions-Handling/Storing: KEEP TIGHTLY CLOSED & STORE IN A COOL, DRY PLACE.
Other Precautions: THIS MATERIAL SHOULD ONLY BE USED BY THOSE PERSONS TRAINED IN THE SAFE HANDLING OF HAZARDOUS CHEMICALS.

=====
Control Measures
=====

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation: NONE SPECIFIED BY MANUFACTURER.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (SUPDAT)
Other Protective Equipment: EYE WASH FOUNTAIN & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N). USE APPROP NIOSH/MSHA APPRVD SAFETY (SUPDAT)
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: MFR'S TRADE NAME/PART NO:5000 UG/ML IN EQUIPMENT. WEAR CHEMICAL RESISTANT CLOTHING SUCH AS LAB COAT &/OR RUBBER APRON TO PREVENT CONTACT W/EYES, SKIN & CLOTHING.

=====
Transportation Data
=====

=====
Disposal Data
=====

=====
Label Data
=====

Label Required: NO
Label Status: X
Common Name: LABEL COVERED UNDER EPA REGS - HAZCOM LABEL NOT AUTHORIZED

ALDRICH CHEMICAL -- CHLOROBENZENE, 99.9+% 27064-4
MATERIAL SAFETY DATA SHEET
NSN: 681000N014224
Manufacturer's CAGE: 60928
Part No. Indicator: A
Part Number/Trade Name: CHLOROBENZENE, 99.9+% 27064-4

=====
General Information
=====

Company's Name: ALDRICH CHEMICAL CO
Company's P. O. Box: 355
Company's City: MILWAUKEE
Company's State: WI
Company's Country: US
Company's Zip Code: 53201
Company's Info Ph #: 414-273-3850
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 07MAR90
Safety Data Review Date: 06MAR91
MSDS Serial Number: BKKVN
Hazard Characteristic Code: F4

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: CHLOROBENZENE (SARA III)
Ingredient Sequence Number: 01
Percent: 99.9+
NIOSH (RTECS) Number: CZ0175000
CAS Number: 108-90-7
OSHA PEL: 75 PPM
ACGIH TLV: 10 PPM; 9192

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: CLEAR, COLORLESS, VOLATILE LIQUID WITH ALMOND-LIKE
ODOR (FP N).
Boiling Point: 270F, 132C
Melting Point: -49F, -45C
Vapor Pressure (MM Hg/70 F): 11.8 @ 25C
Vapor Density (Air=1): 3.86
Specific Gravity: 1.107
Evaporation Rate And Ref: 1 (BUAC=1) (FP N)
Solubility In Water: INSOLUBLE

=====
Fire and Explosion Hazard Data
=====

Flash Point: 75.0F, 23.9C
Flash Point Method: CC
Lower Explosive Limit: 1.3%
Upper Explosive Limit: 7.1%
Extinguishing Media: WATER SPRAY, CO2, DRY CHEMICAL POWDER, ALCOHOL OR
POLYMER FOAM
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA
AND FULL PROTECTIVE EQUIPMENT TO PREVENT CONTACT WITH SKIN AND EYES.
FLAMMABLE LIQUID.
Unusual Fire And Expl Hazrds: EMITS TOXIC FUMES UNDER FIRE CNDTNS. VAP MAY
TRAVEL CONSIDERABLE DISTANCE TO IGNIT SOURCE & FLASH BACK. THERMAL DECOMP
PRODS MAY INCLUDE HCL & PHOSGENE (FP N).

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: OXIDIZING AGENTS.
Hazardous Decomp Products: TOXIC FUMES OF: HCL GAS, CO, CO2. PHOSGENE (FP
N).

Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

=====
Health Hazard Data
=====

LD50-LC50 Mixture: SEE SUPP DATA
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ACUTE: HARMFUL IF SWALLOWED OR INHALED.
VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES AND UPPER
RESPIRATORY TRACT. CAUSES SKIN IRRITATION. EXPOSURE CAN CAUSE: NAUSEA,
DIZZINESS AND HEADACHE, DAMAGE TO LIVER AND KIDNEYS. CHRONIC: POSSIBLE
CARCINOGEN (MFR).
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES: IMMED FLUSH WITH COPIOUS AMOUNTS OF WATER
FOR AT LEAST 15 MINUTES. CONTAMINATION OF THE EYES SHOULD BE TREATED BY
REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF
BREATHING IS DIFFICULT, GIVE OXYGEN. CALL MD. WASH CONTAMINATED CLOTHING
BEFORE REUSE. INGEST: DO NOT INDUCE VOMIT. CALL MD IMMED (FP N).

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: EVACUATE AREA. SHUT OFF ALL SOURCES OF
IGNITION. WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS & HEAVY RUBBER
GLOVES. ABSORB ON SAND OR VERMICULITE & PLACE IN CLOSED CNTNRS FOR
DISPOSAL. VENTILATE AREA & WASH SPILL SITE AFTER MATL PICKUP IS COMPLETE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN
AFTERBURNER AND SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL
IS HIGHLY FLAMMABLE. OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.
Precautions-Handling/Storing: POSSIBLE CARCINOGEN. DO NOT BREATHE VAPOR.
KEEP TIGHTLY CLOSED. HANDLE AND STORE UNDER NITROGEN. STORE IN A COOL, DRY
PLACE.
Other Precautions: IRRITANT. HARMFUL LIQUID. DO NOT GET IN EYES, ON SKIN
OR CLOTHING. KEEP AWAY FROM HEAT, SPARKS & OPEN FLAME. NO SMOKING IN AREA
OF USE. DO NOT USE IN THE GENERAL VICINITY OF ARC WELDING, OPEN FLAMES OR
HOT SURFACES. HEAT (SEE SUPP DATA)

=====
Control Measures
=====

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation: USE ONLY IN A CHEMICAL FUME HOOD.
Protective Gloves: CHEMICAL-RESISTANT GLOVES
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N)
Other Protective Equipment: RUBBER BOOTS AND OTHER PROTECTIVE EQUIPMENT,
SAFETY SHOWER AND EYE BATH
Work Hygienic Practices: WASH HANDS THOROUGHLY AFTER USE AND BEFORE
EATING, DRINKING, SMOKING OR USING SANITARY FACILITIES (FP N).
Suppl. Safety & Health Data: LD50-LC50 MIX: LD50: (ORAL/RAT)=2290 MG/KG,
(ORAL/MUS)=2300 MG/KG, (IPR/MUS)=515 MG/KG, (ORAL/RBT)=2250 MG/KG, (ORAL/
GPG)=2250 MG/KG, (UNR/MAM)=2300 MG/KG. OTHER PREC: AND/OR UV RADIATION MAY
CAUSE THE FORMATION OF HCL AND/OR PHOSGENE (FP N).

=====
Transportation Data
=====

Trans Data Review Date: 91214
DOT PSN Code: DGJ
DOT Proper Shipping Name: CHLOROBENZENE
DOT Class: 3
DOT ID Number: UN1134
DOT Pack Group: III
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: EBV

IMO Proper Shipping Name: CHLORO BENZENE
IMO Regulations Page Number: 3318
IMO UN Number: 1134
IMO UN Class: 3.3
IMO Subsidiary Risk Label: -
IATA PSN Code: GEY
IATA UN ID Number: 1134
IATA Proper Shipping Name: CHLORO BENZENE
IATA UN Class: 3
IATA Label: FLMMABLE LIQUID
AFI PSN Code: GEY
AFI Prop. Shipping Name: CHLORO BENZENE
AFI Class: 3
AFI ID Number: UN1134
AFI Pack Group: III
AFI Basic Pac Ref: 7-7

=====
Disposal Data
==========
Label Data
=====

Label Required: YES
Technical Review Date: 23JUL91
Label Status: F
Common Name: CHLORO BENZENE, 99.9+% 27064-4
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE: EXTREMELY FLAMMABLE LIQUID AND VAPOR.
VAPOR MAY CAUSE FLASH FIRE. KEEP AWAY FROM HEAT, SPARKS AND FLAME. KEEP
CONTAINER CLOSED. USE WITH ADEQUATE VENTILATION. HARMFUL IF SWALLOWED,
INHALED, OR ABSORBED THROUGH SKIN. AVOID BREATHING VAPOR. AVOID CONTACT WITH
EYES, SKIN AND CLOTHING. WASH THOROUGHLY AFTER HANDLING. CAUSES EYE, SKIN,
MUCOUS MEMBRANE AND UPPER RESPIRATORY TRACT IRRITATION. CHRONIC: POSSIBLE
CARCINOGEN (MFR). TARGET ORGANS: LIVER, KIDNEYS.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: ALDRICH CHEMICAL CO.
Label P.O. Box: 355
Label City: MILWAUKEE
Label State: WI
Label Zip Code: 53201
Label Country: US
Label Emergency Number: 414-273-3850

International Chemical Safety Cards

ETHYLBENZENE

ICSC: 0268

ETHYLBENZENE
Ethylbenzol
Phenylethane
EB
 $C_8H_{10}/C_6H_5-C_2H_5$
Molecular mass: 106.2

CAS # 100-41-4
RTECS # DA0700000
ICSC # 0268
UN # 1175
EC # 601-023-00-4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS!	
INHALATION	Cough. Dizziness. Drowsiness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
EYES	Redness. Pain. Blurred vision.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	(further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Collect leaking liquid in covered containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer (extra personal protection: A filter respirator for organic vapour).	Fireproof. Separated from strong oxidants.	F symbol Xn symbol R: 11-20 S: (2-)16-24/25-29 UN Hazard Class: 3 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0268

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

ETHYLBENZENE

ICSC: 0268

I M P O R T A N T D A T A	<p>PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID, WITH AROMATIC ODOUR.</p> <p>PHYSICAL DANGERS: The vapour mixes well with air, explosive mixtures are easily formed.</p> <p>CHEMICAL DANGERS: Reacts with strong oxidants. Attacks plastic and rubber.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV (as TWA): 100 ppm; 434 mg/m³; as STEL: 125 ppm; 543 mg/m³ (ACGIH 1994-1995). MAK: 100 ppm; 440 mg/m³ (1994).</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.</p> <p>INHALATION RISK: A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure far above OEL could cause lowering of consciousness.</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis.</p>
	<p>PHYSICAL PROPERTIES</p> <p>Boiling point: 136°C Melting point: -95°C Relative density (water = 1): 0.9 Solubility in water, g/100 ml at 20°C: 0.015 Vapour pressure, kPa at 20°C: 0.9 Relative vapour density (air = 1): 3.7</p>	<p>Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02 Flash point: 18°C c.c. Auto-ignition temperature: 432°C Explosive limits, vol% in air: 1.0-6.7 Octanol/water partition coefficient as log Pow: 3.2</p>
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms.	
NOTES		
The odour warning when the exposure limit value is exceeded is insufficient.		
Transport Emergency Card: TEC (R)-522 NFPA Code: H2; F3; R0		
ADDITIONAL INFORMATION		
ICSC: 0268		ETHYLBENZENE
© IPCS, CEC, 1993		

IMPORTANT LEGAL NOTICE:

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

ALDRICH CHEMICAL -- 1,4-DICHLOROBENZENE, 99+%, D5682-9
MATERIAL SAFETY DATA SHEET
NSN: 681000N037287
Manufacturer's CAGE: 60928
Part No. Indicator: A
Part Number/Trade Name: 1,4-DICHLOROBENZENE, 99+%, D5682-9

=====
General Information
=====

Company's Name: ALDRICH CHEMICAL CO
Company's P. O. Box: 355
Company's City: MILWAUKEE
Company's State: WI
Company's Country: US
Company's Zip Code: 53201
Company's Emerg Ph #: 414-273-3850
Company's Info Ph #: 414-273-3850
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 04MAR92
Safety Data Review Date: 08DEC92
MSDS Serial Number: BQRTY
Hazard Characteristic Code: T4

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: BENZENE, P-DICHLORO-; (1,4-DICHLOROBENZENE) (SARA III)
Ingredient Sequence Number: 01
Percent: 99+
NIOSH (RTECS) Number: CZ4550000
CAS Number: 106-46-7
OSHA PEL: 75 PPM
ACGIH TLV: 10 PPM,A3 9394

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: COLORLESS CRYSTALS
Boiling Point: 343F,173C
Melting Point: 129F,54C
Vapor Pressure (MM Hg/70 F): SUPDAT
Vapor Density (Air=1): 5.07
Specific Gravity: 1.241

=====
Fire and Explosion Hazard Data
=====

Flash Point: 150F,66C
Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). PREVENT CONTACT WITH SKIN AND EYES.
COMBUSTIBLE.
Unusual Fire And Expl Hazrds: EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: OXIDIZING AGENTS, ALUMINUM AND ITS ALLOYS.
Hazardous Decomp Products: TOXIC FUMES OF CARBON MONOXIDE, CARBON DIOXIDE, HYDROGEN CHLORIDE GAS.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

=====
Health Hazard Data
=====

LD50-LC50 Mixture: LD50: (ORAL RAT) 500 MG/KG.
Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: ACUTE:HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES EYE AND SKIN IRRITATION. MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT. SYMPTOMS OF EXPOSURE MAY INCLUDE BURNING SENSATION, COUGHING, WHEEZING, LARYNGITIS, SHORTNESS OF BREATH, HEADACHE, NAUSEA AND VOMITING. (EFTS OF OVEREXP)
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: 1,4-DICHLOROBENZENE:GROUP 2B (IARC), ANTICIPATED TO BE A CARCINOGEN (NTP).
Signs/Symptoms Of Overexp: HLTH HAZ:MAY CAUSE ALLERGIC SKIN REACTION. CARCINOGEN.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYE:FLUSH IMMED W/COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINS.ASSURE ADEQ FLUSHING OF EYES BY SEPARATING EYELIDS W/ FINGERS. SKIN:FLUSH IMMED WITH COPIOUS AMTS OF WATER FOR AT LEAST 15 MINS MOVE TO FRESH AIR. IF NOT BRTHG GIVE ARTF RESP. IF BRTHG DFCLT GIVE O*2. INGEST:WASH OUT MOUTH W/WATER IF PERSON IS CONSCIOUS.CALL MD.

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: EVACUATE AREA. WEAR NIOSH/MSHA APPROVED SCBA, RUBBER BOOTS AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL. AVOID RAISING DUST. VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: THIS COMBUSTIBLE MATERIAL MAY BE BURNED IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER & SCRUBBER. DISPOSAL MUST BE IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS (FP N).
Precautions-Handling/Storing: STORE IN A COOL DRY PLACE. KEEP AWAY FROM HEAT AND FLAME. KEEP TIGHTLY CLOSED.
Other Precautions: DO NOT BREATHE DUST. DO NOT GET IN EYES, ON SKIN, ON CLOTHING.AVOID PROLONGED OR REPEATED EXPOSURE. TOXIC. CARCINOGEN. IRRITANT.

=====
Control Measures
=====

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR.
Ventilation: USE ONLY IN A CHEMICAL FUME HOOD.
Protective Gloves: CHEMICAL RESISTANT GLOVES.
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: PROTECTIVE CLOTHING. SAFETY SHOWER AND EYE BATH.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.
Suppl. Safety & Health Data: VAP PRESS:1.03 @ 25C. 10 @ 54.8C.

=====
Transportation Data
=====

Trans Data Review Date: 93153
DOT PSN Code: EST
DOT Proper Shipping Name: P- DICHLOROBENZENE *
DOT Class: 6.1
DOT ID Number: UN1592
DOT Pack Group: III
DOT Label: KEEP AWAY FROM FOOD
IMO PSN Code: FIL
IATA PSN Code: UKJ
IATA UN ID Number: 2811
IATA Proper Shipping Name: POISONOUS SOLID, N.O.S.
IATA UN Class: 6.1
IATA Label: KEEP AWAY FROM FOOD
AFI PSN Code: UKJ
AFI Prop. Shipping Name: POISONOUS SOLIDS, N.O.S.
AFI Class: 6.1
AFI ID Number: UN2811
AFI Pack Group: III
AFI Label: KEEP AWAY FROM FOOD
AFI Basic Pac Ref: 10-13

=====
Disposal Data
==========
Label Data
=====

Label Required: YES
Technical Review Date: 08DEC92
Label Date: 08DEC92
Label Status: G
Common Name: 1,4-DICHLOROBENZENE, 99+%, D5682-9
Chronic Hazard: YES
Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Slight: X
Fire Hazard-Moderate: X
Reactivity Hazard-None: X
Special Hazard Precautions: COMBUSTIBLE! KEEP AWAY FROM HEAT, SPARKS, OPEN FLAMES. ACUTE:HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES EYE AND SKIN IRRITATION. MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT. CHRONIC: CANCER HAZARD: 1-4 DICHLOROBENZENE IS LISTED AS A CARCINOGEN (FP N). MAY CAUSE ALLERGIC SKIN REACTION. MAY DAMAGE THE KIDNEYS AND LIVER.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: ALDRICH CHEMICAL CO
Label P.O. Box: 355
Label City: MILWAUKEE
Label State: WI
Label Zip Code: 53201
Label Country: US
Label Emergency Number: 414-273-3850

CHEM SERVICE -- F25 1,2-DICHLOROBENZENE
MATERIAL SAFETY DATA SHEET
NSN: 655000F037531
Manufacturer's CAGE: 8Y898
Part No. Indicator: A
Part Number/Trade Name: F25 1,2-DICHLOROBENZENE

=====
General Information
=====

Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-692-3026/800-452-9994
Company's Info Ph #: 215-692-3026/800-452-9994
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 24MAR92
Safety Data Review Date: 15DEC94
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
MSDS Serial Number: BWJHC

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: O-DICHLOROBENZENE, 1,2-DICHLOROBENZENE (ORTHO) (IARC - GROUP
3) *94-4*
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: CZ4500000
CAS Number: 95-50-1
OSHA PEL: 300 MG/CUM
ACGIH TLV: 25 PPM
Other Recommended Limit: 50 PPM

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: COLORLESS-PALE YELLOW LIQUID W/AROMATIC ODOR.
Boiling Point: 356F
Melting Point: 5F
Vapor Pressure (MM Hg/70 F): 1.2
Vapor Density (Air=1): 5.1
Solubility In Water: INSOLUBLE

=====
Fire and Explosion Hazard Data
=====

Flash Point: 150.8F
Lower Explosive Limit: 2.2
Upper Explosive Limit: 9.2
Extinguishing Media: CO2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire And Expl Hazrds: COMBUSTIBLE COMPOUND.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): LIGHT.
Materials To Avoid: STRONG OXIDIZING AGENTS, MAGNESIUM, ALUMINUM.
Hazardous Decomp Products: TOXIC FUMES.
Hazardous Poly Occur: NO

=====
Health Hazard Data
=====

LD50-LC50 Mixture: ORAL LD50 (RAT/MOUSE): 500 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: SKIN: HARMFUL/FATAL IF ABSORBED, ALLERGIC REACTION, IRRITATION. INHALATION: HARMFUL/FATAL, MUCOUS MEMBRANE IRRITATION. INGESTION: FATAL, MAY CAUSE LIVER & KIDNEY DAMAGE, SEVERE CORROSION OF MOUTH. EYES: SEVERE BURNS.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: IRRITATION, BURNS.
Emergency/First Aid Proc: EYES: FLUSH W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET. INGESTION: INDUCE VOMITING. DON'T GIVE LIQUIDS/INDUCE VOMITING IF UNCONSCIOUS/CONVULSIVE. IF VOMITING OCCURS, WATCH CLOSELY TO AVOID AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

=====
Precautions for Safe Handling and Use
=====

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. DON'T USE MAGNESIUM/ALUMINUM/THEIR ALLOYS AS CONTAINERS.
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT. DARK COLORS DON'T AFFECT PURITY.

=====
Control Measures
=====

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection: EYE SHIELDS
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. READILY ABSORBED & RETAINED ON CLOTHING & SHOES.
Suppl. Safety & Health Data: FOR LABORATORY USE ONLY.

=====
Transportation Data
=====

=====
Disposal Data
=====

=====
Label Data
=====

Label Required: YES
Label Status: G
Common Name: F25 1,2-DICHLOROBENZENE
Special Hazard Precautions: SKIN: HARMFUL/FATAL IF ABSORBED, ALLERGIC REACTION, IRRITATION. INHALATION: HARMFUL/FATAL, MUCOUS MEMBRANE IRRITATION. INGESTION: FATAL, MAY CAUSE LIVER & KIDNEY DAMAGE, SEVERE CORROSION OF MOUTH. EYES: SEVERE BURNS. IRRITATION, BURNS.
Label Name: CHEM SERVICE INC
Label Street: 660 TOWER LN
Label P.O. Box: 3108
Label City: WEST CHESTER
Label State: PA
Label Zip Code: 19381-3108
Label Country: US
Label Emergency Number: 215-692-3026/800-452-9994

PETROKEM -- NAPHTHALENE (AROMATIC HYDROCARBON) - INSECTICIDE, NAPHTHA
 MATERIAL SAFETY DATA SHEET
 NSN: 6840005976111
 Manufacturer's CAGE: 0ADH1
 Part No. Indicator: A
 Part Number/Trade Name: NAPHTHALENE (AROMATIC HYDROCARBON)

=====
 General Information
 =====

Item Name: INSECTICIDE, NAPHTHA
 Company's Name: PETROKEM CORP
 Company's Street: 101 OLIVER ST
 Company's P. O. Box: 2155
 Company's City: PATERSON
 Company's State: NJ
 Company's Country: US
 Company's Zip Code: 07509
 Company's Emerg Ph #: 201-742-6468
 Company's Info Ph #: 201-742-6468/714-864-2310
 Distributor/Vendor # 1: CHEMICAL COMMODITIES AGENCY, INC.
 Distributor/Vendor # 1 Cage: 60777
 Record No. For Safety Entry: 002
 Tot Safety Entries This Stk#: 003
 Status: SE
 Date MSDS Prepared: 15MAR96
 Safety Data Review Date: 12DEC96
 Supply Item Manager: CX
 MSDS Preparer's Name: C. A. EISENHARD
 MSDS Serial Number: BKLJW
 Spec Type, Grade, Class: CL A
 Hazard Characteristic Code: F7
 Unit Of Issue: LB
 Unit Of Issue Container Qty: 1
 Type Of Container: BOX
 Net Unit Weight: 1.0 LB

=====
 Ingredients/Identity Information
 =====

Proprietary: NO
 Ingredient: NAPHTHALENE (SARA III)
 Ingredient Sequence Number: 01
 Percent: UNKNOWN
 NIOSH (RTECS) Number: QJ0525000
 CAS Number: 91-20-3
 OSHA PEL: 10 PPM/15 STEL
 ACGIH TLV: 10 PPM/15 STEL; 9192
 Other Recommended Limit: NONE SPECIFIED

=====
 Physical/Chemical Characteristics
 =====

Appearance And Odor: WHITE SOLID, MOTH BALL ODOR
 Boiling Point: 424F, 218C
 Melting Point: 176F, 80C
 Vapor Pressure (MM Hg/70 F): 0.082
 Vapor Density (Air=1): 4.42
 Specific Gravity: 1.145
 Decomposition Temperature: UNKNOWN
 Evaporation Rate And Ref: 1 (ETHER=1)
 Solubility In Water: NEGLIGIBLE (0.003%)
 Corrosion Rate (IPY): UNKNOWN

=====
 Fire and Explosion Hazard Data
 =====

Flash Point: 190F, 88C
 Flash Point Method: CC
 Lower Explosive Limit: 0.9
 Upper Explosive Limit: 5.9
 Extinguishing Media: CARBON DIOXIDE, DRY CHEMICAL, FOAM AND WATER.
 Special Fire Fighting Proc: SMOKE AND VAPORS FROM NAPHTHALENE FIRES SHOULD

BE AVOIDED. USE SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACE- PIECE.
 Unusual Fire And Expl Hazrds: REACTION BETWEEN WATER AND MOLTEN
 NAPHTHALENE ABOVE 230F (110C) IS VIOLENT; AVOID USE OF WATER ON HOT MOLTEN
 NAPHTHALENE.

=====
 Reactivity Data
 =====

Stability: YES
 Cond To Avoid (Stability): AVOID CLOSED ROOM.
 Materials To Avoid: AVOID CONTACT BETWEEN WATER AND HOT NAPHTHALENE.
 Hazardous Decomp Products: NONE SPECIFIED BY MANUFACTURER.
 Hazardous Poly Occur: NO
 Conditions To Avoid (Poly): NOT APPLICABLE

=====
 Health Hazard Data
 =====

LD50-LC50 Mixture: LD50 (ORAL RAT) IS UNKNOWN
 Route Of Entry - Inhalation: YES
 Route Of Entry - Skin: YES
 Route Of Entry - Ingestion: NO
 Health Haz Acute And Chronic: CONTACT MAY CAUSE SKIN OR EYE IRRITATION.
 Carcinogenicity - NTP: NO
 Carcinogenicity - IARC: NO
 Carcinogenicity - OSHA: NO
 Explanation Carcinogenicity: NOT CARCINOGENIC. LOWEST PUBLISHED LETHAL
 HUMAN ORAL DOSE-50 MG/KG (NIOSH).
 Signs/Symptoms Of Overexp: INHALATION MAY CAUSE HEADACHE, NAUSEA AND
 PERSPIRATION. INGESTION MAY CAUSE CRAMPS, NAUSEA, VOMITING AND DIARRHEA.
 Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
 Emergency/First Aid Proc: REMOVE CONTAMINATED CLOTHING AT ONCE. FLUSH SKIN
 & EYES WITH COPIOUS QUANTITIES OF WATER. SEE A PHYSICIAN IMMEDIATELY FOR
 BURNS, EYES, INHALATION SYSTEMS & INGESTION.

=====
 Precautions for Safe Handling and Use
 =====

Steps If Matl Released/Spill: SOLIDIFIED NAPHTHALENE CAN BE PICKED UP WITH
 BROOM AND NON-SPARKING SHOVEL. WORKERS SHOULD WEAR DUST RESPIRATOR. MOLTEN
 NAPHTHALENE MAY BE ALLOWED TO SOLIDIFY BEFORE BEING CLEANED UP.
 Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
 Waste Disposal Method: WASTE NAPHTHALENE MAY BE INCINERATED OR BURIED AS
 APPLICABLE CODES AND REGULATIONS PERMIT. WORKERS SHOULD WEAR ORGANIC VAPOR/
 DUST RESPIRATOR FOR LIQUID/SOLID HANDLING AND SELF-CONTAINED AIR SUPPLY
 AROUND BURNING NAPHTHALENE.
 Precautions-Handling/Storing: MOLTEN NAPHTHALENE TANKS SHOULD BE
 ADEQUATELY VENTED; INERT GAS BLANKETING IS RECOMMENDED FOR STORAGE TANKS.
 Other Precautions: NONE.

=====
 Control Measures
 =====

Respiratory Protection: NONE SPECIFIED BY MANUFACTURER.
 Ventilation: LOCAL EXHAUST: EXHAUST FANS NEEDED FOR USE IN CLOSED AREAS.
 MECHANICAL (GENERAL) EXHAUST VENT TANKS OF MOLTEN NAPHTHALEN
 Protective Gloves: RUBBER OR OTHER CHEMICAL HAND GLOVES.
 Eye Protection: SAFETY GOGGLES.
 Other Protective Equipment: FACE SHIELD WHEN HANDLING LIQUID, FRESH AIR
 MASK FOR FIRES; LOCATE SAFETY SHOWER AND WASH IN AREA.
 Work Hygienic Practices: OBSERVE GOOD PERSONAL HYGIENE PRACTICES AND
 RECOMMENDED PROCEDURES. WASH THOROUGHLY AFTER HANDLING.
 Suppl. Safety & Health Data: NONE.

=====
 Transportation Data
 =====

Trans Data Review Date: 96347
 DOT PSN Code: JZV
 DOT Proper Shipping Name: NAPHTHALENE, CRUDE OR NAPHTHALENE, REFINED
 DOT Class: 4.1
 DOT ID Number: UN1334
 DOT Pack Group: III
 DOT Label: FLAMMABLE SOLID

IMO PSN Code: KIT
IMO Proper Shipping Name: NAPHTHALENE, CRUDE OR REFINED
IMO Regulations Page Number: 4158
IMO UN Number: 1334
IMO UN Class: 4.1
IMO Subsidiary Risk Label: -
IATA PSN Code: ROD
IATA UN ID Number: 1334
IATA Proper Shipping Name: NAPHTHALENE, CRUDE
IATA UN Class: 4.1
IATA Label: FLAMMABLE SOLID
AFI PSN Code: ROD
AFI Prop. Shipping Name: NAPHTHALENE, CRUDE OR REFINED
AFI Class: 4.1
AFI ID Number: UN1334
AFI Pack Group: III
AFI Special Prov: A1
AFI Basic Pac Ref: A8.4

=====
Disposal Data
=====

=====
Label Data
=====

Label Required: YES
Technical Review Date: 12DEC96
Label Status: X *
Common Name: NAPHTHALENE (AROMATIC HYDROCARBON)
Chronic Hazard: YES
Signal Word: WARNING!
Label Name: PETROKEM CORP
Label Street: 101 OLIVER ST
Label P.O. Box: 2155
Label City: PATERSON
Label State: NJ
Label Zip Code: 07509
Label Country: US
Label Emergency Number: 201-742-6468

ULTRA SCIENTIFIC -- EPA-1007, BROMOFORM SOLUTION AT 5000 UG-ML (SUPDAT)
MATERIAL SAFETY DATA SHEET
NSN: 681000N063007
Manufacturer's CAGE: 0MU35
Part No. Indicator: A
Part Number/Trade Name: EPA-1007, BROMOFORM SOLUTION AT 5000 UG/ML (SUPDAT)

=====
General Information
=====

Company's Name: ULTRA SCIENTIFIC
Company's Street: 250 SMITH ST
Company's City: NORTH KINGSTOWN
Company's State: RI
Company's Country: US
Company's Zip Code: 02852
Company's Emerg Ph #: 401-294-9400
Company's Info Ph #: 401-294-9400
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 19OCT94
Safety Data Review Date: 06SEP95
MSDS Serial Number: BYVLK

=====
Ingredients/Identity Information
=====

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: LIQUID.

=====
Fire and Explosion Hazard Data
=====

Flash Point: N/A
Extinguishing Media: CARBON DIOXIDE, DRY CHEMICAL POWDER OR WATER SPRAY.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA AND FULL
PROTECTIVE EQUIPMENT (FP N). COMBUSTIBLE.
Unusual Fire And Expl Hazrds: NONE SPECIFIED BY MANUFACTURER.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: STRONG OXIDIZERS.

=====
Health Hazard Data
=====

=====
Precautions for Safe Handling and Use
=====

=====
Control Measures
=====

=====
Transportation Data
=====

=====
Disposal Data
=====

=====
Label Data
=====

Label Required: YES
Label Status: G
Common Name: EPA-1007, BROMOFORM SOLUTION AT 5000 UG/ML (SUPDAT)
Label Name: ULTRA SCIENTIFIC
Label Street: 250 SMITH ST
Label City: NORTH KINGSTOWN
Label State: RI

Label Zip Code: 02852

Label Country: US

Label Emergency Number: 401-294-9400

CHEM SERVICE -- 0-659 CIS 1,2-DICHLOROETHENE - LABORATORY STANDARD
MATERIAL SAFETY DATA SHEET
NSN: 655000F037480
Manufacturer's CAGE: 8Y898
Part No. Indicator: A
Part Number/Trade Name: 0-659 CIS 1,2-DICHLOROETHENE

=====
General Information
=====

Item Name: LABORATORY STANDARD
Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-692-3026/800-452-9994
Company's Info Ph #: 215-692-3026/800-452-9994
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 02JUN92
Safety Data Review Date: 06DEC94
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
MSDS Serial Number: BWJDT

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: DICHLOROETHENE
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: KV9420000
CAS Number: 156-59-2

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: COLORLESS LIQUID
Boiling Point: 140F
Melting Point: -112F
Solubility In Water: INSOLUBLE

=====
Fire and Explosion Hazard Data
=====

Flash Point: 42.8F
Extinguishing Media: CO2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL. VAPORS MAY TRAVEL
CONSIDERABLE DISTANCE TO IGNITION SOURCE & FLASH BACK. DECOMPOSITION
PRODUCTS ARE CORROSIVE.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): MOISTURE, AIR, LIGHT, HEAT & OTHER IGNITION
SOURCES.
Materials To Avoid: STRONG OXIDIZING AGENTS, MAGNESIUM, ALUMINUM.
Hazardous Decomp Products: TOXIC FUMES
Hazardous Poly Occur: NO

=====
Health Hazard Data
=====

Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE

IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARMFUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NONE

Signs/Symptoms Of Overexp: IRRITATION, NARCOTIC.

Emergency/First Aid Proc: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS.

SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO

CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED &

CONTINUE LIFE SUPPORT UNTIL MEDICAL ASSISTANCE ARRIVES. INGESTION: RINSE

MOUTH OUT W/WATER, IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

Precautions-Handling/Storing: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION.

Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

Control Measures

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.

Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.

Eye Protection: EYE SHIELDS

Transportation Data

Disposal Data

Label Data

Label Required: YES

Label Status: G

Common Name: 0-659 CIS 1,2-DICHLOROETHENE

Special Hazard Precautions: SKIN: MAY BE HARMFUL IF ABSORBED. CAN CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS MEMBRANCES. INGESTION: MAY BE HARMFUL. EYES: IRRITATION. EXPOSURE CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS. IRRITATION, NARCOTIC.

Label Name: CHEM SERVICE INC

Label Street: 660 TOWER LN

Label P.O. Box: 3108

Label City: WEST CHESTER

Label State: PA

Label Zip Code: 19381-3108

Label Country: US

Label Emergency Number: 215-692-3026/800-452-9994

MONSANTO -- ASKAREL CAT#:M-508A-1 & M-508A-2, (PCBS), AROCLOR - CAPACITOR, FIXED, PAPER DIELE
MATERIAL SAFETY DATA SHEET
NSN: 5910001974068
Manufacturer's CAGE: 76541
Part No. Indicator: B
Part Number/Trade Name: ASKAREL CAT#:M-508A-1 & M-508A-2, (PCBS), AROCLOR
SERIES (SUPP)

=====
General Information
=====

Item Name: CAPACITOR, FIXED, PAPER DIELECTRIC
Company's Name: MONSANTO CO
Company's Street: 800 N LINDBERGH BLVD
Company's City: ST LOUIS
Company's State: MO
Company's Country: US
Company's Zip Code: 63167
Company's Emerg Ph #: 314-694-6661, CHEMTREC 800-424-9300
Company's Info Ph #: 314-694-6661
Distributor/Vendor # 1: ACCUSTANDARD INC (203-786-5290)
Distributor/Vendor # 1 Cage: 0U4A8
Record No. For Safety Entry: 003
Tot Safety Entries This Stk#: 003
Status: FE
Date MSDS Prepared: 01SEP93
Safety Data Review Date: 28FEB95
Supply Item Manager: TX
Preparer's Company: (MSDS NO:G 4048)
MSDS Serial Number: BWMPP
Specification Number: UNKNOWN
Hazard Characteristic Code: T6
Unit Of Issue: EA
Unit Of Issue Container Qty: EACH
Type Of Container: CAPACITOR
Net Unit Weight: UNKNOWN

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: POLYCHLORINATED BIPHENYLS (PCBS). (SARA III)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: TQ1350000
CAS Number: 1336-36-3
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: 1 MG/M3; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: CHLORODIPHENYL; 42% CHLORINE (AROCHLOR 1242) (SARA III)
Ingredient Sequence Number: 02
NIOSH (RTECS) Number: TQ1356000
CAS Number: 53469-21-9
OSHA PEL: S, 1 MG/M3
ACGIH TLV: S, 1MG/M3; 9394
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: AROCLOR 1248 (SARA III)
Ingredient Sequence Number: 03
NIOSH (RTECS) Number: TQ1358000
CAS Number: 12672-29-6
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: NONE RECOMMENDED

Proprietary: NO
Ingredient: CHLORODIPHENYL; 54% CHLORINE (AROCHLOR 1254) (SARA III)
Ingredient Sequence Number: 04
NIOSH (RTECS) Number: TQ1360000

CAS Number: 11097-69-1
 OSHA PEL: S, 0.5 MG/M3
 ACGIH TLV: S, 0.5MG/M3; 9394
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: AROCLOR 1260 (SARA III)
 Ingredient Sequence Number: 05
 NIOSH (RTECS) Number: TQ1362000
 CAS Number: 11096-82-5
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: AROCLOR 1221, 1232 (SARA III)
 Ingredient Sequence Number: 06
 NIOSH (RTECS) Number: TQ1350000
 CAS Number: 1336-36-3
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: 1 MG/M3; 9394
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: AROCLOR 1016 (SARA III)
 Ingredient Sequence Number: 07
 NIOSH (RTECS) Number: TQ1351000
 CAS Number: 12674-11-2
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: NONE RECOMMENDED

 Proprietary: NO
 Ingredient: OTHERS
 Ingredient Sequence Number: 08
 NIOSH (RTECS) Number: 10106110T
 OSHA PEL: NOT ESTABLISHED
 ACGIH TLV: NOT ESTABLISHED
 Other Recommended Limit: NONE RECOMMENDED

=====

Physical/Chemical Characteristics

=====

Appearance And Odor: MOBILE OIL/VIS LIQ/STICKY RESIN; APHA COLOR 40/100/
 150; DEPENDS ON AROCLOR SELECTD
 Boiling Point: N/A
 Melting Point: N/A
 Vapor Pressure (MM Hg/70 F): VARIES
 Specific Gravity: 1.18-1.56 VAR
 Viscosity: VARIES
 Autoignition Temperature: N/A

=====

Fire and Explosion Hazard Data

=====

Flash Point: FIRE-RESISTANT
 Lower Explosive Limit: N/A
 Upper Explosive Limit: N/A
 Extinguishing Media: PCBS ARE FIRE-RESISTANT COMPOUNDS.
 Special Fire Fighting Proc: STD FIREFIGHTING WEARING APPAREL & SCBA SHOULD
 BE WORN WHEN FIGHTING FIRES THAT INVOLVE POSSIBLE EXPO TO CHEM COMBUST
 PROD. CLEAN WELL/DECONTAMIN EQMPT AFT USE.
 Unusual Fire And Expl Hazrds: IF PCB TRANSFORMER INVOLVED IN FIRE-RELATED
 INCIDENT OWENR OF TRANSFORMER MAY BE REQUIRED TO REPORT INCIDENT. CONSULT/
 FOLLOW FED/STATE/LOC REGS.

=====

Reactivity Data

=====

Stability: YES
 Cond To Avoid (Stability): NONE SPECIFIED BY MFG.
 Materials To Avoid: NONE SPECIFIED BY MFG.

Hazardous Decomp Products: CO, CO2, HCL, PHENOLICS, ALDEHYDES & OTHER TOXIC
 COMBUST PRODS UNDER SEVERE CONDITIONS (EXPO TO FLAME/HOT SURFACE).

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT APPLICABLE

=====
 Health Hazard Data
 =====

LD50-LC50 Mixture: UNKNOWN

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: REPEAT/PROLONG CONTACT MAY CAUSE CHLORACNE
 IN SOME PEOPLE. SKIN: ABSORBED THRU INTACT SKIN. LOC ACTION SIMILAR TO COMMON
 MODERATELY IRRIT. INGEST: SLIGHTLY TOXIC. INHAL: ANIMAL EXPERIMENTS SHOWED 54%
 CHLORINATED MATL PRODUCES MORE LIVER INJURY THAN 42%.

Carcinogenicity - NTP: YES

Carcinogenicity - IARC: YES

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: PER MSDS: PCBs HAVE BEEN LISTED IN IARC GROUP
 2B & IN NTP.

Signs/Symptoms Of Overexp: CHLORACNE. DRYING & CRACKING SKIN. MODERATELY
 EYE IRRITANT. SLIGHTLY TOXIC BY INGEST. LIVER INJURY.

Med Cond Aggravated By Exp: A POTENTIAL EXISTS FOR CONTRACTING OF
 CHLORACNE IN SOME PEOPLE.

Emergency/First Aid Proc: INGEST: CONSULT PHYSICIAN. DO NOT INDUCE VOMIT OR
 GIVE ANY OILY LAXATIVES. SKIN: IF LIQ/SOLID PCBs SPLASHED/SPILED ON SKIN
 REMOVE CONTAMIN CLOTH. WASH SKIN THOROUGHLY W/SOAP/WATER. EYES: IRRIGATE IMMED
 W/COPIOUS QUANT OF RUNNING WTER FOR @LEAST 15MINS. PETROLATUM-BASED
 OPHTHALMIC OINTMENT MAY BE APPLIED TO RELIEVE IRRIT EFFECTS. INHAL: REMOVE TO
 FRESH AIR. IF RASH/RESP IRRIT PERSIST CALL PHYSICIAN. (SUPPLEM)

=====
 Precautions for Safe Handling and Use
 =====

Steps If Matl Released/Spill: REMOVE NON-ESSENTIAL PERSONNEL. ADEQUATELY
 VENTILATED. CONTAIN SPILL/LEAK. PREVENT MATL ENTERING SEWER SYS/NAVIGABLE
 WATERWAYS/STREAMS. REMOVE BY MEANS OF ABSORPTIVE MATL (SAWDUST, VERMICULITE,
 DRY SAND, CLAY, DIRT, ETC) OR TRAP/REMOVE BY PUMPING. USE PPE.

Neutralizing Agent: NOT APPLICABLE

Waste Disposal Method: ALL WASTES/RESIDUES CONTAINING PCBs: COLLECT, PLACE
 IN PROPER CNTNR, MARK, DISPOSE IN MANNER PRESCRIBED BY EPA REGS (40CFR761) &
 APPLICABLE STATE/LOC REGS. VAR FED/STATE/LOC REGS REQUIRE REPORTING PCB
 SPILLS & CLEANUP LEVELS. CONSULT ATTORN/OFFICIALS.

Precautions-Handling/Storing: NONE SPECIFIED BY MFG.

Other Precautions: FED REGS UNDER TSCA REQUIRE PCBs AND PCB ITEMS TO BE
 MARKED. (CHECK REGS FOR DETAILS). AVOID BREATH VAP/MIST. PCB IN ELECT EQPMT
 REPORTED TO PROD PCDD & PCDF DURING FIRE SITUATIONS-FROM NON PCB CMPD-SEE
 EQPMT MFG.

=====
 Control Measures
 =====

Respiratory Protection: USE NIOSH/MSHA APPROVE EQPMT WHEN AIRBORNE EXPO
 LIMITS EXCEEDED. FULL FACEPIECE EQPMT RECOMMENDED-CAN REPLACE FACESHIELD &/
 OR CHEM SPLASH GOGG. CONSULT RESP MFG FOR TYP/CONDITIONS. OBSERVED RESP USE
 LIMITATIONS. SCBA/SUP AIR RESP. 29CFR1910.134.

Ventilation: PROVIDE VENTI TO CONTROL EXPO LEVELS BELOW AIRBORNE EXO
 LIMITS. USE LOC MECHANICAL EXHAU VENTI @SOURCES OF AIR CONTAMIN.

Protective Gloves: APPROP GLOVES (VITON) SEE MFG FOR TYP/OPER

Eye Protection: CHEM SPLASH GOGGLES & FACE SHIELD

Other Protective Equipment: EYEBATHS/SAFT SHOWER. PROT CLOTHING FOR
 BARRIER. PROT APRON.

Work Hygienic Practices: LAUNDRY CONTAMIN CLOTH BEF REUSE. CLEAN PROT EQPMT
 BEF REUSE. WASH THOROUGHLY AFT HANDLING. AVOID BREATH VAP/MIST, CONTACT.

Suppl. Safety & Health Data: 1016;1221;1232;1242;1248;1254;1260. FLPT: 170C
 1016;141 150C 1221;152-154C 1232;176-180C 1242;193-196C 1248;NONE 1254/
 1260. 1ST AID: DR: LG AMTS INGEST GASTRIC LAVAGE SUGGESTED. HOT PCBs MAY CAUSE
 THERMAL BURNS. IF ELECTR EQPMT ARCS OVER PCBs/OTHER CHLORINATED HYDROCARBON
 DIELECTRIC FLUIDS MAY DECOMPOSE TO PRODUCE HCL-RESP IRR

=====
 Transportation Data
 =====

```
=====  
Trans Data Review Date: 95059  
DOT PSN Code: LWI  
DOT Symbol: AW  
DOT Proper Shipping Name: POLYCHLORINATED BIPHENYLS  
DOT Class: 9  
DOT ID Number: UN2315  
DOT Pack Group: II  
DOT Label: CLASS 9  
IMO PSN Code: LZM  
IMO Proper Shipping Name: POLYCHLORINATED BIPHENYLS  
IMO Regulations Page Number: 9034  
IMO UN Number: 2315  
IMO UN Class: 9  
IMO Subsidiary Risk Label: -  
IATA PSN Code: UKT  
IATA UN ID Number: 2315  
IATA Proper Shipping Name: POLYCHLORINATED BIPHENYLS  
IATA UN Class: 9  
IATA Label: MISCELLANEOUS  
AFI PSN Code: UKT  
AFI Prop. Shipping Name: POLYCHLORINATED BIPHENYLS  
AFI Class: 9  
AFI ID Number: UN2315  
AFI Pack Group: II  
AFI Special Prov: A37  
AFI Basic Pac Ref: 13-3  
=====
```

```
=====  
Disposal Data  
=====
```

```
=====  
Label Data  
=====
```

```
Label Required: YES  
Technical Review Date: 28FEB95  
Label Status: F  
Common Name: ASKAREL CAT#:M-508A-1 & M-508A-2, (PCBS), AROCLOR  
SERIES(SUPP)  
Signal Word: WARNING!  
Acute Health Hazard-Moderate: X  
Contact Hazard-Moderate: X  
Fire Hazard-None: X  
Reactivity Hazard-None: X  
Special Hazard Precautions: REPEAT/PROLONG CONTACT MAY CAUSE CHLORACNE IN  
SOME PEOPLE. SKIN: ABSORBED THRU INTACT SKIN. LOC ACTION SIMILAR TO COMMON ORG  
MODERATELY IRRIT. INGEST: SLIGHTLY TOXIC. INHAL: ANIMAL EXPERIMENTS SHOWED 54%  
CHLORINATED MATL PRODUCES MORE LIVER INJURY THAN 42%. TAR ORG: SKIN/EYE/LIVER.  
REMOVE CONTAMIN CLOTH. WASH SKIN WELL W/SOAP/WATER. EYES: IRRIGATE IMMED W/  
LOTS OF WATER @LEAST 15MIN. PETROLATUM-BASED OPHTHALMIC OINTMENT MAY BE  
APPLIED TO RELIEVE IRRIT EFFECTS. INHAL: REMOVE TO FRESH AIR. RASH/RESP IRRIT  
PERSIST CALL DR.  
Protect Eye: Y  
Protect Skin: Y  
Protect Respiratory: Y  
Label Name: MONSANTO CO  
Label Street: 800 N LINDBERGH BLVD  
Label City: ST LOUIS  
Label State: MO  
Label Zip Code: 63167  
Label Country: US  
Label Emergency Number: 314-694-6661, CHEMTREC 800-424-9300
```

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

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.

MSDS**Material Safety Data Sheet**

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

MALLINCKRODT

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

LEAD METAL

MSDS Number: L2347 --- *Effective Date: 11/17/99*

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575

CAS No.: 7439-92-1

Molecular Weight: 207.19

Chemical Formula: Pb

Product Codes:

J.T. Baker: 2256, 2266

Mallinckrodt: 5668

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Lead	7439-92-1	95 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.

Ingestion:

POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.

Skin Contact:

Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.

Eye Contact:

Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.

Chronic Exposure:

Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.

Aggravation of Pre-existing Conditions:

Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

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

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

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:

Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

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. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. 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.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Areas in which exposure to lead metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For lead, metal and inorganic dusts and fumes, as Pb:

-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m³ (TWA)

For lead, elemental and inorganic compounds, as Pb:

-ACGIH Threshold Limit Value (TLV): 0.05 mg/m³ (TWA), A3 animal carcinogen

ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).

For lead, inorganic:

-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m³ (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.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face high efficiency dust/mist 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 high efficiency dust/mist 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-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

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

Other Control Measures:

Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

9. Physical and Chemical Properties

Appearance:

Small, white to blue-gray metallic shot or granules.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

11.34

pH:

No information found.

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

0

Boiling Point:

1740C (3164F)

Melting Point:

327.5C (622F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

1.77 @ 1000C (1832F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Lead and other smelter emissions are human reproductive hazards. (Chemical Council on Environmental Quality; Chemical Hazards to Human Reproduction, 1981).

Carcinogenicity:

EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Lead (7439-92-1)	No	No	2B

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. 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

Not regulated.

15. Regulatory Information

```

-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA  EC   Japan  Australia
-----
Lead (7439-92-1)                             Yes  Yes  Yes    Yes

```

```

-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     --Canada--
Korea  DSL  NDSL  Phil.
-----
Lead (7439-92-1)                             Yes  Yes  No     Yes

```

```

-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
RQ      TPQ      List  Chemical Catg.
-----
Lead (7439-92-1)                             No      No      Yes    No

```

```

-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     -RCRA-      -TSCA-
CERCLA  261.33    8(d)
-----
Lead (7439-92-1)                             10         No      No

```

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

WARNING:

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: No information found.

Poison Schedule: S6

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: 3 Flammability: 1 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe dust.

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, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

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.)

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

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.

MSDS

Material Safety Data Sheet

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



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

Chromium, 1,000 (u)g/mL or 10,000 (u)g/mL

MSDS Number: C4304 --- Effective Date: 02/12/98

1. Product Identification

Synonyms: Single Element Plasma Standard
CAS No.: Not applicable to mixtures.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: 5711, 5727

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Chromium	7440-47-3	0.1 - 1%	Yes
Hydrogen Chloride	7647-01-0	< 2%	Yes
Water	7732-18-5	> 97%	No

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. INHALATION MAY CAUSE LUNG DAMAGE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Health hazards given on this data sheet apply to concentrated solutions of hydrochloric acid. Hazards of dilute solutions may be reduced, depending upon the concentration. Degree of hazard for these reduced concentrations is not currently addressed in the available literature.

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.

Ingestion:

Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.

Eye Contact:

Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid. Chronic exposure to chromium may cause skin or lung allergy.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

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:

Not considered to be a fire hazard. Extreme heat or contact with metals can release flammable hydrogen gas.

Explosion:

Contact of concentrated solutions with most metals causes formation of flammable and explosive hydrogen gas.

Fire Extinguishing Media:

Water or water spray. Neutralize with soda ash or slaked lime.

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. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

6. Accidental Release Measures

Ventilate area of leak or spill. 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. Neutralize with alkaline material (soda ash, lime), then 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! 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 NEUTRASORB(tm) or TEAM(tm) 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. 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:

For Hydrochloric acid:

- OSHA Permissible Exposure Limit (PEL):

5 ppm (Ceiling)

- ACGIH Threshold Limit Value (TLV):

5 ppm (STEL/Ceiling)

For Chromium (metal, inorganic Cr, and Cr III) compounds :

- OSHA Permissible Exposure Limit (PEL):

1 mg/m³ (TWA).

- ACGIH Threshold Limit Value (TLV):

0.5 mg/m³ (TWA), A4 - not classifiable as human carcinogen.

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.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge 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-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

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:

Hydrochloric acid odor.

Solubility:

Complete (100%)

Specific Gravity:

No information found.

pH:

No information found.

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

99

Boiling Point:

No information found.

Melting Point:

No information found.

Vapor Density (Air=1):

Not applicable.

Vapor Pressure (mm Hg):

Not applicable.

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:

When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces

toxic chlorine fumes and explosive hydrogen gas.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A strong mineral acid, concentrated hydrochloric acid is incompatible with many substances and highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.

Conditions to Avoid:

Heat, direct sunlight, incompatibles.

11. Toxicological Information

Hydrochloric acid: Inhalation rat LC50: 3124 ppm/1H; Oral rabbit LD50: 900 mg/kg. Investigated as a tumorigen, mutagen, reproductive effector. For Chromium: Investigated as a tumorigen and mutagen.

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Chromium (7440-47-3)	No	No	3
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

For Hydrochloric Acid (Concentrated Solutions):

When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.

Environmental Toxicity:

For Hydrochloric Acid (Concentrated Solutions):

This material may be toxic to aquatic life. LC50 Shrimp: 100-300 ppm/48-hr/salt water; LC100 trout: 10 mg/l/24-hr; TLm mosquito fish: 282 ppm/96-hr.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to 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: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (HYDROGEN CHLORIDE)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

International (Water, I.M.O.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (HYDROGEN CHLORIDE)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

International (Air, I.C.A.O.)

Proper Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (HYDROGEN CHLORIDE)

Hazard Class: 8

UN/NA: UN3264

Packing Group: III

Information reported for product/size: 500ML

5. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Chromium (7440-47-3)	Yes	Yes	Yes	Yes
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
Ingredient	Korea	DSL	Canada-- NDSL	Phil.
Chromium (7440-47-3)	Yes	Yes	No	Yes
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Chromium (7440-47-3)	No	No	Yes	No
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8 (d)
Chromium (7440-47-3)	5000	No	No
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

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

Australian Hazchem Code: No information found.

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: 3 Flammability: 0 Reactivity: 1

Label Hazard Warning:

DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. VAPOR IRRITATING TO EYES AND RESPIRATORY TRACT. INHALATION MAY CAUSE LUNG DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor or mist.

Use only with adequate ventilation.

Keep container closed.

Wash thoroughly after handling.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3, 16.

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.)

GFS CHEMICALS -- CADMIUM, 1147
MATERIAL SAFETY DATA SHEET
NSN: 535000N058818
Manufacturer's CAGE: OTNMO
Part No. Indicator: A
Part Number/Trade Name: CADMIUM, 1147

=====
General Information
=====

Company's Name: GFS CHEMICALS INC
Company's P. O. Box: 245
Company's City: POWELL
Company's State: OH
Company's Country: US
Company's Zip Code: 43065
Company's Emerg Ph #: 800-858-9682
Company's Info Ph #: 800-858-9682
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 24AUG92
Safety Data Review Date: 05MAY95
MSDS Preparer's Name: L M
Preparer's Company: SAME
MSDS Serial Number: BXGGX

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: CADMIUM (SARA 313) (CERCLA)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: EU9800000
CAS Number: 7440-43-9
OSHA PEL: 0.2 MG/M3 DUST; Z-2
ACGIH TLV: 0.01 MG/M3 DUST; 9495

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: SILVERY METALLIC GRANULES OR SHOT. ODORLESS.
Boiling Point: 1413F, 767C
Melting Point: 610F, 321C
Vapor Pressure (MM Hg/70 F): 394C
Specific Gravity: 1.04 (FP N)

=====
Fire and Explosion Hazard Data
=====

Flash Point: NOT APPLICABLE
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: MEDIA SUITABLE FOR SURROUNDING FIRE (FP N). FIGHT SURROUNDING FIRE.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: NOT COMBUSTIBLE. CADMIUM VAPOR MAY FORM IN GENERAL FIRE. AVOID INHALATION OF FUMES.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.

=====
Health Hazard Data
==========
Precautions for Safe Handling and Use
==========
Control Measures
=====

=====
=====
Transportation Data
=====
==========
=====
Disposal Data
=====
==========
=====
Label Data
=====

Label Required: YES
Technical Review Date: 04MAY95
Label Date: 04MAY95
Label Status: G
Common Name: CADMIUM, 1147
Chronic Hazard: YES
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE: VAPOR HAZARDOUS IF INHALED. MUST BE HEATED STRONGLY TO PRODUCE VAPOR. INHALATION OF DUSTS OR VAPORS MAY LEAD TO PROBLEMS IN RESPIRATORY TRACT KIDNEYS. SOLUBLE COMPOUNDS CONSIDERED MUCH MORE HAZARDOUS THAN METAL PIECES. CHRONIC: CANCER HAZARD. CONTAINS CADMIUM WHICH IS LISTED AS A GENITO-URINARY TRACT CARCINOGEN (FP N).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: GFS CHEMICALS INC
Label P.O. Box: 245
Label City: POWELL
Label State: OH
Label Zip Code: 43065
Label Country: US
Label Emergency Number: 800-858-9682

International Chemical Safety Cards

ARSENIC

ICSC: 0013

ARSENIC
 Grey arsenic
 Metallic arsenic
 As
 Atomic mass: 74.9

CAS # 7440-38-2
 RTECS # CG0525000
 ICSC # 0013
 UN # 1558
 EC # 033-001-00-X

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight if in the form of fine powder or dust when exposed to hot surfaces or flames.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Cough. Diarrhoea. Shortness of breath. Sore throat. Vomiting. Weakness. Grey skin.	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
EYES	Redness.	or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Diarrhoea. Nausea. Sore throat. Unconsciousness. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Provision to contain effluent from fire extinguishing. Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. T symbol R: 23/25 S: (1/2-)20/21-28-45 UN Hazard Class: 6.1 UN Packing Group: II Marine pollutant.

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0013	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993
-------------------	--

International Chemical Safety Cards

ARSENIC

ICSC: 0013

I M P O R T A N T D A T A	PHYSICAL STATE; APPEARANCE: ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.
	PHYSICAL DANGERS: CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens causing fire and explosion hazard. Reacts with nitric acid, hot sulfuric acid. Toxic arsine gas may be formed in contact with acid or acidic substances and certain metals, such as galvanized or light metals.	INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.
PHYSICAL PROPERTIES	Sublimation point: 613°C Relative density (water = 1): 5.7	Solubility in water: none
ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment because it persists in the environment.	
NOTES		
The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is indicated. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC # 0377), Arsenic trichloride (ICSC # 0221), Arsenic trioxide (ICSC # 0378), Arsine (ICSC # 0222).		
ADDITIONAL INFORMATION		

ICSC: 0013	ARSENIC	
© IPCS, CEC, 1993		

IMPORTANT LEGAL NOTICE:

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

Appendix B

EnSafe Corporate Health & Safety Manual

Drilling Safety Guide

Drilling Safety Guide

EnSafe is concerned about employee safety while working on or around drill rigs as well as when traveling to and from a drilling site, moving the drill rig and tools from location to location on a site and during maintenance of the drill rig. Every drill crew will have a designated safety supervisor. The safety supervisor will have the responsibility for ensuring that all drilling operations are conducted in a safe manner. All personnel working on, with, or around a drill rig will be under the jurisdiction of the rig safety supervisor.

Drill Rig Safety Supervisor

The safety supervisor for the drill crew will be the drill rig operator. However, the EnSafe safety officer still maintains the overall safety responsibility for the site. The drill crew safety supervisor is a direct representative of the site health and safety supervisor and will report any safety problems directly to the site health and safety officer. The drill rig safety supervisor will:

- be the leader in using proper personal protective equipment. He/she will set an example for other personnel to follow.
- enforce the requirements of the health and safety plan and take appropriate actions when other personnel are not following the requirements of the health and safety plan.
- ensure that all drill rig and associated drill rig equipment is properly maintained.
- ensure that all drill rig operating personnel are thoroughly familiar with the drill operations.
- inspect the drill rig and associated drill rig equipment for damage before starting drilling operations. Check for structural damage, loose bolts or nuts, correct tension in chains and cables, loose or missing guards or protective covers, fluid leaks, damaged hoses and or damaged pressure gauges and pressure relief valves.
- test all emergency and warning devices such as emergency shut-down switches at least daily (prior to starting drilling operations). Drilling will not be permitted until all emergency and warning devices are functioning.
- conduct a safety briefing daily before starting drilling operations. Any new employee will receive a copy of the drilling operations safety manual, and the drill rig manufacturer's operating and maintenance manual.
- ensure that each employee reads and understands the drill rig manufacturer's operating and maintenance manual.
- observe the mental, emotional, and physical capabilities of each worker.
- ensure that each drill rig has a first aid kit and fire extinguisher.
- maintain a list of emergency contact telephone numbers. This list will be posted in a prominent location and each drill rig employee will be informed of the lists location.

Drill Rig Personnel Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling, drill rig personal protective equipment will include the following:

- hard hat
- safety shoes with steel toe and steel shank (or equivalent)
- gloves
- safety glasses with side shields
- close fitting but comfortable clothes
- hearing protection

It is important that clothing does not have loose ends, straps, draw strings or belts, or other unfastened parts that might become caught in or on a rotating or translating part of the drill rig.

Rings, necklaces, or other jewelry will not be worn during drilling operations.

Additional protective equipment may be required by the site specific health and safety plan.

Drill Rig Housekeeping

The following housekeeping measures must be taken for all drilling operations.

- Suitable storage locations will be provided for all tools, materials and supplies. The storage should be conveniently located and will provide for safe handling of all supplies.
- Drill tools, supplies, and materials will not be transported on the drill rig unless the drill rig is designed and equipped to carry drill tools, supplies, and materials.
- Pipe, drill rods, casing, augers, and similar drilling tools when stored will be stacked in a manner that will prevent spreading, rolling, or sliding.
- Penetration or other driving hammers will be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding, and other access ways will be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- Never store gasoline in a non-approved container. Red, non-sparking, vented containers marked with the word gasoline will be used. The fill spout will have a flame arrester.
- Prior to drilling, adequate site clearing and leveling will be performed to accommodate the drill rig and supplies and to provide a safe working area. Drilling will not be started when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

Maintenance Safety

Well maintained drilling equipment makes drilling operations safer. When performing equipment/tool maintenance, the follow safety precautions will be followed:

- Wear safety glasses when maintenance is performed on drill rigs or drilling tools.
- Shut down the drill rig engine to make repairs or adjustments to the rig or to lubricate fittings (except to make repairs or adjustments that can only be made while the engine is running).
- Always block the wheels or lower the leveling jacks or both. Set the hand brake before working under a drill rig.
- Release all pressure on hydraulic systems, the drilling fluid system, and the air operating system of the drill rig prior to performing maintenance.
- Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Allow time for the engine and exhaust to cool before performing maintenance on these systems.
- Never weld or cut on or near the fuel tank.
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent.
- Follow the manufacturer's recommendations for quantity and type of lubricants, hydraulic fluids and coolants.
- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed during maintenance.
- Perform a safety inspection prior to starting drilling equipment after maintenance is performed.

Safe Use of Hand Tools

There are a large number of hand tools that can be used on or around a drill rig. The most important rule of hand tools is to use a tool for its intended purpose. The following are a few safety rules to follow when using hand tools.

- When using a hammer, wear safety glasses and require all others around you to wear safety glasses.
- When using a chisel, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and stored in an orderly manner.
- Use wrenches on nuts, not pliers.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut, use some penetrating oil and use the largest wrench available that fits the nut. When possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing. Check the place where you may fall for sharp objects.

- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches will be wire brushed frequently to prevent accumulation of dirt and grease which cause wrenches to slip.
- Never use pipe wrenches in place of a rod holding device.
- Replace hock and heel jaws when visibly worn.
- When breaking tool joints on the ground or on a drilling platform, position hands so that fingers will not be smashed between the wrench handle and the ground or the platform if the wrench were to slip or the joint suddenly to let go.

Safety During Drilling Operations

- Do not drive a drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast, look up to check for overhead obstructions.
- Before raising the mast, all drill rig personnel (except the person raising the mast) and visitors will be cleared from the area immediately to the rear and sides of the mast. All drill rig personnel and visitors will be informed that the mast is being raised prior to raising the mast.
- All drill rig personnel and visitors will be instructed to stand clear of the drill rig immediately prior to and during starting of the engine.
- All gear boxes will be in the neutral position, all hoist levers will be disengaged, all hydraulic levers will be in the non-actuating positions, and the cathead rope will not be on the cathead before starting the drill rig engine.
- The drill rig must be leveled and stabilized with leveling jacks and/or solid cribbing before the mast is raised. The drill rig will be leveled if settling occurs after initial set up.
- The mast will be lowered only when the leveling jacks are down. The leveling jacks must be in the down position until the mast is completely lowered.
- Secure and/or lock the mast according to the drill rig manufacturer's recommendations before starting drilling operations.
- The drill rig must only be operated from the control position. If the operator must leave the control position, the rotary drive and the feed control must be placed in the neutral position. The drill engine will be shut down when the operator leaves the vicinity of the drill rig.
- Throwing or dropping of tools is not permitted. All tools will be carefully passed by hand between personnel or a hoist line will be used.
- When drilling within an enclosed area, ensure that fumes are exhausted out of the area. Exhaust fumes can be toxic and may not be detected by smell.
- Clean mud and grease from boots before mounting the drill platform. Use hand holds and railings. Watch for slippery ground when dismounting from the drill platform.
- Do not touch any metal parts of the drill rig with exposed flesh during freezing weather. Freezing of moist skin to metal can occur almost instantaneously.
- All unattended boreholes must be covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole.
- Do not attempt to use one or both hands to carry tools when climbing ladders.

Working on Derrick Platforms

- When working on a derrick platform, use a safety belt and a lifeline. The safety belt will be at least 4 inches wide and will fit snugly but comfortably. The lifeline, will be less than 6 feet long and attached to the derrick.
- The safety belt and lifeline will be strong enough to withstand the dynamic force of a 250 pound weight falling 6 feet.
- A safety climbing device will be used when climbing to a derrick platform that is higher than 20 feet.
- The lifeline will be fastened to the derrick just above the derrick platform to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- Tools will be securely attached to the platform with safety lines. Do not attach a tool to a line attached to the wrist or other body part.
- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Derrick platforms over 4 feet above the ground will have toe boards and safety railings.

Working on the Ground

- Workers on the ground must avoid going under elevated platforms.
- Terminate drilling operations and if possible lower the mast during an electrical storm.
- Overhead and buried utilities must be located and marked on all boring location plans and boring assignment sheets.
- When there are overhead electrical power lines at or near a drilling site or project, consider all wire to be charged and dangerous.
- Watch for sagging power lines before entering a site. Do not lift power lines to gain entry. Call the utility to have them lift the power lines or to deenergize the power.
- Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:
 - Power has been shut off and positive means taken to prevent the lines from being energized.
 - Equipment, or any part, does not have the capability of coming within the following minimum clearance from energized overhead lines, or the equipment has been positioned and blocked to assure no part, including cables can come within the following minimum clearances:

Power lines nominal system kv	Minimum required clearance
0 — 50	10 feet
51 — 100	12 feet
101 — 200	15 feet
201 — 300	20 feet
301 — 500	25 feet
501 — 750	35 feet
751 — 1000	45 feet

- While in transit with boom lowered and no load, the equipment clearance will be a minimum of 4 feet for voltages less than 50kv, 10 feet for voltages 51kv to 345kv, and 16 feet for voltages over 345kv.
- Before working near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter will be de-energized. The following precautions will be taken to dissipate induced voltages:
 - The equipment will be provided with an electrical ground to the upper rotating structure supporting the boom.
 - Ground jumper cables will be attached to materials being handled by boom equipment when electrical charge may be induced while working near energized transmitters. Crews will be provided nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load. Insulating gloves will be used.
- Continue to watch overhead power lines. Both hoist lines and overhead power lines can be moved toward each other by the wind.
- If there are any questions concerning drill rig operations on a site in the vicinity of overhead power lines, call the power company. The power company will provide expert advice as a public service.
- Look for warning signs indicating underground utilities. Underground utilities may be located a considerable distance away from the warning sign. Call the utility and jointly determine the precise location of all underground utility lines, mark and flag the locations and determine the specific precautions to be taken to ensure safe drilling operations.

Wire Rope Safety

- All wire ropes and fittings will be visually inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware.
- Wire ropes must be replaced when inspection indicates excessive damage. The Wire Rope User's Manual may be used as a guide for determining excessive damage.
- Wire ropes that have not been used for a period of a month or more will be thoroughly inspected before being returned to service.
- All manufactured and end fittings and connections must be installed according to the manufacturer's specifications.
- Swivel bearings on ball-bearing type hoisting swivels must be inspected and lubricated daily to ensure that the swivel rotates freely under load.
- Do not drill through or rotate drill through a slipping device, do not hoist more than 10 feet of the drill rod column above the top of the last (mast), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool hoists while the rod column is being supported by a rod slipping device.
- Do not attempt to brake the fall of a drill rod column with your hands or by increasing tension on the rod slipping device.
- Wire ropes must be properly matched with each sheave. The sheave will pinch wire rope that is too large. Wire rope that is too small will groove the sheave. Once a sheave is grooved, it will severely pinch and damage larger sized wire rope.
- Use tool handling hoists only for vertical lifting of tools. Do not use tool handling hoists to pull on objects away from the drill rig.
- All hoisting hooks will be equipped with safety latches.
- When tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull for the hoist line or the feed mechanism of the drill.
- Minimize shock loading of a wire rope; apply loads smoothly and steadily.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Know the safe working load of the equipment and tackle. Never exceed safe working limits.
- Periodically inspect clutches and brakes of hoists.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope onto hoist drums with your hands.
- After installation of a new wire rope, the first lift must be a light load to allow the wire rope to adjust.
- Never leave a load suspended when the hoist is unattended.
- Never use a hoist line to ride up the mast.

Cathead and Rope Hoist Safety

- Keep the cathead clean and free of rust and oil and/or grease. The cathead must be cleaned with a wire brush when it becomes rusty.
- Check the cathead for rope wear grooves. If a rope groove forms that is deeper than $\frac{1}{8}$ inch, the cathead must be replaced.
- Always start work with a clean, dry, sound rope. A wet or oily rope may grab the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast. If the rope grabs the cathead or otherwise becomes tangled in the drum, release the rope and sound the alarm for all personnel to clear the area rapidly.
- The rope must not be permitted to contact chemicals.
- Never wrap the rope from a cathead around a hand, wrist, arm, foot, ankle, leg, or any other body part.
- Attach the hammer to the rope using a knot that will not slip such as a bowline.
- A minimum of 18 inches must be maintained between the operating hand and the cathead drum when driving samplers, casing, or other tools. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground. Loosen grip on the rope as the hammer falls. Maintaining a tight grip on the rope increases the chances of being pulled into the cathead.
- Do not use a rope that is longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- The cathead operator must be on a level surface with good, firm footing conditions.

Auger Safety

- The drill rig must be level, the clutch or hydraulic rotation control disengaged, the transmission in low gear and the engine running at low RPM when starting an auger boring.
- Seat the auger head below the ground surface with an adequate amount of downward pressure prior to rotation.
- Observe the auger head while slowly engaging the clutch or rotation control and start rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply downward pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below the surface.
- Follow manufacturer's recommended methods for securing the auger to the power coupling.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never place feet under the auger section that is being hoisted.
- Stay clear of rotating augers and other rotating components of the drill rig.

- Never reach behind or around a rotating auger.
- Use a long-handle shovel to move auger cuttings away from the auger.
- Augers will be cleaned only when the drill rig is in neutral and the augers have stopped rotating.

Rotary and Core Drilling Safety

- Water swivels and hoist plugs must be lubricated and checked for frozen bearings before use.
- Drill rod chuck jaws must be checked periodically and replaced as necessary.
- The weight of the drill rod string and other expected hoist loads must not exceed the hoist and sheaves capacities.
- Only the operator of the drill rig will brake or set a manual chuck to ensure that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- The drill rod chuck jaws will not be used to brake drill rods during lowering into the hole.
- Drill rods will not be held or lowered into the hole with pipe wrenches.
- Do not attempt to grab falling drill rods with hands or wrenches.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction must be relieved or bled down prior to breaking the first tool joint.
- Use a rubber or other suitable rod wiper to clean rods during removal from the hole. Do not use hands to clean drilling fluids from the drill rods.
- Do not lean unsecured drill rods against the mast.

Appendix C

Directions to the Nearest Emergency Medical Facility

DIRECTIONS TO THE NEAREST MEDICAL FACILITIES

Naval Hospital

Lexington Drive

NAS Corpus Christi, TX

361-961-2424 or 961-2735

DIRECTIONS TO THE NEAREST HOSPITAL CAPABLE OF TREATING CHEMICAL EXPOSURES

Spohn Hospital

Third Street

Corpus Christi, TX

361-881-3811 or 911

From the North Gate:

Take Ocean Drive and turn left on Ayers Street. Proceed for two blocks and turn right on Third Street. The Emergency Entrance will be on the right.

Appendix D
Health and Safety Plan Forms

PLAN ACCEPTANCE FORM
PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project site. The completed form shall be returned to EnSafe, Dallas, Texas.

Contract No: N62467-89-D-0318

CTO No: 0152

Project: Affected Property Assessment

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

Signed

Print Name

Company

Date

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:
