Work Plan
Supply-Side Landfill Investigation
Naval Training Center, Great Lakes
Great Lakes, Illinois

Northern Division
Naval Facilities Engineering Command
Contract No. N62472–90–D–1298
Contract Task Order 0062

September 1992

HALLIBURTON NUS
Environmental Corporation

SUPPLY-SIDE LANDFILL INVESTIGATION WORK PLAN
NAVAL TRAINING CENTER, GREAT LAKES
GREAT LAKES, ILLINOIS

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

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LIST OF ACRONYMS/ABBREVIATIONS

ASTM	American Society for Testing and Materials
BNA	Base/Neutral and Acid Extractable Compounds
BOA	Basic Ordering Agreement
BZ	Breathing Zone
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CHSM	Corporate Health and Safety Manager
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COC	Chain of Custody
CRZ	Contamination Reduction Zone
CS	Landfill Cover Soil Sample
CTO	Contract Task Order
CZ	Control Zone
DQO	Data Quality Objective
DR	Duplicate Sample Result
EZ	Exclusion Zone
FB	Field Blank
FD	Field Duplicate
FS	Feasibility Study
FSP	Field Sampling Plan
FTL	Field Team Leader
GL	Great Lakes
GW	Groundwater Sample
HSP	Health and Safety Plan
HDPE	High Density Polyethylene
HEPA	High Efficiency Particulate Air (filter)
HSM	Health and Safety Manager
IAS	Initial Assessment Study
IDLH	Immediately Dangerous to Life or Health
IDW	Investigative Derived Wastes
IEPA	Illinois Environmental Protection Agency
LEA	Leachate Sample
LEL	Lower Explosive Limit
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSDS	Material Safety Data Sheet
MSHA	Mine Safety Health Administration
NACIP	Naval Assessment and Control of Installation Pollutants

NEESA	Naval Energy and Environment Support Activity
NTC	Naval Training Center
OR	Original Sample Result
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Representativeness, Completeness, Comparability
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
PNAs	Polynuclear Aromatic Hydrocarbons
PP	Priority Pollutant
PPE	Personal Protective Equipment
ppm	parts per million
PRP	Potentially Responsible Party
PVC	Polyvinyl Chloride
PWC	Public Works Center
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QL	Quantitation Limit
QC	Quality Control
R	Recovery
RAOs	Remedial Action Objectives
RB	Rinsate Blank
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
SA	Spike Amount
SCBA	Self Contained Breathing Apparatus
SMCL	Secondary Maximum Contaminant Level
SOP	Standard Operating Procedure
SR	Sample Results
SSO	Site Safety Officer
SSR	Spiked Sample Results
SZ	Support Zone
TAL	Target Analyte List
TB	Trip Blank
TCL	Target Compound List
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile Organic Compounds
WZ	Work Zone

1.0 INTRODUCTION

This project is being performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62472-90-D-1298, Contract Task Order (CTO) No. 0062. The activities under the CLEAN Contract are performed by a team of contractors comprised of HALLIBURTON NUS Environmental Corporation (HALLIBURTON NUS), the prime contractor, and SEC Donohue Inc. (SEC Donohue) and ENSR Consulting and Engineering, both team subcontractors. SEC Donohue is the lead technical firm for this CTO.

Preparation of this Work Plan was accomplished pursuant to CTO No. 0062 for the Naval Training Center, Great Lakes (NTC) in Great Lakes, Illinois, dated May 21, 1992. An Implementation Plan was submitted to the Navy on June 5, 1992. The Navy issued final approval of the Implementation Plan on July 14, 1992.

1.1 WORK PLAN ORGANIZATION

The organization of this Work Plan is as follows:

- Section 1.0 Introduction
- Section 2.0 Site Background
- Section 3.0 Project Approach
- Section 4.0 Pre-Remediation Tasks
- Section 5.0 Field Sampling Plan (FSP)
- Section 6.0 Quality Assurance Project Plan (QAPP)
- Section 7.0 Health and Safety Plan (HSP)
- Section 8.0 References

The FSP, the QAPP, and the HSP contain the technical guidelines and procedures for conducting the field work and the laboratory analysis for pre-remediation investigation. These plans are described below.

The FSP includes: sampling objectives; sample location and frequency; sample designations; sampling equipment and procedures; and sample handling and shipping procedures.

The QAPP includes: quality assurance (QA) objectives; chain of custody procedures; calibration procedures; analytical procedures; data reduction, validation, and reporting; data assessment procedures; internal quality control (QC); performance and system audits; preventive maintenance; corrective actions; and QA reports.

The HSP includes: site-specific safety information; a hazard assessment; monitoring procedures for site operations; and other requirements in accordance with U.S. Environmental Protection Agency (USEPA) protocols and Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120 and 29 CFR 1910.126.

2.0 SITE BACKGROUND

2.1 NAVAL TRAINING CENTER LOCATION

NTC is located in Shields Township, Lake County, Illinois, on the shore of Lake Michigan. It is bounded on the west by U.S. Route 41 (Skokie Highway), and on the east by Lake Michigan (Figure 2-1). Not shown on Figure 2-1 are the city of North Chicago which borders NTC to the north, and the Shoreacres Country Club, which borders NTC to the south. NTC occupies approximately 1,640 acres of land.

2.2 NAVAL TRAINING CENTER DESCRIPTION

Construction of the original NTC was finished in 1911 and consisted of 39 buildings on 292 acres. Over the years, the NTC has expanded to its present size of approximately 1,133 buildings on 1,640 acres (NTC, 1986). NTC currently has the following land uses:

- Recruit training.
- Housing and barracks.
- Public works (maintenance, engineering).
- Supply facilities (warehouses).
- Medical facilities (Naval Hospital, Dental Clinic).
- Administration.
- Recreation (Lake Michigan shore line, golf course).
- Utilities (power plant, sewage treatment plant).
- Ammunition storage.

2.2.1 Topography

Most of the facilities at NTC are located on uplands adjacent to Lake Michigan. The upland areas are typically level to gently sloping, but are in places cut by steep walled ravines that contain Pettibone Creek and its tributaries which drain to Lake Michigan. Elevations range from approximately 580 feet above mean sea level (MSL) along the Lake Michigan shore line to a maximum of approximately 730 feet above MSL.

2.2.2 Geology

NTC is underlain by Silurian age bedrock consisting of Niagaran and Alexandrian Limestone. Above the bedrock is glacial till which ranges in thickness from approximately 170 to 210 feet. The predominant glacial deposit in the vicinity of NTC is Wadsworth till. This till is predominately clayey soil with thin, irregular, discontinuous lenses of sand and silty sand (Dames & Moore, 1991).

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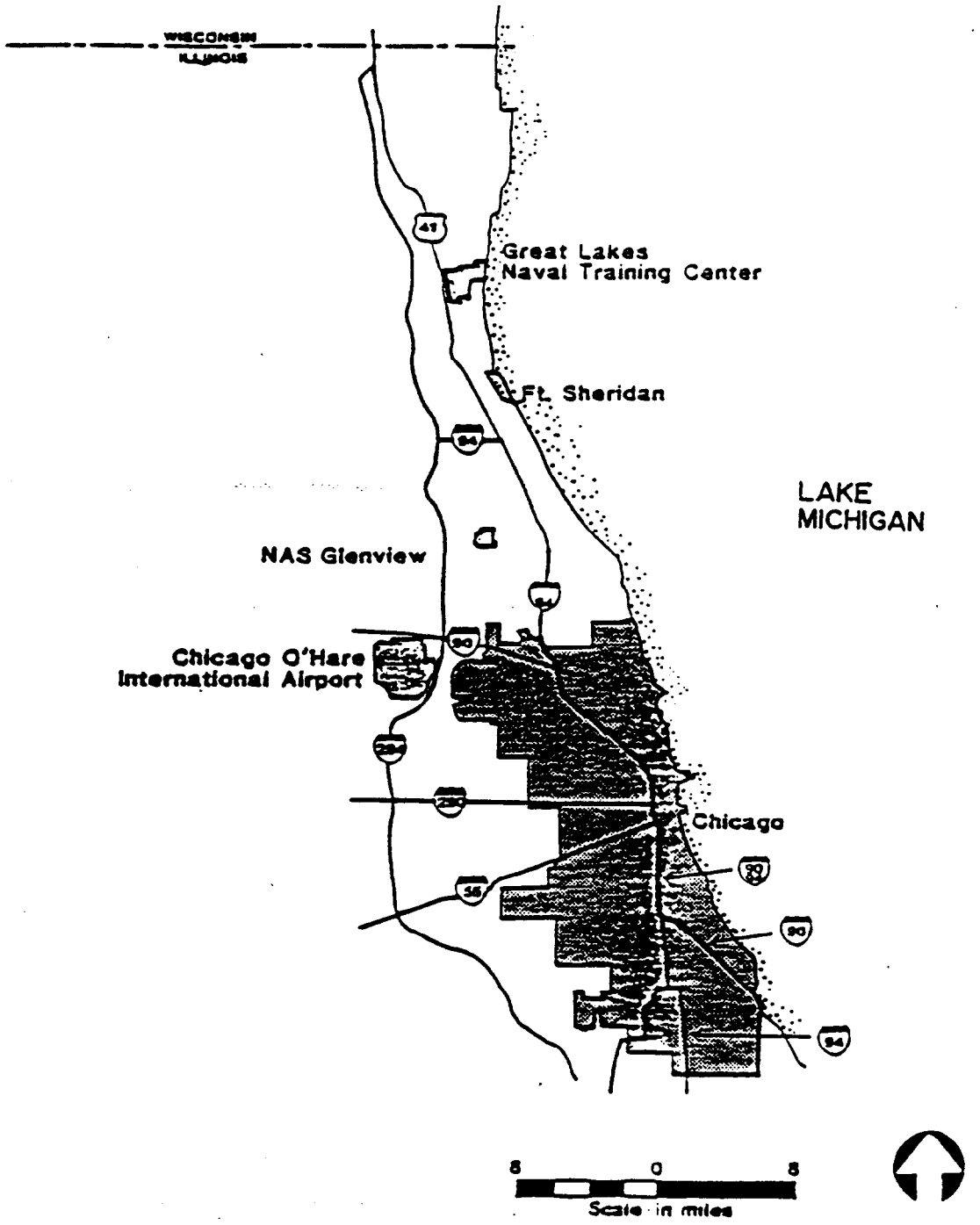

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FIGURE 2-1
GENERAL LOCATION MAP

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NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

2.2.3 Groundwater

Groundwater occurs throughout the till, but due to a low hydraulic conductivity of the clayey material, the till yields very little water. The discontinuous lenses of sand are potential sources of groundwater. Two distinct zones of groundwater were encountered during a drilling investigation conducted in 1988 by Dames & Moore at NTC. The first zone had a potentiometric surface of approximately 10 feet below ground surface, while the deeper zone had a potentiometric surface of between 15 and 30 feet below ground surface. No other water bearing zones were encountered to the maximum depth explored of 45 feet (Dames & Moore, 1991).

2.3 DESCRIPTION OF THE SUPPLY-SIDE LANDFILL

The Navy conducted an Initial Assessment Study (IAS) at NTC that was completed in 1986. The IAS identified seven sites which required further evaluation. An eighth site, referred to as the Supply-side Landfill was also investigated during the IAS but was not included as a site because it was undergoing closure. Figure 2-2 presents the significant features of the landfill including existing passive gas vents, groundwater monitoring wells and gas monitoring wells. The landfill was in use from the mid 1960s to the late 1970s. A closure plan was submitted to the Illinois Environmental Protection Agency (IEPA) and approved. However, the closure process has not been completed.

There are four monitoring wells (referred to as 101, 102, 103 and 104) at the landfill for long-term groundwater monitoring. The wells have been sampled quarterly for the past eight years. Analytical data from these four wells are presented and compared to Maximum Contaminant Levels (MCLs) and Secondary MCLs (SMCLs) on Tables 2-1 through 2-4.

On May 20, 1992, a leachate seep was noted on the landfill's east face. The leachate was sampled by the Navy Public Works Center (PWC). Table 2-5 presents the analytical results of this sample.

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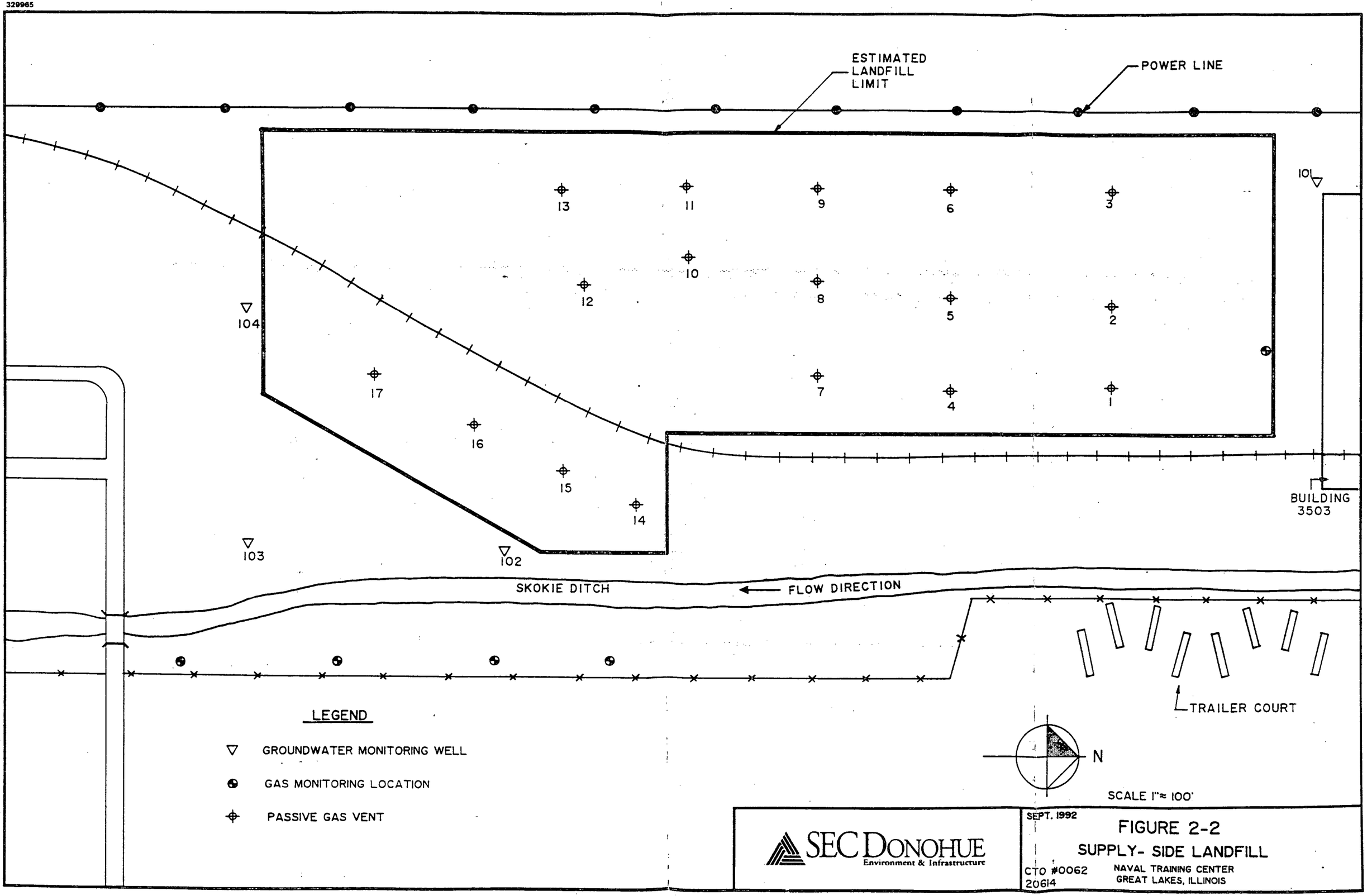

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FIGURE 2-2
SUPPLY- SIDE LANDFILL

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20614

NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

TABLE 2-1

MONITORING WELL 101 EXCEEDANCES
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

PARAMETERS	SAMPLING DATES									
	2/92	11/91	8/91	5/91	2/91	11/90	8/90	5/90	2/90	11/87
pH (<6.5 or >8.5)*										
Sulfate (250 ppm)*						387			320	
TDS (500 ppm)*	960			590		1,780		700	1,680	1,780
Chloride (250 ppm)*										515
Lead (0.015 ppm)**	0.12					0.26			0.06	
Iron (0.3 ppm)*										
Manganese (0.05 ppm)*									0.70	
Cyanide (0.2 ppm)*										

An exceedance is defined as a concentration above the cited standards shown in parentheses.

The standards used for comparison are:

* Secondary Maximum Contaminant Level (SMCL)
** Maximum Contaminant Level (MCL)

TABLE 2-2

MONITORING WELL 102 EXCEEDANCES
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

PARAMETERS	SAMPLING DATES									
	2/92	11/91	8/91	5/91	2/91	11/90	8/90	5/90	2/90	11/87
pH (<6.5 or >8.5)*			8.64							
Sulfate (250 ppm)*			350	389		387				
TDS (500 ppm)*	1,850	510	1,560	1,680	2,440	1,700	1,370	1,300	2,000	1,740
Chloride (250 ppm)*	282				300					294
Lead (0.015 ppm)**	0.10	0.10							0.22	
Iron (0.3 ppm)*			3.10	0.38		2.31	0.95	2.3	1.2	
Manganese (0.05 ppm)*			0.11	0.14	0.07	0.24		0.16		
Cyanide (0.2 ppm)*										

An exceedance is defined as a concentration above the cited standards shown in parentheses.

The standards used for comparison are:

* Secondary Maximum Contaminant Level (SMCL)
** Maximum Contaminant Level (MCL)

TABLE 2-3

MONITORING WELL 103 EXCEEDANCES
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

PARAMETERS	SAMPLING DATES									
	2/92	11/91	8/91	5/91	2/91	11/90	8/90	5/90	2/90	11/87
pH (<6.5 or >8.5)*										
Sulfate (250 ppm)*				322		344				
Ammonia (1.0 ppm)**					5.80	2.8				
TDS (500 ppm)*	1,150			720		1,590				1,500
Chloride (250 ppm)*										
Lead (0.015 ppm)**						0.071				
Iron (0.3 ppm)*				0.05						
Manganese (0.05 ppm)*				1.06		0.640				
Cyanide (0.2 ppm)*										

An exceedance is defined as a concentration above the cited standards shown in parentheses.

The standards used for comparison are:

* Secondary Maximum Contaminant Level (SMCL)
** Maximum Contaminant Level (MCL)

TABLE 2-4

MONITORING WELL 104 EXCEEDANCES
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

PARAMETERS	SAMPLING DATES									
	2/92	11/91	8/91	5/91	2/91	11/90	8/90	5/90	2/90	11/87
pH (<6.5 or >8.5)*										
Sulfate (250 ppm)*					353					
TDS (500 ppm)*	1,150	710		570	1,000	1,000		1,100	1,270	1,500
Chloride (250 ppm)*										
Lead (0.015 ppm)**		0.12				0.076		0.06	0.24	
Iron (0.3 ppm)*										
Manganese (0.05 ppm)*				0.59	0.34					
Cyanide (0.2 ppm)*										

An exceedance is defined as a concentration above the cited standards shown in parentheses.

The standards used for comparison are:

* Secondary Maximum Contaminant Level (SMCL)
** Maximum Contaminant Level (MCL)

TABLE 2-5

LEACHATE SEEP SAMPLE RESULTS
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Parameter	Results (mg/l)
Chloride	470
Sulfate	12
TOC	110
pH	7.0
Total Phenols	<0.40
Reactive Cyanide	<0.030
Reactive Sulfide	<5.0
Flashpoint	>200° F
TCLP Volatiles	ND(1)
TCLP Semivolatiles	ND(1)
TCLP Pesticides	ND(1)
TCLP Herbicides	ND(1)
TCLP Metals	
Arsenic	0.0028
Barium	<2.0
Cadmium	<0.05
Chromium	<0.10
Lead	<0.11
Mercury	<0.00050
Selenium	0.0024
Silver	<0.05

(1) detection limits used for TCLP scans were less than the RCRA hazardous waste regulatory levels.

Acronyms:

ND - Not Detected
TCLP - Toxicity Characteristic Leaching Procedures
TOC - Total Organic Carbon

2.4 SITE VISIT OBSERVATIONS

SEC Donohue and Navy personnel conducted a site visit at the Supply-side Landfill on May 27, 1992. Observations made by SEC Donohue personnel during the site visit are summarized as follows:

- The Supply-side Landfill is approximately 1,200 feet (north-south) by 360 feet (east-west). It rises above the surrounding land surface to a maximum of approximately 21 feet. An old railroad grade divides the landfill into two sections. The Skokie Ditch is present along the east edge of the landfill (refer to Figure 2-2). This ditch contains surface water throughout the year.

- The landfill Closure Plan (STS, 1983) indicates that the site has been graded, covered with clay and topsoil and vegetated. Some differential settlement has taken place since closure.

- With the exception of random bare spots, the landfill is substantially covered with grass and other vegetation including some trees and shrubs. There are indications that the capping system has cracked from desiccation and possibly differential settlement. SEC Donohue personnel monitored the air above and in several cracks in the landfill cover for volatile organics using an HNu photoionization detector (PID), and for oxygen (O_2), % Lower Explosive Limit (LEL)-methane, hydrogen sulfide (H_2S), and carbon monoxide (CO), using a Lumidor gas meter. In one of the cracks, the PID had a short duration deflection of >200 parts per million (ppm) above background. At this same crack, a 3% LEL was measured with the Lumidor.

- There was some indication of vegetative stress as indicated by patches of bare ground, and yellowing and thinning of plants around the bare patches. The type of vegetative stress observed is often associated with the buildup of gases in the soil. This was confirmed by the use of gas probes indicating that gas was escaping from cracks in the landfill cover in several of these areas. There also was evidence of surface boils from the gas and possible leaking leachate in several locations.

- Seventeen gas vents have been installed in the landfill. These gas vents are constructed of 4-inch diameter, schedule 80 polyvinyl chloride (PVC). The gas vents are screened from approximately two feet below grade to their bottom. There is no information on the depths of the gas vents. There were indications of surface subsidence at each of the gas vents. It was observed that the concrete pad poured around the vent pipe had settled and broken the seal around the gas pipe penetration. The gaps which are present between the vent pipes and the concrete pads are now probable pathways for rainfall to infiltrate the landfill.

- In spite of the indication that gas was present in the landfill, there was very little gas getting into the passive gas vents according to the gas monitoring equipment. Further investigation (refer to the next bullet) indicated that the gas vents are likely "watered out" by virtue of high water level inside the landfill.

- SEC Donohue personnel measured the leachate level in three passive gas vents in the north end of the landfill. The leachate level was determined to be three to four feet below ground surface around these vents. Similar conditions may exist in the central and southern areas of the landfill.

- SEC Donohue personnel observed cattails, and other plants normally associated with wet areas, growing halfway up the side of the landfill. This further indicates that there are high leachate levels within the landfill.

- SEC Donohue personnel observed the leachate seep discovered on May 20, 1992. Aqueous leachate was present in a small hand-dug hole on the east face of the landfill. The leachate was contained in the hole and was not flowing down the side of the landfill. The leachate was bubbling, apparently due to escaping gas. Orange-red material was visible and appeared to be floating on the leachate in the hole. All readings were the same as background, with the exception of % LEL-methane which was measured at 1%. The leachate appeared to have stained the soil around the seep a reddish color.

- Three wooden power poles had been installed within the limits of waste on the north face of the landfill. Waste was evident adjacent to the hole. It included magnetic tape that probably contains iron which could contribute to the red color observed in the leachate hole. Dark orange-red staining was observed beneath and surrounding the pile of magnetic tape.

- Four groundwater monitoring wells and three gas monitoring wells are present at the landfill.

During the Site Visit, Mr. Mark Schultz of NTC PWC provided SEC Donohue with (1) oversize drawings including: a landfill contour map, a monitoring well location map, a gas vent and gas monitoring well location map, and two landfill cross-section maps; and (2) a section of a Closure Plan prepared in 1983, along with associated correspondence; and (3) analytical data from groundwater samples collected by PWC at the landfill between 1987 and 1992.

Landfill Contour Map

The landfill is elevated above the surrounding land to a maximum height of approximately 21 feet. The elevation of the surrounding land is shown at about 90 feet NTC datum. NTC datum can be converted to MSL by adding 580.912 feet.

Monitoring Well Location Map

This map shows the location of the four groundwater monitoring wells installed at this landfill. Well 101 is located at the base of the north slope of the landfill. Wells 102, 103 and 104 are located adjacent to and near the southeast corner of the landfill.

Gas Vent and Gas Monitoring Well Location Map

This map shows the location of the 17 passive gas vents in the landfill, and the location of the four gas monitoring wells installed east of the Skokie Ditch and one gas monitoring well just north of the landfill.

Landfill Cross-Section Maps

These two maps show four landfill cross sections (A-A', B-B', C-C' and D-D'). A-A' is a north-south section located east of the landfill and west of Skokie Ditch. This section shows that the native soil in the landfill area is predominantly silty clay. B-B' is a north-south section through the middle of the landfill. This section shows a silty clay cover over the landfill waste. The cover ranges in thickness between three feet in the south area of the landfill to 10 feet in the north. The thickness of the waste is shown to vary between 15 and 30 feet. The waste is the thickest in the central portion of the landfill. Native silty clay is present beneath the waste. There is no evidence of an engineered liner beneath the waste in this cross-section. C-C' is an east-west section south of the landfill. This section shows the native soil to be predominantly silty clay. D-D' is an east-west section through the northern part of the landfill. This section shows a 10-foot thick silty clay cover over the landfill waste. The thickness of the waste in the northern part of the landfill is approximately 18 feet. Native silty clay is present beneath the waste.

Summary of Closure Plan

Mr. Schultz provided SEC Donohue with a section, titled "Recommendations for Closure Plan", of a 1983 STS report. These pages discuss cover placement and compaction, vegetation, groundwater monitoring, and gas migration controls. SEC Donohue was also provided groundwater data (1987 through 1992) from samples collected from the four monitoring wells and three letters (dated September 1983, February 1985 and December 1988) from the IEPA to PWC. The 1983 letter states that the Closure Plan prepared by Young Environmental Services for the landfill at NTC satisfied IEPA closure requirements. The 1985 letter states that the Closure Plan has been reviewed. Apparently, a revised Closure Plan for the Supply-side landfill was submitted to IEPA. The 1988 letter states that the Closure Plan has met the requirements of Illinois Title 35, Section 807.508. Apparently, this is referring to the revised Closure Plan.

3.0 PROJECT APPROACH

This Work Plan presents SEC Donohue's technical scope of work for a pre-remedial investigation at the Supply-side Landfill at NTC. The primary objective of the investigation is to gather data needed to determine whether remediation techniques such as leachate pumping and treatment, or recapping, should be implemented at the landfill.

3.1 PROJECT OBJECTIVE

The project objective is to investigate the landfill and develop a remedy by the following approach:

1. Collect additional field data to address the condition of the landfill.
2. Assess potential remedial actions.
3. Develop long-term remedial alternatives and propose the most appropriate remedy.

3.2 SITE CONCEPTUAL MODEL

Figure 3-1 presents a Site Conceptual Model for the landfill. The Site Conceptual Model includes information on waste source, pathways and receptors to develop an understanding of the site and to evaluate potential risks to human health and the environment. The Site Conceptual Model assists in identifying areas where sampling is necessary and in identifying potential remedial technologies.

3.3 REMEDIAL ACTION OBJECTIVES

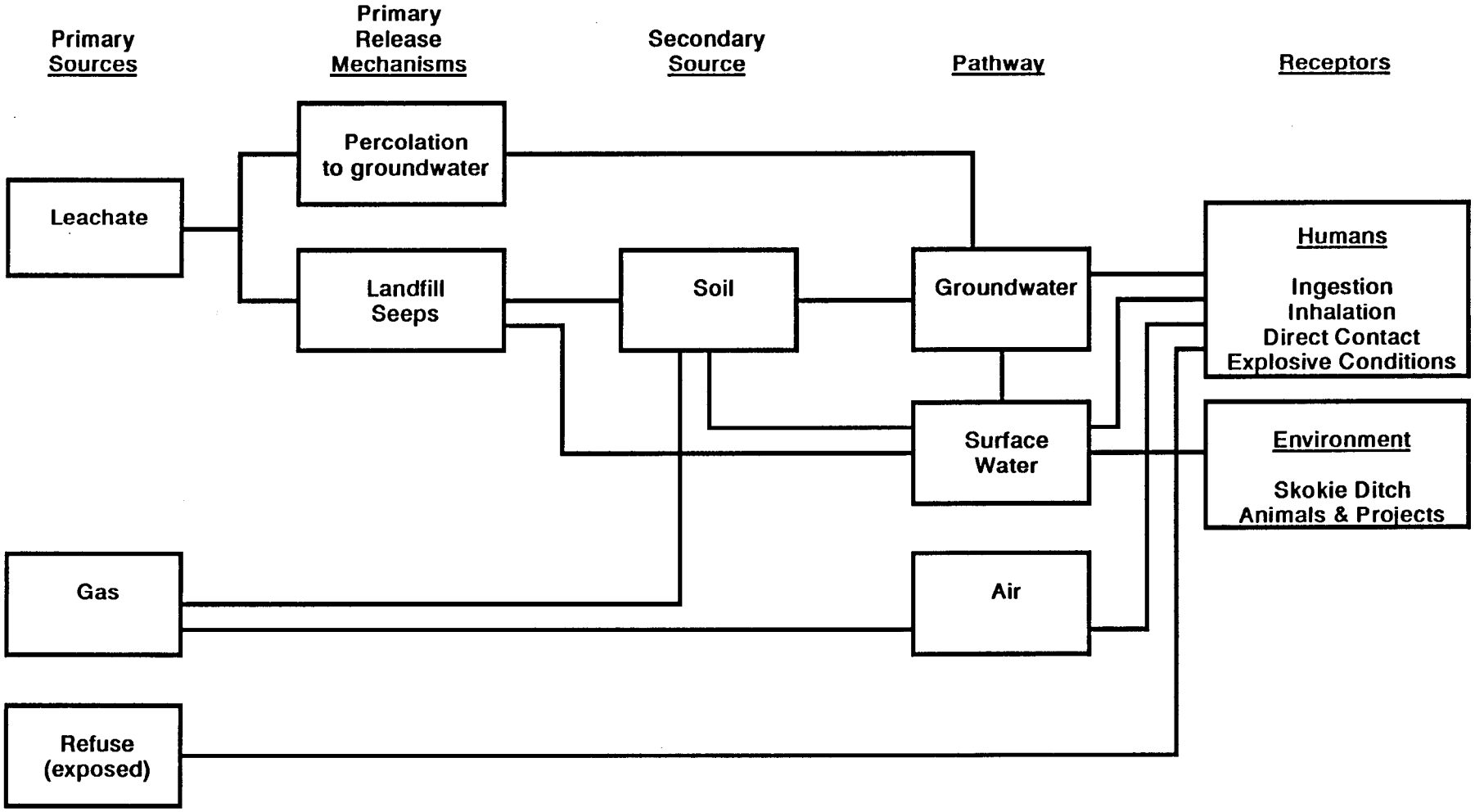
Remedial Action Objectives (RAOs) are defined as medium-specific goals for protecting human health and the environment. The RAOs established for this project include:

1. Mitigate leachate seeps to prevent human ingestion of leachate, dermal contact with leachate, and migration of leachate to surface water.

2. Cover exposed refuse to prevent human dermal contact with the refuse.

3. Prevent off-site gas migration to reduce the potential for explosive conditions and for human inhalation of landfill gas.

FIGURE 3–1
SITE CONCEPTUAL MODEL
SUPPLY–SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992



D:\123FILES\NAVY\FLOW_CHA.WK3

4. Prevent groundwater contamination to reduce the potential for human ingestion of contaminated groundwater or direct contact with contaminated groundwater.

5. Prevent Skokie Ditch contamination to reduce the potential for human or animal direct contact with or ingestion of contaminated water and sediment.

The following General Response Actions have been established for the above RAOs:

RAO 1 - Stop Leachate Seeps

1. Pump and treat leachate.
2. Improve landfill cover.

RAO 2 - Cover Exposed Refuse

1. Improve landfill cover.

RAO 3 - Prevent Off-site Gas Migration

1. Repair existing passive gas venting system including lowering leachate levels.
2. Install a new passive gas venting system including lowering leachate levels.
3. Install an active gas extraction system including lowering leachate levels.
4. Install a new passive gas venting system without lowering leachate levels.
5. Install an active gas extraction system, without lowering leachate levels.
6. Conduct off-landfill gas monitoring.

RAO 4 - Prevent Groundwater Contamination

1. No Action will be taken at this time. Action may be warranted after further groundwater data evaluation is completed.

RAO 5 - Prevent Skokie Ditch Contamination

1. Repair and regrade landfill cover to stop leachate seeps from entering Skokie Ditch.

2. Prevent groundwater impacts to the ditch. No action will be taken at this time. Action may be warranted after further groundwater data evaluation is completed.

3.4 ILLINOIS EPA VOLUNTARY CLEANUP PROGRAM

The IEPA has established a Voluntary Cleanup Program. For sites in this program, the IEPA provides technical document review, cleanup objectives, and, in some cases, a certification that remedial work has been properly performed.

Once the pre-remediation tasks have been completed at the Supply-side Landfill, SEC Donohue and the Navy may contact the IEPA to negotiate cleanup goals for this site. No risk assessment is recommended at this time.

4.0 PRE-REMEDIATION TASKS

4.1 PROPOSED SCOPE OF WORK

The following tasks will be required to meet project objectives.

4.1.1 Task 1 - Mobilization

Mobilization will consist of ordering and obtaining the necessary field equipment (sample bottles, coolers, vehicles, etc.) and health and safety equipment (HNu PID, combustible gas meter, gloves, etc.) to conduct the investigation. SEC Donohue will also prepare laboratory specifications for selecting a contract laboratory for sample analysis.

Time will also be required for the sampling team to become familiar with the project plans, and for the Field Team Leader (FTL) to coordinate with the Project Manager and the NTC Point of Contact.

4.1.2 Task 2 - Field Investigation

The field investigation procedures are described in detail in Section 5.0, FSP, of this Work Plan.

4.1.3 Task 3 - Sample Analysis

This task includes laboratory chemical analysis of samples collected during the investigation. Soil samples collected during the investigation will be analyzed by a contract laboratory approved by the Navy.

4.1.4 Task 4 - Data Validation and Data Entry

Data validation will be performed by a chemist in accordance with the CLEAN data validation procedures established by the Navy. The data validation procedures are discussed in the QAPP which is included as Section 6.0 of this Work Plan. Upon completion of data validation, the data may be entered into an SEC Donohue Database where it can be manipulated and printed in a variety of tabular formats to aid in data evaluation.

4.1.5 Task 5 - Data Evaluation

Data evaluation will be performed upon completion of data entry. The objective of data evaluation will be to determine leachate and groundwater quality, and to identify potential leachate treatment techniques.

4.1.6 Task 6 - Draft and Final Investigation Report

A Draft Investigation Report will be prepared to summarize the results of the field investigation and to recommend potential remedial techniques for the landfill. The Draft Report will be finalized after incorporation of comments made by the Navy and other reviewing agencies.

Specifically, the following items will be included in the Investigation Report, at a minimum:

- A summary of project background information.
- A detailed description and summary of the field work conducted including figures showing sampling locations, observations, and PID screening results.
- A summary of the laboratory analytical results, including associated QA/QC documentation.
- A summary of the data evaluation completed.
- A recommendation of remedial techniques to be implemented at the landfill.

4.1.7 Task 7 - Project Management

The SEC Donohue Project Manager will be responsible for implementing the investigation and coordinating and monitoring daily project activities. Responsibilities include:

- Serving as the principal contact with the Navy Remedial Project Manager (RPM).
- Ensuring that the project is appropriately staffed.
- Monitoring the project budget and schedule to identify variances and take appropriate corrective action, if needed.
- Providing overall project direction and resolving problem areas.

4.2 PRE-REMEDIATION SCHEDULE

The estimated time duration for the completion of the project is 230 working days. Each of the tasks included in this investigation and the approximate execution period are as follows:

Task	Cumulative Schedule (Working Days)
Draft Work Plan	0
Receive Navy's Comments	15
Response to Comments	20
Submit Final Work Plan	35
Navy's Approval of Work Plan	50
Submit Implementation Plan	65
Navy's Authorization to Proceed	85
Mobilization	105
Field Investigation	115
Sample Analysis	145
Data Validation and Entry	155
Data Evaluation	170
Draft Investigation Report	185
Navy's Review of Draft Report	205
Response to Draft Comments	215
Final Investigation Report	230

5.0 FIELD SAMPLING PLAN

This FSP presents the field procedures and techniques to be followed by the SEC Donohue sampling team to gather data needed to meet the objectives of this project.

5.1 FIELD SAMPLING PROGRAM OBJECTIVES

The objective of the field sampling program at the Supply-side Landfill is to gather data to develop remedial alternatives to be implemented to meet the RAOs which have been established for this project. The RAOs are as follows:

1. Mitigate leachate seeps to prevent human inhalation of leachate, dermal contact with leachate, and migration of leachate to surface water.

2. Cover exposed refuse to prevent dermal contact with and ingestion of contaminants.

3. Prevent off-site gas migration to reduce the potential for human inhalation of landfill gas and/or explosive conditions.

4. Prevent groundwater contamination to reduce the potential for human ingestion of contaminated groundwater or direct contact with contaminated groundwater.

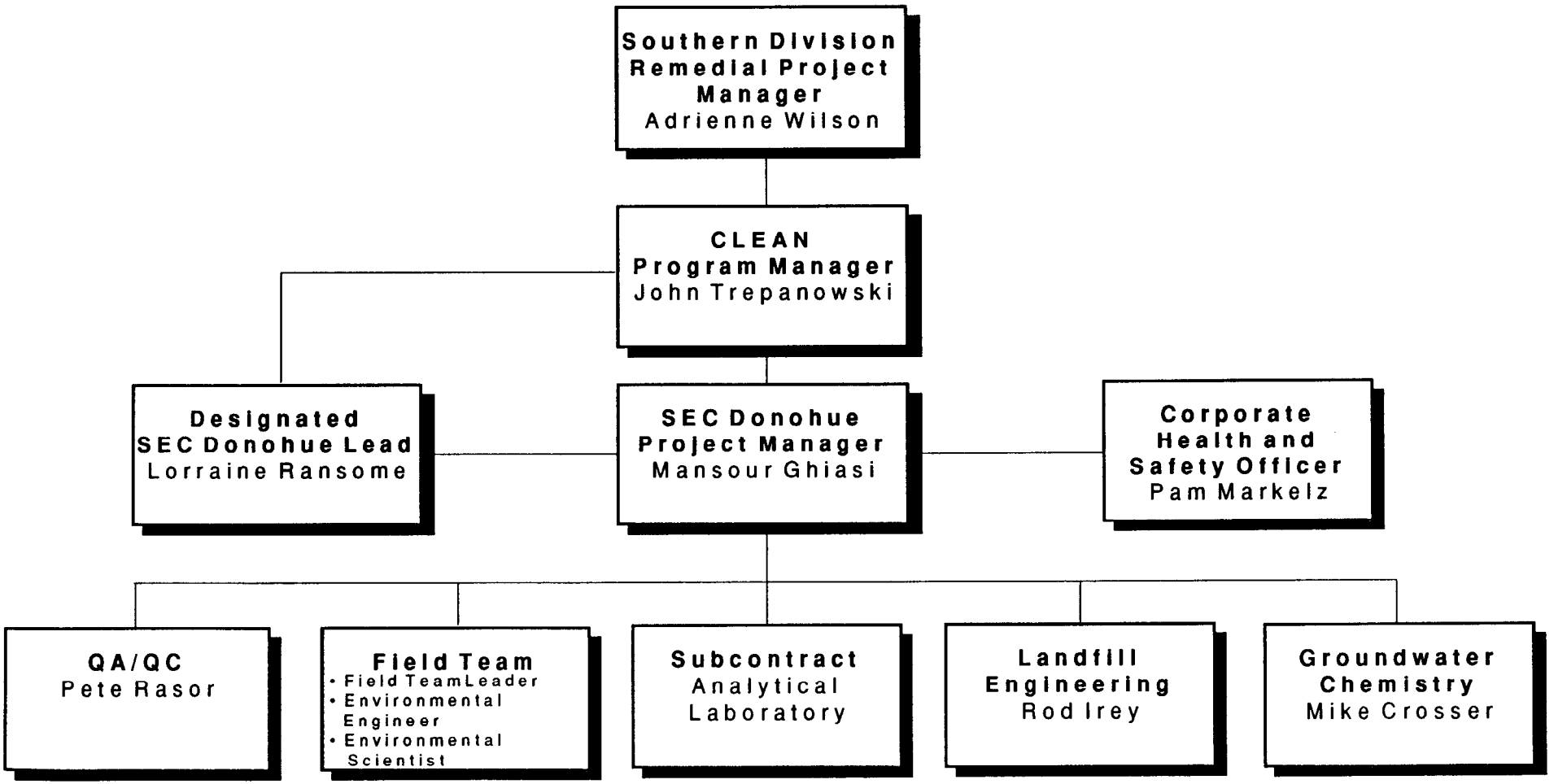
5. Prevent Skokie Ditch contamination to reduce the potential for direct human contact with or ingestion of contaminated water and sediment.

5.2 PROJECT ORGANIZATION AND PERSONNEL RESPONSIBILITIES

The key personnel associated with this project, their respective organizations and the chain of communications are presented below and in Figure 5-1.

- Adrienne Wilson
  Remedial Project Manager
  Southern Division
  Naval Facilities Engineering Command
  2155 Eagle Drive
  P.O. Box 10068
  Charleston, SC 29411-0068
  Phone (803) 743-0582
  Fax (803) 743-0465

FIGURE 5-1
HALLIBURTON NUS TEAM PROJECT ORGANIZATION CHART
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992



- Mark Schultz
  Activity Point of Contact
  c/o Commanding Officer
  Navy Public Works Center, Building 1A
  Great Lakes, IL 60088
  Attn: Code 30E
  Phone (708) 688-4693

- John Trepanowski
  CLEAN Program Manager
  HALLIBURTON NUS Environmental Corporation
  999 West Valley Road
  Wayne, PA 19087
  Phone (215) 971-0900

- Mansour Ghiasi
  Project Manager
  SEC Donohue Inc.
  111 North Canal Street, Suite 305
  Chicago, IL 60606
  Phone (312) 902-7100
  Fax (312) 902-7099

Field work will be performed by a three person sampling team comprised of the FTL and two environmental scientists/engineers. One of the environmental scientists/engineers will serve as the the Site Safety Officer (SSO). The specific responsibilities of the FTL and SSO are discussed below.

5.2.1 Field Team Leader (FTL)

The FTL will have overall responsibility for completion of field activities according to this FSP. The FTL is the overall coordinator of activities at the site and is the communication link between the sampling team and the SEC Donohue Project Manager. The FTL will be on-site during all field activities and will oversee operations. The FTL will be responsible for the following:

- Mobilizing and demobilizing the sampling team.

- Assuring that the sampling team is familiar with this document and the HASP.

- Collecting soil and water samples for chemical analysis and completing sample collection logs, as necessary.

- Ensuring that samples are packaged and shipped in accordance with the FSP and QAPP.

- Ensuring that Investigative Derived Wastes (IDW) are properly managed as described in Section 5.11.

- Resolving logistical problems hindering field activities such as equipment malfunctions or personnel conflicts.

- Completing the site logbook on a daily basis.

- Ensuring that a sample tracking logbook is completed on a daily basis.

- Informing the Project Manager of daily activities.

5.2.2 Site Safety Officer (SSO)

The SSO will be present on-site during field operations and will be responsible for health and safety activities. The SSO reports to the SEC Donohue Corporate Health and Safety Manager (CHSM), and indirectly to the FTL, Project Manager and CLEAN Health and Safety Manager. The SSO is responsible for the following:

- Controlling health and safety-related field operations such as personnel decontamination, monitoring of workers for heat or cold stress, and calibration and operation of safety equipment.

- Terminating work if an imminent safety hazard, emergency condition, or other potentially dangerous situation, such as detrimental weather conditions, is encountered.

- Conducting and documenting a health and safety meeting each day, or as needed, at the site.

- Ensuring that the sampling team complies with the HSP.

- Collecting samples for chemical analysis and completing sample collection logs, as necessary.

- Ensuring that NTC personnel are adequately advised and kept clear of potentially contaminated materials.

5.3 SITE ACCESS

Access to NTC is controlled through the pass office located at the NTC Main Entrance on Sheridan Road. A driver's license and proof of vehicle registration and insurance are required to obtain a pass. Once a pass has been acquired, access to the Supply-side Landfill is unrestricted.

Fifteen working days prior to the start of field activities, the SEC Donohue Project Manager will contact the Navy RPM to obtain verbal permission to begin work. After the Navy's authorization to begin work, the SEC Donohue FTL will notify the NTC Point of Contact to inform him of the upcoming work.

5.4 GROUNDWATER AND LEACHATE SAMPLING PLAN

5.4.1 Introduction

Four grab groundwater samples will be collected from the four existing monitoring wells at the Supply-side Landfill. Leachate will be collected from three of the "watered out" gas vents present in the landfill and composited into one leachate sample. For the volatile organic compound (VOC) fraction, individual samples will be collected from each of the three gas vents. The locations of the monitoring wells and gas vents to be sampled are shown in Figure 5-2.

Groundwater levels will be measured in the four groundwater monitoring wells, the seventeen passive gas vents, and the four gas monitoring wells located east of Skokie Ditch. As part of this investigation, the elevation of each of these wells will be surveyed so that groundwater flow patterns can be evaluated.

Leachate samples and groundwater samples will be analyzed for the parameters presented in Table 5-1, the Sampling and Analysis Summary Table.

5.4.2 Equipment

The equipment to be used for groundwater and leachate sampling consists of:

- Submersible pump.
- Generator for submersible pump.
- Stainless steel or teflon bailers.
- Bailer rope.
- Electronic water level indicator or water level popper
- Field notebook.
- Field filtration apparatus including 0.45 micron filters.

329965

ESTIMATED LANDFILL LIMIT

POWER LINE

101

10

2

104

16

103

102

BUILDING 3503

SKOKIE DITCH

FLOW DIRECTION

TRAILER COURT

N

LEGEND

- GROUNDWATER SAMPLE LOCATION
- GAS MONITORING LOCATION
- LEACHATE COLLECTION LOCATION
- LANDFILL CAP GEOTECHNICAL SAMPLE

SCALE 1"= 100'

SEC DONOHUE
Environment & Infrastructure

SEPT. 1992

FIGURE 5-2
SUPPLY- SIDE LANDFILL
SAMPLE LOCATIONS

CTO #0062
20614

NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

TABLE 5–1

SAMPLING AND ANALYSIS SUMMARY TABLE
SUPPLY–SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Sample Matrix	Field Parameters	Laboratory Parameters	# Field Samples (4)	Field QC Samples			Lab QC Samples		
				(1) RB	(2) FB	(3) FD	LD	MSD	MS
LEACHATE	pH	TCL VOC	3	1	1	1	–	1	1
	Conductivity	TCL BNA	1	1	1	1	–	1	1
	Temperature	TCL Pest/PCB	1	1	1	1	–	1	1
		TAL Metals/CN	1	1	1	1	1	–	1
		BOD	1	1	1	1	1	–	1
		COD	1	1	1	1	1	–	1
		TOC	1	1	1	1	1	–	1
		TDS	1	1	1	1	1	–	1
		TSS	1	1	1	1	1	–	1
		Ammonia	1	1	1	1	1	–	1
		TKN	1	1	1	1	1	–	1
		O&G	1	1	1	1	1	–	1
		Major Ions (Filtered)							
		Ca	1	1	1	1	1	–	1
		Mg	1	1	1	1	1	–	1
		Na	1	1	1	1	1	–	1
		K	1	1	1	1	1	–	1
		Fe	1	1	1	1	1	–	1
		Mn	1	1	1	1	1	–	1
		SO_4	1	1	1	1	1	–	1
		Cl	1	1	1	1	1	–	1
		Alkalinity	1	1	1	1	1	–	1
GROUNDWATER	pH	TCL VOC	4	–	–	1	–	1	1
	Conductivity	TCL BNA	4	–	–	1	–	1	1
	Temperature	TCL Pest/PCB	4	–	–	1	–	1	1
		TAL Metals	4	–	–	1	1	–	1
		BOD	4	–	–	1	1	–	1
		COD	4	–	–	1	1	–	1
		TSS	4	–	–	1	1	–	1
		TKN	4	–	–	1	1	–	1
		O&G	4	–	–	1	1	–	1
		Major Ions (Filtered)							
		Ca	4	–	–	1	1	–	1
		Mg	4	–	–	1	1	–	1
		Na	4	–	–	1	1	–	1
		K	4	–	–	1	1	–	1
		Fe	4	–	–	1	1	–	1
		Mn	4	–	–	1	1	–	1
		Alkalinity	4	–	–	1	1	–	1

TABLE 5–1

SAMPLING AND ANALYSIS SUMMARY TABLE
SUPPLY–SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Sample Matrix	Field Parameters	Laboratory Parameters	# Field Samples (4)	Field QC Samples			Lab QC Samples		
				(1) RB	(2) FB	(3) FD	LD	MSD	MS
LANDFILL COVER SOIL	Depth of Cover	Grain Size	6	–	–	–	–	–	–
		Atterberg Limits	6	–	–	–	–	–	–
		Permeability	6	–	–	–	–	–	–
		Density	6	–	–	–	–	–	–
		Moisture Content	6	–	–	–	–	–	–

Notes:

One trip blank is required with every shipping container with soil or water samples for VOC analysis.
(1) Rinsate blanks will be collected at a rate of one per day. However, only samples from every other day will be analyzed. The sampling will designate which blank samples are to be analyzed.
(2) Field blanks will be prepared at a rate of one per source of decontamination water per sampling event.
(3) Field duplicate samples will be collected at a frequency of one per ten samples per matrix collected.
(4) Leachate samples will composited except for VOCs.

Acronyms/Abbreviations

BOD – Biological Oxygen Demand
BNA – Base/Neutral and Acid Extractable Compounds
Ca – Calcium
Cl – Chloride
CN – Cyanide
COD – Chemical Oxygen Demand
FB – Field Blank
FD – Field Duplicate
Fe – Iron
K – Potassium
Mg – Magnesium
Mn – Manganese
Na – Sodium
O&G – Oil and Grease
PCB – Polychlorinated Biphenyls
Pest – Pesticides
RB – Rinsate Blank
SO4 – Sulfate
TAL – Target Analyte List
TCL – Target Compound List
TDS – Total Dissolved Solids
TKN – Total Kjeldahl Nitrogen
TOC – Total Organic Carbon
TSS – Total Suspended Solids
VOC – Volatile Organic Compounds

- Conductivity meter.
- pH meter and calibration buffer solutions.
- Thermometer.
- Tap and distilled water (American Society for Testing and Materials (ASTM) Type II).
- Five-gallon buckets with lids for collecting and storing decontamination fluids.
- Alconox detergent.
- Sample tags and chain of custody forms.
- Plastic sheeting.
- Sample containers and preservatives.
- High density polyethylene (HDPE) filtration jugs.
- pH paper.
- Coolers.
- Blue ice or ice.

5.4.3 Sample Collection Procedures

In order to prevent contamination during transportation to the site, sampling equipment will be stored in clean plastic containers. A new sheet of plastic sheeting will be used at each sampling location to provide a clean surface on which to place sampling equipment during sample collection.

Well Purging

Well purging will be conducted prior to sample collection using either a submersible pump or a bailer. Before beginning the purging process, field meters will be calibrated according to manufacturer's specifications. The results of the meter calibrations will be recorded on Field Meter Instrument Calibration Logs (Appendix 5-A).

The purging process will begin by determining the volume of water to be removed from each groundwater monitoring well and each "watered out" gas vent. To calculate the well volume, the depths to the static water level and to the bottom of the well will be measured. The measuring tape will be rinsed with distilled water between measurements at each well. By using the depth to water, well depth, and well radius, the volume of standing water in the well (well volume) will be calculated using the following equation:

$$\text{Well volume (gallons)} = 3.14r^2 \times h \times 7.48 \text{ gallons/ft}^3$$

where r = well radius (feet) and h = water height (feet).

The purging process will then proceed until (1) the well has been purged dry, or until (2) a minimum of three well volumes have been removed and the water being removed from the well has the following characteristics:

- Water temperature is stabilized to $\pm 0.5^{\circ}$ C.
- pH is stabilized to ± 0.2 units.
- Conductivity is stabilized to ± 10 percent.

The above characteristics will be recorded on a Well Purging and Sample Collection Form (included in Appendix 5-A) before pumping begins and after each well volume is removed.

If the above requirements cannot be achieved, purging of groundwater monitoring wells will be considered complete after ten well volumes have been removed and purging of the "watered out" gas vents will be considered complete after five well volumes have been removed. Purge water will be containerized and may be discharged to the NTC sanitary sewer system. Prior permission will be obtained from NTC PWC for this discharge.

Leachate and Groundwater Sample Collection

Following the well purging process, groundwater and leachate samples will be collected with either the submersible pump or with a stainless steel or teflon bailer. The time between the completion of purging and collection of the sample is not to exceed 24 hours unless the rate of recovery of the well requires more time for the required sample volume to collect in the well.

Table 5-2 summarizes sample containers and preservatives to be used. Following the addition of the preservative to a sample, sample pH will be checked with pH paper to ensure that adequate preservative was added.

Samples for major ion analysis (Ca, Mg, Na, K, Fe, Mn, SO_4, Chloride, Alkalinity) will be collected in a HDPE filtration jug and field-filtered within 15 minutes of collection, or sooner, if possible. Following field filtering, the sample will be preserved. The pH of the preserved sample will be checked to ensure that adequate preservative was added.

Water Level Measurements

Water level and well depth measurements will be taken before and after well purging. Site conditions at the time of measurements, rain events, and well integrity will also be noted. Static water levels will be measured and recorded for the purpose of evaluating groundwater flow directions at the site. The water level surface will be measured using a popper or electronic water level indicator on the top of the inside well casing.

Measurements will be noted to the nearest 0.01 feet. Elevations of the wells will be established by survey with respect to mean sea level elevation with an adjusted accuracy of 0.01 feet.

5.4.4 Decontamination

The outer parts of the submersible pump which contact groundwater or leachate will be decontaminated between wells by: (1) Alconox and water wash, (2) tap water rinse, and (3) two distilled water rinses. The inner parts of the submersible pump will be cleaned between well locations by pumping 1 gallon of distilled water through the pump and tubing system. Note that all distilled water used for decontamination should be ASTM Type II.

Stainless steel or teflon bailers will be cleaned between wells by: 1) Alconox and water wash, 2) tap water rinse, and 3) two distilled water rinses.

The field filtration unit will be rinsed with distilled water.

Decontamination fluids will be retained in a closed container and may be discharged to the NTC sanitary sewer system with prior permission.

5.4.5 Quality Control

In order to verify the quality of the sampling process, field duplicates, rinsate blanks, and field blanks will be collected during the sampling process. The number of QC samples to be collected is listed in Table 5-1.

Field duplicate samples will be collected at the same time and in the same manner as the original samples at a rate of ten percent of samples collected, per sample matrix. Samples selected for matrix spike analysis will require triple the volume listed in Table 5-2.

Rinsate blank samples will be collected at a frequency of one sample per day by either pumping distilled water through the submersible pump, or by pouring distilled water into a decontaminated stainless steel or teflon bailer and then pouring the distilled water from the bailer into the appropriate bottles listed in Table 5-2. Rinsate blank samples will be analyzed by the laboratory every other day. The sampling team will specify which rinsate blank samples are to be analyzed.

Field blank samples will be collected from each source of water used for decontamination by pouring the source water directly in appropriate sample containers listed in Table 4-2.

TABLE 5–2
SAMPLE CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
SUPPLY–SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Sample Matrix	Lab Parameters	Containers	Preservatives	Holding Times
LEACHATE	TCL VOC	Three 40 ml vials	4 C HCl to pH < 2	14 days
	TCL BNA	Two 1–liter amber glass	4 C	7 days to extraction, 40 days to analysis
	TCL PEST/PCB	Two 1–liter amber glass	4 C	7 days to extraction, 40 days to analysis
	TAL Metals	One 1–liter HDPE	4 C, HNO3 to pH < 2	6 months, Hg 28 days
	CYANIDE	One 1–liter HDPE	4 C, NaOH to pH > 12	14 days
	BOD, TDS, TSS	One 1–liter HDPE	4 C	2 days
	COD, TOC	One 1–liter HDPE	4 C, H2S04 to pH < 2	28 days
	AMMONIA, TKN	One 1–liter HDPE	4 C, H2S04 to pH < 2	28 days
	O&G	One 1–liter glass	4 C, H2S04 to pH < 2	28 days
	Major Ions Ca Mg Na K Fe Mn	One 1–liter HDPE	4 C, HNO3 to pH < 2	6 months
	SO4, Cl	One 1–liter HDPE	4 C	28 days
	Alkalinity	One 1–liter HDPE	4 C	14 days
GROUNDWATER	TCL VOC	Three 40 ml vials	4 C, HCl to pH < 2	14 days
	TCL BNA	Two 1–liter amber glass	4 C	7 days to extraction, 40 days to analysis
	TCL PEST/PCB	Two 1–liter amber glass	4 C	7 days to extraction, 40 days to analysis
	TAL Metals	One 1–liter HDPE	4 C, HNO3 to pH < 2	6 months, Hg 28 days
	BOD	One 1–liter HDPE	4 C	2 days
	COD	One 1–liter HDPE	4 C, H2SO4 to pH < 2	28 days
	TSS	One 1–liter HDPE	4 C	7 days
	TKN	One 1–liter HDPE	4 C, H2SO4 to pH < 2	28 days
	O&G	One 1–liter glass	4 C, H2SO4 to pH < 2	28 days

TABLE 5–2
SAMPLE CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
SUPPLY–SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Sample Matrix	Lab Parameters	Containers	Preservatives	Holding Times
	Major Ions Ca Mg Na K Fe Mn	One 1–liter HDPE	4 C, HNO3 to pH < 2	6 months
	Alkalinity	One 1–liter HDPE	4 C	14 days
LANDFILL COVER SOIL	Grain Size, Atterberg Limits, Permeability, Density, and Moisture Content	Two 3–ft. Shelby tubes	None	None

Acronyms/Abbreviations

BOD – Biological Oxygen Demand
BNA – Base/Neutral and Acid Extractable Compounds
Ca – Calcium
Cl – Chloride
CN – Cyanide
COD – Chemical Oxygen Demand
FB – Field Blank
FD – Field Duplicate
Fe – Iron
K – Potassium
Mg – Magnesium
Mn – Manganese
Na – Sodium
O&G – Oil and Grease
PCB – Polychlorinated Biphenyls
Pest – Pesticides
RB – Rinsate Blank
SO4 – Sulfate
TAL – Target Analyte List
TCL – Target Compound List
TDS – Total Dissolved Solids
TKN – Total Kjeldahl Nitrogen
TOC – Total Organic Carbon
TSS – Total Suspended Solids
VOC – Volatile Organic Compound

5.4.6 Documentation

Data collected and observations made during groundwater sampling will be recorded on the following field documentation forms (Appendix 5-A):

- Daily Time Log
- Well Purging and Sample Collection Form
- Field Meter Instrument Calibration Log

5.5 LANDFILL COVER SOIL SAMPLING PLAN

5.5.1 Introduction

Six landfill cover soil samples will be collected for geotechnical testing from the locations shown on Figure 5-2. Each landfill cover sample will be tested for the geotechnical parameters presented in Table 5-1. The purpose of these samples is to determine whether the existing landfill cover complies with the site closure plan.

In addition to the six samples for geotechnical testing, approximately 20 hand auger holes will be made in the landfill cover. The purpose of these hand auger holes will be to classify the landfill cover soil according to Unified Soil Classification System (USCS) and to determine the average thickness of the landfill cover. After USCS classification is made, each hand auger hole will be filled in with the existing cover soil and tamped with hand tools.

A topographic survey of the Supply-side Landfill will be completed during the field investigation by a registered surveyor. A topographic map of the site will be generated which will allow SEC Donohue to determine the slopes of the existing landfill cover.

The following sections of this sampling plan detail the equipment and procedures to be followed for collecting the landfill cover samples for geotechnical testing.

5.5.2 Equipment

The following equipment and materials will be used to collect the landfill cover samples:

- Stainless steel hand auger
- 3-inch diameter, 3-ft. long, Shelby tube
- Sledgehammer
- Tap and distilled water

- Alconox soap
- Brushes
- Containers as indicated on Table 5-2
- Sample tags and chain of custody forms
- Stainless steel hand trowel
- Shovel
- Field notebook

5.5.3 Sample Collection Procedures

Six soil samples will be collected for geotechnical testing from the existing landfill cover at the approximate locations shown on Figure 5-2. Upon reaching a sample location, vegetation which hinders the collection of the sample will be cut away using a grass clipper. At each of the six sample locations two three-inch diameter, three-foot long Shelby tubes will be collected. Shelby tubes will be manually pushed into the landfill cap material if possible. If not possible, a sledgehammer will be used to pound the Shelby tubes into the landfill cover. The filled Shelby tubes will be removed from the cover by excavating the soil from around the filled tube and then manually withdrawing the tube.

5.5.4 Decontamination

Before sampling and between samples, sampling equipment (hand auger and shovel) will be decontaminated with: 1) Alconox soap and tap water wash, 2) a tap water rinse, and 3) two distilled water rinses. Shelby tubes will be decontaminated once, and then used to collect a sample. Shelby tubes will not be reused.

Decontamination fluids will be retained in a closed container and may be discharged to the NTC sanitary sewer system with prior permission.

5.5.5 Quality Control

Because landfill cover samples will not be subjected to chemical analysis, field quality control samples will not be collected.

5.5.6 Documentation

Data collected and observations made during sample collection will be recorded on appropriate field forms. Documentation will consist of:

- Daily Time Logs
- Photographs of sample locations
- Soils Data Form
- Entries in the field logbook

5.6 LANDFILL GAS MONITORING PLAN

5.6.1 Introduction

To monitor for off-site gas migration, one gas monitoring well has been installed north of the landfill, and four gas monitoring wells have been installed east of Skokie Ditch. The locations of these gas monitoring wells are shown on Figure 5-2. Gas monitoring instruments will be used to check these wells for the presence of organic vapors, methane, hydrogen sulfide and carbon monoxide.

5.6.2 Equipment

The following equipment will be needed to conduct gas monitoring:

- HNu photoionization detector
- Lumidor Gasponder IV Model PGM-14
- Atmospheric monitoring logs
- Field logbook

5.6.3 Procedures

The sampling team will remove the cover of each gas monitoring well and immediately insert the probes of the HNu photoionization detector and the Lumidor gas meter into the well. Screening will continue for five minutes at each well location. Instrument readings will be recorded on Atmospheric Monitoring Logs and in the field logbook.

5.6.4 Decontamination

Decontamination is not required.

5.6.5 Quality Control

The field logbook and field documentation forms will undergo an internal QC review by the Project Manager after the completion of field activities.

5.6.6 Documentation

Data collected and observations made during gas monitoring will be recorded as follows:

- On Atmospheric Monitoring Logs
- Entries in the field logbook

5.7 NEARBY BUILDING GAS SCREENING PLAN

5.7.1 Introduction

Screening for landfill gas will be conducted in buildings immediately north, south, and east of the Supply-side Landfill, to evaluate if any landfill gas has migrated off-site. This screening will be qualitative in nature, and will check for carbon monoxide (CO), methane, hydrogen sulfide (H_2S), and organic vapors. At this time, no data exists for the air quality in the basements of these buildings.

5.7.2 Equipment

1. Lumidor Gasponder IV Model PGM-14
2. HNu photoionization meter
3. Field notebook
4. Camera and film
5. Thermometer

5.7.3 Procedures

Once inside the basement of the building, the sampler should check for prominent cracks in the building foundation and floor drains or sumps. These areas will likely have the highest concentration of hydrogen sulfide and methane, if present at all. Once up to two areas have been selected in the basement, the Lumidor and HNu should be started and the following parameters recorded on the field Atmospheric Monitoring Log: location, date, time, and instrument readings. After the Lumidor and HNu have been allowed to equilibrate (approximately 5 to 10 minutes), the concentration of methane, organic vapor, and hydrogen sulfide should be recorded.

5.7.4 Decontamination

No decontamination is required.

5.7.5 Quality Control

Field documentation logs will undergo an internal QC review after the completion of field activities. Original field data will be reviewed for completeness, accuracy, and compliance with the FSP. Original field data will be stored on-site until completion of the field program at which time all documentation will be relinquished to the Project Manager.

5.7.6 Documentation

Data collected and observations made during the building gas screening will be recorded in a field notebook and on the following field documentation forms (Appendix 5-A):

1. Field Atmospheric Monitoring Log
2. Daily Time Log

Photographs of the building gas screening locations will be taken and filed with project documents.

5.8 SAMPLE IDENTIFICATION SYSTEM

Samples will be identified using the following system.

Field 1: NTC, Great Lakes and CTO62 identification ("GL62")

Field 2: Sample matrix:

CS - Landfill Cover Soil
GW - Groundwater
LEA - Leachate

Field 3: Sample Number (well number in the case of groundwater and leachate)

Examples of specific sample identifications are as follows:

GL62-CS-04	NTC, Great Lakes, Supply-side Landfill, Cover Soil sample 04.
GL62-LEA-02	NTC, Great Lakes, Supply-side Landfill, grab leachate sample collected from passive gas vent number 2.
GL62-LEA-Comp	NTC, Great Lakes, Supply-side Landfill, composite leachate sample collected from passive gas vents 2, 10 and 16.
GL62-GW-102	NTC, Great Lakes, Supply-side Landfill, groundwater sample collected from monitoring well 102.
GL62-GW-102D	NTC, Great Lakes, Supply-side Landfill, groundwater duplicate sample collected from monitoring well 102.

Rinsate blank samples will have an identification code of "RB" followed by a numerical code which will be assigned in sequential order (for example, sample GL62-RB-02 is the second rinsate blank sample collected during the project).

Field blank samples will have an identification code of "FB" followed by a numerical code which will be assigned in sequential order (for example, sample GL62-FB-03 is the third field blank sample collected during the project).

Trip blank samples will have an identification code of "TB" followed by a numerical code which will be assigned in sequential order (for example, sample GL62-TB-03 is the third trip blank sample collected during the project).

The FTL will describe in the field logbook and mark on a site map the location and sample identification of all samples collected during the project.

5.9 SAMPLE HANDLING

The FTL is responsible for the care and custody of the samples collected until they are given to a carrier for shipment to the laboratory.

A label will be affixed to the sample container of each soil sample to be submitted to the laboratory for chemical analysis. The following information shall be included on the sample label:

- Site name.
- Sample identification number using the previously identified system.
- Date and time of sample collection.
- Designation of the sample as a grab or composite.
- Sample matrix.
- The initials of the sampler.
- Sample preservative used, if any.
- The types of analyses to be conducted.

A Chain of Custody (COC) Form will be completed in the field and will accompany the samples at all times. An example COC Form is included in Appendix 5-A. The COC Forms will contain the following minimum information:

- Project name.
- Signature of samplers.
- Sample identification number.
- Grab or composite sample designation.

- Description of the sample location.
- Signatures of individuals involved in sample collection and packaging.
- Sample matrix.
- Preservative applied, if any.
- Sample analyses.
- Carrier airbill numbers.

COC Forms will be completed legibly using waterproof ink.

The FTL will ensure that a sample tracking logbook is maintained throughout the duration of the project. This sample logbook is separate from the field logbook. Information to be included in the sample tracking logbook includes:

- Date of sample collection.
- Time of sample collection.
- Initials of sampler.
- Sample identification number.
- Sample matrix.
- Analyses.
- Sample jar label number, if any.
- Date shipped.
- Laboratory.
- Carrier airbill number.

5.10 SAMPLE PACKAGING AND SHIPPING

Packaging of samples will be completed in the following manner:

An adhesive sample label will be attached to each sample container. Each sample container will then be placed in an appropriately sized Ziploc® bag and sealed. Bagged samples will be placed in foam shipping sleeves or wrapped with bubble wrap.

An appropriately sized, insulated, metal or plastic shipping container will be selected, and the drain plug will be taped on the inside and outside with Duct® tape. Samples (in sleeves or bubble wrap) will then be placed into the shipping container. To keep the samples at 4° C, the containers will be surrounded on the bottom, sides and top with ice. The ice will be placed in a Ziploc® bag so that water will not fill the cooler as the ice melts. COC Forms will be placed in plastic Ziploc® bags and taped to the inside of the shipping container lid.

The closed shipping container will be taped with reinforced strapping tape in two locations. Custody seals will be placed on opposite corners of the shipping container so that the seals will break if the shipping container is opened. The seals will be covered with clear tape.

A label marked "Environmental Samples" will be placed on top of the shipping container. Appropriate sides of the shipping container will be marked "This End Up" and arrows will be added accordingly.

Shipping containers will be shipped to the project laboratory on the same day that the samples were collected through a reliable commercial carrier, such as Federal Express, Emery, or Purolator. Arrangements will be made with the laboratory to accept Saturday delivery of samples.

5.11 WASTE DISPOSAL

It is anticipated that the following Investigative Derived Waste (IDW) will be generated during this project:

- Purge water.
- Decontamination fluids.
- Used personal protective equipment (PPE).

IDW will be handled in the following manner:

- Purge water. Water generated during the purging of wells will be containerized and may be discharged to the NTC sanitary sewer system with prior permission.

- Decontamination fluids. Decontamination fluids will be containerized and may be discharged to the NTC sanitary sewer system with prior permission.

- PPE. Used PPE will be bagged and placed into drums with appropriate labeling affixed. The drums will be disposed by the Navy. At the end of the field investigation, the FTL will provide the Activity Point of Contact with a written description of the quantity and contents of drums at the site.

APPENDIX 5-A

FIELD DOCUMENTATION FORMS

Date ___/___/___

Circle: Sun Mon Tue Wed Thu Fri Sat

Atmospheric Monitoring Log
Field Health and Safety

Site: _____ Project No.: _____

Site Safety Officer: _____

Action Levels: D ☐ ——→ C ☐ ——→ B ☐ ——→ (Stop work call in for instructions)

(Check box and write in levels for upgrade)

Task/Equipment: _____

Weather: _____

Time	OVA PPM	HNu PPM	O_2 %	LEL %	H_2S PPM		Comments: Duration of Readings, Upgrades, Location, etc.

Additional Comments: _____

_____

_____

_____

Signature: _____

Donohue ENGINEERS ARCHITECTS SCIENTISTS

Chain of Custody Record

Check delivery method:
- ☐ Samples delivered in person
- ☐ Donohue courier
- ☐ Common carrier
- ☐ Mail

Custody Seal #

Project Number	Project Name/Client
Samplers: (Signature)	

Item No.	Sample Description (Field ID Number)	Date	Time	Grab	Comp.	Lab Sample Number	Container Number	Analysis Required																		Matrix	
																										Sample Type (Water, Soil) etc.	Sample Container
1																											
2																											
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											
11																											
12																											
13																											
14																											
15																											
16																											

X-Field Filtered
X-Susp. Hazard Mtrl.

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Disposed of by: (Signature)	Items:	Date/Time
Relinquished by: (Signature)	Date/Time	Received by: (Signature) [Laboratory]	Disposed of by: (Signature)	Items:	Date/Time

Send Lab Results To:	Remarks:	Laboratory Receiving Notes:
		Custody Seal Intact?
		Temp. of Shipping Container:
		Sample Condition:

White Copy – Lab Yellow Copy – File Pink Copy – Client

M/F/Ruechel/Chain of Custody

FIELD METER
INSTRUMENT CALIBRATION LOG:
pH METER

	4.0 BUFFER		7.0 BUFFER		10.0 BUFFER			
Date Calibrated	True Value	Meter Reading	True Value	Meter Reading	True Value	Meter Reading	Adjustments	CAL By

COMMENTS: _____

pH Meter: MFG _____ Model _____ EPA ID # _____

Buffers: 4 Source _____ Date Opened _____

7 Source _____ Date Opened _____

10 Source _____ Date Opened _____

INSTRUMENT CALIBRATION LOG

INSTRUMENT: _____

Date Calibrated	Known Standard	Actual Instrument Reading	Adjustments Made	Calibrated By	Comments

COMMENTS: _____

ENGINEERS
ARCHITECTS
SCIENTISTS

Project: _____
Project Location: _____
Project No.: _____
Site Safety Officer: _____
Date: _____
Page No.: _____

Daily Sign–In/Out Log

Time				
In	Out	Name	Firm	Purpose On–Site

Note: This form is to be completed on a daily basis by all personnel working on the site.

Donohue ENGINEERS ARCHITECTS SCIENTISTS

Site Safety Meeting

Project _____ Date _____

Project Number _____ Time _____

Meeting Conducted By _____ _____
Name Signature

Summary of Items Discussed _____

_____

_____

_____

_____

Personnel Present

	Name	Representing	Signature
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

SHEET ____ OF ____

Donohue **Soils Data Form** **Soil Sample Area** _____

Soil Subsample _____

Engineers & Architects & Scientists **Site** _____ **Project No.** _____

DATE _____

TIME _____

COLLECTOR _____

_____

SAMPLE DEPTH _____

_____

_____

_____

PHYSICAL DESCRIPTION OF SUBSAMPLING LOCATION: _____

DESCRIPTION OF SUBSAMPLE: _____

ANY OTHER CHARACTERISTICS OF NOTE: _____

DONOHUE

WATER ELEVATION

PROJECT NO _____ SITE _____

WELL NUMBER	ELEVATION OF TOP OF PIPE	DEPTH TO WATER	WATER ELEVATION	DEPTH TO BOTTOM	WELL INTEGRITY				COMMENTS
					LOCKED	CAPPED	CRACKED	OBSTRUCT	

DESCRIPTION OF SITE _____

SOIL CONDITIONS _____

WEATHER _____ TEMPERATURE _____

ENTERED ON COMPUTER ___ SIGNATURE _____ DATE _____

Donohue
Engineers & Architects

Well Development

Project No. _____ Site _____

Method of Development Pumped _____ Bailed _____ Blown _____ Surge Block _____

Equipment _____ Airlift _____ N2 Lift _____ In. Bailer _____ Length _____ Ft. Material _____

Pump _____ Manufacturer _____ Diameter _____

Description of site (weather, temp, soil conditions) _____

Well No / Time	Depth to Water	Depth to Bottom	Volume Removed (gal.)	Depth After	pH	Cond.	Color	Odor Y/N	Temp.	Turbidity	Comments

Additional Notes: _____

Entered on computer _____ Signature _____ Date ___/___/___

Dunlobue ENGINEERS ARCHITECTS SCIENTISTS

Well Purging and Sample Collection

Well No. ( )

Project No.: _____ Site: _____

Purging Method: Pumped ☐ Bailed ☐ Other: _____

Pump Type: _____ Bailer Type: _____

Weather Conditions: _____

Volume Calculation: _____

(D.T.B. – D.T.W. x vol./ft. = Gals./well vol.) Gals./well vol.: _____

Time	Depth to Water (D.T.W.)	Depth to Bottom (D.T.B.)	Volume Removed (gal.)	pH	Cond.	Temp.	Color	Odor Y/N	Turbidity
		Sample Readings							

Comments: _____

_____

_____

Inside Diameter	vol./ft.
1"	0.04
1.25"	0.06
2"	0.16
4"	0.65

Field Blank Taken ☐ Time: _____

Well Duplicated ☐ No. _____

HNu/PPM	LEL/%	O2/%	H2S/PPM	CO/PPM	

Signature: _____

Date: ____/____/____

FIELD FORM

6.0 QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) describes the policies, organization, goals, functional activities (sample collection, chemical analyses, etc.), and generally accepted QA/QC protocols required to achieve the Data Quality Objective (DQO) for the Supply-side Landfill investigation at NTC, Great Lakes.

The project objectives are presented in Section 3.1 of this document. Project organization and responsibility is presented in Section 5.3 of this document.

6.1 QUALITY ASSURANCE OBJECTIVES

Achieving the intended project objectives requires the data collected from the field conform to an appropriate level of quality. The quality of a data set is measured by certain characteristics of the data: precision, accuracy, representativeness, completeness, and comparability (PARCC). The PARCC goals for a particular project are determined by the intended use of the data, referred to as DQOs. The DQO for this project is discussed in Section 6.1.1 and the PARCC parameters are discussed in Section 6.1.2. All laboratory analyses will be performed by a laboratory that has been approved by Naval Energy and Environmental Support Activity (NEESA).

6.1.1 Data Quality Objective

The DQO level proposed for this project is Level C, as defined by NEESA in "Sampling and Chemical Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA 20.2-047B 6/88).

Level C is to be used for sites near a populated area, not on the National Priorities List, and not likely to be undergoing litigation. Level C includes review of laboratory QA and the site Work Plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports on QA. The laboratory must have passed the performance sample furnished by the Superfund Contract Laboratory Program (CLP) in the past year (NEESA, 1988).

6.1.2 PARCC Parameters

The PARCC goals for the work covered by this Work Plan are discussed in the following sections. The information obtained in reviewing the PARCC parameters will be incorporated into the project investigation report.

6.1.2.1 Precision and Accuracy

Precision and accuracy characterize the amount of variability and bias inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for a sample under the same or similar conditions. Precision is expressed as a range (the difference between two measurements of the same parameter) or as a relative percent difference (RPD). Range and RPD values are calculated as follows:

$$\text{Range} = OR - DR$$

and

$$RPD = \frac{OR - DR}{(OR + DR)} \times 100\%$$

where:

OR = original sample result
DR = duplicate sample result

The internal laboratory control limits for precision are three times the standard deviation of a series of RPD or range values. RPD values may be calculated for both laboratory and field duplicates, and can be compared to the control limits as a QA check.

Accuracy is expressed as a percent recovery (%R). Percent recoveries are derived from analysis of standards spiked into deionized water (standard recovery) or into actual samples (matrix spike or surrogate spike recovery). Recovery is calculated as follows:

$$\%R = \frac{E}{T} \times 100\%$$

where:

E = Experimental result
T = True value or theoretical result

with

$$T = \frac{(\text{Sample aliquot})(\text{Sample conc.}) + (\text{Spike aliquot})(\text{Spike conc.})}{(\text{Sample aliquot})}$$

Control limits for accuracy are set at the mean plus or minus three times the standard deviation of a series of %R values. Organic %R values are set at the mean plus or minus two times the standard deviation.

Field and laboratory precision and accuracy performance can affect the attainment of project objectives, particularly when compliance with established criteria is based on laboratory analysis of environmental samples. Such criteria are used in risk assessment and screening of remedial alternatives.

Analytical precision and accuracy will be evaluated upon receipt of the laboratory data. Analytical precision will be measured as the relative standard deviation of the data from the laboratory (internal) duplicates. Analytical accuracy measures the bias as the percent R from matrix spike and surrogate spike samples.

Field sampling precision and accuracy are not easily measured. Field contamination, sample preservation, and sample handling will affect precision and accuracy. By following the procedures described in the FSP, precision and accuracy errors associated with field activities can be minimized. Field duplicates, equipment rinsate blanks, and field blanks will be used to estimate field sampling and accuracy.

No project resources will be expended to develop precision and accuracy data for method (field or analytical) validation except those commonly applied for collection of routine QA/QC data. Routine QA/QC data will include analyses from field duplicates and equipment rinsate blanks based on the existing guidance that specifies the type and proportion of samples submitted for QA/QC (NEESA, 1988).

Validity of data with respect to its intended use will be assessed based on laboratory-supplied QA/QC data and protocols outlined in USEPA's National Functional Guidelines for Validating Data. In general, results that are rejected by the validation process will be disqualified from application to the intended use. Qualified data will be used to the greatest extent practicable.

6.1.2.2 Representativeness

Representativeness describes the degree to which analytical data accurately and precisely define the material being measured. Several elements of the sampling and sample handling process must be controlled to maximize the representativeness of the analytical data. Sample collection, preservation, and storage are discussed in Section 5.0 of this document. The sampling program is designed to ensure that the data obtained during the this investigation accurately represent the site conditions.

6.1.2.3 Completeness

Completeness describes the amount of data generated that meets the objectives for precision, accuracy, and representativeness versus the amount of data expected to be obtained. For relatively clean, homogeneous matrices, 100 percent completeness is expected. However, as matrix complexity and heterogenicity increase, completeness may decrease. Where analysis is precluded or where DQOs are compromised, effects on the overall investigation must be considered. Whether or not any particular sample is critical to the investigation will be evaluated in terms of the sample location, the parameter in question and the intended data use.

6.1.2.4 Comparability

An objective of the QAPP is to provide analytical data of comparable quality between sample locations. Both analytical procedures and sample collection techniques will maximize the comparability of the data collected within this investigation.

6.1.3 Quality Control Samples

The QC samples to be collected during the sampling effort are identified below. Each type of field quality control sample will undergo the same preservation, holding times, analysis, reporting, and validation as the field samples. Field QC samples will be collected in accordance with "Sampling and Chemical Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA 20.2-047B 6/88). Table 5-1 in the FSP presents a summary of QA/QC samples to be collected for the Supply-side Landfill investigation.

6.1.3.1 Field Duplicates

Field duplicate results are used to assess the combined field and laboratory precision. Field duplicate samples will be collected at a frequency of ten percent per sample matrix. Field duplicate results will be compared to assess sample homogeneity, handling, shipping, storage, preparation, and analysis.

6.1.3.2 Trip Blanks

Trip blanks are defined as samples which originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory for VOC analysis. Trip blanks will be collected and analyzed at the rate of one trip blank per shipping container containing samples for VOC analysis.

6.1.3.3 Equipment Rinsate Blanks

Equipment rinsate blanks are obtained under representative field conditions by running analyte-free deionized water through sample collection equipment after decontamination and prior to use, and collecting the runoff in the appropriate sample containers for analysis. These samples are used to assess the effectiveness of decontamination procedures. Rinsate blanks will be prepared at the rate of one per day per matrix during sampling events. However, only samples from every other day will be analyzed. The sampling team will specify which rinsate blank samples are to be analyzed. Rinsate blanks will be analyzed for the same parameters as the related samples.

6.1.3.4 Field Blanks

Field blanks will consist of the source water used in decontamination and will be prepared at the rate of one per source of water per sampling event. Field blanks will be analyzed for the same parameters as the related samples.

6.1.3.5 Method Blanks

Method blanks are generated within the laboratory during the processing of the actual samples. These blanks are processed using the same reagents and procedures and at the same time as the actual samples. Contamination found in a method blank would indicate that similar contamination found in the samples may have been introduced in the laboratory and is not actually present in the original samples. Method blanks will be prepared and analyzed for VOCs at a frequency of one per analytical batch, or one per 12-hour analysis period, whichever is greater. Method blanks will be prepared and analyzed for all other samples at a frequency of one per 20 samples or one per day, whichever is greater.

6.1.3.6 Laboratory Duplicates

Duplicate samples prepared in the laboratory account for analytical variability, only. Laboratory duplicates are prepared by splitting duplicate samples and analyzing the resulting samples following the same procedures.

For organic analyses, the laboratory duplicates are analyzed as field duplicates and matrix spike/matrix spike duplicates, as discussed in Section 6.1.3.1 and 6.1.3.7. Assessment of duplicate results will be consistent with USEPA and NEESA guidelines.

For inorganic analyses, laboratory duplicates will be analyzed from each group of samples of a similar matrix type and concentration. Laboratory duplicate results will be assessed in accordance with USEPA and NEESA guidelines.

6.1.3.7 Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MS) are prepared by adding a known quantity of analyte into an actual field sample. The MS is prepared and processed as specified in the cited methods (Table 6-1). Recovery of the spike reflects the ability to accurately determine the quantity of the analyte in that particular sample.

MS results are expressed in terms of percent recoveries. MS recoveries must fall within the established control limits specified in the cited methods (Table 6-1).

Matrix spike duplicates (MSD) are identical to MS. Another aliquot of the same field sample used for the MS is fortified with an identical quantity of analyte and processed in an identical manner. In addition to providing a measure of the accuracy of the determination, the results of the MS and MSD provide a measure of the precision of the determinations. The precision is expressed as the RPD. RPDs must fall within the established control limits specified in the cited methods (Table 6-1).

Samples for MS/MSD analyses will be collected at a frequency of 5% (1 MS/MSD sample per 20 field samples).

6.2 SAMPLING PROCEDURES

Field sampling will be conducted in accordance with the applicable sections of the FSP. Allowable sample holding times, preservation, and sample container requirements are outlined in Table 5-2 in the FSP.

6.3 SAMPLE IDENTIFICATION

As samples are collected and containerized in the field, a label will be affixed to the sample jars. The information to be recorded on the sample labels is listed in Section 5.9 of the FSP.

Each sample will be identified by a unique alphanumeric code which is described in the FSP. Information necessary to identity each sample, and the corresponding sample code, will be recorded in the field logbook. Sampling locations will be recorded on a scale map of the site.

After collection, preservations and labeling, the sample will be maintained under the COC procedures discussed below.

6.4 CHAIN OF CUSTODY PROCEDURES

COC procedures are intended to maintain and permanently document sample possession from the time of collection to disposal, in accordance with federal guidelines. A sample is considered to be under custody if:

- It is in the possession of the sampler/analyst.
- It is in view, after being in the possession of the sampler/analyst.
- It was in possession of the sampler/analyst and was then placed by the sampler/analyst in a secure location.
- It is in a designated secure area.

The COC Form will be initiated in the field for all samples collected. The information to be recorded on the COC Form is listed in Section 5.9 of the FSP.

The sample custodian will: sign; enter the date, time, and custody seal numbers on the COC Form; tear off and retain the pink copy; and place the white (original) and yellow copies in a sealed plastic bag that is taped to the inside lid of the shipping container. Each shipping container will be sealed with custody seals, which are signed and dated by the sample custodian.

The sample custodian will sign and date the COC Form when they assume custody of the sample container, and again when they have relinquished custody to someone else. The shipper's waybill or airbill will be retained by the sample custodian prior to shipment.

The laboratory sample custodian will receive and sign the COC Form for the laboratory, and record the date, time, and custody seal numbers. The laboratory log-in record will explicitly state the condition of the custody seals, any evidence of damage, whether the seal is secure, and the completeness of accompanying records. After inspection, each sample will be logged in and assigned a unique laboratory sample identification number. In addition, the following information will be entered in the logging system for each sample:

- Field sample identification number.
- Date received.
- Project name and number.
- Collection date.
- Sample type.
- Condition of sample.
- Sample pH.
- Temperature of sample cooler (if samples were stored on ice).
- Analyses to be performed.
- Assigned storage location.

The laboratory sample custodian will notify the laboratory project director if samples are received that are damaged, warm, frozen, or incompletely documented. The laboratory project director or laboratory program coordinator will contact the Project Manager with any discrepancies. If samples cannot be analyzed within the holding times, the Project Manager will be notified so recollection can occur as necessary.

6.5 CALIBRATION PROCEDURES

6.5.1 Field Instrumentation

Field equipment requiring calibration will be calibrated and operated in accordance with the manufacturer's instructions and manuals. At a minimum, calibration will be performed at the start of field activities each day. Recalibration will take place as necessary during the course of each day. The calibration results for each field instrument will be recorded in the field logbook and on appropriate field data sheets.

6.5.2 Laboratory Instrumentation

Calibration is required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet the necessary detection limits. For this project, all samples will be analyzed for the parameters identified in Table 5-1. All laboratory instrumentation will be calibrated according to the method being utilized. Once a laboratory has been selected for this project, a copy of the laboratory's QA program manual will be supplied to the Navy RPM.

6.6 ANALYTICAL PROCEDURES

Environmental samples collected during the field investigations covered by this Work Plan will be analyzed by a NEESA-approved laboratory under a Basic Ordering Agreement (BOA) with HALLIBURTON NUS. All analytical procedures will conform to established methods approved by USEPA and meet NEESA Level C as defined by "Sampling and Chemical Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA 20.2-047B 6/88). The methods of analysis are those shown in Table 6-1. Tables 6-2 through 6-6 provide specific compounds for analysis and their associated quantitation or detection limits. Sample quantitation limits are highly matrix-dependent. The expected quantitation and detection limits listed herein are provided for laboratory guidance and may not always be achieveable.

TABLE 6-1

ANALYTICAL METHODS
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Parameter	Source	Method
TCL VOC	SW-846	8240
TCL BNA	SW-846	8270
TCL Pest/PCB	SW-846	8080
TAL Metals	SW-846	6010
Arsenic	SW-846	7060
Lead	SW-846	7421
Selenium	SW-846	7740
Mercury	SW-846	7470
Thallium	SW-846	7841
Cyanide	E	335.2
BOD	SM	5210B
COD (Low)	E	410.2
COD (Medium)	E	410.1
TOC	E	415.1
TDS	E	160.2
TSS	E	160.1
Oil & Grease	SW-846	9070
Ammonia	E	350.2
TKN	E	351.3
Sulfate	E	375.4
Chloride	E	325.2
Alkalinity	E	310.1
Geotechnical	ASTM	

Methods:

SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA, 1986.
E - Methods for the Chemical Analysis of Water and Waste, EPA, March 1973.
SM - Standard Methods for the Examination of Water and Wastewater, 17th Edition, 1989, APHA.
ASTM - American Society for Testing and Materials.

TABLE 6-1 (Continued)

ANALYTICAL METHODS
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Acronyms:

BOD - Biological Oxygen Demand
BNA - Base/Neutral and Acid Extractable compounds
COD - Chemical Oxygen Demand
TAL - Target Analyte List
TCL - Target Compound List
TDS - Total Dissolved Solids
TKN - Total Kjeldahl Nitrogen
TOC - Total Organic Carbon
TSS - Total Suspended Solids
VOC - Volatile Organic Compound

TABLE 6-2

TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QLs)
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Volatile Organics	CAS Number	Quantitation Limits(ug/l)
Benzene	71-43-2	5
Bromdichloromethane	75-27-4	5
Bromoform	75-25-2	5
Bromomethane	74-83-9	10
Carbon Tetrachloride	56-23-5	5
Chlorobenzene	108-90-7	5
Chloroethane	75-00-3	10
2-Chloroethyl Vinyl Ether	110-75-8	10
Chloroform	67-66-3	5
Chloromethane	74-87-3	10
Dibromochloromethane	124-48-1	5
1,1-Dichloroethane	75-34-3	5
1,2-Dichloroethane	107-06-2	5
1,1-Dichloroethene	75-35-4	5
trans-1,2-Dichloroethene	156-60-5	5
1,2-Dichloropropane	78-87-5	5
Cis-1,3-Dichloropropene	10061-01-5	5
Trans-1,3-Dichloropropene	10061-02-6	5
Ethyl Benzene	100-41-4	5
Methylene Chloride (1)	75-09-2	5
1,1,2,2-Tetrachloroethane	79-34-5	5
Tetrachloroethene	127-18-4	5
Toluene (1)	108-88-3	5
1,1,1-Trichloroethane	71-55-6	5
1,1,2-Trichloroethane	79-00-5	5
Trichloroethene	79-01-6	5
Vinyl Chloride	75-01-4	10
Acetone (1)	67-64-1	100
Carbon Disulfide	75-15-0	5
2-Butanone (1)	78-93-3	100
Vinyl Acetate	108-05-4	50

TABLE 6-2 (Continued)

TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QLs)
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Volatile Organics	CAS Number	Quantitation Limits(ug/l)
4-Methyl-2-Pentanone	108-10-1	50
2-Hexanone	519-78-6	50
Styrene	100-42-5	5
Total Xylenes (2)	100-42-5	5

NOTES:

(1) Common laboratory solvent. Control limits for blanks are 5 times the method detection limits.

(2) m-Xylene, o-Xylene and p-Xylene are reported as a total of the three.

TABLE 6-3

TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QLs)
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Semivolatiles	CAS Number	Quantitation Limits(ug/l)
Bis(2-chloroethyl) ether	111-44-4	10
Phenol	108-95-2	10
2-Chlorophenol	95-57-8	10
1,3-Dichlorobenzene	541-73-1	10
1,4-Dichlorobenzene	106-46-7	10
1,2-Dichlorobenzene	95-50-1	10
Benzyl Alcohol	100-51-6	20
Bis(2-chloroisopropyl) ether	39638-32-9	10
2-Methyl Phenol	95-48-7	10
Hexachloroethane	67-72-1	10
N-Nitroso-Di-N-propylamine	621-64-7	10
Nitrobenzene	98-95-3	10
4-Methylphenol	106-44-5	10
Isophorone	78-59-1	10
2-Nitrophenol	88-75-5	10
2,4-Dimethylphenol	105-57-9	10
Bis(2-chloroethoxy) Methane	111-91-1	10
2,4-Dichlorophenol	120-83-2	10
1,2,4-Trichlorobenzene	120-82-1	10
Naphthalene	91-20-3	10
4-Chloroaniline	106-47-8	20
Hexachlorobutadiene	87-68-3	10
Benzoic Acid	65-85-0	50
2-Methyl Naphthalene	91-57-6	10
4-Chloro-3-Methylphenol	59-50-7	20
Hexachlorocyclopentadiene	77-47-4	10
2,4,6-Trichlorophenol	88-06-2	10
2,4,5-Trichlorophenol	95-95-4	10
2-ChloroNaphthalene	91-58-7	10
Acenaphthylene	208-96-8	10
Dimethyl Phthalate	131-11-3	10
2,6-Dinitrotoluene	606-20-2	10
Acenaphthene	83-32-9	10

TABLE 6-3 (Continued)

TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QLs)
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Semivolatiles	CAS Number	Quantitation Limits(ug/l)
3-Nitroaniline	99-09-2	50
Dibenzofuran	132-64-9	10
2,4-Dinitrophenol	51-28-5	50
2,4-Dinitrotoluene	121-14-2	10
Fluorene	86-73-7	10
4-Nitrophenol	100-02-7	50
4-Chlorophenyl Phenyl Ether	7005-72-3	10
Diethyl Phthalate	84-66-2	10
4,6-Dinitro-2-Methylphenol	534-52-1	50
N-Nitrosodiphenylamine (1)	86-30-6	10
4-Nitroaniline	100-01-6	50
4-Bromophenyl Phenyl ether	101-55-3	10
Hexachlorobenzene	118-74-1	10
Pentachlorophenol	87-86-5	50
Phenanthrene	85-01-8	10
Anthracene	120-12-7	10
Di-n-Butyl Phthalate	84-74-2	10
Fluoranthene	206-44-0	10
Pyrene	129-00-0	10
Butyl Benzyl Phthalate	85-68-7	10
3,3'-Dichlorobenzidine	91-94-1	20
Chrysene (2)	218-01-9	10
Benzo(a)Anthracene (2)	56-55-3	10
Bis(2-Ethylhexyl) Phthalate	117-81-7	10
Di-n-Octyl Phthalate	117-84-0	10
Benzo(b)Fluoranthene (3)	205-99-2	10
Benzo(k)Fluoranthene (3)	207-08-9	10
Benzo(a) Pyrene	50-32-8	10
Indeno(1,2,3-cd) Pyrene	193-39-5	10
Dibenzo(a,h) Anthracene	53-70-3	10
Benzo(g,h,i) Perylene	191-24-2	10
2-Nitroaniline	88-74-4	50

NOTE: (1), (2), (3) These two compounds are reported as a total.

TABLE 6-4

TARGET COMPOUND LIST (TCL) AND QUANTITATION LIMITS (QLs)
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Pesticides/PCBs	CAS Number	Quantitation Limits(ug/l)
alpha-BHC	319-84-6	0.03
Beta-BHC	319-85-7	0.06
delta-BHC	319-86-8	0.09
Gamma-BHC (Lindane)	58-89-9	0.04
Heptachlor	76-44-8	0.03
Aldrin	309-00-2	0.04
Heptachlor epoxide	1024-57-3	0.83
Endosulfan I	959-98-8	0.14
Dieldrin	60-57-1	0.02
4,4'-DDE	72-55-9	0.04
Endrin	72-20-8	0.06
Endosulfan II	33213-65-9	0.04
4,4'-DDD	72-54-8	0.11
Endosulfan Sulfate	1031-07-8	0.66
4,4'-DDT	50-29-3	0.12
Endrin Aldehyde		0.23
Methoxychlor	72-43-5	1.76
Chlordane (technical)	(mpr)	0.14
Toxaphene	8001-35-2	2.4
Aroclor-1016	12674-11-2	1.0
Aroclor-1221	11104-28-2	1.0
Aroclor-1232	11141-16-5	1.0
Aroclor-1242	53469-21-9	1.0
Aroclor 1248	12672-29-6	1.0
Aroclor-1254	11097-69-1	1.0
Aroclor-1260	11096-82-5	1.0

(mpr) - Multiple peak response, alpha and gamma isomers included.

TABLE 6-5

TARGET ANALYTE LIST (TAL) AND DETECTION LIMITS (DLs)
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Element	Detection Limits (ug/L)*	Analytical Method
Aluminum (Al)	45	ICP
Antimony (Sb)	32	ICP
Arsenic (As)	5	GFAA
Barium (Ba)	200	ICP
Beryllium (Be)	0.3	ICP
Boron (B)	5	ICP
Cadmium (Cd)	4	ICP
Calcium (Ca)	10	ICP
Chromium (Cr)	7	ICP
Cobalt (Co)	7	ICP
Copper (Cu)	6	ICP
Iron (Fe)	7	ICP
Lead (Pb)	5	GFAA
Mangnesium (Mg)	30	ICP
Manganese (Mn)	2	ICP
Mercury (Hg)	0.2	Cold Vapor AA
Molybdenum (Mo)	8	ICP
Nickel (Ni)	15	ICP
Potassium (K)	100	ICP
Selenium (Se)	5	GFAA
Silicon (Si)	58	ICP
Silver (Ag)	7	ICP
Sodium (Na)	100	ICP
Thallium (Tl)	10	GFAA
Vanadium (V)	8	ICP
Zinc (Zn)	2	ICP

* Detection limits are determined in reagent water.

Methods:
- AA - Atomic Absorption
- GFAA - Graphite Furnace Atomic Adsorption
- ICP - Inductively Coupled Plasma

TABLE 6-6

INORGANIC ANALYTE LIST AND QUANTITATION LIMITS (QLs)
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Parameter	Quantitation Limits (mg/L)
Ammonia Nitrogen	0.1
Alkalinity	2
BOD (Biochemical Oxygen Demand)	10
Chloride	5
COD (Chemical Oxygen Demand - Low)	5
COD (Chemical Oxygen Demand - Medium)	50
Cyanide	0.01
Oil & Grease	5
Sulfate	5
TKN (Total Kjeldahl Nitrogen)	0.1
TOC (Total Organic Carbon)	1
TDS (Total Dissolved Solids)	20
TSS (Total Suspended Solids)	5

6.7 DATA REDUCTION, VALIDATION, AND REPORTING

6.7.1 Laboratory Data Review

The Laboratory QC Coordinator will be responsible for performing data review in the laboratory. The precision and accuracy of data will be computed and compared to the control limits as part of the data review process. Precision is determined from the analytical results of duplicate samples. Accuracy is computed from spike recoveries.

6.7.2 Analytical Records

All results will be reported in accordance with the referenced methodology (Table 6-1) and should include all deliverables as outlined in Section 6.7.3.

6.7.3 Data Deliverables

A report narrative should accompany each submission, summarizing the contents, results and all relevant circumstances of the work. The following data deliverables are required from the laboratory:

- Analyses requested.
- Sample Identification
  - Date and time collected.
  - Date extracted and/or digested.
  - Date and time analyzed.
  - COC documentation; including sample login tracking information.
- Sample Results
  - Sample results.
  - Field duplicate results.
  - Laboratory blanks, field blanks, and trip blanks results.
  - Matrix spike/matrix spike duplicate and/or blank spike results.
  - Surrogate recoveries, if applicable.
- Support QA/QC
  - Methodology.
  - Method detection limits.
  - Initial and continuing calibration summaries; including standard chromatograms and integration tables.
  - Preparation procedures used, if applicable.
  - Cleanup procedures used, if applicable.
  - Laboratory QA/QC procedures and checklists.

6.7.4 Data Validation

Data validation is a process of review of the analytical results and documentation against established criteria. Validation of all data generated as part of this field investigation will be performed in accordance with HALLIBURTON NUS and USEPA guidelines. USEPA guidelines are presented in the following documents:

- National Functional Guidelines for Organic Data Review, USEPA Draft, December 1990, Revised June, 1991.
- Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses, USEPA, February 1, 1988.
- Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, USEPA, July 1, 1988.

Validation of data generated from non-Contract Laboratory Program (CLP) methods will involve thorough review of the method specified QA/QC criteria, including method blanks, field blanks, instrument calibration, spikes and duplicates.

Validation will be performed by SEC Donohue and will include a QA assessment to assess that the proper analytical and QA/QC protocols were followed by the laboratory. Data qualifiers will be reviewed by the data validator and specific data validation qualifiers will be added to data spreadsheets.

6.8 DATA ASSESSMENT PROCEDURES

Analytical data will be evaluated for precision, accuracy, and completeness. The acceptability of the analytical precision and accuracy will be determined by comparing to the control limits recommended in the methods. Data determined to be insufficiently precise or accurate will be subject to the corrective action prescribed by the appropriate analytical method. The QC samples used in the determination of precision and accuracy were previously described in Section 6.1.3.

6.9 INTERNAL QUALITY CONTROL

QC samples will be collected in the field to assess sampling precision and accuracy. The types and frequency of QC samples that will be prepared during this field investigation are discussed in Section 6.1.3. A summary of the QC samples to be collected is presented in Table 5-1.

Internal laboratory QC checks include matrix spike and matrix spike duplicate analysis, sample duplicate analysis, method blank analysis, and system monitoring compounds (surrogate) recoveries. Laboratory QC procedures will be performed in accordance with USEPA requirements and NEESA Level C.

6.10 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and QAPP.

6.10.1 Field Audits

An audit of field activities (sampling and measurements) will be conducted by the Project Manager. The audit will include examination of field sampling records, sample collection, sample handling and packaging, and COC procedures. The audit will occur at the onset of the project to verify that all established procedures are followed. A follow-up audit may be conducted to verify that deficiencies were corrected and QA procedures are maintained throughout the investigation.

6.10.2 Laboratory Audits

The performance and system audits of the laboratory will be conducted by NEESA personnel. Additional audits may be conducted by the HALLIBURTON NUS Team QA Advisor. The system audits, which will be performed on an annual basis, will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. The performance audits will be conducted annually, but may be conducted on a quarterly basis. The analytical results of performance samples will be evaluated to ensure the laboratory maintains a good performance.

6.11 PREVENTIVE MAINTENANCE

Field measurement equipment will be maintained in accordance with the manufacturer's instructions. The SEC Donohue field equipment maintenance program consists of the following elements:

- The equipment manager keeps an inventory of the equipment in terms of items (model and serial number), quantity, and conditions. Each item of equipment is signed out when in use, and its operating condition and cleanliness checked upon return.

- The equipment manager conducts routine checks on the status of equipment and is responsible for the stocking of spare parts and equipment readiness.

- The equipment manager maintains the equipment manual library and trains field personnel in the proper use and care of equipment.

- The FTL is responsible for working with the equipment manager to make sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the job site.

6.12 CORRECTIVE ACTIONS

The QA program will enable problems to be identified, controlled, and corrected. Potential problems may involve nonconformance with the analytical methods established for the project or other unforeseen difficulties. Any person identifying an unacceptable condition will notify the Project Manager. The Project Manager, with the assistance of the Project QA Advisor, will be responsible for developing and initiating appropriate corrective action and verifying that the corrective action has been effective. Corrective actions may include resampling and/or reanalysis of samples or modifying project procedures. If warranted by the severity of the problem (for example, if a change in the approved Work Plan is required), the Navy will be notified in writing and their approval will be obtained prior to implementing any change.

6.13 DOCUMENTATION

A bound, weatherproof site logbook shall be maintained by the FTL. The FTL or his/her designee shall record all information related to sampling and field activities. The information should include sample description, location, sampler, sampling time, weather conditions, unusual events, field measurements, description of photographs, etc. Sample collection data will also be recorded on a matrix-specific sample collection data log for each collected sample. The site logbook will contain a summary of each day's activities and will reference sample collection data log sheets when applicable.

Custody of samples will be maintained and documented at all times. COC begins with the collection of the samples in the field. Section 6.4 addresses the topic of sample custody.

At the completion of field activities, the FTL shall submit to the Project Manager all field records, the site logbook, COC receipts, and the sample tracking logbook. The Project Manager will ensure that these materials are properly labelled, organized, and entered into the project file.

Changes in project sampling procedures may be necessary as a result of changed field conditions or unanticipated events. A summary of the sequence of events associated with field changes is as follows:

- The FTL notifies the Project Manager of the need for the change.
- If necessary, the Project Manager will discuss the change with HALLIBURTON NUS personnel and Navy RPM and will provide verbal approval or denial to the FTL for the proposed change.
- If approved, the FTL will document the change on a Field Modification Form and forward the form to the Project Manager.
- The Project Manager will sign the form and distribute copies to the Navy RPM, the HALLIBURTON NUS QA Advisor, the FTL, and the project file.
- The FTL will attach his or her copy of the completed Field Modification Form to the field copy of the affected document (i.e., HSP).

6.14 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The quality assurance report to management will be prepared by the Project Manager at the end of this project and provided to the HALLIBURTON NUS Project Manager. The final report will contain sections that summarize data quality information collected during the project.

The quality assurance report will include appropriate discussions concerning:

- Changes in the Quality Assurance Project Plan.
- A summary of the QA/QC programs and accomplishments.
- Results of technical systems and performance evaluation audits.

- Significant QA/QC problems, recommended solutions, and results of corrective actions taken.
- Data quality assessment in terms of precision, accuracy, representiveness, completeness, and comparability.
- An indication of whether the QA objectives were met.
- Limitations on the use of the measurement data.

SUPPLY-SIDE LANDFILL INVESTIGATION HEALTH AND SAFETY PLAN
NAVAL TRAINING CENTER, GREAT LAKES
GREAT LAKES, ILLINOIS

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

Submitted to:
Northern Division
Environmental Branch, Code 18
Naval Facilities Engineering Command
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APPROVED BY:

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COPRPORATE HEALTH AND
SAFETY MANAGER
SEC DONOHUE INC.
SHEBOYGAN, WISCONSIN

APPROVED BY:

MATTHEW M. SOLTIS, CSP
CLEAN HEALTH AND SAFETY
MANAGER
HALLIBURTON NUS ENVIRONMENTAL
CORP.

7.0 HEALTH AND SAFETY PLAN

7.1 GENERAL

This site specific Health and Safety Plan (HSP) has been prepared by SEC Donohue Inc. for the Naval Training Center (NTC), Great Lakes, Illinois, for the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62472-90-D-1298 for the U.S. Navy, Northern Division, Philadelphia, Pennsylvania, in accordance with the regulatory requirements of 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response." In addition, the scope of work shall comply with and reflect the following applicable regulations and appropriate guidance publications, as a minimum:

- Federal Acquisition Regulation, F.A.R. Clause 52.236-13: Accident Prevention.
- U.S. Army Corps of Engineers (USACE), Safety and Health Requirements Manual, EM 385-1-1 (latest revision, 1987).
- Occupational Safety and Health Administration (OSHA), Construction Industry Standards, 29 CFR 1926, and General Industry Standards, 29 CFR 1910.
- NIOSH/OSHA/USCG/EPA, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," October 1985.
- Other applicable Federal, State, and local safety and health requirements.

The purpose of this HSP is to summarize the project organization and responsibilities; establish Standard Operating Procedures (SOPs) for preventing accidents, injuries, and illnesses; identify hazards; discuss the personal protective equipment that may be used at the site; identify personnel health and safety training requirements; summarize the monitoring techniques to be used; establish emergency procedures; describe the medical surveillance program; identify that appropriate first aid equipment is available; provide for accident recordkeeping; and establish a schedule for safety inspections.

The HSP will be implemented by the SEC Donohue Corporate Health and Safety Manager (CHSM), the CLEAN Health and Safety Manager (CLEAN HSM), and the Site Safety Officer (SSO) during site work. Compliance with this HSP is required of all personnel who enter this site. Assistance in implementing this plan can be obtained from the SEC Donohue CHSM and the CLEAN HSM.

The content of this HSP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the technical scope of work. Any changes proposed must be approved by the CHSM and the CLEAN HSM. Refer to Appendix 7-C for HSP Modification Form.

The scope of work to be addressed during the Supply-side Landfill field investigation includes:

- Topographic survey.
- Leachate sampling from existing passive gas extraction wells.
- Groundwater sampling from existing monitoring wells.
- Soil sampling of existing landfill cover.
- Gas monitoring in existing gas monitoring wells and in nearby basements.

Project personnel responsible for field investigation activities include:

Name/Firm	Title	Work Phone	Home Phone
Lorrie Ransome, Ph.D., SEC Donohue	Program Manager	414-458-8711	414-452-1368
Mansour Ghiasi, P.E. SEC Donohue	Project Manager	312-902-7100	708-827-1317
Pam Markelz, CSS, CET, SEC Donohue	Corp. Health and Safety Manager	414-458-8711	414-451-4570
Matthew M. Soltis	CLEAN Health and Safety Manager	412-921-8912	412-695-8571
SEC Donohue	Site Safety Officer	(To be determined before field activities are initiated)	
SEC Donohue	Site Safety Officer (alternate)	(To be determined before field activities are initiated)	

7.2 ASSIGNMENT OF INVESTIGATION HSP RESPONSIBILITY

The following describes the health and safety designations and general responsibilities which will be implemented for the Supply-side Landfill activities.

7.2.1 Corporate Health and Safety Manager

The CHSM and the CLEAN HSM have overall responsibility for development and implementation of this RI HSP. The Safety Managers shall approve any changes to this plan due to modification of procedures or newly proposed site activities.

The HSMs will be responsible for the development of company safety protocols and procedures necessary for field operations and will also be responsible for the resolution of any outstanding safety issues which arise during the site work. Health and safety-related duties and responsibilities will be assigned only to qualified individuals by the HSMs. Before personnel may work on site, a current medical examination and acceptable health and safety training must be approved by the CHSM and the CLEAN HSM.

7.2.2 Site Safety Officer

The HSMs shall direct the site health and safety efforts through an Assistant SSO as needed. The SSO will be responsible for implementing the HSP. The SSO may direct or participate in on-site activities as appropriate when this does not interfere with primary SSO responsibilities. The SSO has stop-work authorization which he/she will execute upon determination of an imminent safety hazard, emergency situation, or other potentially dangerous situations, such as detrimental weather conditions. Authorization to proceed with work will be issued by the HSMs in conjunction with the Project Manager after such action.

7.2.3 Subcontractors

Subcontracts will be issued for various tasks at the site. Subcontractors shall comply with the requirements outlined in this HSP and in accordance with OSHA 29 CFR 1910 and 29 CFR 1926; but, in all cases, subcontractors shall be responsible for site safety related to or affected by their own field operations.

7.3 SITE HISTORY AND BACKGROUND

Please refer to Section 2.0 of this document.

7.4 HAZARD ASSESSMENT

7.4.1 Waste Description/Characterization

The following chemical information is presented in order to identify the types of materials that may be encountered at the facility. The detailed information on these materials was obtained from:

- ACGIH, Threshold Limit Values and Biological Exposure Indices for 1990-91.
- Hazardline.
- Chemical Data Sheets.
- NIOSH Pocket Guide to Chemical Hazards - 1990.

The following is a list of chemicals and compounds that are potentially found on-site. Chemical Data Sheets and/or Hazardlines for each compound listed below, providing information such as the chemical's characteristics, health hazards, protection, exposure limits, and first aid procedures, are presented in Appendix 7-A. These chemicals include:

Ammonia	Carbon monoxide
Lead	Methane
Manganese	Hydrogen sulfide

Waste Types: Liquid X Solid X Gas X
Sludge ____ Semi-solid X Other X

Characteristics: Corrosive ____ Flammable X
Explosive ____ Volatile X
Radioactive ____ Inert ____
Other Toxic

Exposure limits for the materials of concern are presented in Table 7-1.

7.5 DEGREE OF HAZARD

On-site hazards include physical and chemical hazards. No radiological, biological, or laboratory wastes are suspected on-site.

The contaminants of concern at the site can affect the body if they are inhaled, come in contact with the eyes or skin, or are ingested. These materials may be released during soil intrusive activities. The primary concern is for skin exposure and inhalation exposure to contaminated soils. Exposure to these substances by inhalation (in the breathing zone (BZ)) is not anticipated due to the levels found during past studies. Atmospheric monitoring, however, will be conducted during all sampling and surveying activities conducted on the landfill.

TABLE 7-1

EXPOSURE LIMITS
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Compounds	OSHA PEL (ppm)	OSHA STEL (ppm)	ACGIH TLV (ppm)	ACGIH STEL (ppm)	IP eV	Odor (ppm)
Ammonia	-	35	25	35	10.18	5.2
Lead	0.05 mg/m^3	-	0.15 mg/m^3	-	-	-
Manganese	5.0 mg/m^3	-	5.0 mg/m^3	-	-	-
Hydrogen sulfide	10	15	10	15	0	0.0047
Carbon monoxide	35	200	50	400	-	-
Methane	-	-	-	-	-	200

References:

American Conference of Governmental Hygienists (ACGIH) Threshold Limit Values (TLV) for 1991-92.
Hazard Lines 1992.
1989 Amended Permissible Exposure Limits (PELs), U.S. Department of Labor, OSHA.
IP - Ionization Potential.
PEL - Permissible Exposure Limit.
TLV - Threshold Limit Value.
REL - Recommended Exposure Limit

R/CTO62/AA8

Physical hazards which may be encountered at the site during field activities include overhead and tripping hazards.

Depending on seasonal weather conditions, there is some potential for workers on-site to be affected by heat stress if site activities are scheduled for the summer months. The SSO will monitor for heat stress in accordance with Section 7.13.7.1 of this HSP.

A summary of task-specific hazards and control measures is presented in Table 7-2.

7.5.1 Confined Space Entry

Confined space entry is not anticipated for soil, groundwater, leachate, or gas sampling and is, therefore, not addressed in this HSP.

7.5.2 Spill Containment

Sampling activities are unlikely to require spill containment and are, therefore, not addressed in this plan.

7.6 TRAINING REQUIREMENTS

7.6.1 Basic Training Required

Personnel who are required to work in areas where the potential for toxic exposure exists shall complete training or have site experience conforming to the requirements of 29 CFR 1910.120(e).

The 40-hour course describes procedures for working at hazardous waste sites. These procedures include a health and safety program, medical surveillance, decontamination, site characterization and analysis, protective clothing and monitoring equipment, site control work documentation, emergency response, engineering and administrative control to reduce exposure, and site safety evacuation procedures.

Contractors/subcontractors shall provide written documentation that these training/experience requirements have been met. An example of a training documentation form is presented in Figure 7-1. All personnel shall also be trained in the contents of Appendix 7-B, "Respiratory Protection Program."

TABLE 7-2

TASK-SPECIFIC HAZARD ASSESSMENT TABLE
SUPPLY-SIDE LANDFILL
GREAT LAKES, ILLINOIS
SEPTEMBER 1992

Task	Hazard	Control Measures
Topographic Survey	Vehicle traffic	Personnel identification (vests, beacons)
	Slipping, tripping, falling	Flagging, marking of hazards
	Thermal stress	Work/rest cycles: Liquids
	Toxic/explosive atmospheres	Continuous monitoring
	Inhalation contact	Respiratory protection
	Dermal contact	Use of PPE
Sample Collection	Dermal contact	Use of PPE
	Inhalation contact	Respiratory protection
	Thermal stress	Work/rest cycles: Liquid
	Toxic/explosive atmospheres	Continuous monitoring
Building Screening	Toxic/explosive atmospheres	Continuous monitoring
	Slipping, tripping, falling	Flagging, marking of hazards
Equipment Decontamination	Dermal contact	Use of PPE
	Thermal stress	Work/rest cycles: Liquids
	Inhalation contact	Respiratory protection

PPE - Personal Protective Equipment

R/CTO62/AB7

OSHA TRAINING COMPLIANCE LETTER

Note: The following statements must be typed on company letterhead and signed by an officer of the company.

LOGO
XYZ CORPORATION
555 East 5th Street
Nowheresville, Kansas 55555

Month, day, year

(Project Manager)
SEC Donohue Inc.
4738 North 40th Street
Sheboygan, Wisconsin 53083

Subject: OSHA Compliance and Testing

Dear (Project Manager):

As an officer of XYZ Corporation, I hereby state that I am aware of the potential hazardous nature of the subject project. I also understand that it is our responsibility to comply with all applicable occupational safety and health regulations including those stipulated in Title 29 of the Code of Federal Regulations (CFR), Parts 1900 through 1910 and Parts 1926.

I also understand that Title 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response: Final Rule;" requires, but is not limited to, medical surveillance, for applicable employees, and appropriate level of training as required in paragraph (e) of 29 CFR 1910.120 for employees engaged in certain hazardous waste operations. I hereby state that I have reviewed these requirements; understand Title 29 of the CFR, Parts 1900 through 1910, and Part 1910, and Part 1926; and that XYZ Corporation and all of its employees who will perform work at the _____ site are in full compliance.

The following employees have had 40 hours of introductory hazardous waste site training or equivalent work experience as required by 29 CFR 1910.120(e) and have had 8 hours of refresher training as required by 29 CFR 1910.120(e)(8).

LIST EMPLOYEE NAMES, TYPE(S) OF TRAINING RECEIVED, AND DATES OF TRAINING HERE

Sincerely,

(Name of Company Officer)
Title

FIGURE 7-1

7.6.2 Site-Specific Training

Site-specific training to employees to minimize on-site hazards will be provided that will address the activities, procedures, monitoring, and equipment for the field operations. This training will include identifying the names of personnel and alternate personnel responsible for site safety, and facility layout.

In addition, this training, at a minimum, will include the following:

1. Site description and history.
2. Project activities, including coordination with other contractors.
3. Hazard evaluation.
4. On-site safety responsibilities.
5. Site control and work zones (WZ).
6. Personnel training.
7. Medical monitoring.
8. Atmospheric monitoring.
9. Personal protection, clothing, and equipment.
10. Decontamination procedures.
11. Emergency procedures.
12. Review of site-specific material safety data sheets (MSDS's).
13. Safe work practices.
14. Other elements covered in this site-specific HSP.

This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safe operations. Training must include emergency preparedness, location of assembly areas, proper entry and exit procedures for exclusion zone (EZ), warning systems, location of emergency equipment, and route to hospital.

7.6.3 Safety Briefings

Project personnel will be given briefings by the SSO on a daily or as-needed basis to further assist site personnel in conducting their activities safely. Briefings will be provided when new operations are to be conducted, changes in work practices must be implemented due to new information made available, or if site or environmental conditions change. Briefings will also be given to facilitate conformance with prescribed safety practices when performance deficiencies are identified during routine daily activities or as a result of safety audits.

7.6.4 Safety Audits

The CHSM, as deemed necessary for particular projects, conducts regular safety audits of field operations and subcontractor performance to review for compliance with health and safety policies and procedures. Daily operations will adhere to the SOPs outlined in this HSP and will be enforced by the SSO.

7.6.5 First Aid and CPR

At least two individuals shall be trained and qualified to administer first aid and CPR.

The HSMs will identify the individuals requiring this training in order to ensure that emergency treatment is available during every work shift from a person qualified in first aid and CPR. These courses will be consistent with requirements of the American Red Cross and/or American Heart Association.

7.7 MEDICAL SURVEILLANCE PROGRAM

All SEC Donohue personnel and subcontractors performing field work at the site will be required to have passed a pre-assignment and/or periodic medical examination that is consistent with 29 CFR 1910.120(f). A release for work will be confirmed by the CHSM before an employee can begin hazardous site activities.

Additional medical testing may be required in consultation with the company physician if an overt exposure or accident occurs, or if other site conditions warrant further medical surveillance.

Contractors/subcontractors will maintain the medical records for their own employees, but shall also provide written documentation certifying that each employee at the site has met the requirements of the Medical Surveillance Program. This documentation will be provided before the first day of work for each employee assigned to the site. An example of a medical documentation form is presented in Figure 7-2. The pre-assignment and annual examinations are essentially the same in content and will include:

- An updated medical and occupational history.
- A screening physical examination.
- Blood and urine laboratory tests.
- Chest x-ray.
- Electrocardiogram.
- Pulmonary function tests.
- Audiometry.
- Visual acuity test.

The physician has the authority to include other tests.

MEDICAL SURVEILLANCE LETTER

Note: The following statements must be typed on company letterhead and signed by an officer of the company.

LOGO
XYZ CORPORATION
555 East 5th Street
Nowheresville, Kansas 55555

Month, day, year

(Project Manager)
SEC Donohue Inc.
4738 North 40th Street
Sheboygan, Wisconsin 53083

Subject: OSHA Compliance and Testing

Dear (Project Manager):

As an officer of XYZ Corporation, I hereby state that the persons listed below participated in a medical surveillance program meeting the requirements contained in paragraph (f) of Title 29 of the Code of Federal Regulations, Part 1910.120 entitled "Hazardous Waste Operations and Emergency Response: Final Rule." I further state that the persons listed below have had physical examinations under this program within the last 12 months and that they have been cleared, by a licensed physician, to perform hazardous waste site work and to wear respiratory protection. I also state that, to my knowledge, no person listed below has any medical restrictions that would preclude him/her from performing their assigned activities at the _____ site.

LIST EMPLOYEE NAMES AND DATES OF MOST RECENT PHYSICAL EXAMS HERE

Should you have any questions, please contact me at 555/555-5555.

Sincerely,

(Name of Company Officer)
Title

FIGURE 7-2

7.7.1 Emergency Medical Treatment

Provisions for emergency medical treatment shall be integrated with the overall Site Emergency Plan (see Section 7.13) and shall include:

- At least two individuals per shift qualified to render first aid and CPR.
- First aid kits in compliance with OSHA requirements and emergency first aid stations in the immediate work vicinity.
- Conspicuously posted phone numbers and procedures for contacting ambulance services, fire department, police, and medical facilities.
- Maps and directions to medical facilities.

7.8 SITE CONTROL MEASURES

The purpose of the site control measures discussed in this section are to maintain order at the site and to minimize chemical and physical hazards to on-site personnel, visitors, and the public. Site control zones (CZ) will include an EZ, a contamination reduction zone (CRZ), and a support zone (SZ). In addition, temporary activity-specific WZs will be established at specific locations.

7.8.1 Exclusion Zone

The EZ is the area containing or suspected of containing contaminated materials. Since investigation activities will be conducted at different locations (i.e,. wells, basements, and soil sampling) each site will be delineated as the EZ.

7.8.2 Work Zones

A temporary WZ shall be established at each sampling location where sample collection activities occur. These WZ areas shall be established by laying about 5 square feet of plastic sheeting next to the sampling location for the placement of equipment and supplies. A portable eye wash, first aid kit, towels, plastic garbage bags, and decontamination supplies are also required in this area.

7.8.3 Personnel Decontamination

Personnel decontamination areas will be established on-site. Personnel will decontaminate and/or dispose of soiled protective clothing (i.e. disposable boots and gloves, etc.) in the CRZ established next to the temporary WZ. Refer to Section 7.11 for further decontamination procedures.

7.8.4 Equipment Decontamination Area

Nondisposable sampling equipment will be decontaminated before use, between samples, and before leaving the sampling location. Decontamination liquids will be collected and disposed of as directed by the Navy. Refer to Section 7.11 for further decontamination procedures.

7.8.5 Support Zone

The SZ is considered the uncontaminated area and will be identified by the SSO when field activities begin. It will contain the Command Post which will provide for team communications and emergency response. A mobile telephone will be located in this area. Appropriate sanitary facilities, safety, medical, and support equipment will be identified.

7.8.6 Site Visitors

Visitors are required to report to the SSO prior to accessing the site, although none are anticipated. The SSO will determine the purpose of individual visits, and will document decisions regarding their access to the site. If granted limited access, visitors must sign in and out under the SSO's direction daily for the duration of their approved visit. Under no circumstances will visitors be allowed to interfere with or participate in operations within the scope of the field investigation.

As needed, the SSO will establish a designated Level D area as an observation point for potentially responsible party (PRP) representatives, among other visitors, during intrusive activities. This designated area will be located to offer proximate viewing of site operations, and positioned such that visitors in no way may inhibit site access, logistics, or general operations. Further, the SSO will locate the viewing areas such that visitors present are at minimal risk of exposure to site hazards.

Prior to gaining access to designated viewing areas described above, visitors must provide the SSO with documented compliance with Section 6.0 of the HSP, comply with other applicable sections, and satisfy additional conditions placed on them as deemed appropriate by the SSO to assure visitor safety. Site visitors will be escorted throughout the site by the SSO.

7.9 PERSONAL PROTECTIVE EQUIPMENT

7.9.1 General

Personal protective equipment (PPE) for general operations will be consistent with the requirements of 29 CFR 1910 Subpart I, "Personal Protective Equipment." Basic levels of protection for hazardous waste operations will be selected in accordance with the provisions of 29 CFR 1910.120(g)(3), "Personal Protective Equipment Selection," and Appendix D, "General Description and Discussion of the Levels of Protection and Protective Gear." Modification to basic PPE ensembles may be necessary for specific operations. In these cases, further definition will be provided by review of specific hazards, conditions, and proposed operational requirements and by conducting monitoring at the particular operation. Protection may be upgraded or downgraded, as deemed appropriate by the SSO and verified by the Safety Managers.

7.9.2 Anticipated Levels of Protection for Site Operations

- Leachate Sampling D/C
- Groundwater Sampling D/C
- Soil Sample Collection D/C
- Gas Monitoring D/C
- Topographic Survey Modified D
- Building Screen Modified D

Level D personal protective clothing and equipment includes:

- Tyvek disposable coveralls.
- Polycoated polyethylene disposable tyvek coveralls - required in sampling areas when splashing by contaminated soils, water, or leachate is a possibility.
- Hardhat (when overhead hazards exist).
- Safety glasses or goggles - required.
- Steel toe, steel shank boots - required.
- Disposable latex gloves - required when handling and collecting soil and water samples.
- Outer nitrile gloves - required when handling and collecting soil and water samples.
- Disposable outer boots - required.

Modified Level D includes: disposable outer boots, hardhat (when overhead hazards exist), and disposable latex gloves (when handling materials).

Level C protective clothing and equipment includes:

- Full-face air-purifying respirator (NIOSH/Mine Safety Health Administration (MSHA) approved) fitted with acid gas/organic vapor/High Efficiency Particulate Air (filter) (HEPA) cartridges.
- Hard hat (when overhead hazards exist).
- Disposable tyvek coveralls.
- Disposable latex inner gloves.
- Nitrile outer gloves.
- Steel toe, steel shank boots.
- Disposable outer boots.

Level B PPE, although not anticipated, includes the above Level C clothing with the addition of a self-contained breathing apparatus (SCBA) or supplied air-line respirator in place of an air-purifying respirator. If action levels are exceeded, and based on evaluation of the conditions, if Level B respiratory protection is deemed necessary, work activities will be halted and arrangements for Level B equipment will be implemented.

The use and care of respiratory protection will be in accordance with the protocols described in Attachment 7-B.

Action levels used to determine the need to upgrade or downgrade the levels of protection are described in Section 7.10.3 of this RI HSP.

7.10 AIR MONITORING

7.10.1 General

It will be necessary to monitor the atmospheric conditions during on-site field sampling activities to determine the possible need to upgrade the personal protection of on-site workers. Atmosphere in the BZ, at the sample extraction point shall be monitored.

7.10.2 Soil, Groundwater, Building Screen, and Leachate Sample Collection

These activities shall be initiated in Level D protection with the contingency to upgrade the level of protection based on the action levels.

Monitoring shall be performed continuously during the sampling activities. A photoionization detector (PID) shall be used to monitor the BZ and the sampling extraction point. A Combustible Gas Indicator (CGI) equipped with an oxygen, hydrogen sulfide, and carbon monoxide alarm shall be used to monitor the gas extraction wells, gas monitoring wells, and basements for the presence of combustible toxic gases.

7.10.3 Action Levels

Instrumentation will include a PID and a CGI equipped with an oxygen, lower explosive level, and hydrogen sulfide sensor. These instruments will be used to monitor the WZs and BZs at each site. The action levels in this RI HSP will apply to all site work during the duration of activities at the NTC site. Action levels for direct-reading instruments in the BZ are as follows:

Instrument	Action Levels	Level of Respiratory Protection/Action
PID (10.2 Ev)*	Continuous readings of background (0.2 ppm) to 1 ppm in BZ	Level D
PID (10.2 Ev)*	Continuous readings of 1 ppm above background (0.2) to 5 ppm in BZ	Level C (based on identification of contaminant)
PID (10.2 Ev)*	Continuous readings of 5 to 250 ppm above background in BZ	Level B (if Level C is not appropriate for contaminant identified)
CGI	10% $\leq$ LEL $\leq$ 20%	Proceed with caution
CGI	> 20% LEL	Halt work, ventilate, begin work only after levels are below 20%
Oxygen	< 19.5% O_2	Halt work, ventilate, begin work only after levels maintain 19.5%-21.0%

Carbon Monoxide	≥35 ppm	Halt work, ventilate, begin work only after levels fall below 35 ppm
Hydrogen Sulfide	≥10 ppm	Halt work, ventilate, begin work only after levels fall below 10 ppm

* In the event action levels are exceeded, work activities shall be halted and an attempt will be made to identify the contaminants present using colorimeter indicator tubes for ammonia so that correct respiratory protection can be selected. The SSO shall notify the CHSM and the CLEAN HSM immediately and prior to upgrading the level of respiratory protection.

In the event of dusty conditions, Level C respiratory protection shall be implemented as deemed necessary by the SSO.

7.10.4 Exposure Monitoring/Air Sampling Program

7.10.4.1 Personal and Perimeter Monitoring

It is not anticipated that personal exposure or migration of contaminants off site will be of concern due to the low concentrations of contaminants found on-site; therefore, personal and perimeter monitoring will not be conducted. In the event action levels addressed in Section 7.10.3 are exceeded, work activities shall be halted and re-evaluation of the work plan will be conducted and an appropriate air monitoring plan may be prepared.

7.10.5 Instrument Calibration and Maintenance

Instrument calibration and maintenance shall be performed according to manufacturer's specifications which will be maintained on-site and documented on Field Instrument Calibration Logs. PID calibration shall be completed at least on a daily basis or more frequently by the SSO or other designated personnel. Combustible gas/oxygen/hydrogen sulfide meter shall be calibrated according to manufacturer's recommended frequency (i.e., daily or weekly).

7.11 DECONTAMINATION PROCEDURES

The SSO shall determine the level of decontamination necessary based on the evaluation of specific work activities and the potential degree of contamination encountered. Temporary CRZs shall be established at all sampling locations.

7.11.1 Equipment

Nondisposable sampling equipment will be decontaminated before use, between samples, and before leaving the sampling location.

Equipment that cannot be immersed in soap solution and water will be wiped clean and rinsed with distilled water.

7.11.2 Personnel

Personnel will perform decontamination in the personal decontamination area upon entering the SZ and leaving the project site. Decontamination of personnel in Level D will consist of removal and disposal of coveralls (when worn), disposable boots, and gloves. Decontamination of personnel using Level C protective equipment will consist of:

- Removal and disposal of boot covers.
- Removal and disposal of coveralls.
- Removal and disposal of outer gloves.
- Removal, cleaning, and storage of respiratory equipment.
- Washing boots or other nondisposable protective equipment (i.e., hard hat, safety glasses/goggles, etc.) suspected of being contaminated using soap solution followed by potable or distilled water rinse.
- Removal and disposal of inner gloves.

7.11.3 Contamination Prevention

One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel

- Know the limitations of all PPE being used.
- Do not walk through areas of obvious or known contamination.
- Do not handle or touch contaminated materials directly. Do not sit or lean on potentially contaminated surfaces.

- Make sure all PPE has no cuts or tears prior to donning.
- Fasten all closures on suits, covering with tape, if necessary.
- Take particular care to protect any skin injuries.
- Stay upwind of airborne contaminants.
- Do not carry cigarettes, gum, food, or candy into contaminated areas.
- Do not smoke, eat, or drink in contaminated areas.
- Shower at the hotel or home at the end of the work day.

Sampling/Monitoring

- Cover instruments with clear plastic, leaving openings for sampling ports, sensor points.
- Bag sample containers prior to placement of sample material into containers.

7.11.4 Disposal Procedures

Discarded materials, waste materials, or other field equipment and supplies shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left on site. Potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed with appropriate labeling affixed as regulated, and segregated for disposal by the Navy. Noncontaminated materials shall be collected, bagged, and disposed of as normal domestic waste.

7.12 GENERAL SAFE WORK PRACTICES AND COMMUNICATIONS

7.12.1 Safety Equipment

Basic emergency and first aid equipment will be available at the SZ and/or the CRZ, as appropriate. This shall include communications equipment, first aid kit, emergency eye wash, fire extinguishers, and other safety-related equipment.

7.12.2 Communications

Walkie-Talkies - Hand-held units shall be used as much as possible by field teams for communication between downrange operations and the Command Post base station.

Telephones - A mobile telephone will be located in the Command Post area in the SZ for communication with emergency support services/facilities.

7.12.3 Safe Work Practices

The following safe work practices will be implemented during site operations:

- Only properly trained and equipped personnel will be allowed to work in potentially contaminated areas.
- The number of personnel and equipment in the sampling areas will be kept to a minimum, consistent with safe site operations.
- Workers shall adhere to the "buddy system" while working downrange and in designated exclusion areas. Radio contact shall be maintained between pairs on-site in order to assist each other in case of emergencies. Symptoms to look for in the case of an emergency situation will be discussed during safety meetings held at the site conducted by the SSO.
- Workers shall not exit exclusion areas until soiled equipment and clothing have been removed and decontaminated or properly disposed.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer, ingestion, and inhalation of potentially contaminated materials is prohibited.
- As necessary, personnel will thoroughly wash their hands and faces upon leaving the investigation areas.
- Contact with potentially contaminated materials and surfaces shall be avoided. Personnel shall comply with contamination control measures.
- Personnel with facial hair or other facepiece seal obstructions will not be permitted to work where respirators are required.
- Work shall only be conducted if adequate illumination is provided, i.e., visual observation is not impaired due to loss of daylight conditions.

7.13 EMERGENCY PREPAREDNESS

7.13.1 Emergency Coordinator

The Site Emergency Coordinator shall be the SSO and implement the emergency action plan as outlined (29 CFR 1910.38). Although the following six items are typically more applicable to operating facilities, they will be implemented to the extent possible when applicable. (These shall be determined prior to site work and presented during the site initiation meeting.)

- Emergency escape procedures and routes.
- Procedures for those remaining for critical operations (this will not apply).
- Procedures to account for employees after evacuation.
- Rescue and medical duties.
- Preferred means of reporting fires and emergencies.
- Names, job titles, or departments to contact for additional information of duties.

These items will be discussed during each site orientation meeting conducted on-site by the SSO.

7.13.2 Emergency Service Contacts

The Emergency Coordinator shall verify appropriate emergency contacts and make contact with these before beginning work on-site. The Emergency Coordinator will inform the emergency contacts about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. Also at this time, the Emergency Coordinator and the emergency response contacts shall make arrangements to handle any emergencies that might be anticipated.

EMERGENCY PHONE NUMBERS:

Police Department:	911
Fire Department:	911
Hospital:	Great Lakes Naval Hospital (708) 688-5618
Hospital Address:	Sheridan Road and Southgate Entrance of Naval Base
National Response Center:	1-800-424-8802
Poison Control Center:	1-800-942-5969
CCSM:	Pamela B. Markelz (414) 458-8711 (work), (414) 457-4570 (home)
SSO:	To be determined before field activities begin.

HOSPITAL ROUTE:

A hospital route map and written description depicting the route to the hospital from the investigation area is presented on Figure 7-3.

Once the SZ is established, and before field activity start-up, the Site Emergency Coordinator shall drive the route to the hospital, post directions and/or a map to the hospital, and set up the first aid station, 10-pound Type A/B/C fire extinguisher, and other emergency equipment.

7.13.3 Implementation

The Site Emergency Coordinator shall implement the emergency action procedures whenever conditions at the site warrant such action. The Site Emergency Coordinator will be responsible for coordinating the evacuation, emergency treatment, and emergency transport of site personnel as necessary, and for notification of emergency response units and the appropriate management staff. The following conditions may require implementation of emergency action procedures:

- Fire or explosion on-site.
- Serious personal injury.
- Release of hazardous materials, including gases or vapors at levels greater than the maximum use concentrations of respirators.
- Unsafe working conditions, such as inclement weather.

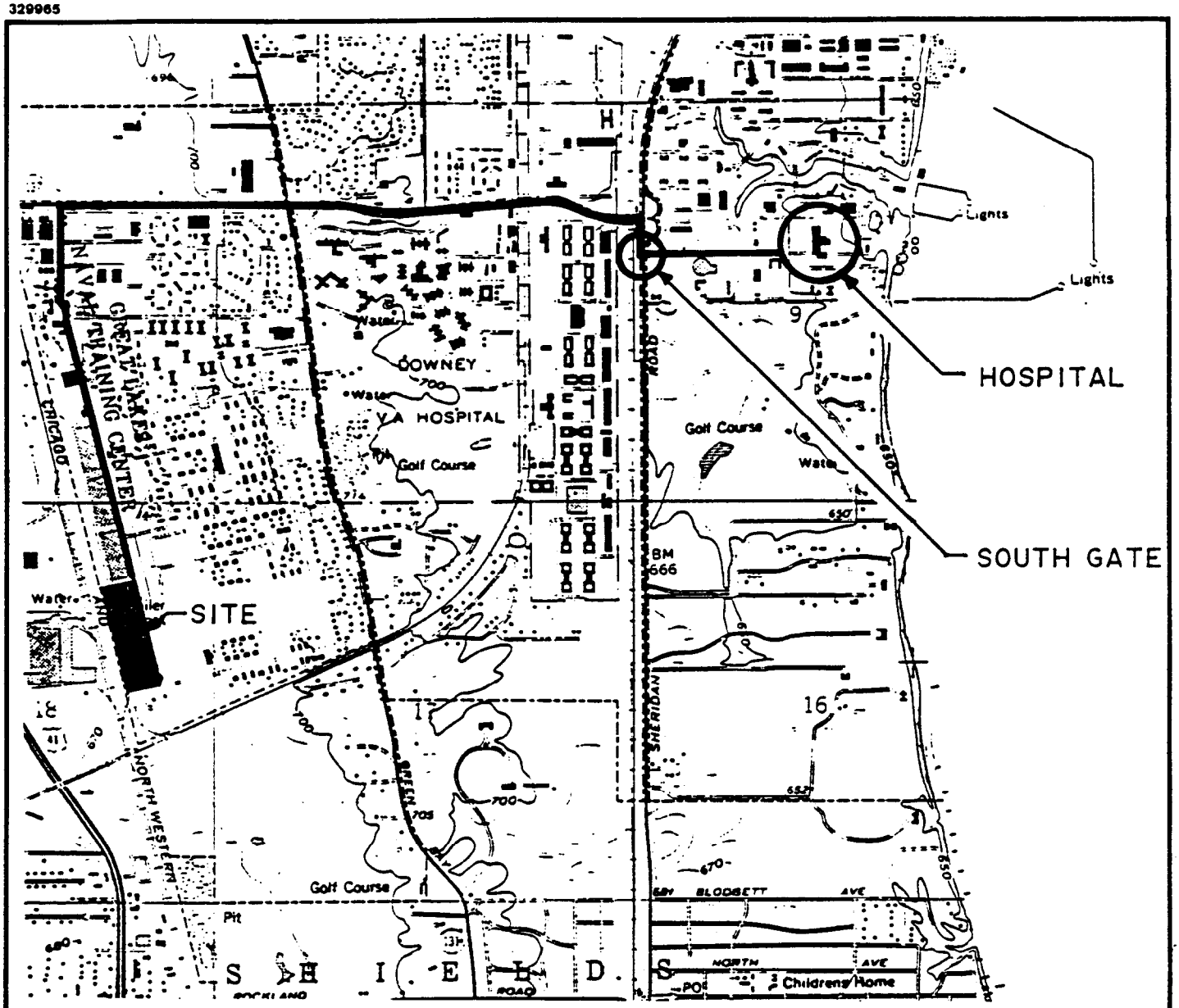
7.13.4 Fire or Explosion

If an actual fire or explosion has taken place, emergency steps will include 1) evacuation of work area and venting, and 2) notification of the fire department and other appropriate emergency response groups if necessary.

7.13.5 Personal Injury

Emergency first aid will be administered on-site as appropriate. Then, the individual will be decontaminated if possible, depending on the severity of the injury, and transported to the nearest medical facility if needed.

329965



DIRECTIONS TO HOSPITAL:

FROM SITE GO NORTH ON SUPERIOR ST. (TURNS INTO MISSISSIPPI ST.). TURN RIGHT (EAST) ON BUCKLEY RD. TURN RIGHT (SOUTH) ON SHERIDAN RD. TURN LEFT (EAST) AT NTC SOUTH GATE. HOSPITAL IS 4 BLOCKS AHEAD.

GREAT LAKES NAVAL HOSPITAL

AMBULANCE (708) 688-5555
EMERGENCY (708) 688-5618

N

0 2000 4000

SCALE: FEET
SCALE IS APPROXIMATE

SOURCE:
USGS 7.5 MINUTE QUADRANGLE
WAUKEGAN, ILLINOIS 1960
PHOTOREVISED 1972 AND 1980

SEC DONOHUE
Environment & Infrastructure

SEPT. 1992

FIGURE 7-3
HOSPITAL ROUTE MAP

CTO #0062
20614

NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

7.13.6 Overt Chemical Exposure

Typical response procedures include:

SKIN CONTACT: Use copious amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention. Eye wash will be provided on-site at the CRZ and/or support zone as appropriate. Eyes should be rinsed for 15 minutes upon chemical contamination.

INHALATION: Move to fresh air and/or, if necessary, decontaminate/transport to hospital.

INGESTION: Decontaminate and transport to emergency medical facility.

PUNCTURE WOUND OR LACERATION: Decontaminate and transport to emergency medical facility. The SSO will provide medical data sheets to medical personnel as requested.

7.13.7 Adverse Weather Conditions

In the event of adverse weather conditions, the SSO will determine if work can continue without endangering the health and safety of field workers. Some items to be considered before determining if work should continue are:

- Potential for heat stress and heat-related injuries. Treacherous weather-related working conditions.
- Limited visibility.
- Potential for electrical storms.

7.13.7.1 Heat Stress

The SSO shall continuously visually monitor personnel to note for signs of heat stress. In addition, field personnel will be instructed to observe for symptoms of heat stress and methods on how to control it. One or more of the following control measures can be used to help control heat stress:

- Provision of adequate liquids to replace lost body fluids. Employees must replace water and salt lost from sweating. Employees must be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.

- Replacement fluids can be commercial mixes such as Gatorade®.
- Establishment of a work regime that will provide adequate rest periods for cooling down. This may require additional shifts of workers.
- Cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments.
- All breaks are to be taken in a cool rest area (77° F is best).
- Employees shall remove impermeable protective garments during rest periods.
- Employees shall not be assigned other tasks during rest periods.
- Employees shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

The heat stress of employees on-site may be monitored by the Wet Bulb Globe Temperature Index technique when workers are not wearing protective coveralls (i.e. tyvek). This method will require the use of a heat stress monitoring device.

7.13.7.2 Cold Exposure

Field activities will occur during a period when temperatures average above freezing.

7.13.8 Poison Ivy

If someone should come in contact with poison ivy, the individual should immediately wash the affected area with the Ivy Cleaner provided in the first aid kit. If a rash develops, it should be treated at a medical facility as soon as possible.

7.13.9 Snakes and Ticks

7.13.9.1 Snake Bite Prevention and First Aid

On project sites, precautions against the possible presence of snakes should be taken when walking through overgrown vegetation and when moving debris (i.e., lumber, scrap metals, etc.). If someone is bitten by a snake, and the snake bite occurs in a location that is within a 1-hour drive of a medical facility, a conservative approach is safest. Keeping the victim quiet, lying or sitting and reassuring him/her is all that is required. He/she should be transported safely (no speeding) to the nearest medical facility. For the reassurance of both the victim and the first aider, a snake bite is not nearly as dangerous as popular mythology would suggest. In North America, death from snakebite to healthy adults is very rare. Many bites, even from known poisonous snakes, do not result in a significant amount of venom being injected. Even when significant envenomation occurs, symptoms develop slowly over many hours and can be controlled with appropriate treatment. Field treatments advised against include ice, cutting and suction around the wound, and tourniquets. Studies indicate that ice leads to increased tissue destruction. Cutting and sucking out the wound can be shown to offer some help if it is done with the correct technique and equipment and if the victim has received a large dose of venom. In light of the damage that can be done, the risk of such a procedure is too high. It is best to transport the person immediately to a medical facility.

7.13.9.2 Tick Bite Prevention and First Aid

Routinely check for ticks after being outdoors. Remove ticks as soon as possible before they embed. To minimize exposure, wear light-colored clothing so ticks can be detected. Tuck pants into boots or socks and wear long-sleeved shirts. Apply tick/insect repellent to clothing.

When a tick is found embedded, remove it by grasping it with a tweezers as close to the skin as possible and gently pull it straight out. Do not twist or jerk the tick because the head may remain embedded. Once the tick is removed, wash the bite area and your hands with soap and water and apply an antiseptic to the bite. Save the tick in a jar labeled with the date and the place where the tick was acquired. A physician may find this information and the tick specimen helpful in diagnosis if an infection results.

7.14 AUTHORIZATIONS AND FIELD TEAM REVIEW

7.14.1 Authorized Personnel

Personnel authorized to enter NTC, Great Lakes while field activities are being conducted must be authorized by the CHSM and the CLEAN HSM. Authorization will involve completion of appropriate training courses and medical examination requirements as required by OSHA 29 CFR 1910.120, current fit-testing, and review and signing of this RI HSP. All personnel must be escorted by appropriately trained personnel, and check in with the Field Team Leader at the Command Post.

PERSONNEL AUTHORIZED TO PERFORM WORK ON-SITE:

1. Mansour Ghiasi
2. Bill Schaefer
3. Jeffrey Bub
4. Pam Markelz CHSM
5. Personnel Authorized by the SEC Donohue CHSM and the CLEAN HSM

OTHER PERSONNEL AUTHORIZED TO ENTER SITE:

1. U.S. Navy Representatives
2. HALLIBURTON NUS Personnel
3. Subcontractor Personnel

7.14.2 Field Team Review

Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read and understand this Site Inspection Health and Safety Plan. I will comply with the provisions contained therein.

Site/Project: **Naval Training Center**
Great Lakes, Illinois

Name Printed	Signature	Date

7.15 RECORDKEEPING

The following records and reports will be established and kept as appropriate for the NTC, Great Lakes Site investigation:

- Accident/Incident Reports.
- Daily Sign In/Sign Out Log.
- Air Monitoring Records.
- Sample Manifest/Transmittal (Chain of Custody Form).
- Employee Training Certificates.
- Employee Exposure Record.
- Site-Safety Orientation Log.
- Health and Safety Audit Reports.
- Instrumentation Calibration Logs.
- Material Safety Data Sheets/Chem Data Sheets or Hazardlines.
- Medical Data Sheets (to be sent with injured personnel to hospital).
- Medical Examination Reports (Physician's Written Opinion).
- Respirator Fit Test Records.
- Respirator Inspection Records.

A blank Medical Data Sheet is included as the next page of this document. A Medical Data Sheet will be completed for each person working at the site.

MEDICAL DATA SHEET

Project Name/Location: _____

Employee Name: _____ Home Telephone: _____

Address: _____

_____

_____

Birthdate: _____ Height: _____ Weight: _____

Drug and Other Allergies: _____

_____

_____

_____

_____

Notable Medical Conditions/Medical Restrictions:

_____

_____

_____

_____

_____

_____

Do You Wear Contact Lenses? __ Yes __ No

Are you using any medications? __ Yes __ No Please list:

_____

_____

_____

Emergency Contact: _____ Relationship: _____

Address: _____ Phone: ( ) _____

_____

Personal Physician: _____ Phone: ( ) _____

Address: _____

APPENDIX 7-A

CHEMICAL DATA SHEETS/HAZARDLINES

AMMONIA

- Hazardous substance (EPA)

Description: NH_3, ammonia is a colorless, strongly alkaline, and extremely soluble gas with a characteristic pungent odor.

Code Numbers: CAS 7664-41-7 RTECS BO0875000 UN 1005.

DOT Designation: Nonflammable gas.

Synonyms: Anhydrous ammonia.

Potential Exposures: Ammonia is used as a nitrogen source for many nitrogen-containing compounds. It is used in the production of ammonium sulfate and ammonium nitrate for fertilizers and in the manufacture of nitric acid, soda, synthetic urea, synthetic fibers, dyes, and plastics. It is also utilized as a refrigerant and in the petroleum refining and chemical industries. It is used in the production of many drugs (A-41) and pesticides (A-32).

Other sources of occupational exposure include the silvering of mirrors, glue-making, tanning of leather, and around nitriding furnaces. Ammonia is produced as a by-product in coal distillation and by the action of steam on calcium cyanamide, and from the decomposition of nitrogenous materials.

Incompatibilities: Strong oxidizers, calcium, hypochlorite bleaches, gold, mercury, silver, halogens.

Permissible Exposure Limits in Air: The Federal standard for ammonia is an 8-hour time-weighted average of 50 ppm (35 mg/m^3). NIOSH has recommended 50 ppm expressed as a ceiling and determined by a 5-minute sampling period. ACGIH as of 1983/84 has set TWA values of 25 ppm (18 mg/m^3). The tentative STEL value is 35 ppm (27 mg/m^3). The IDLH level is 500 ppm.

Determination in Air: Collection by midget impinger and colorimetric analysis using Nessler's reagent (A-10). Ammonia may also be determined using long-duration detector tubes (A-11).

Permissible Concentration in Water: EPA in 1976 (A-3) proposed a limit of 0.02 mg/ℓ (as unionized ammonia) for the protection of freshwater aquatic life. As of 1980, EPA (2) first proposed adding ammonia to the list of priority toxic pollutants and developing criteria for it, but then withdrew the proposal. NAS/NRC proposed (A-2) a limit of 0.5 mg/ℓ for drinking water.

Routes of Entry: Inhalation of gas, ingestion, skin and eye contact.

Harmful Effects and Symptoms: *Local* — Contact with anhydrous liquid ammonia or with aqueous solutions is intensely irritating to the mucous membranes, eyes, and skin. Eye symptoms range from lacrimation, blepharospasm, and palpebral edema to a rise of intraocular pressure, and other signs resembling acute-angle closure glaucoma, corneal ulceration, and blindness. There may be corrosive burns of skin or blister formation. Ammonia gas is also irritating to the eyes and to moist skin.

Systemic — Mild to moderate exposure to the gas can produce headache, salivation, burning of throat, anosmia, perspiration, nausea, vomiting, and substernal pain. Irritation of ammonia gas in eyes and nose may be sufficiently intense to compel workers to leave the area. If escape is not possible, there may be severe irritation of the respiratory tract with the production of cough, glottal edema, bronchospasm, pulmonary edema, or respiratory arrest. Bronchitis or pneumonia may follow a severe exposure if patient survives. Urticaria is a rare allergic manifestation from inhalation of the gas.

Points of Attack: Lungs, respiratory system, eyes.

Medical Surveillance: Preemployment physical examinations for workers in ammonia exposure areas should be directed toward significant changes in the skin, eyes, and respiratory system. Persons with corneal disease, and glaucoma, or chronic respiratory diseases may suffer increased risk. Periodic examinations should include evaluation of skin, eyes, and respiratory system, and pulmonary function tests to compare with baselines established at preemployment examination.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, flush with water immediately. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Do not induce vomiting.

Personal Protective Methods: Where ammonia hazards exist in concentrations above the standard, respiratory, eye, and skin protection should be provided. Fullface gas masks with ammonia canister or supplied air respirators, both with full facepieces, afford good protection. In areas where exposure to liquid ammonia occurs, goggles or face shields, as well as protective clothing impervious to ammonia and including gloves, aprons, and boots should be required. Where ammonia gas or concentrated ammonia solution is splashed in eyes, immediate flooding of the eyes with large quantities of water for 15 minutes or longer is advised, followed at once by medical examination.

In heavy concentrations of ammonia gas, workers should be outfitted with complete self-contained protective suits impervious to ammonia, with supplied air source, and full headpiece and facepiece. Appropriate clothing should be worn to prevent any possible skin contact with liquids of >10% content or reasonable probability of contact with liquids of <10% content. Wear eye protection to prevent any possibility of eye contact with liquids of >10% NH_3 content. Employees should wash immediately when skin is wet or contaminated with liquids of >10% content. Remove nonimpervious clothing immediately if wet or contaminated with liquids containing >10% and promptly remove if liquid contains <10% NH_3. Provide emergency showers and eyewash if liquids containing >10% NH_3 are involved.

Respirator Selection:

100 ppm: CCRS/SA/SCBA
300 ppm: CCRSF
500 ppm: GMS/SAF/SCBAF
Escape: GMS/SCBA

Disposal Method Suggested: Dilute with water, neutralize with HCl and discharge to sewer (A-38). Recovery is an option to disposal which should be considered for paper manufacture, textile treating, fertilizer manufacture and chemical process wastes (A-57).

References

(1) National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Ammonia,* NIOSH Doc. No. 74-136, Washington, DC (1974).

(2) U.S. Environmental Protection Agency, "Toxic Pollutant List: Proposal to Add Ammonia," *Federal Register,* 45, No. 2, 803-806 (January 3, 1980) Rescinded by *Federal Register,* 45, No. 232, 79692-79693 (December 1, 1980).

(3) National Research Council, Committee on Medical and Biologic Effects of Environmental Pollutants, *Ammonia,* Baltimore, MD, University Park Press (1979).

(4) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report, 2,* No. 1, 65-68, New York, Van Nostrand Reinhold Co. (1982).

(5) See Reference (A-61).

(6) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report, 3,* No. 3, 49-53, New York, Van Nostrand Reinhold Co. (1983).

(7) See Reference (A-60).

(8) Parmeggiani, L., Ed., *Encyclopedia of Occupational Health & Safety,* Third Edition, Vol. 1, pp 148-150, Geneva, International Labour Office (1983).

CARBON MONOXIDE

CMO

Common Synonyms			
Monoxide	Compressed gas or liquefied compressed gas	Colorless	Odorless

Liquid floats and boils on water. Poisonous, flammable vapor cloud is produced.

AVOID CONTACT WITH LIQUID AND VAPOR. KEEP PEOPLE AWAY.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources. Call fire department.
Stop discharge if possible.
Evacuate area in case of large discharge.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Containers may explode in fire.
Wear goggles and self-contained breathing apparatus.
Let fire burn.
Stop flow of gas if possible.
Cool exposed containers and protect men effecting shutoff with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED.
Move victim to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will cause frostbite.
Flush affected areas with plenty of water.
DO NOT RUB AFFECTED AREAS.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison, high flammability
Restrict access
Evacuate area

2. LABEL

2.1 Category: Flammable gas
2.2 Class: 2

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: CO
3.3 IMO/UN Designation: 2/1016
3.4 DOT ID No.: 1016
3.5 CAS Registry No.: 630-08-0

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Compressed gas or liquefied gas
4.2 Color: Colorless
4.3 Odor: None

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety glasses and safety shoes; Type O or Type N canister mask.
5.2 Symptoms Following Exposure: Inhalation causes headache, dizziness, weakness of limbs, confusion, nausea, unconsciousness, and finally death. 0.04% conc., 2-3 hr. or .08% conc., 1 hr.- headache and discomfort; with moderate exercise, 0.1-0.2% will produce throbbing in the head in about 1/2 hr., a tendency to stagger in about 1 1/2 hr., and confusion of the mind, headache, and nausea in about 2 hrs. 0.20-25% usually produces unconsciousness in about 1/2 hr. Inhalation of a 0.4% conc. can prove fatal in less than 1 hr. Inhalation of high concentrations can cause sudden, unexpected collapse. Contact of liquid with skin will cause frostbite.
5.3 Treatment of Exposure: INHALATION: remove from exposure; give oxygen if available; support respiration; call a doctor. SKIN: if burned by liquid, treat as frostbite.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 400 ppm, 15 min.
5.6 Toxicity by Ingestion: Not pertinent (gas with low boiling point)
5.7 Late Toxicity: Toxicity from overexposure persists for many days.
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Not pertinent
5.11 IDLH Value: 1,500 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not pertinent
6.2 Flammable Limits in Air: 12%-75%
6.3 Fire Extinguishing Agents: Let fire burn; shut off flow of gas and cool adjacent exposures with water. Extinguish (only if wearing self-contained breathing apparatus) with dry chemicals or carbon dioxide.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Asphyxiation due to carbon dioxide production may result.
6.6 Behavior in Fire: Flame has very little color. Containers may explode in fire.
6.7 Ignition Temperature: 1,128°F
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: 2701. (Est.)

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1.5 ppm/1-6 hr/minnows and sunfish/tolad/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Liquid: 98.6+%; Gas: Research High Purity; CP (99.5%); Technical (99.0+%); Commercial (97.5+%)
9.2 Storage Temperature: Ambient (for gas); −312.7°F (for liquid)
9.3 Inert Atmosphere: No requirement
9.4 Venting: Safety relief

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-B-C-D-E-F-G

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable gas
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Gas
12.2 Molecular Weight: 28.0
12.3 Boiling Point at 1 atm: −312.7°F = −191.5°C = 81.7°K
12.4 Freezing Point: −326°F = −199°C = 74°K
12.5 Critical Temperature: −220°F = −140°C = 133°K
12.6 Critical Pressure: 507.5 psa = 34.51 atm = 3.502 MN/m²
12.7 Specific Gravity: 0.791 at −191.5°C (liquid)
12.8 Liquid Surface Tension: 9.8 dynes/cm = 0.098 N/m at -193°C
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Data not available
12.11 Ratio of Specific Heats of Vapor (Gas): 1.3962
12.12 Latent Heat of Vaporization: 92.8 Btu/lb = 51.6 cal/g = 2.16 X 10⁴ J/kg
12.13 Heat of Combustion: −4,343 Btu/lb = −2,412 cal/g = −101 X 10⁴ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 7.13 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: 2.451 (Est.)
6.12 Flame Temperature: Data not available

AN ACCESSION NUMBER: 1496. 9112.
CN CHEMICAL NAME: HYDROGEN SULFIDE.
SY SYNONYMS: SULFURETED HYDROGEN. HYDROSULFURIC ACID. HYDROGEN SULFIDE (H2S). STINK DAMP. SULFUR HYDRIDE. UN 1053. HYDROGEN SULPHIDE. SULFUR DIHYDRIDE. DIHYDROGEN MONOSULFIDE. DIHYDROGEN SULFIDE. RCRA U135. STCC 4905410.
RN CAS NUMBER: 7783-06-4.

REG. TOXIC NUMBER: MX1225000.

CHEMICAL FORMULA: H2S.

PD
PHYSICAL DESCRIPTION:
COLORLESS GAS OR LIQUID WITH AN ODOR OF ROTTEN EGGS.

MOL WT:	34.08
BOILING PT:	-78 F (-61 C)
SOLUBILITY:	2.9%
FLASH PT:	FLAMMABLE GAS
VAPOR PRES:	15,200 MMHG @ 25 C
MELT PT:	-123 F (-86 C)
UEL IN AIR:	44%
LEL IN AIR:	4.0%
MEC IN AIR:	500 F (260 C)
SPEC GRAVITY:	1.539 G/L @ 0 C
VAPOR DENSITY:	1.2
ODOR THRESHOLD:	0.13 PPM
OCTANOL/WATER CO-EFFICIENT:	.

EL
PERMISSABLE EXPOSURE:
10 PPM OSHA TWA
15 PPM OSHA STEL
10 PPM ACGIH TWA
15 PPM ACGIH STEL

10 PPM NIOSH RECOMMENDED 10 MIN CEILING
CERCLA HAZARD RATING - TOXICITY 3 - IGNITABILITY 3 - REACTIVITY 0 - PERSISTENCE 0
TOXICOLOGY: HYDROGEN SULFIDE IS AN EYE, SKIN AND MUCOUS MEMBRANE IRRITANT. IT IS A CHEMICAL ASPHYXIANT AND IS TOXIC BY INHALATION. POISONING MAY AFFECT THE CENTRAL NERVOUS AND CARDIOVASCULAR SYSTEMS AND THE KIDNEYS. EXPOSURE MAY RESULT IN OLFACTORY PARALYSIS, SLEEPINESS, MUCOUS DISCHARGE AND BLURRED VISION REACHING A MAXIMUM THE NEXT DAY. REPEATED EXPOSURES MAY RESULT IN INCREASED SUSCEPTIBILITY SO THAT SYMPTOMS MAY OCCUR FROM CONCENTRATIONS PREVIOUSLY TOLERATED WITHOUT ANY EFFECT.
HYDROGEN SULFIDE IS TREATED AS A MATERIAL WITH POOR WARNING PROPERTIES SINCE OLFACTORY FATIGUE OCCURS AT HIGH CONCENTRATIONS, AND SINCE IRRITANT EFFECTS ARE DELAYED. THE THRESHOLD LIMIT VALUE WAS ESTABLISHED BASED ON SUBACUTE EFFECTS AND ACUTE EYE IRRITATION. PERSONS WITH PRE-EXISTING RESPIRATORY OR EYE DISEASE MAY BE AT AN INCREASED RISK FROM EXPOSURE.
THE USE OF ALCOHOLIC BEVERAGES MAY ENHANCE THE TOXIC EFFECTS.
IHL-HMN LCLO: 600 PPM/30 MIN IHL-MAN LDLO: 5700 UG/KG
IHL-HMN LCLO: 800 PPM/5 MIN IHL-RAT LC50: 444 PPM
IHL-MUS LC50: 673 PPM/1 HR IHL-MAM LCLO: 800 PPM/5 MIN

OSHA STANDARD 1910.1200 HAZARD COMMUNICATION REQUIRES CHEMICAL MANUFACTURERS AND IMPORTERS TO ASSESS THE HAZARDS OF CHEMICALS WHICH THEY PRODUCE OR IMPORT, AND ALL EMPLOYERS TO PROVIDE INFORMATION TO THEIR EMPLOYEES CONCERNING HAZARDOUS CHEMICALS BY MEANS OF A HAZARD COMMUNICATION PROGRAM, LABELS AND OTHER FORMS OF WARNING, MATERIAL SAFETY DATA SHEETS, AND INFORMATION AND TRAINING. REQUIRES DISTRIBUTORS TO TRANSMIT REQUIRED INFORMATION TO EMPLOYEES.

DANGEROUS EXPOSURE:
300 PPM OSHA/NIOSH
COLORLESS GAS OR LIQUID WITH A.

IC

INCOMPATIBILITIES:
SEND BACK AREA EXCEDED. CTION BARIUM: INCANDESCENT REACTION BARIUM OXIDE + MERCUROUS OXIDE: INCANDESCENT REACTION OR EXPLOSION BARIUM OXIDE + NICKEL OXIDE: INCANDESCENT REACTION OR EXPLOSION BARIUM PEROXIDE: IGNITION REACTION BROMINE PENTAFLUORIDE: FIRE AND EXPLOSION HAZARD 4-BROMOBENZENEDIAZONIUM CHLORIDE: MAY EXPLODE CALCIUM OXIDE + MERCURY OXIDE: INCANDESCENT REACTION OR EXPLOSION CALCIUM OXIDE + NICKEL OXIDE: INCANDESCENT REACTION OR EXPLOSION CHLORINE MONOXIDE: MAY IGNITE OR EXPLODE CHLORINE TRIFLUORIDE: EXPLOSIVE REACTION CHROMIC ANHYDRIDE: INCANDESCENT REACTION COPPER: INTENSE EXOTHERMIC REACTION COPPER CHROMATE: MAY IGNITE ON CONTACT COPPER OXIDE: MAY IGNITE ON CONTACT DIBISMUTH DICHRONIUM NONAOXIDE: MAY IGNITE DICHLORINE OXIDE: EXPLOSIVE REACTION FLUORINE: IGNITES ON CONTACT HEPTASILVER NITRATE OCTAOXIDE: IGNITES ON CONTACT IRON OXIDE (HYDRATED): FORMS PYROPHORIC MATERIAL LEAD(II) HYPOCHLORITE: IGNITES ON CONTACT LEAD(IV) OXIDE: INCANDESCENT REACTION AND IGNITION MANGANESE DIOXIDE: MAY IGNITE ON CONTACT MERCURY (I) BROMATE: MAY IGNITE ON CONTACT.

CL

CLOTHING:
FOLLOWING INFORMATION FROM NIOSH/OSHA "OCCUPATIONAL HEALTH GUIDELINES FOR CHEMICAL HAZARDS":
EMPLOYERS SHALL PROVIDE AND ENSURE THAT EMPLOYEES USE APPROPRIATE PROTECTIVE CLOTHING AND EQUIPMENT NECESSARY TO PREVENT THE SKIN FROM BECOMING FROZEN FROM CONTACT WITH THIS LIQUID OR FROM CONTACT WITH

VESSELS CONTAINING THIS LIQUID.
-ACGIH "GUIDELINES FOR THE SELECTION OF CHEMICAL PROTECTIVE CLOTHING" INDICATED THE FOLLOWING PROTECTIVE RATINGS FOR MATERIALS COMMONLY USED FOR PROTECTIVE CLOTHING. THESE RATINGS ARE BASED PRIMARILY ON QUANTITATIVE TEST RESULTS AND QUALITATIVE RESISTANCE INFORMATION. (THE RECOMMENDATIONS APPLY TO THE PURE SUBSTANCE ONLY; BREAKTHROUGH-TIME MAY VARY FOR MIXTURES.) (A "+" DESIGNATES A BLEND OF MATERIALS, WHILE A "/" DESIGNATES A COATED OR LAMINATED MATERIAL.) -
HYDROGEN SULFIDE: EXCELLENT/GOOD: NEOPRENE POLYVINYL CHLORIDE GOOD/FAIR: BUTYL RUBBER CHLORINATED POLYETHYLENE NITRILE + POLYVINYL CHLORIDE POOR/FAIR: NATURAL RUBBER POLYURETHANE POOR: NONE INDICATED.

WEAR EYE PROTECTION TO PREVENT:
FOLLOWING INFORMATION FROM NIOSH/OSHA "OCCUPATIONAL HEALTH GUIDELINES FOR CHEMICAL HAZARDS":
EMPLOYERS SHALL PROVIDE AND ENSURE THAT EMPLOYEES USE SPLASH-PROOF SAFETY GOGGLES WHICH COMPLY WITH 29CFR1910.133(A)(2)-(A)(6) WHERE THIS LIQUID MAY CONTACT THE EYES.

EMPLOYEE SHOULD WASH:
NO SPECIFIC REQUIREMENT. WASH APPROPRIATELY AS INDICATED BY THE NATURE OF THE CONTAMINANT AND THE CONDITIONS OF EXPOSURE.

WORK CLOTHING SHOULD BE CHANGED DAILY:
NO SPECIFIC REQUIREMENT. IF INDICATED BY THE NATURE OF THE CONTAMINANT AND THE EXTENT OF EXPOSURE, CHANGE INTO UNCONTAMINATED CLOTHING BEFORE LEAVING THE WORK PREMISES.

REMOVE CLOTHING:
FOLLOWING INFORMATION FROM NIOSH/OSHA "OCCUPATIONAL HEALTH GUIDELINES FOR CHEMICAL HAZARDS":
EMPLOYERS SHALL ENSURE THAT ANY CLOTHING WHICH BECOMES WET WITH THIS FLAMMABLE LIQUID BE REMOVED IMMEDIATELY AND NOT REWORN UNTIL THE SUBSTANCE IS REMOVED FROM THE CLOTHING.

THE FOLLOWING EQUIPMENT SHOULD BE AVAILABLE:
NO SPECIFIC REQUIREMENT. IF INDICATED BY THE NATURE OF THE SUBSTANCE AND THE PROBABILITY OF EXPOSURE, PROVIDE AN EYE WASH AND FACILITIES FOR QUICK DRENCHING OF THE BODY WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

RP

RESPIRATOR SELECTION (UPPER LIMIT DEVICES PERMITTED):
100 PPM
- SUPPLIED-AIR RESPIRATOR
- SELF-CONTAINED BREATHING APPARATUS

250 PPM
- SUPPLIED-AIR RESPIRATOR OPERATED IN CONTINUOUS FLOW MODE

300 PPM
- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACE-PIECE
- SUPPLIED-AIR RESPIRATOR
WITH A FULL FACE-PIECE

ESCAPE
- GAS MASK WITH A CANISTER PROVIDING PROTECTION AGAINST SPECIFIC COMPOUND OF CONCERN (CHIN-STYLE OR FRONTOR BACK-MOUNTED CANISTER)
- APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS

FIREFIGHTING
- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACE-PIECE OPERATED IN PRESSURE-DEMAND OR POSITIVE-PRESSURE MODE.

MS
MEDICAL SURVEILLANCE:
GENERAL MEDICAL HISTORY.
EKG RECOMMENDED IF EMPLOYEE TO WEAR FULL-FACE RESPIRATOR.
40CFR717 RECORDS AND REPORTS OF ALLEGATIONS THAT CHEMICAL SUBSTANCES CAUSE SIGNIFICANT ADVERSE REACTIONS TO HEALTH OR THE ENVIRONMENT TOXIC SUBSTANCES CONTROL ACT (TSCA) SECTION 8(C) RULE REQUIRES MANUFACTURERS AND CERTAIN PROCESSORS OF CHEMICAL SUBSTANCES AND MIXTURES TO KEEP RECORDS OF SIGNIFICANT ADVERSE REACTIONS TO EMPLOYEE HEALTH FOR 30 YEARS.
PHYSICIAN PRE-PLACEMENT AND ANNUAL EXAMS.
MEDICAL WARNING FOR REFUSAL OF MEDICAL EXAMINATION.
EYE DISEASE.
14 BY 17 CHEST P.A. X-RAY.
FORCED VITAL CAPACITY.
FORCED EXPIRATORY VOLUME (1 SECOND).
NEUROMUSCULAR DISORDER.
29CFR1910.20 OSHA STANDARD SUBPART C - GENERAL SAFETY AND HEALTH PROVISIONS PROVIDES FOR EMPLOYEE, DESIGNATED REPRESENTATIVE, AND OSHA ACCESS TO EMPLOYER-MAINTAINED EXPOSURE AND MEDICAL RECORDS RELEVANT TO EMPLOYEES EXPOSED TO TOXIC SUBSTANCES AND HARMFUL PHYSICAL AGENTS.
53FR38140 9/29/88 (AMENDED).

RE
ROUTE OF ENTRY:
INHALATION. SKIN OR EYE CONTACT.

TO
TARGET ORGANS:
EYES. RESPIRATORY SYSTEM. CENTRAL NERVOUS SYSTEM. CARDIOVASCULAR SYSTEM. GASTROINTESTINAL.

SP
SYMPTOMS:
SKIN, COVERING OF BODY (SC0174);
IRRITATION, EXTREME REACTION TO A CONDITION (SC0090).
EYE, ORGAN OF SIGHT (SC0170);
IRRITATION, EXTREME REACTION TO A CONDITION (SC0090).
MUCOUS MEMBRANE, MEMBRANE LINING PASSAGES/CAVITIES (SC0109);
IRRITATION, EXTREME REACTION TO A CONDITION (SC0090). COUGHING, FORCEFUL EXPIRATION (SC0173).
OLFACTORY, PERTAINING TO SMELL (SC0351);
PARALYSIS, LOSS OF POWER OF VOLUNTARY MOVEMENT (SC0124). SLEEPINESS, DROWSINESS (SC0150). SALIVATION, EXCESS DISCHARGE OF SALIVA (SC0146). BLURRED VISION, (SC0015). DYSPNEA, DIFFICULTY IN BREATHING (SC0052). HEMORRHAGE, BLEEDING (SC0080).
PULMONARY, PERTAINING TO THE RESPIRATORY TRACT (SC0500);
EDEMA, FLUID RETENTION WITH SWELLING (SC0181). HEADACHE, PAIN IN HEAD OR CRANIUM AREA (SC0075). NAUSEA, SICKNESS AT THE STOMACH (SC0115). HYPERPNEA, RAPID AND DEEP RESPIRATION (SC0467). VOMITING, PERTAINING TO NAUSEA (SC0166). WEAKNESS, LACK OF STRENGTH (SC0167). DISORIENTATION, INABILITY TO SENSE DIRECTION OR TIME (SC0169). ATAXIA, MUSCULAR INCOORDINATION (SC0013). TREMORS, TREMBLING, SHAKING (SC0197). PNEUMONIA, ACUTE INFECTIOUS DISEASE OF LUNGS (SC0136). BRONCHITIS, INFLAMED BRONCHIAL MUCOUS MEMBRANES (SC0017). BRADYCARDIA, SLOW HEART BEAT (SC0456).
MYOCARDIAL, PERTAINING TO THE HEART MUSCLE (SC0601);
INFLAMMATION, EXTREME INFLAMMATORY TISSUE REACTION (SC0086).

GASTROINTESTINAL, PERTAINING TO STOMACH & INTESTINE (SC0070); DISTURBANCE, INTERRUPTION OF A NORMAL STATE (SC0047). SOMNOLENCE, PROLONGED SLEEPINESS (SC0152). AMNESIA, LOSS OF MEMORY (SC0438). SHOCK SUDDEN PHYSICAL OR MENTAL DISTURBANCE(SC0228). HALLUCINATIONS, PERCEPTIONS OF WHAT DOES NOT EXIST (SC0074). DYSPHAGIA, DIFFICULTY IN SWALLOWING (SC0325). HYPOTENSION, LOW BLOOD PRESSURE (SC0180). ERUCTATION, BELCHING; BURPING (SC0732). HALITOSIS, OFFENSIVE BREATH (SC0333). INCOORDINATION, LACK OF COORDINATION (SC0085). CARDIAC, PERTAINING TO HEART (SC0023); ARRHYTHMIA, ABSENCE OF RHYTHM; IRREGULARITY (SC0010). VERTIGO, FEELING OF WHIRLING MOTION (SC0163). STRABISMUS, SIGHT AXES FAIL TO CONVERGE PROPERLY (SC0154). DIPLOPIA, DOUBLE VISION (SC0474). DECREASED VITAL CAPACITY, DECREASED PULMONARY FUNCTION (SC0546). ANOREXIA, DIMINISHED APPETITE (SC0006). WEIGHT LOSS, DROP IN BODY WEIGHT (SC0104). INSOMNIA INABILITY TO OBTAIN NORMAL SLEEP (SC0088). ASTHENIA, LOSS OF STRENGTH (SC0430). PARALYSIS, LOSS OF POWER OF VOLUNTARY MOVEMENT (SC0124). POLYNEURITIS, INFLAMMATION OF MANY NERVES (SC0624). GINGIVAL BLUE LINE BLUE LINE ON GUMS (SC0575). ERYTHEMA, REDNESS, SPOTS ON SKIN (SC0060). FROSTBITE, FREEZING OF TISSUE (SC0068). ASPHYXIA, SUFFOCATION (SC0011). CONVULSIONS, SUDDEN MUSCLE CONTRACTIONS (SC0034). COMA, STATE OF DEEP UNCONSCIOUSNESS (SC0583);.

FA

FIRST AID.

(1 OF 4)
IF THIS SUBSTANCE GETS INTO THE EYES, IMMEDIATELY WASH THE EYES WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). IF FROSTBITE IS PRESENT, WARM WATER MAY BE PREFERRED. GET MEDICAL ATTENTION IMMEDIATELY.

(2 OF 4)
IF THIS CHEMICAL GETS ON THE SKIN, REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF THE CHEMICAL REMAINS. IN CASE OF FROSTBITE, WARM AFFECTED AREA IN WARM WATER AT A TEMPERATURE OF 107 F. IF WARM WATER IS NOT AVAILABLE OR IMPRACTICAL TO USE, GENTLY WRAP AFFECTED PART IN BLANKETS. ENCOURAGE VICTIM TO EXERCISE AFFECTED PART WHILE IT IS BEING WARMED. ALLOW CIRCULATION TO RETURN NATURALLY. (MATHESON GAS, 6TH ED.). GET MEDICAL ATTENTION IMMEDIATELY.

(3 OF 4)
IF THIS CHEMICAL HAS BEEN INHALED, REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

(4 OF 4)
IF INGESTED, IT IS UNLIKELY THAT EMERGENCY TREATMENT WILL BE REQUIRED. IF ADVERSE EFFECTS OCCUR, TREAT SYMPTOMATICALLY AND SUPPORTIVELY AND GET MEDICAL ATTENTION.

12

AN ACCESSION NUMBER: 1835. 9112.
CN CHEMICAL NAME: MERCURY.
SY SYNONYMS: METALLIC MERCURY. INORGANIC MERCURY. MERCURY, METALLIC.

- Hazardous substances (Various compounds, EPA)
  Lead compounds which are classified by EPA as hazardous substances include: lead acetate, lead arsenate (see separate entry), lead chloride, lead fluoborate, lead fluoride (see also "Fluorides"), lead iodide, lead nitrate, lead stearate, lead sulfate, lead sulfide, and lead thiocyanate.
- Hazardous waste constituents (EPA)
- Priority toxic pollutant (EPA)

Description: Pb, inorganic lead, includes lead oxides, metallic lead, lead salts, and organic salts such as lead soaps, but excludes lead arsenate and organic lead compounds. Lead is a blue-grey metal which is very soft and maleable. Commercially important lead ores are galena, cerussite, anglesite, crocoisite, wulfenite, pyromorphite, matlockite, and vanadinite. Lead is slightly soluble in water in presence of nitrates, ammonium salts, and carbon dioxide.

Code Numbers: Lead metal—CAS 7439-92-1 RTECS OF7525000

DOT Designation: —

Synonyms: None.

Potential Exposures: Metallic lead is used for lining tanks, piping, and other equipment where pliability and corrosion resistance are required such as in the chemical industry in handling corrosive gases and liquids used in the manufacture of sulfuric acid; in petroleum refining; and in halogenation, sulfonation, extraction, and condensation processes; and in the building industry.

It is also used as an ingredient in solder, a filler in the automobile industry, and a shielding material for x-rays and atomic radiation; in manufacture of tetraethyllead and organic and inorganic lead compounds, pigments for paints and varnishes, storage batteries, flint glass, vitreous enameling, ceramics as a glaze, litharge rubber, plastics, and electronic devices. Lead is utilized in metallurgy and may be added to bronze, brass, steel, and other alloys to improve their characteristics. It forms alloys with antimony, tin, copper, etc. It is also used in metallizing to provide protective coatings and as a heat treatment bath in wire drawing.

Exposures to lead dust may occur during mining, smelting, and refining, and to fume, during high temperature (above 500°C) operations such as welding or spray coating of metals with molten lead. There are numerous applications for lead compounds, some of the more common being in the plates of electric batteries and accumulators, as compounding agents in rubber manufacture, as ingredients in paints, glazes, enamels, glass, pigments, and in the chemical industry.

It is estimated that approximately 783,000 industrial workers are potentially exposed to lead products.

In addition to these usual levels of exposure from environmental media, there exist miscellaneous sources which are hazardous. The level of exposure resulting from contact is highly variable. Children with pica for paint chips or for soil may experience elevation in blood lead ranging from marginal to sufficiently great to cause clinical illness. Certain adults may also be exposed to hazardous concentrations of lead in the workplace, notably in lead smelters and storage battery manufacturing plants. Again, the range of exposure is highly variable. Women in the workplace are more likely to experience adverse effects from lead exposure than men due to the fact that their hematopoietic system is more lead-sensitive than men's.

Incompatibilities: Strong oxidizers, hydrogen peroxide, active metals—sodium, potassium.

Permissible Exposure Limits in Air: The Federal (OSHA) standard for lead and its inorganic compounds was 0.2 mg/m^3 as a time-weighted average. The EPA has set a national ambient air quality standard for lead of 1.5 mg/m^3 on a 3-month average basis. The NIOSH Criteria Document recommends a time-weighted average value of 0.15 mg Pb/m^3. On November 14, 1978, OSHA set a final standard in which industries will be given 1 to 3 years to reach 0.1 mg (100 μg)/m^3 level and from 1 to 10 years to reach a final standard of 0.05 mg (50 μg)/m^3. ACGIH as of 1983/84 has set a TWA of 0.15 mg/m^3 (as Pb) and an STEL of 0.45 mg/m^3. Lead chromate is assigned a TWA of 0.05 mg/m^3 by ACGIH (1983/84) with the notation that it is a substance suspect of carcinogenic potential for man.

Determination in Air: Collection on a filter, workup with nitric acid, analysis by atomic absorption spectrometry. See NIOSH Methods, Set O. See also reference (A-10).

Permissible Concentration in Water: To protect freshwater aquatic life–

$$e^{[2.35 \ln (\text{hardness}) - 9.48]}$$

never to exceed

$$e^{[1.22 \ln (\text{hardness}) - 0.47]}$$

To protect saltwater aquatic life–668 μg/ℓ on an acute toxicity basis and 25 μg/ℓ on a chronic basis. To protect human health–50 μg/ℓ (USEPA).

Various organizations worldwide have set other standards for lead in drinking water as follows (A-65): South African Bureau of Standards, 150 μg/ℓ; World Health Organization, 100 μg/ℓ; Federal Republic of Germany (1975), 40 μg/ℓ.

Determination in Water: Digestion followed by atomic absorption or by colorimetric (dithizone) analysis or by inductively coupled plasma (ICP) optical emission spectrometry. That gives total lead; dissolved lead may be determined by 0.45 micron filtration prior to such analyses.

Routes of Entry: Ingestion of dust; inhalation of dust or fume, skin and eye contact.

Harmful Effects and Symptoms: *Local* – None.

Systemic – The early effects of lead poisoning are nonspecific and, except by laboratory testing, are difficult to distinguish from the symptoms of minor seasonal illnesses. The symptoms are decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, digestive symptoms (particularly constipation), abdominal pains, and decreased appetite. These symptoms are reversible and complete recovery is possible.

Later findings include anemia, pallor, a "lead line" on the gums, and decreased hand-grip strength. Lead colic produces an intense periodic abdominal cramping associated with severe constipation and, occasionally, nausea and vomiting. Alcohol ingestion and physical exertion may precipitate these symptoms. The peripheral nerve affected most frequently is the radial nerve. This will occur only with exposure over an extended period of time and causes "wrist drop." Recovery is slow and not always complete. When the central nervous system is affected, it is usually due to the ingestion or inhalation of large amounts of lead. This results in severe headache, convulsions, coma, delirium, and possibly death. The kidneys can also be damaged after long periods of exposure to lead, with loss of kidney function and progressive azotemia.

Because of more efficient material handling methods and biological monitoring, serious cases of lead poisoning are rare in industry today.

Points of Attack: Kidneys, blood, gingival tissue, gastrointestinal system, central nervous system.

Medical Surveillance: In preemployment physical examinations, special attention is given to neurologic and renal disease and baseline blood lead levels. Periodic physical examinations should include hemoglobin determinations, tests for blood lead levels, and evaluation of any gastrointestinal or neurologic symptoms. Renal function should be evaluated.

Periodic evaluation of blood lead levels are widely used as an indicator of increased or excessive lead absorption. Other indicators are urine coproporphyrin and delta aminolevulinic acid (ALA). Erythrocytic protoporphyrin determinations may also be helpful. See also reference (10).

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, flush with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: Wear appropriate clothing to prevent repeated or prolonged skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash daily at the end of each work shift. Remove nonimpervious clothing immediately if wet or contaminated.

Respirator Selection:

0.5 mg/m^3: HiEP
2.5 mg/m^3: HiEPF
50 mg/m^3: PAPHiE/SA:PD,PP,CF
100 mg/m^3: SAF:PD,PP,CF

Disposal Method Suggested: Lead oxide—chemical conversion to the sulfide or carbonate followed by collection of the precipitate and lead recovery via smelting operations. Landfilling of the oxide is also an acceptable procedure (A-31). Alternatively, it may be dissolved in HNO_3, precipitated as the sulfide and returned to a supplier for reprocessing (A-38). Processes for recovering and recycling lead from a number of industrial waste sources have been described (A-57).

References

(1) National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Inorganic Lead*, NIOSH Doc. No. 73-11010, Wash., DC (1973).

(2) OSHA, "Occupational exposure to lead: Final standard," *Federal Register* 43 No. 220, 52952-53014 (Nov. 14, 1978).

(3) U.S. Environmental Protection Agency, *Toxicology of Metals, Vol. II: Lead*, pp 242-300, Report EPA-600/1-77-022, Research Triangle Park, NC (May 1977).

(4) U.S. Environmental Protection Agency, *Lead: Ambient Water Quality Criteria*, Wash., DC (1980).

(5) U.S. Environmental Protection Agency, *Status Assessment of Toxic Chemicals: Lead*, Report EPA-600/2-79-210h, Cincinnati, Ohio (Dec. 1979).

(6) U.S. Environmental Protection Agency, *Reviews of the Environmental Effects of Pollutants: VII. Lead*, Report EPA-600/1-78-029, Cincinnati, Ohio (1978).

(7) U.S. Environmental Protection Agency, *Air Quality Criteria Document for Lead*, Report EPA-600/8-77-017, Research Triangle Park, NC (1977).

(8) National Academy of Sciences, *Medical and Biologic Effects of Environmental Pollutants: Lead, Airborne Lead in Perspective*, Wash., DC (1972).

(9) U.S. Environmental Protection Agency, *Lead*, Health and Environmental Effects Profile No. 121, Wash., DC, Office of Solid Waste (April 30, 1980).

(10) Nat. Inst. for Occup. Safety and Health, *A Guide to the Work Relatedness of Disease*, Revised Edition, DHEW (NIOSH) Pub. No. 79-116, pp 98-116, Cincinnati, Ohio (Jan. 1979).

(11) World Health Organization, *Lead*, Environmental Health Criteria No. 3, Geneva, Switzerland (1977).

(12) See Reference (A-60) for citations to: Lead, Lead Carbonate, Lead Chromate, Lead Naphthenate, Lead Nitrate and Lead Peroxide.

(13) Parmeggiani, L., Ed., *Encyclopedia of Occupational Health & Safety*, Third Edition, Vol. 2, pp 1200-1205, Geneva, International Labour Office (1983).

(14) United Nations Environment Programme, *IRPTC Legal File 1983*, Vol. II, pp VII/405-14, Geneva, Switzerland, International Register of Potentially Toxic Chemicals (1984).

MANGANESE AND COMPOUNDS

Description: Mn, manganese, is a reddish-grey or silvery, soft metal. The most important ore containing manganese is pyrolusite. Manganese may also be produced from ferrous scrap used in the production of electric and open-hearth steel. Manganese decomposes in water and is soluble in dilute acid.

Code Numbers: (Manganese metal): CAS 7439-96-5 RTECS OO9275000

DOT Designation: –

Synonyms: None.

Potential Exposure: Most of the manganese produced is used in the iron and steel industry in steel alloys, e.g., ferromanganese, silicomanganese, Manganin, spiegeleisen, and as an agent to reduce oxygen and sulfur content of molten steel. Other alloys may be formed with copper, zinc, and aluminum. Manganese and its compounds are utilized in the manufacture of dry cell batteries (MnO_2), paints, varnishes, inks, dyes, matches and fireworks, as a fertilizer, disinfectant, bleaching agent, laboratory reagent, drier for oils, an oxidizing agent in the chemical industry particularly in the synthesis of potassium permanganate, and as a decolorizer and coloring agent in the glass and ceramics industry.

Organomanganese compounds such as methylcyclopentadienyl manganese tricarbonyl (MMT) have been proposed as supplements and/or replacements for tetraethyllead (TEL) as an antiknock in gasoline.

Exposure may occur during the mining, smelting and refining of manganese, in the production of various materials, and in welding operations with manganese-coated rods.

Manganese normally is ingested as a trace nutrient in food. The average human intake is approximately 10 mg/day.

Permissible Exposure Limits in Air: The Federal standard for manganese dust and compounds is 5 mg/m^3 as a ceiling value. The Illinois Environmental Health Resource Center recommends an environmental standard for particulate manganese of 0.006 $\mu g/m^3$. ACGIH (1983/84) has set a TWA of 1.0 mg/m^3 for manganese tetroxide and manganese fume as well as an STEL of 3.0 mg/m^3 for manganese fume.

The ACGIH has set a TWA value of 0.2 mg/m^3 for manganese methylcyclopentadienyl tricarbonyl and an STEL of 0.6 mg/m^3 as of 1983/84. This compound is capable of cutaneous absorption, as is cyclopentadienyl manganese tricarbonyl for which ACGIH has set a TWA of 0.1 mg/m^3 and an STEL of 0.3 mg/m^3.

The IDLH level for manganese is 10,000 ppm.

Determination in Air: Collection on a filter, workup with HCl, analysis by atomic absorption. See NIOSH Methods, Set A. See also reference (A-10).

Permissible Concentration in Water: The EPA (A-3) has suggested the following criteria:

50 $\mu g/\ell$ for domestic water supplies (welfare).
100 $\mu g/\ell$ for protection of consumers of marine mollusks.

No specific criterion for manganese in agricultural waters is proposed. In select areas, and where acidophilic crops are cultivated and irrigated, a criterion of 200 $\mu g/\ell$ is suggested for consideration.

Determination in Water: The manganese detection limit by direct flame atomization is 2 $\mu g/\ell$. However, solvent extraction is used for many determinations. Analytic conditions are more critical for the extraction of manganese than for most other metals, because many manganese-chelate complexes are unstable in solution. With pH control and immediate analysis after extraction, accurate determinations are possible.

When the graphite furnace is used to increase sample atomization, the detection limit is lowered to 0.01 $\mu g/\ell$ according to NAS/NRC.

Routes of Entry: Inhalation of dust or fume; limited percutaneous absorption of liquids; ingestion.

Harmful Effects and Symptoms: *Local* – Manganese dust and fumes are only minor irritants to the eyes and mucous membranes of the respiratory tract, and apparently are completely innocuous to the intact skin.

Systemic – Chronic manganese poisoning has long been recognized as a clinical entity. The dust or fumes (manganous compounds) enter the respiratory tract and are absorbed into the blood stream. Manganese is then deposited in major body organs with a special predilection for the liver, spleen, and certain nerve cells of the brain and spinal cord. Among workers there is a very marked variation in individual susceptibility to manganese. Some workers have worked in heavy exposure for a lifetime and have shown no signs of the disease; others have developed manganese intoxication with as little as 49 days of exposure.

The early phase of chronic manganese poisoning is most difficult to recognize, but it is also important to recognize since early removal from the exposure may arrest the course of the disease. The onset is insidious, with apathy, anorexia, and asthenia. Headache, hypersomnia, spasms, weakness of the legs, arthralgias, and irritability are frequently noted. Manganese psychosis follows with certain definitive features: unaccountable laughter, euphoria, impulsive acts, absentmindedness, mental confusion, aggressiveness, and hallucinations. These symptoms usually disappear with the onset of true neurological disturbances, or may resolve completely with removal from manganese exposure.

Progression of the disease presents a range of neurological manifestations that can vary widely among individuals affected. Speech disturbances are common: monotonous tone, inability to speak above a whisper, difficult articulation, incoherence, even complete muteness. The face may take on masklike quality, and handwriting may be affected by micrographia. Disturbances in gait and balance occur, and frequently propulsion, retropropulsion and lateropropulsion are affected, with no movement for protection when falling. Tremors are frequent, particularly of the tongue, arms, and legs. These will increase with intentional movements and are more frequent at night. Absolute detachment, broken by sporadic or spasmodic laughter, ensues, and as in extrapyramidal affections, there may be excessive salivation and excessive sweating. At this point the disease is indistinguishable from classical Parkinson's disease.

Chronic manganese poisoning is not a fatal disease although it is extremely disabling.

Manganese dust is no longer believed to be a causative factor in pneumonia. If there is any relationship at all, it appears to be as an aggravating factor to a preexisting condition. Freshly formed fumes have been reported to cause fever and chills similar to metal fume fever.

Points of Attack: Respiratory system, central nervous system, lungs, blood, kidneys.

Medical Surveillance: Preemployment physical exams should be directed toward the individual's general health with special attention to neurologic and personality abnormalities. Periodic physical examinations may be required as often as every two months. Special emphasis should be given to behavioral and neurological changes: speech defects, emotional disturbances, hypertonia, tremor, equilibrium, difficulty in walking or squatting, adiadochokinesis, and handwriting.

There are no laboratory tests which can be used to diagnose manganese poisoning.

First Aid: If a person breathes in large amounts of manganese or its compounds, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: In areas where the ceiling value standards are exceeded, dust masks or respirators are necessary. Education in the use and necessity of these devices is important.

Respirator Selection:

25 mg/m³: OM/DMXS
50 mg/m³: OMXSO/DMFu
50 mg/m³: FuHIEP/SA/SCBA
250 mg/m³: HIEPF/SAF/SCBAF
5,000 mg/m³: PAPHIE/SA:PO, PP, CF
10,000 mg/m³: SAF:PO, PP, CF

Disposal Method Suggested: Manganese metal—sanitary landfill. Manganese chloride or sulfate—chemical conversion to the oxide followed by landfilling, or conversion to the sulfate for use in fertilizer.

References

(1) Illinois Institute for Environmental Quality, *Airborne Manganese Health Effects and Recommended Standard*, Doc. No. 75-18, Chicago, Ill. (Sept. 1975).

(2) National Academy of Sciences, *Manganese*, (in a series on medical and biologic effects of environmental pollutants), Wash., DC (1973).

(3) Nat. Inst. for Occup. Safety and Health, *Information Profile on Potential Occupational Hazards*, pp 157-168, Report PB-267 678, Rockville, MD (Oct. 1977).

(4) National Academy of Sciences, *Medical and Biologic Effects of Environmental Pollutants: Manganese*, Wash., DC (1973).

(5) See Reference (A-61).

(6) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 1, No. 2, 44-45, New York, Van Nostrand Reinhold Co. (1980).

(7) See Reference (A-60) under Manganese Acetate and Manganese Dioxide.

(8) U.S. Environmental Protection Agency, *Chemical Hazard Information Profile: Methylcyclopentadienyl Manganese Tricarbonyl*, Wash., DC (October 21, 1983).

(9) Parmeggiani, Ed., *Encyclopedia of Occupational Health & Safety*, Third Edition, Vol. 2, pp 1279-82, Geneva, International Labour Office (1983).

(10) United Nations Environment Programme, *IRPTC Legal File 1983*, Vol. II, pp VII/420-21, Geneva, Switzerland, International Register of Potentially Toxic Chemicals (1984).

METHANE

MTH

Common Synonyms	Gas	Colorless	Weak odor
Marsh gas Natural gas	Liquid floats and boils on water. Flammable visible vapor cloud is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Evacuate area in case of large discharge.
Avoid contact with liquid and vapor.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
May explode if ignited in an enclosed area.
Stop discharge if possible.
Cool exposed containers and protect men effecting shutoff with water.
Let fire burn.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Not irritating to eyes, nose or throat.
If inhaled, will cause dizziness, difficult breathing, and loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will cause frostbite.
Flush affected areas with plenty of water.
DO NOT RUB AFFECTED AREAS.

Water Pollution

Not harmful to aquatic life.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Restrict access
Evacuate area

2. LABEL

2.1 **Category:** Flammable gas
2.2 **Class:** 2

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Paraffin
3.2 **Formula:** CH_4
3.3 **IMO/UN Designation:** 2.0/1971
3.4 **DOT ID No.:** 1971
3.5 **CAS Registry No.:** 74-82-8

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquefied gas
4.2 **Color:** Colorless
4.3 **Odor:** Mild, sweet

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Self-contained breathing apparatus for high concentrations; protective clothing if exposed to liquid.
5.2 **Symptoms Following Exposure:** High concentrations may cause asphyxiation. No systemic effects, even at 5% concentration in air.
5.3 **Treatment of Exposure:** Remove to fresh air. Support respiration.
5.4 **Threshold Limit Value:** Not pertinent (methane is an asphyxiant, and limiting factor is available oxygen)
5.5 **Short Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Not pertinent
5.7 **Late Toxicity:** None
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors are nonirritating to the eyes and throat
5.9 **Liquid or Solid Irritant Characteristics:** No appreciable hazard. Practically harmless to the skin, because it evaporates quickly, but may cause some frostbite.
5.10 **Odor Threshold:** 200 ppm
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** Flammable gas
6.2 **Flammable Limits in Air:** 5.0%-15.0%
6.3 **Fire Extinguishing Agents:** Stop flow of gas
6.4 **Fire Extinguishing Agents Not to be Used:** Water
6.5 **Special Hazards of Combustion Products:** None
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** 1004°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 12.5 mm/min.
6.10 **Adiabatic Flame Temperature:** 2339. (Est.)
6.11 **Stoichiometric Air to Fuel Ratio:** 17.16 (Est.)
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 31

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** None
8.2 **Waterfowl Toxicity:** None
8.3 **Biological Oxygen Demand (BOD):** None
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research grade; pure grade
9.2 **Storage Temperature:** -260°F
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Safety relief

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-B-C-D-E-F-G

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable gas
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	4
Health	
Vapor Irritant	0
Liquid or Solid Irritant	0
Poisons	0
Water Pollution	
Human Toxicity	0
Aquatic Toxicity	0
Aesthetic Effect	0
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	4
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Gas
12.2 **Molecular Weight:** 16.04
12.3 **Boiling Point at 1 atm:** −258.7°F = −161.5°C = 111.7°K
12.4 **Freezing Point:** −296.5°F = −182.5°C = 90.7°K
12.5 **Critical Temperature:** −116.5°F = −82.5°C = 190.7°K
12.6 **Critical Pressure:** 668 psia = 45.44 atm = 4.60 MN/m²
12.7 **Specific Gravity:** 0.422 at −160°C (liquid)
12.8 **Liquid Surface Tension:** 14 dynes/cm = 0.014 N/m at −161°
12.9 **Liquid Water Interfacial Tension:** (est.) 50 dynes/cm = 0.050 N/m at −161°
12.10 **Vapor (Gas) Specific Gravity:** 0.55 1.0
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.306
12.12 **Latent Heat of Vaporization:** 219.4 Btu/lb = 121.9 cal/g = 5.100 X 10⁵ J/kg
12.13 **Heat of Combustion:** −21,517 Btu/lb = −11,954 cal/g = −500.2 X 10⁵ J/k
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 13.96 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Very high

NOTES

APPENDIX 7-B

RESPIRATOR PROGRAM FOR NAVAL TRAINING CENTER, GREAT LAKES

APPENDIX 7-B

RESPIRATOR PROGRAM FOR NAVAL TRAINING CENTER, GREAT LAKES INVESTIGATION

The following respirator program is in accordance with OSHA 29 CFR 1910.134 Respiratory Protection Program requirements. This program governs the selection and use of respirators on-site.

Respirators for the SEC Donohue field sampling team will be provided by SEC Donohue Inc. The respirator protection program will be administered by, and is the responsibility of, the CHSM and/or SSO for the site. Subcontractors (i.e., drillers) will furnish their own respirators and medical surveillance for their employees. The CHSM and/or SSO will be responsible for ensuring that they are in compliance with this respirator program.

The respirators will be selected according to the hazard and level of protection determined by monitoring action levels and the decision of the CHSM and/or the SSO. The respirators and levels are:

Level	Respirator
B	Positive Pressure-Pressure Demand SCBA or Supplied Air Respirator with 5-minute escape bottle. Level B is 5 to 250 ppm above background in (BZ).
C	Full-face air purifying respirator with combination dust (HEPA) and organic vapor/acid gas cartridge. Level C is 1 ppm to 5 ppm above background in BZ based on identification of contaminant present. The full facepiece respirator with combination dust and organic vapor/acid gas cartridge will be appropriate for the dust conditions and organics that may be encountered.
D	No respirator required. Continuous reading of background (0.2 ppm) to 1 ppm in the worker's BZ.

The respirator users will be fit tested with the size, style, and make of the respirator they will be using on-site. The fit test will be recorded and these Fit Test Records will be maintained in the Command Post.

Employee respirator training is provided on an annual basis and at site-specific training sessions. This training includes:

- A discussion of the nature of the respiratory hazards and the dangers if the respirator is not used properly.
- The reasons that respirators are required for protection, along with any engineering controls that may be used.
- Instruction in the selection, use, sanitary care, maintenance, proper storage, and limitation of the full facepiece respirator with combination cartridge, and the SCBA.
- Practice in proper fitting, wearing, adjusting, and checking face seal of the respirator.
- An opportunity to handle the respirator.
- Instruction on how to recognize and cope with emergency situations requiring respiratory protection.
- Explanation of the requirements for a self-contained breathing device for work in unknown concentrations and Immediately Dangerous to Life or Health (IDLH) atmosphere and for fire fighting.
- Explanation of the medical surveillance program and how it relates to respirator use.
- Explanation of the requirements for maintaining a tight seal, why beard and facial hair is prohibited, and why use of contact lenses while wearing respirators is prohibited.

Respirators will be assigned to individual workers. Each individual shall be responsible for cleaning and maintaining their assigned respirator. They will be cleaned and disinfected before being reassigned. Respirators will be cleaned after each day of work according to manufacturer's instructions. The cleaning will be done at the Command Post. Used cartridges will be disposed of and replaced with new ones.

After cleaning, the respirators will be inspected and checked for defects such as excessive dirt, cracks or other distortions, scratches, incorrectly mounted lens, broken or worn cartridge holders on the facepiece, breaks, loss of elasticity, broken buckles, and excessively worn serrations on head harness that may cause slippage on the headstraps or head harness.

Further checks include:

- A check of the tightness of the connections.
- A check of the facepiece, valves, connecting tube, and canisters.
- A check of the regulator and warning devices on SCBA for proper functioning.
- For air purifying:
  - Check the exhalation valve after removing its cover for:
    -- Foreign material, such as detergent residue, dust particles, or human hair under the valve seat.
    -- Cracks, tears, or distortion in the valve material.
    -- Improper insertion of the valve body in the facepiece.
    -- Cracks, breaks, or chips in the valve body, particularly in the sealing surface.
    -- Missing or defective valve cover.
    -- Improper installation of the valve in the valve body.
  - Check the air purifying elements for:
    -- Incorrect cartridges, canister, or filter for the hazard.
    -- Incorrect installation, loose connections, missing or worn gaskets, or cross threading in holder.
    -- Expired shelf life of cartridge or canister.
    -- Cracks, dents, or breaks in the cartridge or canisters case.
    -- Evidence of prior use of cartridge or canister, such as broken seal tape foil or other sealing material.

- For air supplied respirators, check the air supply system for:

  - Integrity and condition of air supply lines and hoses, including attachments and end fitting.

  - Correct operation and condition of all regulators, valves, or other air-flow regulators.

  - If SCBA, that the cylinder is sufficiently charged for the intended use, preferably fully charged (mandatory on an emergency device). The emergency SCBA will have a tag for logging in the monthly inspections.

Monitoring of the work area will be performed and the results will be used to select the appropriate level of protection.

This Respirator Program will be re-evaluated and revisions and updates added regularly.

Persons will not be assigned to tasks requiring the use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. The SEC Donohue-contracted physician will determine what health and physical conditions are pertinent.

Only those respirators jointly approved by NIOSH/MSHA shall be used. All component parts (i.e., canister, replacement straps, etc.) will be of the same make.

APPENDIX 7-C

HSP MODIFICATION FORM

SEC DONOHUE
Environment & Infrastructure

HEALTH AND SAFETY PLAN
FIELD MODIFICATION FORM

PAGE NO. ____ OF ____

PROJECT: _____

PROJECT LOCATION: _____

PROJECT NO.: _____

SITE SAFETY OFFICER: _____

FIELD MODIFICATION TO HASP: _____

PREPARED BY: _____
SITE SAFETY OFFICER — DATE

ACCEPTED BY: _____
SEC DONOHUE FIELD MANAGER — DATE

ACCEPTED BY: _____
CONTRACTOR REPRESENTATIVE (IF APPLICABLE) — DATE

APPROVED BY: _____
SEC DONOHUE CORPORATE HEALTH AND SAFETY MANAGER — DATE

NOTE: Field Modifications to HASP's must be discussed with the SEC Donohue RHSS or CHSM with subsequent written approval. SEC Donohue fax number – 414-458-0537.

8.0 REFERENCES

Dames & Moore, September 1991, Technical Memorandum on the Remedial Investigation Step for the Naval Training Center Great Lakes, Illinois.

NTC, Great Lakes September 1986, Naval Training Center Great Lakes, IL Master Plan.

Naval Energy and Environmental Support Activity, June 1988, Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, NEESA 20.1-047B.

STS Consultants, Ltd., May 6, 1983, Recommendations for Closure Plan, STS Project No. 22839, Northbrook, Illinois.

USEPA, February 1, 1988, Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses, modified November 1, 1988.

USEPA, June 13, 1988, Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses, modified February 1989.

USEPA, December 1990, National Functional Guidelines for Organic Data Review, draft, revised June 1991.

R/CTO62/AB5