Work Plan for:

PHASE II SITE INVESTIGATION AT EKONOL POLYESTER RESINS WHEATFIELD, NEW YORK

Submitted to:

**New York State Department of
Environmental Conservation
Division of Hazardous Waste Remediation**

Submitted by:

BP Amoco Corporation

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August 2001

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PHASE II WORK PLAN FOR SITE INVESTIGATION AT THE EKONOL POLYESTER RESINS FACILITY WHEATFIELD, NEW YORK

1.0 PROJECT OBJECTIVES AND BACKGROUND

The Ekonol Polyester Resins facility, currently owned by Norton, a division of Saint-Gobain Performance Plastics Corporation, is located on the west side of Walmore Road, approximately ½-mile north of Niagara Falls Boulevard (Route 62) in the Town of Wheatfield, New York (Figure 1). A former concrete secondary containment tank for process water was removed from service at the facility in October 1999. Following removal of the tank and surrounding soils, soil sampling of the walls and floor of the excavation was conducted. Results of the sampling indicated the presence of several organic compounds, including trichloroethane (TCE), tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-1,2 DCE), and phenol. Because some of the sample results exceeded New York State Department of Environmental Conservation (NYSDEC) TAGM 4046 values, a site characterization was required.

The purpose of the initial site characterization was to determine the extent of the target organic compounds and metals in soil and groundwater in the vicinity of the former containment tank. The initial site characterization activities included soil borings, temporary well installations, soil and groundwater sampling, and surveying. The initial work was summarized and presented to the NYSDEC in a report, dated March 2001. The NYSDEC reviewed the report and requested additional characterization of soil and groundwater.

To address the NYSDEC comments, Phase II site characterization activities will be undertaken. The objective of this phase of work is to further characterize the extent of contamination. The following sections describe the work effort that will be necessary to complete the Phase II activities.

2.0 FIELD INVESTIGATION

The Phase II Field Investigation program will consist of soil borings, well installation, soil and groundwater sampling, and a sewer investigation. Soil borings, well installation, and soil and groundwater sampling will follow NYSDEC guidelines as outlined in the following sections.

2.1 Soil Borings

To define the horizontal extent of soil contamination, five soil borings will be advanced in the vicinity of the former containment tank location. The soil borings will be advanced using direct-push methodology (Geoprobe™), at the approximate locations shown on Figure 2. These locations were selected to better define the extent of soil impacts. The actual boring locations may be altered in the field based on underground utility locations, field screening results, and visual observations.

Each soil boring will be advanced to the top of bedrock. The estimated depth to the top of bedrock is between 10 and 15 feet below ground surface (bgs). Field techniques, including photoionization detector (PID) headspace readings and visual observations, will be used to screen the soil samples collected from each boring.

After the soil boring reaches its total depth, a temporary piezometer will be installed. Using a peristaltic pump, a groundwater sample will be collected from each borehole. The groundwater sample will be field screened for volatile organic halides, using EPA Method 8535. This is a colorimetric screening procedure, which is intended for onsite use. The method is not specific to any one halogenated hydrocarbon compound. The testing product is based on a photochemical reaction involving ultraviolet (UV) light. The method detection limit has been calculated by the manufacturer at 4 ug/L. Based on the groundwater screening results, the borehole may be abandoned, and an alternate location chosen. Alternate borehole locations will be considered if the screening results reveal a TCE concentration in groundwater that is greater than the method detection limit.

2.2 Soil Sampling and Analysis

Using the results of the field screening, including PID readings, field observations, and on-site groundwater analysis, a total of five soil samples will be submitted for laboratory analysis. Soil samples will be analyzed for volatile organic compounds (VOCs), including trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2 DCE), 1,1-dichloroethane (1,1-DCA), and trichloroethane (1,1,1-TCA), using EPA Method 8260. Target semi-volatile organic compounds (SVOCs) include phenol and aniline. Analysis for target SVOCs will be performed using EPA Method 8270. Metals, including zinc and lead, will be analyzed using EPA Method 6010B. For QA/QC purposes, one field duplicate sample will be collected. Analysis of these samples, in conjunction with the results of the field screening, is anticipated to confirm the extent of soil impacts from the former containment tank.

2.3 Monitoring Well Installation and Construction

Eight monitoring wells (4 shallow and 4 deep) will be installed as well pairs consisting of one overburden well and one bedrock well at each location. The approximate proposed location of these wells is shown in Figure 2. One well pair will be installed at a location upgradient of the former containment tank. A second well pair will be installed at a location adjacent to the former containment tank location and its service lines. The remaining two pairs will be installed at hydraulically downgradient locations. Actual locations for the well pairs will be determined following completion of the soil boring program and receipt of soil analytical results from the laboratory. The installation of the well pairs will enable an assessment of bedrock and overburden groundwater quality, a determination of potential offsite contaminant migration, if any, in overburden and bedrock groundwater, definition of the horizontal extent of groundwater contamination, and the potential presence of dense non-aqueous phase liquids (DNAPL) in bedrock.

Overburden Wells

The shallow monitoring wells will be installed in the overburden using 4.25-inch inside diameter (ID), hollow-stem augers (HSAs). Each well will be advanced to the top of bedrock (approximately 10 to 15 feet bgs). After the total depth of the boring is reached, a two-inch ID, schedule-40 PVC well screen with a 0.010-inch slot size will be installed in the well. Well screens are anticipated to be five feet in length.

The annulus around the outside of the screen will be backfilled with sand to two feet above the screen, followed by a bentonite seal above the sand pack. The seal will be allowed to hydrate, prior to the placement of grout above it. Each well will be completed with a flush-mount protective cover.

One overburden well (MW-1) will be installed in the apparent upgradient direction of the site, to the north of the former containment tank. A second overburden well (MW-2) will be installed in the immediate source area, near the former containment tank location. This location will be used to examine the level of the shallow groundwater contamination near the source area. The other two overburden wells will be installed south and southwest from the former containment tank to determine if any contamination has migrated in the downgradient direction. Water levels will be collected from the overburden wells and used with survey elevation data to determine the local direction of groundwater flow in the overburden aquifer. Groundwater quality of the overburden aquifer will be determined, as described in Section 2.4.

Bedrock Wells

The four bedrock wells will be installed by advancing 6.25-inch HSAs to the top of bedrock. After reaching the top of bedrock, a tri-cone roller bit will be used to drill a rock socket approximately two feet into the competent bedrock. After drilling the rock socket into the bedrock, a four-inch casing will be placed to the bottom of the boring. The casing will be grouted in-place by tremie grouting from the bottom up. After allowing the grout to set for a minimum of 24 hours, an NX-sized core barrel will be advanced into bedrock. The core barrel will be advanced a maximum of 20 feet into competent bedrock or until a water bearing zone is encountered in bedrock, whichever is encountered first. If a water-bearing zone is encountered within the top ten feet of coring, coring will continue to a minimum of ten feet below the overburden/bedrock interface. A two-inch ID, schedule 40 PVC well screen and riser will then be installed in the boring. The screen length will be a maximum of ten feet. The screen will have 0.010-inch slots (10-slot). The annular space outside of the PVC will be tremied with filter pack sand, up to a minimum of three feet above the top of the screen. A swab (a surge block) will then be worked through the screened zone for a minimum of ten minutes. After swabbing, the depth to the top of the filter pack will be remeasured to confirm that the filter pack is at the appropriate depth. The annular space around the two-inch casing will be completed above the filter pack with a minimum of a three-foot bentonite seal, which will be mixed at the surface, then tremied. The bentonite seal will be allowed to set for a minimum of two hours, prior to placing grout. Grout will be tremied from above the bentonite seal to the surface. Below the screen, a two-foot portion of casing will be installed as a sump to collect any DNAPL, if present. The bedrock wells will be completed with a flush-mount protective casing.

All bedrock monitoring wells will be installed at locations adjacent to overburden monitoring wells forming well couplets. One bedrock well (MW-1) will be installed in the presumed upgradient direction of the site to the north, to evaluate potential upgradient impacts to the site. A second bedrock well (MW-2) will be installed in the immediate source area, near the former containment tank location, to examine the possibility of downward migration of contamination from the overburden aquifer to the bedrock aquifer. The other two bedrock wells will be installed downgradient of the former containment tank location to determine the potential for offsite contaminant migration. Water levels will be collected from the bedrock wells and used with survey elevation data to accurately determine the local direction of groundwater flow in the bedrock aquifer. Also, groundwater quality of the bedrock aquifer will be determined, as described in Section 2.4.

2.4 Groundwater Sampling and Analysis

After the monitoring wells are installed, the wells will be developed and purged following standard NYSDEC guidelines. Groundwater samples will be collected in accordance with NYSDEC protocols and guidance using dedicated bailers, disposable bailers, a submersible pump, or a peristaltic pump.

Eight groundwater samples will be collected and submitted for laboratory analysis. Groundwater samples will be analyzed by EPA Method 8260 for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target SVOC parameters include phenol and aniline, and will be analyzed using EPA Method 8270. Analysis for zinc and lead will be performed using EPA Method 6010B. For QA/QC purposes, one field duplicate sample will be collected and analyzed. One trip blank will be analyzed for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA).

After receiving the analytical results from the laboratory, the effective solubility of the detected target compounds will be determined and compared to analytical results. If the concentration of a detected parameter is approaching the effective solubility limit (within 3% of the effective solubility), an additional groundwater sample will be collected from the sump of the well to screen for the possible presence of DNAPL. A hydrophobic dye, Sudan IV, will be mixed with the sample. Sudan IV will dye any free-phase liquid and leave water clear. If the results of the screening indicate possible presence of DNAPL, a second groundwater sample will be collected from the sump and submitted for laboratory verification.

All soil boring and well locations will be surveyed for location and elevation, following installation.

All investigation derived waste (IDW), including excess soils, decontamination rinsates, well development water, purge water, and personal protective equipment, will be placed in Department of Transportation- (DOT) approved 55-gallon, 17-H type drums. Alternately, a plastic wastewater tank (approximately 1,000 gallon) may be used to stage liquid IDW (development water, purge water, and decontamination liquids). The IDW will be evaluated as hazardous or non-hazardous, and will be disposed of in accordance with the appropriate regulations.

2.5 Sewer Investigation

To evaluate potential preferential pathways for offsite migration of contaminants, the sewers in the vicinity of the site will be investigated. The storm and sanitary sewer lines in the vicinity of the containment tank will be measured for invert elevations. This will be conducted at the manholes and at the catch basins. The direction of flow in the pipe will then be established, based on this information. This information will be used to determine the best areas to place test pits. The test pits will be used to evaluate the condition of the sewer bedding, if any, and if the pipelines are above or below the water table. The proposed test pit locations are shown on Figure 2. Locations may be changed based on information collected prior to test pit excavation.

After each test pit is completed, a soil sample will be collected from beneath the pipeline, if possible. This soil sample will be collected from the native soil, not the pipeline bedding. The soil sample will be submitted for laboratory analysis by EPA Method 8260 for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target SVOC parameters include phenol and aniline, and will be analyzed using EPA Method 8270. Analysis for zinc and lead will be performed using EPA Method 6010B.

All field activities will be conducted in accordance with the QAPP (Appendix A) and a site-specific Health and Safety Plan (Appendix B).

3.0 REPORT PREPARATION

All data obtained during data collection and field investigation tasks will be compiled, evaluated, and summarized. Laboratory analytical data will be entered into an electronic database. A Phase II Site Investigation Report will then be prepared following completion of the field investigation and receipt of analytical data. This report will document the field investigation activities, including soil borings, soil sampling, well installation, and groundwater sampling. Water level contour maps for overburden and bedrock wells, showing groundwater flow direction, will be constructed from water level measurements.

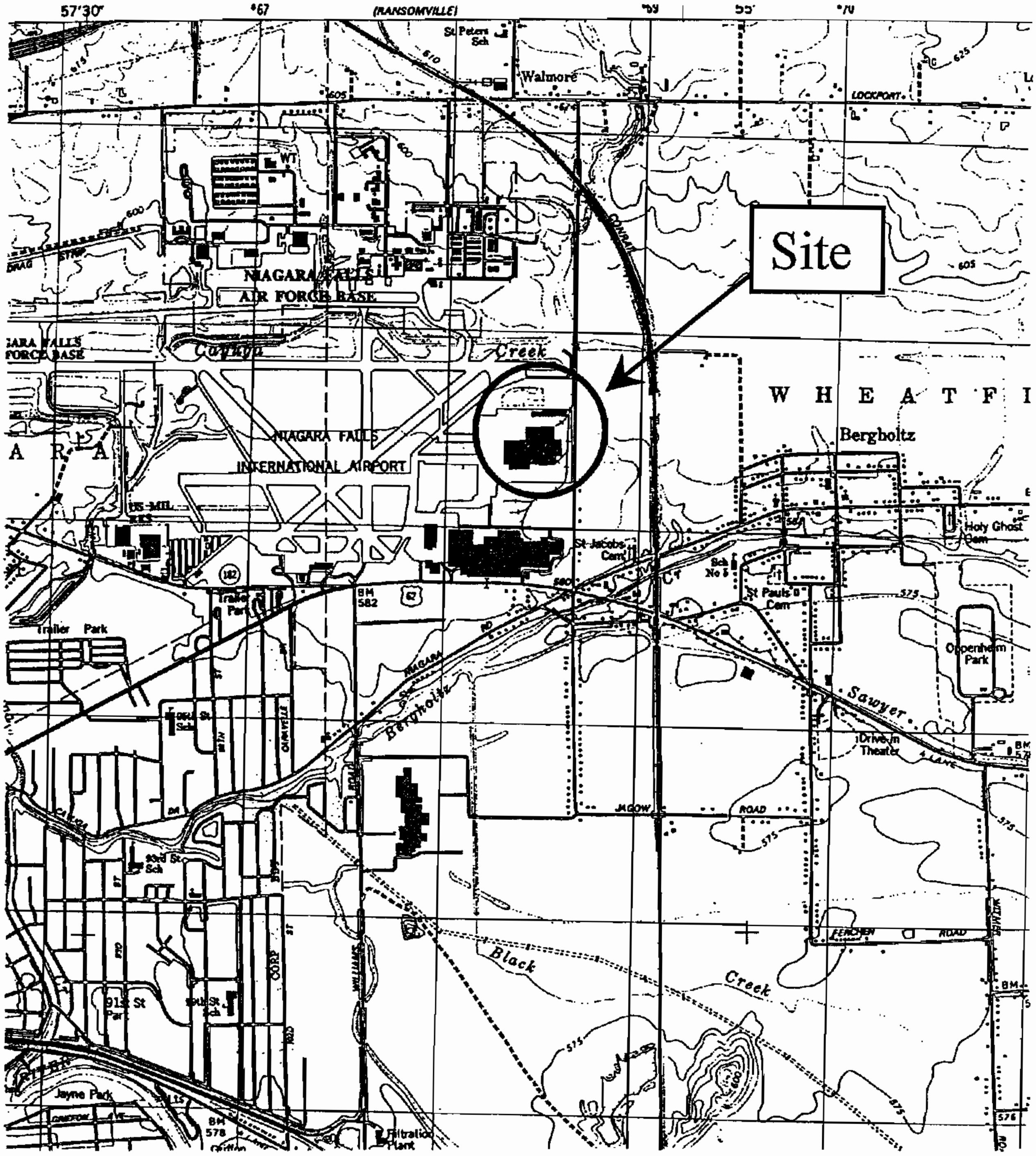
The chemical analytical results for soil and groundwater will be compared to screening criteria. Soil results will be screened by comparing them to the guidance values in NYSDEC's Technical Administrative Guidance Memorandum (TAGM) 4046. For groundwater screening, the analytical results will be compared to NYSDEC's Ambient Water Quality Standards and Guidance Values and Groundwater Effluent

Limitations (TOGS 1.1.1, October 1998). Potential cleanup criteria will be evaluated based on site-specific conditions.

4.0 SCHEDULE

Following approval of the Work Plan by NYSDEC, approximately 28 weeks will be required to conduct the field investigation, obtain laboratory analytical results, and submit a Site Investigation Report to NYSDEC.

FIGURES



LEGEND

Not To Scale

Adapted from USGS 7.5 Minute Topographic Maps,

(Tonawanda West, NY)

Figure 1

Site Location Map
BP Amoco
Ekonol Facility
Wheatfield, NY

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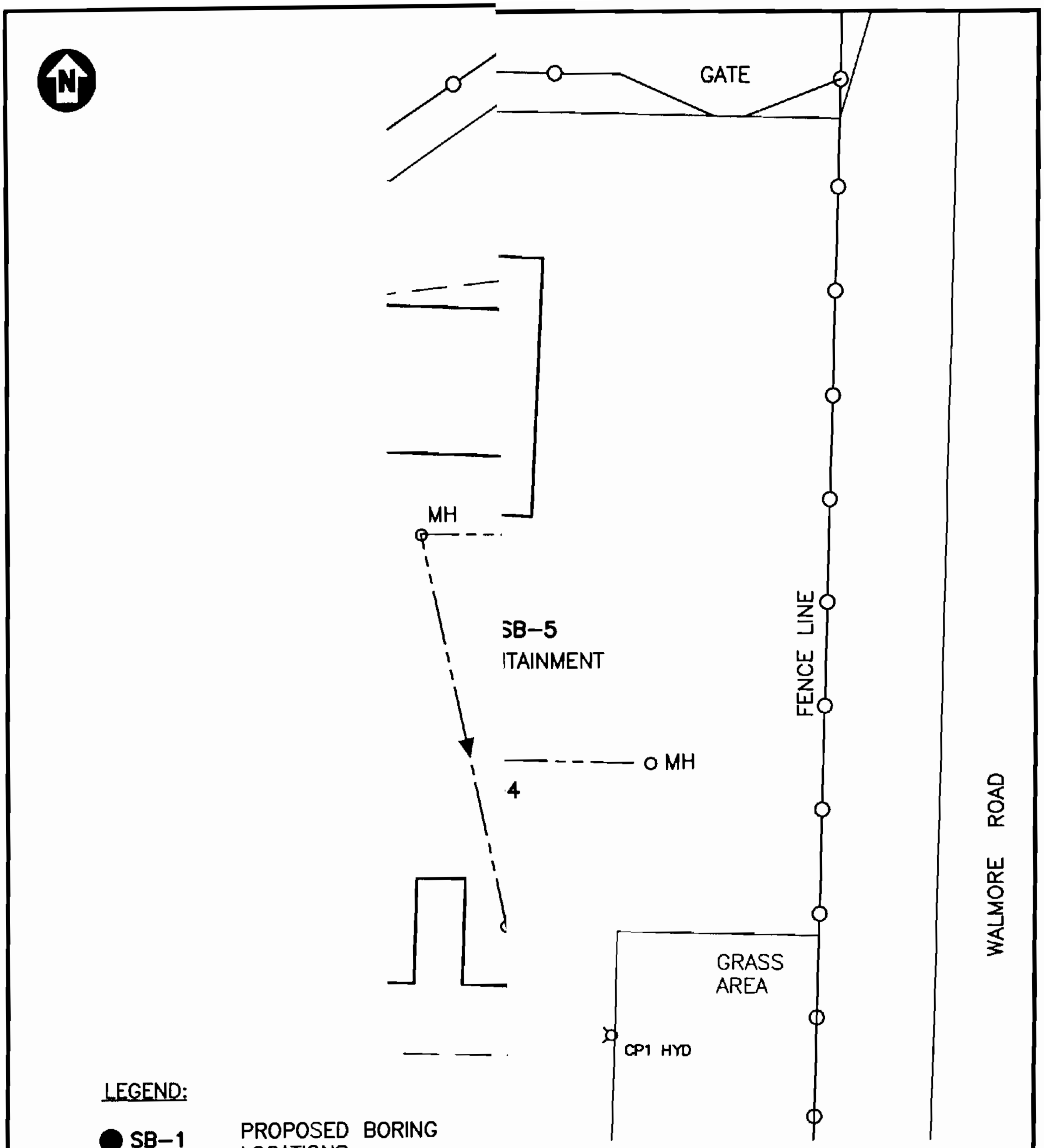
DESIGN * RESEARCH * PLANNING
180 LAWRENCE BELL DRIVE - SUITE 100 * WILLIAMSVILLE, N.Y. 14221 * 716 / 633-7074
OFFICES IN PRINCIPAL CITIES



LEGEND:

●	**SB–1**	PROPOSED BORING LOCATIONS
◐	**MW–1**	PROPOSED BEDROCK MONITORING WELL
◑	**MW–1**	PROPOSED OVERBURDEN MONITORING WELL
⌖	SP–20	EXISTING STANDPIPE LOCATION
◈	SP–2	FORMER WELL/SOIL BORING LOCATION
—— – – ——		SANITARY SEWER LINE

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FIGURE 2

BP AMOCO
EKONOL FACILITY
WHEATFIELD, NEW YORK

SAMPLE LOCATION PLAN

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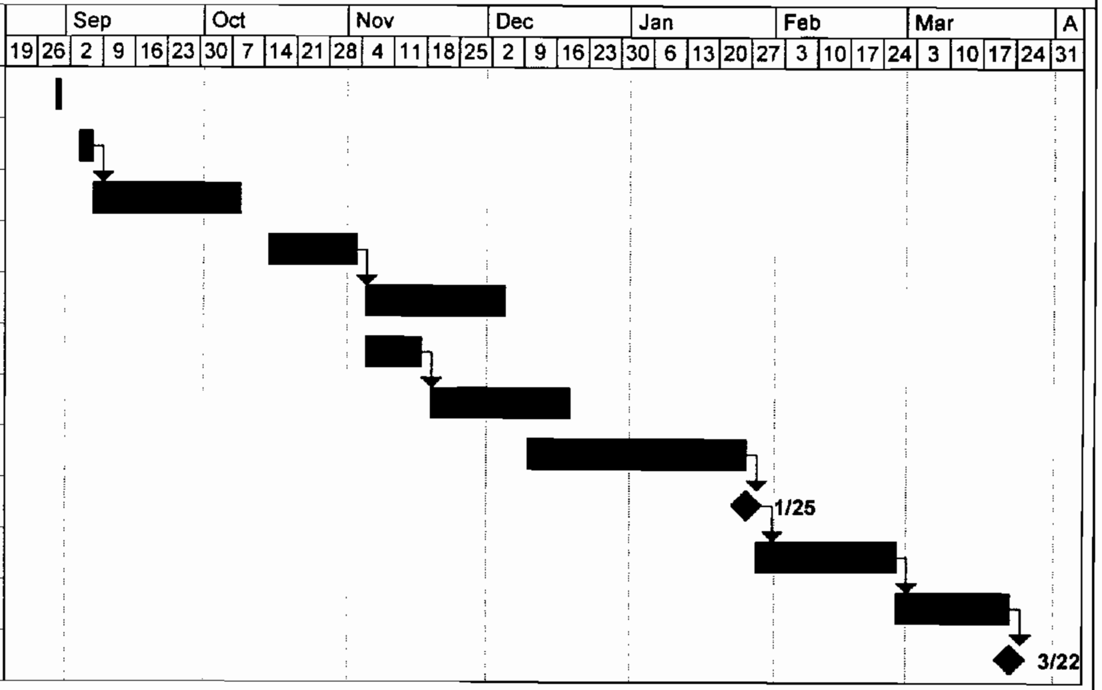
Figure 3
Anticipated Project Schedule
BP Amoco Ekonol Facility
Phase II Site Investigation

ID	Task Name	Duration	Start	Finish
1	Work Plan Approval	1 day	8/30/01	8/30/01
2	Soil Borings/Soil Sampling	3 days	9/4/01	9/6/01
3	Laboratory Analysis	22 days	9/7/01	10/8/01
4	Monitoring Well Installation	15 days	10/15/01	11/2/01
5	Laboratory Analysis	22 days	11/5/01	12/4/01
6	Sewer Investigation	10 days	11/5/01	11/16/01
7	Laboratory Analysis	22 days	11/19/01	12/18/01
8	Data Analysis/Reporting	35 days	12/10/01	1/25/02
9	Submit Report to NYSDEC	0 days	1/25/02	1/25/02
10	NYSDEC Review	22 days	1/28/02	2/26/02
11	Respond to Comments	18 days	2/27/02	3/22/02
12	Submit Final Report to NYSDEC	0 days	3/22/02	3/22/02



Project: bpekonol
Date: 8/7/01

Task ■
Split ⋯
Progress ■
Milestone ◆
Summary
Rolled Up Task ■
Rolled Up Split ⋯
Rolled Up Milestone ◇
Rolled Up Progress ■
External Tasks ▨
Project Summary

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TABLES

Table 1
Chemical Analysis Summary
Ekonol Facility
Wheatfield, New York

			Field Samples				QC Samples		
Matrix	Parameter	Analytical Method	Number of Samples	Field Duplicate	MS/MSD (Total)	Sub-Total	Trip Blank	Control Blank	Total
Groundwater	tce; 1,2-dce; 1,1-dca; 1,1,1-tca	8260	8	1	1	11			11
	aniline, phenol	8270	8	1		9	1		10
	lead, zinc	6010	8	1		9			9
Soil	tce; 1,2-dce; 1,1-dca; 1,1,1-tca	8260	5	1	1	8			8
	aniline, phenol	8270	5	1		6			6
	lead, zinc	6010	5	1		6			6

Note: Batch QA/QC from the laboratory will be used for MS/MSDs.

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan For:

PHASE II SITE INVESTIGATION
AT
EKONOL POLYESTER RESINS
WHEATFIELD, NEW YORK

Submitted to:

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SECTION 1

PROJECT DESCRIPTION

1.1 INTRODUCTION AND OBJECTIVES

The objective of this phase is to further characterize the extent of contamination. The Phase II data will be used to assess whether the site can be closed with no further action, or whether remedial action is required. The site is located at 6600 Walmore Road, Town of Wheatfield, Niagara County, New York.

A concrete storage tank, formerly used as secondary containment for process water, was removed in October 1999. Following removal of the tank and surrounding soils, soil sampling of the walls and floor of the excavation was conducted. Results of the sampling indicated the presence of several organic compounds, including trichloroethene, tetrachloroethene, cis-1,2'-dichloroethene, and phenol.

1.2 SCOPE OF WORK

Soil Borings and Soil Sampling

An anticipated 5 soil borings will be advanced in the vicinity of the former settling pit using a Geoprobe™ direct push sampling unit. Each soil boring will be advanced to the top of bedrock, to depths of approximately 10 to 15 feet below ground surface. Field techniques, such as photo ionization detector (PID) headspace readings, and visual observations, will be used to screen the soil samples retrieved from the borings. Using the results of the field screening, a total of 5 soil samples will be submitted for laboratory analysis. These 5 samples, in conjunction with the results of the field screening, are expected to be sufficient to define the extent of impacts from the former containment tank. Analytical parameters will include TCE, 1,2-DCE, 1,1-DCA, 1,1,1-TCA (EPA Method 8260), phenol, aniline (EPA Method 8270), zinc, and lead (Method 6010B). For QA/QC purposes, one field duplicate sample will be collected, along with one trip blank.

After the soil boring has reached its total depth, a temporary piezometer will be installed. Using a peristaltic pump, a groundwater sample will be collected from each borehole. The groundwater sample will be field screened for volatile organic halides using EPA method 8535. This is a colorimetric screening procedure which is intended for on-site use. The method is not specific to any one halogenated hydrocarbon compound. The testing product is based on a photochemical reaction involving UV light. The method detection limit has been calculated by the manufacturer at 4 ug/L. Based on the groundwater screening results, the borehole may be abandoned, and an alternate location chosen.

Groundwater Sampling and Analysis

Eight monitoring wells (4 shallow and 4 deep) will be installed as well pairs consisting of one overburden well and one bedrock well at each location. The proposed location of these wells is shown in Figure 2. One well pair will be installed at a location upgradient of the former containment tank. A second well pair will be installed at a location adjacent to the former containment tank location and its service lines. The remaining well pairs will be installed at hydraulically downgradient locations. Actual locations for the well pairs will be determined following completion of the soil boring program and receipt of soil analytical results from the laboratory. The installation of the well pairs will enable an assessment of bedrock and overburden groundwater quality, a determination of potential offsite contaminant migration, if any, in shallow and deep groundwater, definition of the horizontal extent of groundwater contamination, and the potential presence of DNAPL in bedrock.

After the monitoring wells are installed, the wells will be developed and purged following standard NYSDEC guidelines. Groundwater samples will be collected in accordance with NYSDEC protocols and guidance using dedicated, disposable bailers, a submersible pump, or a peristaltic pump.

Eight groundwater samples will be collected and submitted for laboratory analysis. Groundwater samples will be analyzed by EPA Method 8260 for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target SVOC parameters include phenol and aniline using EPA Method 8270. Analysis for zinc and lead will be performed using EPA Method 6010B. For QA/QC purposes, one field duplicate sample will be collected and analyzed. One trip blank will be analyzed for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA).

After receiving the analytical results from the laboratory, the effective solubility of the detected target compounds will be determined and compared to analytical results. If the analytical results are within 10% of the effective solubility, an additional groundwater sample will be collected from the sump of the well. To screen for the possible presence of DNAPL the groundwater sample will be mixed with Sudan IV, a hydrophobic dye. Sudan IV will dye any free-phase liquid but will leave water clear. If the results of the screening indicate possible presence of DNAPL, a second groundwater sample will be collected from the sump and submitted for laboratory verification.

All soil boring and well locations will be surveyed for location and elevation, following installation.

All investigation derived waste (IDW), including excess soils, decontamination rinsates, well development water, purge water, and personal protective equipment, will be placed in Department of Transportation- (DOT) approved 55-gallon 17-H type drums. Alternately, a plastic wastewater tank (approximately 1,000 gallon) may be used to stage liquid IDW (development water, purge water, and decontamination liquids). The IDW will be evaluated as hazardous or non-hazardous and will be disposed of in accordance with the appropriate regulations.

Sewer Investigation

To evaluate potential preferential pathways for offsite migration of contaminants, the sewers in the vicinity of the site will be investigated. The storm and sanitary sewer lines in the vicinity of the containment tank will be measured for invert elevations. This will be conducted at the manholes and at the catch basins. The direction of flow in the pipe will then be established, based on this information. This information will also be used to determine the best areas to place test pits. The test pits will used to evaluate the condition of the sewer bedding, if any, and if the pipelines are above or below the water table. Locations may be changed based on information collected prior to test pit excavation.

After each test pit is completed, a soil sample will be collected from beneath the pipeline, if possible. This soil sample will be collected from the native soil, not the pipe line bedding. The soil sample will be submitted for laboratory analysis by EPA Method 8260 for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target SVOC parameters include phenol and aniline, using EPA Method 8270. Analysis for zinc and lead will be performed using EPA Method 6010B.

SECTION 2
PROJECT ORGANIZATION

2.1 BP PROJECT MANAGER

William B. Barber, CPG
Senior Project Manager
BP Amoco Corporation
Global Environmental Management

2.2 PARSONS ES PROJECT TEAM

Project Manager	George Hermance, P.G.
Technical Director	William Hughes, P.G.
Field Team Leader	Andrew Janik
Quality Assurance Officer	Maryanne Kosciewicz

2.2 LABORATORY

The laboratory identified to provide analytical support for this project is Severn Trent Laboratories, Inc. The laboratory is local to the site and will provide analysis of both soil and groundwater samples collected during the field activity.

SECTION 3

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OBJECTIVES FOR MEASUREMENT OF DATA

3.1 INTRODUCTION

The quality assurance and quality control objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. These objectives are defined in following subsections. They are formulated to meet the requirements of the specified methods. The analytical methods and their Contract Required Quantitation Limits (CRQLs) are given in Section 7.

3.2 PRECISION

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation if required (Section 8), calculating the RPD for duplicate sample results.

3.3 ACCURACY

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor, 1987), or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise." Higher concentrations will not be as affected by instrument noise or other variables, and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program (USEPA, 1987). Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices and digging equipment will be performed between samples, as outlined in the Field Sampling Plan. Laboratory sample containers will be thoroughly cleaned in accordance with procedures outlined in Section 4.2. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow acceptable procedures to ensure the samples are adequately homogenized, prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate, and chain-of-custody procedures are presented in Sections 4 and 5.

3.5 COMPLETENESS

Completeness is defined as the percentage of measurements made which are judged to be valid (USEPA, 1987). The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.

V = Number of measurements judged valid.

T = Total number of measurements.

3.6 COMPARABILITY

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA, 1987). The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the U.S. Environmental Protection Agency (USEPA), or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation, if required, on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure that all future users of either the data, or the conclusions drawn from them, will be able to judge the comparability of these data and conclusions.

SECTION 4

SAMPLING PROGRAM

4.1 INTRODUCTION

The sampling program is intended to provide data concerning the nature and extent of contamination in subsurface soil and groundwater. This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. The number of environmental and QC samples to be taken are given in Table 4.1. The sampling procedures are generally described in the Work Plan.

4.2 SAMPLE CONTAINERS AND SAMPLE PRESERVATION

Sample containers will be properly washed and decontaminated, prior to their use, by either the analytical laboratory or the container vendor to the specifications required by the applicable method. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged, and the appropriate preservatives will be added. The types of containers are shown in Table 4.2.

Samples will be preserved according to generally accepted preservation techniques. Preservatives will be added to the sample bottles by the laboratory, prior to their shipment, in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed in the shipping cooler, cooled to 4°C with ice, and delivered to the laboratory within 48 hours of collection. Chain-of-custody procedures are described in Section 5.

4.3 SAMPLE HOLDING TIMES

The sample holding times for organic and inorganic parameters are given in Table 4.2. They meet the USEPA Region II requirements. These holding times must be strictly adhered to by the laboratory. Any holding time exceedances must be reported to the Project Quality Assurance Officer.

4.4 FIELD QC SAMPLES

To assess field sampling and decontamination performance, "trip blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates.

Trip Blanks - A trip blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-ml VOA vial containing distilled, deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples. The Trip Blank will be analyzed for VOCs to assess any contamination from sampling and transport, and internal laboratory procedures.

Coded Field Duplicate - To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.

Table 4.1
Chemical Analysis Summary
Ekonol Facility
Wheatfield, New York

			Field Samples				QC Samples		
Matrix	Parameter	Analytical Method	Number of Samples	Field Duplicate	MS/MSD (Total)	Sub-Total	Trip Blank	Control Blank	Total
Groundwater	tce; 1,2-dce; 1,1-dca; 1,1,1-tca	8260	8	1	1	11			11
	aniline, phenol	8270	8	1		9	1		10
	lead, zinc	6010	8	1		9			9
Soil	tce; 1,2-dce; 1,1-dca; 1,1,1-tca	8260	5	1	1	8			8
	aniline, phenol	8270	5	1		6			6
	lead, zinc	6010	5	1		6			6

Note: Batch QA/QC from the laboratory will be used for MS/MSDs.

TABLE 4.2
SAMPLE CONTAINERIZATION, PRESERVATION, AND HOLDING TIMES

Water Samples

Analysis Parameter	Bottle Type	Preservation [a]	Holding Time [b]
8260 (VOCs)	40 mL glass vial w/ Teflon septum	Cool to 4°C	14 days
8270 (SVOCs)	1000 mL amber glass bottle	Cool to 4 °C	5 days
6010 (Metals)	1000 mL plastic bottle	Nitric Acid to pH<2 Cool to 4 °C	6 months

Soil Samples

Analysis Parameter	Bottle Type	Preservation [a]	Holding Time [b]
8260 (VOCs)	wide-mouth glass w/ Teflon cap	Cool to 4°C	7 days
8270 (SVOCs)	wide-mouth glass w/ Teflon cap	Cool to 4 °C	5 days
6010 (Metals)	wide-mouth plastic or glass	Cool to 4 °C	6 months

[a] All samples to be preserved in ice during collection and transport.

[b] Days from date of sample collection.

SECTION 5

SAMPLE TRACKING AND CUSTODY

5.1 INTRODUCTION

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the chain-of-custody (COC) and transfer of samples will be trained as to the purpose and procedures, prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 5.1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

5.2 FIELD SAMPLE CUSTODY

A COC record (Figure 5.2) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample set collected.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The REMARKS space on the COC is used to indicate if the sample is a matrix spike, matrix spike duplicate, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC. Mistakes will be crossed out with a single line in ink and initialed by the author.

One copy of the COC is retained by sampling personnel and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample will not be analyzed.

5.3 LABORATORY SAMPLE CUSTODY

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped, as well as the anticipated date of arrival.

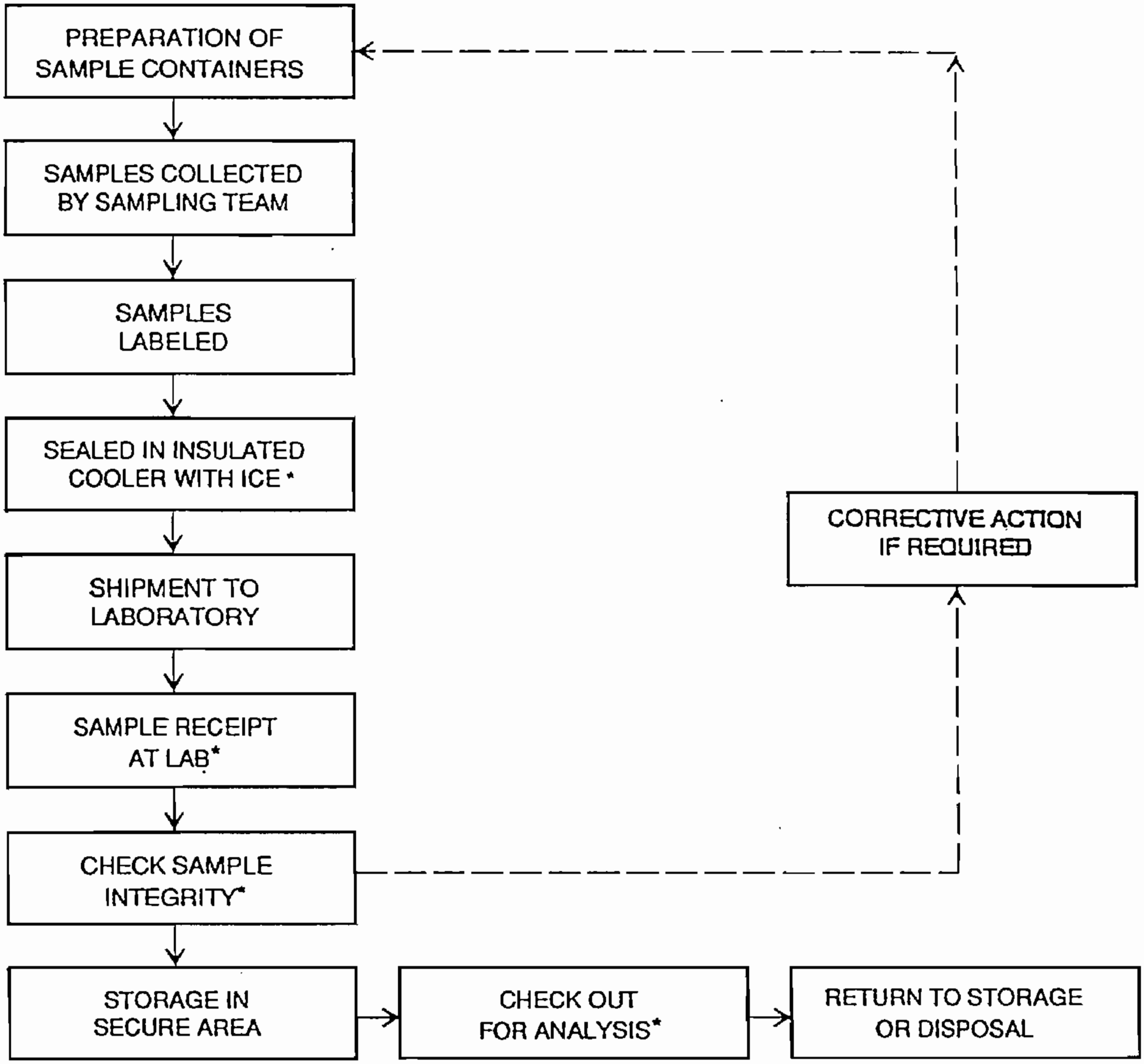
The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record, and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.
- The samples will be stored in a secured area at a temperature of approximately 4°C until analyses commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

The Project Manager, or a designated representative, will maintain day-to-day contact with the laboratory concerning specific samples and analyses, either directly or by assignment.

Figure 5.1

SAMPLE CUSTODY



* REQUIRES SIGN-OFF ON CHAIN OF CUSTODY FORM.

Figure 5.2

CHAIN OF CUSTODY RECORD

NO: 1078

CLIENT:

PROJECT NO.

PROJECT MGR:

PROJECT NAME:

NOTES – (Reference QAPP and/or analytical protocols to be used):

SAMPLERS:

Send results to:

PARSONS ENGINEERING SCIENCE, INC
290 Elwood Davis Road–Suite 312
Liverpool, NY 13088

Telephone: (315) 451–9560
Fax: (315) 451–9570

Lab Submitted to:

FIELD SAMPLE ID: TYPE	NUMBER	DEPTH CODES / QC IDENTIFIER	Location Description	Date	Time	GRAB	COMP.	NO OF Bottles	TYPES OF ANALYSES REQUESTED									Matrix / Preservative / Remarks
XX	001	001–002																

Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by: (Signature)	Date:	Time:	Cooler Temp: ___ °C Samples Intact ___ Yes ___ No
Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by: (Signature)	Date:	Time:	Cooler Temp: ___ °C Samples Intact ___ Yes ___ No
Relinquished by: (Signature)	Date:	Time:	Shipped via:	Airbill #:	Received by: (Signature)	Date:	Time:	Cooler Temp: ___ °C Samples Intact ___ Yes ___ No

TYPE CODES:

SOLID
- SD–Sediment
- SS–Surface Soil
- SB–Subsurface Soil
- MW–Monitoring Well Boring
- TP–Test Pit/Tank Pit
- DR–Drum Waste
- WA–Solid Waste
- OS–Other Solid (eg. wipe samples, asbestos, etc.)

WATER
- MW– Monitoring Well
- LC– Leachate
- SW– Surface Water
- DW– Drill Water
- FD– Fuel Dispenser
- MH– Manhole
- OW– Oil Water Separator
- PR– Piping Run
- ST– Storm Water
- WW– Waste Water
- OL– Other Liquid (eg. Drum liquid)

QUALITY CONTROL
- FB– Field Blank (number each)
- TB– Trip Blank (number each)
- WB– Wash Blank (number each)

NO: 1078

SECTION 6

CALIBRATION PROCEDURES

6.1 FIELD INSTRUMENTS

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the Work Plan. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader and will be subjected to audit by the project Quality Assurance Officer (QAO). Copies of all the instrument manuals will be maintained onsite by the Field Team Leader.

Calibration procedures for instruments used for monitoring health and safety hazards (e.g., flame ionization detector and explosimeter) are provided in the Health and Safety Plan.

6.2 LABORATORY INSTRUMENTS

The laboratory will follow all calibration procedures and schedules as specified in the sections of the applicable methods which apply to the instruments necessary for the analytical methods given in Section 7.

SECTION 7

ANALYTICAL PROCEDURES

7.1 INTRODUCTION

Samples will be analyzed according to the applicable methods, per Table 4.1.

The methods to be used for the laboratory analysis of water samples were presented in Table 4.1. These methods were selected because they attain the Contract Required Quantitation Limits (CRQLs).

Table 7.1 defines the practical quantitation limits.

TABLE 7.1
PROJECT QUANTITATION AND DETECTION LIMITS

			Quantitation Limits		Method Detection Limits		State of New York Standards	
	Analysis/Compound	Method	Water (ug/L)	Soil (ug/kg)	Water (ug/L)	Soil (ug/kg)	Water (ug/L) [a]	Soil (mg/kg) [b]
	Volatile Organics (25 ml purge)							
1	1,1,1-Trichloroethane	SW8260B	1	5	0.267	1.616	5	800
2	1,1,2,2-Tetrachloroethane	SW8260B	1	5	0.264	1.902	5	600
3	1,1,2-Trichloroethane	SW8260B	1	5	0.281	2.19	1	
4	1,1-Dichloroethane	SW8260B	1	5	0.211	1.737	5	200
5	1,1-Dichloroethene	SW8260B	1	5	0.185	1.605	5	400
6	1,2-Dichloroethane	SW8260B	1	5	0.18	1.863	0.6	100
7	1,2-Dichloroethene(total)	SW8260B	1	5	0.411	1.186	5	300
8	1,2-Dichloropropane	SW8260B	1	5	0.265	1.958	1	
9	2-Butanone (MEK)	SW8260B	10	20	1.926	1.852		300
10	2-Hexanone	SW8260B	10	20	1.027	2.218		
11	4-Methyl-2-pentanone(MIBK)	SW8260B	5	20	0.764	1.617		1000
12	Acetone	SW8260B	10	20	0.894	2.571		200
13	Benzene	SW8260B	1	5	0.214	1.668	1	60
14	Bromodichloromethane	SW8260B	1	5	0.238	1.411		
15	Bromoform	SW8260B	1	5	0.289	1.584		
16	Bromomethane	SW8260B	2	10	0.659	0.644	5	
17	Carbon Disulfide	SW8260B	1	5	0.243	1.254		2700
18	Carbon Tetrachloride	SW8260B	1	5	0.267	1.219	5	600
19	Chlorobenzene	SW8260B	1	5	0.324	1.798	5	1700
20	Chloroethane	SW8260B	2	10	0.582	1.219	5	1900
21	Chloroform	SW8260B	1	5	0.241	1.695	7	300
22	Chloromethane	SW8260B	2	10	1.157	0.579	5	
23	cis-1,3-Dichloropropene	SW8260B	1	5	0.28	1.55	0.4	
24	Dibromochloromethane	SW8260B	1	5	0.294	1.852	5	
25	Ethyl Benzene	SW8260B	1	5	0.349	1.77	5	5500
26	Methylene Chloride	SW8260B	1	5	0.208	1.756	5	100
27	Styrene	SW8260B	1	5	0.313	1.677	5	
28	Tetrachloroethene	SW8260B	1	5	0.304	1.772	5	1400
29	Toluene	SW8260B	1	5	0.287	2.039	5	1500
30	trans-1,3-Dichloropropene	SW8260B	1	5	0.267	1.549	0.4	
31	Trichloroethene	SW8260B	1	5	0.299	1.599	5	700
32	Vinyl Chloride	SW8260B	2	10	0.46	0.96	2	200
33	Xylenes(total)	SW8260B	1	5	0.316	1.716	5	1200

TABLE 7.1
PROJECT QUANTITATION AND DETECTION LIMITS

	Analysis/Compound	Method	Quantitation Limits		Method Detection Limits		State of New York Standards	
			Water (ug/L)	Soil (ug/kg)	Water (ug/L)	Soil (ug/kg)	Water (ug/L) [(a)]	Soil (ug/kg) [(b)]
	Semivolatile Organics							
1	1,2,4-Trichlorobenzene	SW8270C	10	330	1.702	150.278	5	3400
2	1,2-Dichlorobenzene	SW8270C	10	330	1.723	66.261	3	7900
3	1,3-Dichlorobenzene	SW8270C	10	330	1.612	117.32	3	1600
4	1,4-Dichlorobenzene	SW8270C	10	330	1.696	114.419	3	8500
5	2,2'-oxybis(1-chloropropane)*	SW8270C	10	330	0.692	166.264	5	
6	2,4,5-Trichlorophenol	SW8270C	25	330	1.274	121.03	1	100
7	2,4,6-Trichlorophenol	SW8270C	10	330	1.396	149.203	1	
8	2,4-Dichlorophenol	SW8270C	10	330	1.927	163.393	1	400
9	2,4-Dimethylphenol	SW8270C	10	330	2.196	153.93	1	
10	2,4-Dinitrophenol	SW8270C	25	330	1.594	112.236	1	200
11	2,4-Dinitrotoluene	SW8270C	10	330	1.024	145.884	5	
12	2,6-Dinitrotoluene	SW8270C	10	330	1.061	149.066	5	1000
13	2-Chloronaphthalene	SW8270C	10	330	1.596	92.834		
14	2-Chlorophenol	SW8270C	10	330	1.817	77.346	1	800
15	2-methyl-4,6-Dinitrophenol	SW8270C	25	330	0.994	150.305		
16	2-Methylnaphthalene	SW8270C	10	330	1.794	149.669		36400
17	2-Methylphenol	SW8270C	10	330	2.163	157.575	1	100
18	2-Nitroaniline	SW8270C	25	330	1.201	146.821	5	430
19	2-Nitrophenol	SW8270C	10	330	1.817	152.416	1	330
20	3,3'-Dichlorobenzidine	SW8270C	10	330	7.464	68.784	5	
21	3-Nitroaniline	SW8270C	25	330	2.719	79.197	5	500
22	4-Bromophenyl-phenyl ether	SW8270C	10	330	1.082	120.011		
23	4-Chloro-3-methylphenol	SW8270C	10	330	1.351	165.472		240
24	4-Chloroaniline	SW8270C	10	330	1.318	45.01	5	220
25	4-Chlorophenyl-phenyl ether	SW8270C	10	330	1.342	153.603		
26	4-Methylphenol	SW8270C	10	330	4.909	140.237	1	900
27	4-Nitroaniline	SW8270C	25	330	2.461	119.879	5	
28	4-Nitrophenol	SW8270C	25	330	2.332	66.706	1	100
29	Acenaphthene	SW8270C	10	330	1.545	147.466		50000
30	Acenaphthylene	SW8270C	10	330	1.561	143.603		41000
31	Anthracene	SW8270C	10	330	1.202	133.821		50000
32	Benzo(a)anthracene	SW8270C	10	330	1.103	108.684		224
33	Benzo(a)pyrene	SW8270C	10	330	1.842	132.975		61
34	Benzo(b)fluoranthene	SW8270C	10	330	0.96	102.788		1100

TABLE 7.1
PROJECT QUANTITATION AND DETECTION LIMITS

			Quantitation Limits		Method Detection Limits		State of New York Standards	
	Analysis/Compound	Method	Water (ug/L)	Soil (ug/kg)	Water (ug/L)	Soil (ug/kg)	Water (ug/L) [(a)]	Soil (ug/kg) [(b)]
	Semivolatile Organics, cont.							
35	Benzo(g,h,i)perylene	SW8270C	10	330	1.112	32.586		50000
36	Benzo(k)fluoranthene	SW8270C	10	330	0.99	141.519		1100
37	bis(2-Chloroethoxy) methane	SW8270C	10	330	2.563	150.88	5	
38	bis(2-Chloroethyl) ether	SW8270C	10	330	1.653	162.485	1	
39	bis(2-ethylhexyl)phthalate	SW8270C	10	330	3.325	101.958	5	50000
40	Butylbenzylphthalate	SW8270C	10	330	1.329	138.269		50000
41	Carbazole	SW8270C	10	330	1.784	134.433		
42	Chrysene	SW8270C	10	330	1.259	126.329		400
43	Di-n-butylphthalate	SW8270C	10	330	1.178	147.807	50	8100
44	Di-n-octylphthalate	SW8270C	10	330	0.888	124.815		50000
45	Dibenz(a,h)anthracene	SW8270C	10	330	0.876	35.044		14
46	Dibenzofuran	SW8270C	10	330	1.362	145.66		6200
47	Diethylphthalate	SW8270C	10	330	1.424	147.245		7100
48	Dimethylphthalate	SW8270C	10	330	1.263	146.033		2000
49	Fluoranthene	SW8270C	10	330	0.947	142.421		50000
50	Fluorene	SW8270C	10	330	1.315	113.973		50000
51	Hexachlorobenzene	SW8270C	NA (8081A)	330	1.198	131.689		410
52	Hexachlorobutadiene	SW8270C	10	330	0.915	152.443	0.5	
53	Hexachlorocyclopentadiene	SW8270C	10	330	7.31	84.971	5	
54	Hexachloroethane	SW8270C	10	330	1.591	116.13	5	
55	Indeno(1,2,3-cd)pyrene	SW8270C	10	330	3.333	30.446		3200
56	Isophorone	SW8270C	10	330	1.841	155.064		4400
57	N-Nitroso-di-n-propylamine	SW8270C	10	330	2.063	160.17		
58	N-nitrosodiphenylamine	SW8270C	10	330	7.723	150.469		
59	Naphthalene	SW8270C	10	330	1.87	152.419		13000
60	Nitrobenzene	SW8270C	10	330	4.092	117.707	0.4	200
61	Pentachlorophenol	SW8270C	25	330	1.17	135.607	1	1000
62	Phenanthrene	SW8270C	10	330	1.132	134.683		50000
63	Phenol	SW8270C	10	330	2.061	78.84	1	30
64	Pyrene	SW8270C	10	330	1.224	151.364		50000

TABLE 7.1
PROJECT QUANTITATION AND DETECTION LIMITS

	Analysis/Compound	Method	Quantitation Limits		Method Detection Limits		State of New York Standards	
			Water (ug/L)	Soil (ug/kg)	Water (ug/L)	Soil (ug/kg)	Water (ug/L) [(a)]	Soil (mg/kg) [(b)]
	Pesticides							
1	Aldrin	SW8081	0.05	1.7	0.00318	0.138	ND	41
2	alpha-BHC	SW8081	0.05	1.7	0.0104	0.101		110
3	beta-BHC	SW8081	0.05	1.7	0.00411	0.407		200
4	delta-BHC	SW8081	0.05	1.7	0.0029	0.348		300
5	gamma-BHC (Lindane)	SW8081	0.05	1.7	0.00396	0.122		60
6	alpha-Chlordane	SW8081	0.05	1.7	0.0104	0.163	0.05	540
7	gamma-Chlordane	SW8081	0.05	1.7	0.00307	0.112	0.05	540
8	4,4'-DDD	SW8081	0.05	1.7	0.00781	0.238	0.3	2900
9	4,4'-DDE	SW8081	0.05	1.7	0.00181	0.171	0.2	2100
10	4,4'-DDT	SW8081	0.05	1.7	0.00721	0.0542	0.2	2100
11	Dieldrin	SW8081	0.05	1.7	0.00269	0.0716	0.004	44
12	Endosulfan I	SW8081	0.05	1.7	0.00391	0.309		900
13	Endosulfan II	SW8081	0.05	1.7	0.00237	0.138		900
14	Endosulfan sulfate	SW8081	0.05	1.7	0.00424	0.245		1000
15	Endrin	SW8081	0.05	1.7	0.00385	0.0804	ND	100
16	Endrin aldehyde	SW8081	0.05	1.7	0.00308	0.164	5	
17	Endrin ketone	SW8081	0.05	1.7	0.00302	0.143	5	
18	Heptachlor	SW8081	0.05	1.7	0.00556	0.209	0.04	100
19	Heptachlor epoxide	SW8081	0.05	1.7	0.00178	0.198	0.03	20
20	Hexachlorobenzene	SW8081	0.1	N/A	0.1	N/A	0.04	
21	Methoxychlor	SW8081	0.5	17	0.00471	0.266	35	10,000
22	Toxaphene	SW8081	2	67	0.15	2.624	0.06	
	PCBs							
1	Aroclor-1016	SW8082	1.0	33	0.263	3.92	0.09	1000
2	Aroclor-1221	SW8082	2.0	33	0.22	8.09	0.09	1000
3	Aroclor-1232	SW8082	1.0	33	0.22	8.09	0.09	1000
4	Aroclor-1242	SW8082	1.0	33	0.22	8.09	0.09	1000
5	Aroclor-1248	SW8082	1.0	33	0.22	8.09	0.09	1000
6	Aroclor-1254	SW8082	1.0	33	0.22	8	0.09	1000
7	Aroclor-1260	SW8082	1.0	33	0.22	8.09	0.09	1000

TABLE 7.1
PROJECT QUANTITATION AND DETECTION LIMITS

Analysis/Compound	Method	Quantitation Limits Water (ug/L)	Quantitation Limits Soil (mg/kg)	Method Detection Limits Water (ug/L)	Method Detection Limits Soil (mg/kg)	State of New York Standards Water (ug/L) $^{(a)}$	State of New York Standards Soil (mg/kg) $^{(b)}$
Metals							
*1 Antimony	SW6010B	60	5.0	2.114	0.211	3	
*2 Arsenic	SW6010B	10	1	1.9	0.2	25	7.5
3 Barium	SW6010B	200	1	0.5	0.035	1000	300
4 Beryllium	SW6010B	5	0.5	0.1	0.005	$3^{(G)}$	0.16
*5 Cadmium	SW6010B	5	0.5	0.246	0.025	5	1
*6 Chromium	SW6010B	10	1	0.378	0.038	50	10
7 Copper	SW6010B	25	2.5	1.281	0.001	200	25
*8 Lead	SW6010B	3	0.5	1.087	0.109	25	$400^{(c)}$
9 Mercury	SW7470A/7471A	0.2	0.01	0.0567	0.00945	0.07	0.1
10 Nickel	SW6010B	40	4	5.486	0.81	100	13
*11 Selenium	SW6010B	5	1	1.356	0.136	10	2
*12 Silver	SW6010B	10	1	0.702	0.071	50	
*13 Thallium	SW7841	10	1	3.534	0.353	$0.5^{(G)}$	
14 Zinc	SW6010B	20	2	5.219	0.612	$2000^{(G)}$	20
15 Vanadium	SW6010B	50	1	2.381	0.412		150
16 Cobalt	SW6010B	50	1	4.046	0.143		30
17 Aluminum	SW6010B	200	20	20.778	0.541		
18 Calcium	SW6010B	5000	500	15.886	16.193		
19 Iron	SW6010B	100	10	7.937	0.652	300	2000
20 Magnesium	SW6010B	5000	500	12.999	1.501	$35000^{(G)}$	
21 Manganese	SW6010B	15	1.5	0.864	0.106	300	
22 Potassium	SW6010B	5000	500	249.072	35.416		
23 Sodium	SW6010B	5000	500	41.469	2.281	20000	

Notes:

N/A - Not Applicable

(a) - Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, NYSDEC, October 1998

(b) - Determination of Soil Cleanup Objectives and Cleanup Levels, NYSDEC, January 24, 1994. For metals in soil, the standards are typically based on site-specific background.

(c) - EPA Guidance on Residential Lead-Based Paint, Lead Contaminated Dust, and Lead Contaminated Soil, July 14, 1994

* - Analyzed using Trace ICP.

(G) - Guidance value.

SECTION 8

DATA REDUCTION, VALIDATION, AND REPORTING

8.1 INTRODUCTION

Data collected during the field investigation will be reduced, reviewed, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods. The data package provided by the laboratory will contain all items specified for the analyses to be performed. A "ASP-equivalent" analytical data package, and an electronic disk deliverable will be required.

The completed copies of the chain-of-custody records (both external and internal), accompanying each sample from time of initial bottle preparation to completion of analysis, will be attached to the analytical reports.

8.2 DATA REDUCTION

Two copies of the analytical data packages, and an electronic disk deliverable will be provided by the laboratory. The copies of the data packages will be sent to the Parsons office. The Project Manager will immediately arrange for filing one copy; the second copy and the disk deliverable will be used to generate summary tables. These tables will form the database for assessment of the Site contamination condition.

Data packages will be checked by the Parsons QA reviewer to ensure all deliverables have been provided. If problems are identified during this screening, the laboratory will be alerted, and corrective actions will be requested.

The electronic deliverable format required is an ASCII, delimited file with the fields and character lengths summarized in Table 8.1.

Each diskette deliverable must be formatted and copied using an MS-DOS operating system. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system (LIMS). If this cannot be accomplished, Parsons should be notified, via letter of transmittal, indicating that manual entry of data is required for a particular method of analysis. All diskette deliverables must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager or Task Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon, prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

8.3 DATA VALIDATION

Data validation will not be performed on the soil and water samples collected during this study.

8.4 DATA REPORTING

The laboratory report will include a summary assessment of the laboratory analyses and data. The laboratory analytical results will be reported by the laboratory using the following usability qualifiers:

- "U" - Not detected at given value;
- "UJ" - Estimated not detected at given value;
- "J" - Estimated value;
- "N" - Presumptive evidence of a compound/analyte;
- "R" - Result not useable; and
- No Flag - Result accepted without qualification.

TABLE 8.1
FIELD AND CHARACTER LENGTHS FOR DISK DELIVERABLE

Description	Length	Format
Field Sample ID (as shown on COC)	15	Character
Cas. No. (including -'s)	10	Character
Parameter Name	31	Character
Concentration	13	Numeric
Qualifier	4	Character
Units	8	Character
SDG	8	Character
Lab Sample ID	15	Character
Date Sampled (from COC)	D	Date
Matrix (soil/water/air)	5	Character
Method Detection Limit	13	Numeric
Method Code	8	Character
Lab Code	6	Character

SECTION 9

INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1 QUALITY ASSURANCE BATCHING

Each set of samples will be analyzed concurrently with calibration standards, method blanks, laboratory duplicates, and QC check samples (if required by the protocol).

9.2 CALIBRATION STANDARDS AND SURROGATES

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the USEPA or NIST, or other similar program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or more frequently, based upon data indicating deterioration.

9.3 ORGANIC BLANKS AND MATRIX SPIKE

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives." The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing $KMnO_4$. The matrix spike is generated by addition of surrogate standard to each sample.

9.4 TRIP AND FIELD BLANKS

Trip blanks and field blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation, and to evaluate the possibility of atmospheric or cross-contamination of the samples.

SECTION 10

QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

10.1 INTRODUCTION

Quality assurance audits are performed by the project quality assurance group, under the direction and approval of the project Quality Assurance Officer (QAO). These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to Parsons ES's corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon Parsons ES's procedure, customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2 SYSTEM AUDITS

System audits, performed by the QAO or designated auditors, will encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected, or if the Project Manager requests, additional audits may occur.

10.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation (PE) samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

10.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in non-compliance will be identified at exit interviews conducted with the involved management. Non-compliances will be logged, and documented through audit findings which are attached to, and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the non-compliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO, prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

SECTION 11

PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

11.1 PREVENTIVE MAINTENANCE PROCEDURES

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations, and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce the downtime. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2 SCHEDULES

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3 RECORDS

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

SECTION 12

CORRECTIVE ACTION

12.1 INTRODUCTION

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader, and involved subcontractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by the applicable methods.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the Parsons ES office, sites, laboratories, or subcontractor locations. Activities or documents ascertained to be non-compliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control corrective action request (CAR) forms (Figure 12.1). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify non-compliance issues, however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

CORRECTIVE ACTION REQUEST

Number________________________ Date____________________

TO____________________________________

You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) prevent it from recurring. Your written response is to be returned to the project quality assurance manager by__________________________.

CONDITION:

REFERENCE DOCUMENTS:

RECOMMENDED CORRECTIVE ACTIONS:

________	____	________	____	________	____
ORIGINATOR	DATE	APPROVAL	DATE	APPROVAL	DATE

RESPONSE

CAUSE OF CONDITION:

CORRECTIVE ACTION

(A) RESOLUTION

(B1) PREVENTION

(B2) AFFECTED DOCUMENTS

C.A. FOLLOWUP:

CORRECTIVE ACTION VERIFIED: BY____________________ DATE__________________

SECTION 13

REFERENCES

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan

USEPA, 1987. Data Quality Objectives for Remedial Response Actions Activities: Development Process, EPA/540/G-87/003, OSWER Directive 9355.0-7-B. U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 1994. Contract Laboratory Program Statement of Work For Organic Analysis: OLM03.1 and For Inorganic Analysis: ILM03.0, EPA 540/R-94/073, dated August 1994. U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 1994a. Region III Modifications to National Functional Guidelines for Organic Data Review, dated September 1994. USEPA Region III.

USEPA, 1994b. Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, dated September 1994. USEPA Region III.

APPENDIX B

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN FOR:

PHASE II SITE INVESTIGATION
AT
EKONOL POLYESTER RESINS
WHEATFIELD, NEW YORK

Submitted to:

New York State Department of
Environmental Conservation
Division of Hazardous Waste Remediation

Submitted by:

BP Amoco

4850 East 49th Street
MBC 3-147
Cuyahoga Heights, Ohio 44125

Prepared By:

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August 2001

Reviewed and Approved by :	**Name**	**Date**
Project Manager:	George W. Hermance	8/20/01
Parsons ES H&S Officer:	Brian A. Powell	8/20/01

PARSONS

TABLE OF CONTENTS

LIST OF TABLES

HEALTH AND SAFETY PLAN SUMMARY

EMERGENCY CONTACTS

Emergency contacts are provided for each site in Appendix F.

EMERGENCY PROCEDURES

Emergency procedures are described in Section 6.

SITE SPECIFIC HAZARDS AND TRAINING

Site Specific Hazards are described in Appendix F.

The Site Safety Officer will be responsible for providing site-specific training to all personnel that work at the site. This training will cover the following topics:

- Names of personnel responsible for site safety and health.
- Safety, health, and other hazards at the site.
- Proper use of personal protective equipment.
- Work practices by which the employee can minimize risk from hazards.
- Acute effects of compounds at the site.
- Decontamination procedures.

Personnel will be required to sign and date the Site-Specific Training Form provided in Appendix B prior to working on-site.

GENERAL HEALTH AND SAFETY REQUIREMENTS

Personnel will be required to sign and date the Plan Acceptance Form provided in Appendix B prior to working on-site.

Personnel Protective Equipment

Level D protection will be worn for initial entry on-site and for all activities except as noted in Appendix F. Level D protection will consist of:

- Standard work clothes
- Steel-toe safety boots
- Safety glasses or goggles must be worn when splash hazard is present
- Nitrile outer gloves and PVC or nitrile inner gloves must be worn during all sampling activities
- Hard hat (must be worn during all sampling activities)

Level C protection, unless otherwise specified in Appendix F, will consist of Level D equipment and the following additional equipment:

- Full-face air-purifying respirator
- Combination dust/organic vapor cartridges (or cartridges as required in Appendix F)
- Tyvek coveralls
- PVC or nitrile inner and nitrile outer gloves
- 5-minute escape SCBA

Level B protection will consist of the following equipment:

- Hard hat
- Positive Pressure SCBA or positive pressure air line and respirator with escape SCBA
- PE-Coated Tyvek coverall
- Nitrile outer and PVC or nitrile inner gloves
- Safety Boots
- Nitrile boot covering

Air Monitoring

Monitoring for organic vapors in the breathing zone will be conducted with a flame ionization detector (FID) during all intrusive field activities. A FID is needed to monitor suspected organic compounds which are inadequately monitored by a photoionization detector (See Appendix F). Readings will be taken under the following circumstances:

- Upon initial entry onto the site
- When weather conditions change.
- When work begins on another portion of the site.
- Every five feet during drilling.
- At regular intervals during activities such as test pit excavation, drum overpacking, and sampling activities.

Air monitoring for combustible gases/vapors will be monitored with an explosimeter during drilling.

Summary of Action Levels and Restrictions (1)

Readings	Action Level or Restriction
PID or FID (ppm)	
0-1	D
1-5	C
>5	Retreat (B)
Explosimeter (% LEL)	
0-10	None
>10	Retreat

(1) Unless otherwise specified in Appendix F.

SECTION 1
INTRODUCTION

1.1 PURPOSE AND POLICY

The purpose of this safety plan is to establish personnel protection standards and mandatory safety practices and procedures. This plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted at known or suspected hazardous waste sites.

The provisions of the plan are mandatory for all on-site personnel. Any supplemental plans used by subcontractors shall conform to this plan as a minimum. All personnel who engage in project activities must be familiar with this plan, comply with its requirements, and sign the Plan Acceptance Form (Appendix B) prior to working on the site. The Plan Acceptance Form must be submitted to the Parsons ES Health and Safety Officer.

1.2 SITE DESCRIPTION

A site description is provided in Appendix F.

1.3 SCOPE OF WORK

The Scope-of-Work for the site is presented in Appendix F.

1.4 PROJECT TEAM ORGANIZATION

Table 1.1 describes the responsibilities of all on-site personnel associated with this project. The names of principal personnel associated with this project are:

Project Manager:	George Hermance (Parsons -Buffalo)
Parsons ES H&S Officer:	Brian Powell (Parsons -Syracuse)
Field Team Leader:	Andrew Janik (Parsons –Buffalo)
Site Safety Officer:	Andrew Janik (Parsons –Buffalo)

All Parsons ES personnel have been appropriately trained in first aid and hazardous waste safety procedures, including the operating and fitting of personal protective equipment, and are experienced with the field operations planned for this site.

TABLE 1.1
ON-SITE PERSONNEL AND RESPONSIBILITIES

PROJECT MANAGER - Assumes total control over site activities. Reports to upper-level management. Has authority to direct response operations.

Responsibilities:

- Prepares and organizes the background review of the situation, the Work Plan, the Site Safety Plan, and the field team.
- Obtains permission for site access and coordinates activities with appropriate officials.
- Ensures that the Work Plan is completed and on schedule.
- Briefs the field team on their specific assignments.
- Coordinates with the site health and safety officer to ensure that health and safety requirements are met.
- Prepares the final report and support files on the response activities.
- Serves as the liaison with public officials.

SITE SAFETY OFFICER - Advises the Project Manager on all aspects of health and safety on site. Stops work if any operation threatens worker or public health or safety.

Responsibilities:

- Ensures that all necessary Health and Safety Equipment is available on-site. Ensures that all equipment is functional.
- Periodically inspects protective clothing and equipment.
- Ensures that protective clothing and equipment are properly stored and maintained.
- Controls entry and exit at the Access Control Points.
- Coordinates health and safety program activities with the Project Safety Officer.
- Confirms each team member's suitability for work based on a physician's recommendation.
- Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue.
- Implements the Site Safety Plan.
- Conducts periodic inspections to determine if the Site Safety Plan is being followed.
- Enforces the "buddy" system.

TABLE 1.1 - CONTINUED
ON-SITE PERSONNEL AND RESPONSIBILITIES

- Knows emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Notifies, when necessary, local public emergency officials.
- Coordinates emergency medical care.
- Sets up decontamination lines and the decontamination solutions appropriate for the type of chemical contamination on the site.
- Controls the decontamination of all equipment, personnel, and samples from the contaminated areas.
- Assures proper disposal of contaminated clothing and materials.
- Ensures that all required equipment is available.
- Advises medical personnel of potential exposures and consequences.
- Notifies emergency response personnel by telephone or radio in the event of an emergency.

FIELD TEAM LEADER - Advises the Project Manager on all aspects of health and safety on site. Stops work if any operation threatens worker or public health or safety. Responsible for field team operations and safety.

Responsibilities:

- Manages field operations.
- Executes the Work Plan and schedule.
- Enforces safety procedures.
- Coordinates with the Site Safety Officer in determining protection level.
- Enforces site control.
- Documents field activities and sample collection.
- Serves as a liaison with public officials.

WORK TEAM - Drillers, samplers. The work party must consist of at least two people.

Responsibilities:

- Safely completes the on-site tasks required to fulfill the Work Plan.
- Complies with Site Safety Plan.
- Notifies Site Safety Officer or supervisor of suspected unsafe conditions.

SECTION 2
RISK ANALYSIS

2.1 CHEMICAL HAZARDS

The chemical hazards associated with the site are presented in Appendix F.

2.2 RADIATION HAZARDS

No radiation hazards are known at the site.

2.3 PHYSICAL HAZARDS

2.3.1 Explosion

Any concerns associated with explosion hazards at the site are presented in Appendix F.

2.3.2 Heat Stress

The use of protective equipment may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 70°F or above. Table 2.1 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Heat stress monitoring should be performed by a person with a current first aid certification who is trained to recognize heat stress symptoms. For monitoring the body's recuperative abilities to excess heat, one or more of the following techniques will be used. Other methods for determining heat stress monitoring, such as the wet bulb globe temperature (WBGT) Index from American Conference of Governmental Industrial Hygienist (ACGIH) TLV Booklet can be used.

To monitor the worker, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.
    - If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
    - If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third.
- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

  - If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.
  - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third.
  - Do not permit a worker to wear a semipermeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

Prevention of Heat Stress - Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules.
  - Modify work/rest schedules according to monitoring requirements.
  - Mandate work slowdowns as needed.
  - Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, id., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
  - Maintain water temperature 50° to 60°F (10° to 16.6°C).
  - Provide small disposal cups that hold about four ounces (0.1 liter).
  - Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
  - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat related illness.

2.3.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

Hypothermia - Hypothermia is defined as a decrease in the patient core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

Frostbite - Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of Cold-Related Illness - To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia
- Identify and limit known risk factors:
- Assure the availability of enclosed, heated environment on or adjacent to the site.
- Assure the availability of dry changes of clothing.
- Assure the availability of warm drinks.
- Start (oral) temperature recording at the job site:
    - At the Field Team Leader's discretion when suspicion is based on changes in a worker's performance or mental status.
    - At a worker's request.
    - As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).
    - As a screening measure whenever any one worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

TABLE 2.1
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS[a]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

---

[a] For work levels of 250 kilocalories/hour.

[b] Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

SECTION 3
PERSONNEL PROTECTION AND MONITORING

3.1 MEDICAL SURVEILLANCE

Parsons ES will use the services of a licensed occupational health physician who is familiar with the hazards associated with the project to provide the medical examinations and surveillance specified herein.

Personnel involved in this operation have undergone medical surveillance prior to employment at Parsons ES, and thereafter at 12 month intervals. The 12 month medical examination includes a complete medical and work history and a standard occupational physical, examination of all major organ systems, complete blood count with differential (CBC), and a SMAC/23 blood chemistry screen which includes calcium, phosphorous, glucose, uric acid, BUN, creatinine, albumin, SGPT, SGOT, LDH, globulin, A/G ratio, alkaline phosphatase, total protein, total bilirubin, triglyceride, cholesterol, and a creatinine/BUN ratio. Additionally a pulmonary function test will be performed by trained personnel to record Forced Vital Capacity (FVC) and Forced Expiratory Volume in second ($FEV_{1.0}$). An audiogram and visual acuity measurement, including color perception, is provided The medical exam is performed under the direction of a licensed Occupational Health Physician. A medical certification as to the fitness or unfitness for employment on hazardous waste projects, or any restrictions on his/her utilization that may be indicated, is provided by the physician. This evaluation will be repeated as indicated by substandard performance or evidence of particular stress that is evident by injury or time loss illness on the part of any worker.

3.2 SITE-SPECIFIC TRAINING

The Site Health and Safety Officer will be responsible for developing a site specific occupational hazard training program and providing training to all Parsons ES personnel that are to work at the site. This training will consist of the following topics:

- Names of personnel responsible for site safety and health.
- Safety, health, and other hazards at the site.
- Proper use of personal protective equipment.
- Work practices by which the employee can minimize risk from hazards.
- Safe use of engineering controls and equipment on the site.
- Acute effects of compounds at the site.
- Decontamination procedures.

Upon completion of site-specific training, workers will sign the Site-Specific-Training Form provided in Appendix B.

3.3 MONITORING REQUIREMENTS

3.3.1 Organic Vapors

Organic vapors in the breathing zone (4 to 6 feet above ground) and the top of any borehole will be monitored with a photoionization detector (PID) or a flame ionization detector (FID). The FID will be used to monitor suspected organic compounds which are inadequately monitored by a PID (See Appendix F). Readings will be taken under the following circumstances:

- Prior to initial entry onto the site.
- Upon initial entry onto the site.
- When weather conditions change.
- When work begins on another portion of the site.
- Every five feet during drilling.

Prior to initial entry onto a site, a PID or FID will be used to monitor conditions upwind and downwind of the site. Protective equipment will be selected, based on initial monitoring, as provided in Section 3.4. During initial on-site reconnaissance, PID or FID readings will be monitored continuously. Readings will be taken upwind and downwind of potential contaminant sources on-site. Readings exceeding background and the locations of such readings will be noted. A sketch of the site will be prepared and photographs taken to document and locate observations that contribute to determining whether hazardous wastes are present at the site, and whether the site poses a significant threat to public health or the environment.

During on-site field activities PID and FID readings will be taken in the breathing zone. In the event that readings taken in the breathing zone exceed 5 ppm, personnel must monitor at the site boundary to determine whether contamination is spreading off site. IN THE EVENT THAT READINGS TAKEN AT THE PERIMETER OF THE SITE EQUAL OR EXCEED 5 PPM, WORK AT THE SITE MUST STOP, AND THE PARSONS ES HEALTH AND SAFETY OFFICER AND NYSDEC REPRESENTATIVE MUST BE NOTIFIED. Steps will be taken to determine whether the health and safety of nearby residents might be compromised by the release of airborne volatiles during field activities.

3.3.2 Combustible Gases

An explosimeter will be used to monitor combustible gases during all drilling. Guidelines have been established by the National Institute for Occupational Safety and

Health (NIOSH) concerning the action levels for work in a potentially explosive environment. These guidelines are as follows:

1) 0-10% LEL - Limit all activities to those which do not generate sparks.
2) >10% LEL - Cease all activities in order to allow time for the combustible gases to vent.

If the combustible gases remain at concentrations exceeding 20% LEL after allowing adequate time to vent, then the following steps should be taken:

- Obtain an air compressor (minimum 1.5 horsepower).
- Place the compressor a safe distance from the well or pit (at least 20 ft.). This precaution is necessary because the compressor itself is an ignition source.
- Place hose into the boring or pit until it reaches bottom.
- Run compressor for 15 minutes.
- Measure the percent LEL in the boring or pit. If the reading remains above 20% LEL, continue to run the compressor. If levels drop below 20% LEL, continue to monitor the boring for 5 minutes; if readings remain below 20% LEL, resume drilling or excavation, and continue to monitor.

3.3.3 Radiation

Concerns over the potential for ionizing radiation are minimal at the site.

3.3.4 Summary of Action levels and Restrictions (1)

Readings	Action Level or Restriction
PID or FID (ppm)	
0-25 (benzene < 1)(total VOCs <25)	D
25 to 50 (30 seconds sustained)(benzene > 1)	C
Explosimeter (% LEL)	
0-10	None
>10	Retreat

(1) Unless otherwise specified in Appendix F.

3.4.1 Level D

Level D protection will be worn for initial entry on-site and initially for all activities. Level D protection will consist of:

- Standard Work Clothes.
- Safety boots with steel-toes.
- Nitrile outer and PVC or nitrile inner gloves (must be worn during all sampling activities).
- Hard hat (must be worn during intrusive activities).
- Splash goggles or safety glasses (where splash hazard is present).

3.4.2 Level C

The level of personal protection will be upgraded to Level C if the concentration of volatile organic compounds which can be detected with the PID or the FID in the breathing zone equals or exceeds 1 ppm.

Level C protection will consist of Level D equipment and the following additional equipment:

- 5-minute escape SCBA.
- Full-face air-purifying respirator.
- Combination dust/organic vapor cartridges.
- Tyvek coverall suit.
- PVC or Nitrile inner and Nitrile outer gloves.

If the concentration of volatile organics which can be detected with a PID and FID equals or exceeds 50 ppm, all field personnel will immediately retreat from the area and consult with the Office Health and Safety Officer.

3.4.3 Level B

If the concentration of volatile organics which can be detected with a PID or FID equals or exceeds the maximum use limit (MUL) of the air purifying respirators in use at the site, all field personnel will immediately retreat from the area. After retreat, the Field Team Leader must consult with the Parsons ES Health and Safety Officer to discuss two options for resumption of work: (1) don level B protection and continue, or (2) wait until the concentration of volatile organics falls below the MUL. For example, if PID readings reached or exceeded 50 ppm at a site where benzene is contaminant of concern and the MUL is for full-face air purifying respirators is 50 ppm, Level B personal protection would be required to resume work.

In the unlikely event that concentrations of contaminants approach IDLH concentrations, workers shall retreat from the site immediately and consult the Parsons ES Health and Safety Officer before resuming work, even if they are in Level B protection.

The Field Team Leader for Level B work shall be a person qualified to be a Level B Supervisor. At a minimum, the Field Team Leader will have had 3 days of experience working in Level B under the direction of a qualified Level B Supervisor, and will have received the required supervisory training as required by 29 CFR 1910.120(e)(3).

Level B protection will consist of Level C equipment and the following additional equipment:

- Pressure-demand supplied air full-face respirator with 5 minute escape bottle.
- Air cascade system with grade D compressed breathing air, regulator, and appropriate fittings will be used depending on requirement for Level B work.
- Disposable polyethylene coated Tyvek suit with hood.
- The amount of air on hand will be sufficient to complete work, with extra for contingencies and emergencies.

Equipment sufficient for two persons to work in Level B will be available for work requiring Level B protection.

3.4.4 OSHA Requirements for Personal Protective Equipment

All personal protective equipment used during the course of this field investigation must meet the following OSHA standards:

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1-1968
Respiratory	29 CFR 1910.134	ANSI Z88.1-1980
Head	29 CFR 1910.135	ANSI Z89.1-1969
Foot	29 CFR 1910.136	ANSI Z41.1-1967

ANSI = American National Standards Institute

Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.1025; 29 CFR 1910.134).

Air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency
- IDLH concentrations
- High relative humidity
- If contaminant levels exceed designated use concentrations.

Note: If respiratory protection is used the appropriate respirator usage log(s) must be completed and returned to the Office Health and Safety Officer (Appendix B).

SECTION 4
WORK ZONES AND DECONTAMINATION

4.1 SITE WORK ZONES

To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, work zones will be delineated at the site. The flow of personnel between the zones should be controlled. The establishment of the work zones will help ensure that personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency.

4.1.1 Exclusion Zone

Exclusion zones will be established at the site for all drilling and excavation activities; unprotected onlookers should be located 50 feet upwind of drilling, excavation or soil sampling activities. In the event that volatile organics are detected in the breathing zone as discussed in Section 3, all personnel within the exclusion zone must don Level C protection. Exclusion zones will also be established during any activity when Level C protection is established as a result of conditions discussed in Section 3.

All personnel within the exclusion zone will be required to use the specified level of protection. No food, drink, or smoking will be allowed in the exclusion or decontamination zones. Contact lenses and cosmetics are not permitted on-site.

4.1.2 Decontamination Zone

Should it be necessary to establish an exclusion zone, a decontamination zone will be utilized. This zone will be established between the exclusion zone and the support zone, and will include the personnel and equipment necessary for decontamination of equipment and personnel (discussed below). Personnel and equipment in the exclusion zone must pass through this zone before entering the support zone. This zone should always be located upwind of the exclusion zone.

4.1.3 Support Zone

The support zone will include the remaining areas of the job site. Break areas, operational direction and support facilities (to include supplies, equipment storage and maintenance areas) will be located in this area. No equipment or personnel will be permitted to enter the support zone from the exclusion zone without passing through the personnel or equipment decontamination station. Eating, smoking, and drinking will be allowed only in this area.

4.2 DECONTAMINATION

Generally, any water used in decontamination procedures will be placed in containers and stored on-site. Disposal procedures that may be required by site-specific conditions are noted in Appendix F.

4.2.1 Decontamination of Personnel

Decontamination of personnel will be necessary if Level C or Level B protection is used. Decontamination will not be necessary if only Level D protection is used. However, disposable gloves used during sampling activities should be removed and bagged; personnel should be encouraged to remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel will wash hands and face prior to eating and before and after using the restroom.

The following OSHA-specified procedures include steps necessary for complete decontamination prior to entry into the support zone, and steps necessary if a worker only needs to change a respirator or respirator canister. Modification can be made to the twelve station decontamination process by the site health and safety officer depending upon the extent of contamination.

Station 1 - Segregated Equipment Drop

Deposit equipment used on the site (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Station 2 - Suit, Safety Boots, and Outer Glove Wash

Thoroughly wash chemically resistant suit, safety boots and outer-gloves. Scrub with long-handle, soft-bristle scrub brush and copious amounts of Alconox/water solution. Necessary equipment includes:

- Wash tub (30 gallon or large enough for person to stand in)
- Alconox/water solution
- Long-handle soft-bristle scrub brushes

Station 3 - Suit, Safety Boots, and Outer Glove Rinse

Rinse off Alconox/water solution using copious amounts of water. Repeat as many times as necessary. Necessary equipment includes:

- Wash tub (30 gallon or large enough for person to stand in)
- Spray unit
- Water

- Long-handle, soft-bristle scrub brushes

Station 4 - Outer Gloves Removal

Remove the outer gloves and deposit in individually marked plastic bags. Necessary equipment includes:

- Plastic bag

Station 5 - Canister, Air Tank, or Mask Change

If a worker leaves the exclusion zone to change a canister, mask or air tank, this is the last step in the decontamination procedures. The worker's canisters or tank are exchanged, new outer glove donned, and joints taped. Worker returns to duty. Otherwise the worker proceeds to Station 6. Necessary equipment includes:

- Canisters, air tanks, or mask
- Tape
- Gloves

Station 6 - Removal of Chemically Resistant Suit

With assistance of helper, remove suit. Deposit in container with plastic liner. Necessary equipment includes:

- Container with plastic liner

Station 7 - Inner-Glove Wash

Wash inner gloves with Alconox/water solution that will not harm skin. Repeat as many times as necessary. Necessary equipment includes:

- Alconox/water solution
- Wash tub
- Long-handle, soft-bristle brushes

Station 8 - Inner-Glove Rinse

Rinse inner-gloves with water. Repeat as many times as necessary. Necessary equipment includes:

- Water
- Wash tub

Station 9 - Respirator Removal

Remove facepiece. Avoid touching face. Wash respirator in clean, sanitized solution, allow to dry and deposit facepiece in plastic bag. Store in clean area. Necessary equipment includes:

- Plastic bags
- Sanitizing solution
- Cotton

Station 10 - Inner-Glove Removal

Remove inner gloves and deposit in container with plastic liner. Necessary equipment includes:

- Container with plastic liner

Station 11 - Field Wash

Wash hands and face. Necessary equipment includes:

- Water
- Soap
- Tables
- Wash basins or buckets
- Clean towels

Station 12 - Redress

If re-entering Exclusion Zone put on clean field clothes (e.g., Tyvek, gloves, etc.). Necessary equipment includes:

- Table
- Clothing

4.2.2 Decontamination of Field Equipment

Field Equipment decontamination procedures are described in the project Quality Assurance Plan.

SECTION 5
SAMPLE SHIPMENT

5.1 ENVIRONMENTAL SAMPLES

Samples collected in this study will be classified as environmental samples. In general, environmental samples are collected from streams, ponds, or wells and are not expected to be grossly contaminated with high levels of hazardous materials.

Sample containers must have a completed sample identification tag and the outside container must be marked "Environmental Sample". The sample tag will be legibly written and completed with an indelible pencil or waterproof ink. The information will also be recorded in a log book. As a minimum, it will include:

- Exact location of sample;
- Time and date sample was collected;
- Name of sampler witnesses (if necessary);
- Project codes, sample station number, and identifying code (if applicable);
- Type of sample (if known);
- Tag number (if sequential tag system is used);
- Laboratory number (if applicable); and
- Any other pertinent information.

Environmental samples will be packaged and shipped according to the following procedure:

1. Place sample container, properly identified and with a sealed lid, in a polyethylene bag, and seal bag;
2. Place sample in a fiberboard container or metal picnic cooler which has been lined with a large polyethylene bag.
3. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking.
4. Seal large bag.
5. Seal or close outside container

The appropriate side of the container must be marked "This End Up" and arrows should be drawn accordingly. No DOT marking labeling is required. No DOT shipping papers are required. There are no DOT restrictions on mode of transportation.

5.2 HAZARDOUS SAMPLES

Drum samples, tank samples, sludge samples, and grossly contaminated soil samples will be shipped as DOT Hazardous Materials. The designation "Flammable Liquid" or "Flammable Solid" will be used. The samples will be transported as follows:

1. Collect sample in a 16 ounce or smaller glass or polyethylene container with nonmetallic teflon-lined screw cap. Allow sufficient air space (approximately 10% by volume) so container is not liquid full at 54 °C (130 °F). If collecting a solid material, the container plus contents should not exceed 1 pound net weight. if sampling for volatile organic analysis, fill VOA container to septum but place the VOA container inside a 16 ounce or smaller container so the required air space may be provided. large quantities, up to 3.786 liters (1 gallon), may be collected if the sample's flash point is 23 °C (75 °F) or higher. In this case, the flash point must be marked on the outside container (e.g., carton, cooler), and shipping papers should state that "Flash point is 73 °F or higher."
2. Seal sample and place in a 4 mil thick polyethylene bag, one sample per bag.
3. Place sealed bag inside a metal can with noncombustible, absorbent cushioning material (e.g., vermiculite or earth) to prevent breakage, one bag per can. Pressure-close the can and use clips, tape or other positive means to hold the lid securely.
4. Mark the can with:

   Name and address of originator

   "Flammable Liquid N.O.S. UN 1993"

   (or "Flammable Solid N.O.S. UN 1325)

   NOTE: UN numbers are now required in proper shipping names.
5. Place one or more metal cans in a strong outside container such as a picnic cooler or fiberboard box. Preservatives are not used for hazardous waste site samples.
6. Prepare for shipping:

   "Flammable Liquid, N.O.S. UN 1993" or "Flammable Solid, N.O.S. UN 1325"; "Cargo Aircraft Only (if more than 1 quart net per outside package); "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight ___" or "Net Volume ___" (of hazardous contents) should be indicated on shipping papers and on outside of shipping container. "This Side Up" or "This End Up" should also be on container. Sign shipper certification.
7. Stand by for possible carrier requests to open outside containers for inspection or modify packaging. It is wise to contact carrier before packing to ascertain local packaging requirements and not to leave area before the carrier vehicle (aircraft, truck) is on its way.

SECTION 6
ACCIDENT PREVENTION AND CONTINGENCY PLAN

6.1 ACCIDENT PREVENTION

6.1.1 Site-Specific Training

All field personnel will receive health and safety training prior to the initiation of any site activities. The site-specific training form provided in Appendix B must be signed, dated, and returned to the Parsons ES Health and Safety Officer. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, regular meeting should be held. Discussion should include:

- Tasks to be performed.
- Time constraints (e.g., rest breaks, cartridge changes).
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- Emergency procedures.

6.1.2 Drilling

Drilling procedures will be consistent with procedures provided in Appendix E. Prior to any drilling activity efforts will be made to determine whether underground installations will be encountered and, if so, where these installations are located. Hard hats and safety boots must as a minimum be worn within 50 feet of the drill rig or Georprobe. The drilling rig cannot be operated within 10 feet of power lines.

The Field Team Leader or Site Health and Safety Officer will provide constant on-site supervision of the drilling subcontractor to ensure that they are meeting the health and safety requirements. If deficiencies are noted, work will be stopped and corrective action will be taken (e.g., retrain, purchase additional safety equipment). Reports of health and safety deficiencies and the corrective action taken will be forwarded to the Project Manager.

6.2 CONTINGENCY PLAN

6.2.1 Emergency Procedures

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

General emergency procedures, and specific procedures for personal injury, chemical exposure and radiation exposure, are described below.

6.2.2 Chemical Exposure

If a member of the field crew demonstrates symptoms of chemical exposure the procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the Field Team Leader (via voice and hand signals) of the chemical exposure. The Field Team Leader should contact the appropriate emergency response agency.
- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.
- All chemical exposure incidents must be reported in writing to the Office Health and Safety Representative. The Site Health and Safety Officer or Field Team Leader is responsible for completing the accident report (See Part 7 of this Section). In addition, chemical exposure incidents must be reported to the Facility Emergency Coordinator at AWPI.

6.2.3 Personal Injury

In case of personal injury at the site, the following procedures should be followed:

- Another team member (buddy) should signal the Field Team Leader that an injury has occurred.
- A field team member trained in first aid can administer treatment to an injured worker.
- The victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.
- For less severe cases, the individual can be taken to the site dispensary.

- The Field Team Leader or Site Health and Safety Officer is responsible for making certain that an Accident Report Form is completed. This form is to be submitted to the Office Health and Safety Representative. Follow-up action should be taken to correct the situation that caused the accident.

6.2.5 Evacuation Procedures

- The Field Team Leader will initiate evacuation procedure by signaling to leave the site.
- All personnel in the work area should evacuate the area and meet in the common designated area.
- All personnel suspected to be in or near the contract work area should be accounted for and the whereabouts or missing persons determined immediately.
- Further instruction will then be given by the Field Team Leader.

6.2.6 Procedures Implemented in the Event of a Major Fire, Explosion, or On-Site Health Emergency Crisis

- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep the area surrounding the problem source clear after the incident occurs;
- Complete accident report for and distribute to appropriate personnel.

APPENDIX A
AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

All monitoring instruments must be calibrated and maintained periodically. The limitations and possible sources of errors for each instrument must be understood by the operator. It is important that the operator ensures that the instrument responds properly to the substances it was designed to monitor. Portable air quality monitoring equipment that measures total ionizables present such as the Photovac MicroTip HL-2000 (or equivalent) photoionization detector (PID) must be calibrated at least once each day. Combustible gas/oxygen meters (explosimeters) such as the Gas Tech GX-82 triple range monitor must be calibrated at least once a week. The specific instructions for calibration and maintenance provided for each instrument should be followed.

APPENDIX B
FORMS FOR HEALTH AND SAFETY-RELATED ACTIVITIES

This OSHA Job Safety and Health Protection Form must be posted prominently on-site during field activities.

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to $7,000 for each serious violation and for optional penalties of up to $7,000 for each nonserious violation. Penalties of up to $7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $70,000 for each such violation. A minimum penalty of $5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to $7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of $10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 347-3573
Boston, MA	(617) 565-7164
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 391-5858
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 744-6670
Seattle, WA	(206) 553-5930

Robert B. Reich, Secretary of Labor

Washington, DC
1995 (Reprinted)
OSHA 2203

U.S. Department of Labor

Occupational Safety and Health Administration

This information will be made available to sensory impaired individuals upon request. Voice phone: (202) 219-8615; TDD message referral phone: 1-800-326-2577

GPO : 1995 O - 163-097 OL 3

Accident Report Form

(Page 1 of 2)

Project Name:______________________________

INJURED OR ILL EMPLOYEE

1. Name ________________________ Social Security #_______________
   (First) (Middle) (Last)
2. Home Address ____
   (No. and Street) (City or Town) (State and Zip)
3. Age _____ 4. Sex: Male ( ) Female ( )
5. Occupation ____
   (Specific job title, <u>not</u> the specific activity employee was performing at time of injury)
6. Department ____
   (Enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

EMPLOYER

7. Name ____
8. Mailing Address ____
   (No. and Street) (City or Town) (State and Zip)
9. Location (if different from mailing address):______________________
   ____

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure ________________________________
    (No. and Street) (City or Town) (State and Zip)
11. Was place of accident or exposure on employer's premises? _(Yes/No)
12. What was the employee doing when injured?________________________

____

(Be specific - was employee using tools or equipment or handling material?)

____

13. How did the accident occur? ___________________________________
    (Describe fully the events that resulted in the injury or

____

occupational illness. Tell what happened and how. Name objects and

____

substances involved. Give details on all factors that led to accident. Use separate sheet if needed)

Accident Report Form

(Page 2 of 2)

14. Time of accident: ________________
15. Date of injury or initial diagnosis of occupational illness ______________ (Date)

16. WITNESS TO ACCIDENT

(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

17. Describe the injury or illness in detail; indicate part of body affected.

____

____

18. Name the object or substance which directly injured the employee. (For example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.)

____

____

19. Did the accident result in employee fatality? ________ (Yes or No)
20. Number of lost workdays ____/restricted workdays _____ resulting from injury or illness?

OTHER

21. Did you see a physician for treatment? ________ (Yes or No) ________ (Date)
22. Name and address of physician ______________________________

____

(No. and Street) (City or Town) (State and Zip)

23. If hospitalized, name and address of hospital ______________________

____

(No. and Street) (City or Town) (State and Zip)

Date of report ____________________ Prepared by ____________________

Official position ____________________________

PROJECT HEALTH AND SAFETY PLAN AND WORK PLAN ACCEPTANCE FORM

(For Parsons ES employees only)

I have read and agree to abide by the contents of the Work Plan and Health and Safety Plan for the following project:

________________________ ________________________

(Project Title) (Project Number)

Furthermore, I have read and am familiar with the work plan or proposal which describes the field work to be conducted and the procedures to be utilized in the conduct of this work.

Name (print)	Signature	Date

Place in project Health and Safety File as soon as possible

SITE-SPECIFIC HEALTH AND SAFETY TRAINING

(FOR ALL PARSONS ES AND SUBCONTRACT EMPLOYEES ON SITE)

I hereby confirm that site-specific health and safety training has been conducted by the site health and safety officer which included:

- Names of personnel responsible for site safety and health
- Safety, health, and other hazards at the site
- Proper use of personal protective equipment
- Work practices by which the employee can minimize risk from hazards
- Safe use of engineering controls and equipment on the site
- Acute effects of compounds at the site
- Decontamination procedures

For the following project:

____________________ ____________________

(Project Title) (Project Number)

Name (print)	Signature	Date

Place in project Health and Safety File as soon as possible

APPENDIX C
MATERIAL SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET

SULFURIC ACID 96%

Effective Date: 12-08-95 Supersedes 12-23-93

MALLINCKRODT

A Division of Mallinckrodt Baker, Inc. • 222 Red School Lane • Phillipsburg, NJ 08865 • Telephone: (908) 859-2151 • Fax: (908) 859-9318
Emergency Phone: 908-859-2151 ■ CHEMTREC: 202-483-7616 ● CANUTEC: 613-996-6666

PRODUCT IDENTFICATION:

Synonyms: Oil of Vitriol
CAS No.: 7664-93-9
Molecular Weight: 98.07
Chemical Formula: H2SO4
Hazardous Ingredients: Sulfuric acid

PRECAUTIONARY MEASURES:

POISON. DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE. WATER REACTIVE. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER.

- Do not get in eyes, on skin, or on clothing.
- Do not breathe mist.
- Keep container closed.
- Use only with adequate ventilation.
- Wash thoroughly after handling.
- This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY FIRST AID:

In all cases call a physician. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. SEE SECTION 5.

SECTION 1 - Physical Data

Appearance: Colorless, oily liquid.
Odor: Odorless.
Solubility: Infinite @ 20 C.
Boiling Point: ca. 310 C (590 F)
Melting Point: ca. -14 C (6 F).
Specific Gravity: 1.84
Vapor Pressure (mm Hg): < 0.1 @ 20 C
Vapor Density (Air=1): 3.4
Evaporation Rate: No information found.
NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 2 Other: Water reactive

SECTION 2 - Fire and Explosion Information

Fire:

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

Explosion:

Contact with most metals causes formation of flammable and explosive hydrogen gas.A violent exothermic reaction occurs with water. Sufficient heat may be produced to ignite combustible materials.

Fire Extinguishing Media:

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

Special Information:

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

SECTION 3 - Reactivity Data

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Toxic fumes of oxides of sulfur. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Water, bases, organic material, halogens, metal acetylides, oxides and hydrides, strong oxidizing and reducing agents and many other reactive substances.

SECTION 4 - Leak/Spill Disposal Information

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 6. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Absorb with an inert material (e.g., vermiculite, dry sand, earth). Do not use combustible materials, such as saw dust. Cover spill with sodium bicarbonate or soda ash and mix. Transfer to a chemical waste container. Flush area of spill with dilute soda ash solution and discard to sewer. Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. US Regulations require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Gaurd National Response Center is (800) 424-8802. Reportable Quantity (RQ)(CWA/CERCLA) : 1000 lbs.

Dispose of container and unused contents in accordance with federal, state, and local requirements.

SECTION 5 - Health Hazard Information

A. Exposure/Health Effects

Inhalation:

Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. May cause lung edema. Symptoms may include irritation of the nose and throat, and labored breathing.

Ingestion:

Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea.

Skin Contact:

Corrosive. Symptoms of redness, pain, and severe burn can occur.

Eye Contact:

Corrosive. Splashes can cause blurred vision, redness, pain and severe tissue burns.

Chronic Exposure:

Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.

Aggravation of Pre-existing Conditions:

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

B. FIRST AID

Inhalation:

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

Ingestion:

If swallowed, DO NOT induce vomiting. Give large quantities of water or milk if available. Call a physician immediately. Never give anything by mouth to an unconscious person.

Skin Exposure:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.

Eye Exposure:

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

C. TOXICITY (RTECS, 1994)

Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m3/2H; investigated as a tumorigen, mutagen, reproductive effector; Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containg sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

SECTION 6 - Occupational Control Measures

Airborne Exposure Limits:

-OSHA Permissible Explosure Limit (PEL):
1 mg/m3 (TWA).
-ACGIH Threshold Limit Value (TLV):
1 mg/m3 (TWA), 3 mg/m3 (STEL)

Ventilation System:

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

Personal Respirators: (NIOSH Approved)

If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge and dust/mist filter may be worn up to ten times the exposure limit or the maximum use concentration specified by the respirator supplier, whichever is less. For emergencies or instances where the exposure levels are not known, use a positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

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

Eye Protection:

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

SECTION 7 - Storage and Special Information

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

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

BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Addendum to Material Safety Data Sheet

REGULATORY STATUS

This Addendum Must Not Be
Detached from the MSDS
Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS
must include a copy of this addendum

Hazard Categories for SARA
Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X	X			X

Product or Components of Product:	SARA EHS Sec. 302 RQ	SARA EHS Sec. 302 TPQ	SARA Sec. 313 Chemicals Name List	SARA Sec. 313 Chemicals Chemical Category	CERCLA Sec.103 RQ lbs	RCRA Sec. 261.3
SULFURIC ACID 96%						
Sulfuric acid (7664-93-9) 96%	1000	1,000	Yes	No	1000	No
Water (7732-18-5) 4%	No	No	No	No	No	No

Listed on the TSCA Inventory.

SARA Section 302 EHS RQ:
Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.

SARA Section 302 EHS TPQ:
Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.

SARA Section 313 Chemicals:
Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.

CERLCA Sec. 103:

Comprehensive Environmental Response, Compensation and Liability Act (Superfund) Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4

RCRA:

Resource Conservation and Recovery Act. Commercial chemical product wastes designated as acute hazards or toxic under 40 CFR 261.33.

MATERIAL SAFETY DATA SHEET

SODIUM HYDROXIDE

Effective Date: 08-08-95 Supersedes 04-06-89

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Emergency Phone: 908-859-2151 ● CHEMTREC: 202-483-7616 ● CANUTEC: 613-996-6666

PRODUCT IDENTFICATION:

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate
CAS No.: 1310-73-2
Molecular Weight: 40.00
Chemical Formula: NaOH
Hazardous Ingredients: Sodium hydroxide

PRECAUTIONARY MEASURES:

DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

- Do not get in eyes, on skin, or on clothing.
- Do not breathe dust.
- Keep container closed.
- Use with adequate ventilation.
- Wash thoroughly after handling.
- This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY FIRST AID:

If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases call a physician. SEE SECTION 5.

SECTION 1 - Physical Data

Appearance: White, deliquescent pellets.
Odor: Odorless.
Solubility: 111 g/100 g of water.
Boiling Point: 1390 C (2534 F)
Melting Point: 318 C (604 F)
Specific Gravity (water=1): 2.13
Vapor Pressure (mm Hg): Negligible.
Vapor Density (Air=1): > 1
Evaporation Rate: No information found.
NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 2

SECTION 2 - Fire and Explosion Information

Fire:

Not considered to be a fire hazard. Hot or molten material can react violently with water. Can react with certain metals, such as aluminium, to generate flammable hydrogen Contact with moisture or water may generate enough heat to ignite combustible

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.

Special Information:

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

SECTION 3 - Reactivity Data

Stability:

Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.

Hazardous Decomposition Products:

Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas

Hazardous Polymerization:

This substance does not polymerize.

Incompatibilities:

Contact with water, acids, flammable liquids, and organic halogen compounds, especially trichloroethylene, may cause fire or explosion. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, tin, and zinc causes formation of flammable hydrogen gas.

SECTION 4 - Leak/Spill Disposal Information

Clean-up personnel require protective clothing and respiratory protection from dust. Sweep, scoop or pick up spilled material. Avoid dusting. Collected waste may be transferred to a closed, preferably metal, container and sent to a RCRA-approved waste disposal facility. Do not flush to the sewer. Caution! Floor and other surfaces may be slippery. Do not contact with water. Neutralize traces with dilute acid. Reportable Quantity (RQ)(CWA/CERCLA) : 1000 lbs.

Dispose of container and unused contents in accordance with federal, state, and local requirements.

SECTION 5 - Health Hazard Information

A. Exposure/Health Effects

Inhalation:

Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symtoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.

Ingestion:

Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appears days afer exposure.

Skin Contact:

Corrosive! Contact of skin can cause irritation or severe burns and scarring with greater exposures.

Eye Contact:

Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns tha may result in permanent impairment of vision, even blindness.

Chronic Exposure:

Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.

Aggravation of Pre-existing Conditions:

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

B. FIRST AID

Inhalation:

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

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician immediately.

Eye Exposure:

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

C. TOXICITY (RTECS, 1994)

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

SECTION 6 - Occupational Control Measures

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
2 mg/m3 Ceiling
-ACGIH Threshold Limit Value (TLV):
2 mg/m3 Ceiling

Ventilation System:

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

Personal Respirators: (NIOSH Approved)

If the TLV is exceeded, a dust/mist respirator with chemical goggles may be worn, in general, up to ten times the TLV. Consult respirator supplier for limitations. Alternatively, a supplied air full facepiece respirator or airlined hood may be worn.

Skin Protection:

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

Eye Protection:

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

SECTION 7 - Storage and Special Information

Keep in a tightly closed container. Protect from physical damage. Store in a cool,dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

Addendum to Material Safety Data Sheet

REGULATORY STATUS

This Addendum Must Not Be
Detached from the MSDS

MATERIAL SAFETY DATA SHEET

SODIUM HYDROXIDE

Effective Date: 08-08-95 Supersedes 04-06-89

MALLINCKRODT

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Emergency Phone: 908-859-2151 • CHEMTREC: 202-483-7616 • CANUTEC: 613-996-6666

Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS
must include a copy of this addendum

Hazard Categories for SARA
Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X				

Product or Components of Product:	SARA EHS Sec. 302 RQ	SARA EHS Sec. 302 TPQ	SARA Sec. 313 Chemicals Name List	SARA Sec. 313 Chemicals Chemical Category	CERCLA Sec.103 RQ lbs	RCRA Sec. 261.3
SODIUM HYDROXIDE Sodium hydroxide (1310-73-2)	No	No	Yes	No	1000	No

Listed on the TSCA Inventory.

SARA Section 302 EHS RQ:
Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.

SARA Section 302 EHS TPQ:
Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.

SARA Section 313 Chemicals:
Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.

CERLCA Sec. 103:
Comprehensive Environmental Response, Compensation and Liability Act (Superfund) Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4

RCRA:
Resource Conservation and Recovery Act. Commercial chemical product wastes designated as acute hazards or toxic under 40 CFR 261.33.

MATERIAL SAFETY DATA SHEET

MALLINCKRODT

NITRIC ACID, 70%

Effective Date: 12-08-95 Supersedes 04-04-95

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Emergency Phone: 908-859-2151 ■ CHEMTREC: 202-483-7616 ● CANUTEC: 613-996-6666

PRODUCT IDENTFICATION:

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 70%
CAS No.: 7697-37-2
Molecular Weight: 63.00
Chemical Formula: HNO3
Hazardous Ingredients: Nitric acid

PRECAUTIONARY MEASURES:

POISON. DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUS FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

- Do not get in eyes, on skin, or on clothing.
- Avoid breathing mist.
- Use only with adequate ventilation.
- Wash thoroughly after handling.
- Keep from contact with clothing and other combustible materials.
- Do not store near combustible materials.
- Store in a tightly closed container.
- Remove and wash contaminated clothing promptly.
- This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY FIRST AID:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician. SEE SECTION 5.

SECTION 1 - Physical Data

Appearance: Clear, colorless to slightly yellow liquid.
Odor: Suffocating acrid.
Solubility: Infinite in water.
Boiling Point: 122 C (252 F)
Melting Point: -34 C (-29 F)
Specific Gravity: 1.41
Odor Threshold: 0.27 ppm
Volatiles by volume: 100%
Vapor Pressure (mm Hg): 62 @ 20 C (68 F)

Vapor Density (Air=1): 2-3 approximately
Evaporation Rate: No information found.
NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0 Other: Oxidizer

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SECTION 2 - Fire and Explosion Information

Fire:

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:

Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

If involved in a fire, use water spray.

Special Information:

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

SECTION 3 - Reactivity Data

Stability:

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

Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

SECTION 4 - Leak/Spill Disposal Information

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 6. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e.g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! Waste may be neutralized with with alkaline material (lime, soda ash). Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. US Regulations require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Gaurd National Response Center is (800) 424-8802. Reportable Quantity (RQ)(CWA/CERCLA) : 1000 lbs.

Dispose of container and unused contents in accordance with federal, state, and local requirements.

SECTION 5 - Health Hazard Information

A. Exposure/Health Effects

Inhalation:

Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

Ingestion:

Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:

Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:

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

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

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

B. FIRST AID

Inhalation:

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

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:

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

Eye Exposure:

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

C. TOXICITY (RTECS, 1994)

Inhalation rat LC50: 244 ppm (NO2)/30M; investigated as a mutagen, reproductive effector.

SECTION 6 - Occupational Control Measures

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:

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

Personal Respirators: (NIOSH Approved)

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and cannisters that contain oxidizable materials, such as activated charcoal.

Skin Protection:

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

Eye Protection:

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

SECTION 7 - Storage and Special Information

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

Mallinckrodt Baker provides the information contained herein in good faith but makes no representation as to its

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

Addendum to Material Safety Data Sheet

REGULATORY STATUS

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Detached from the MSDS
Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS
must include a copy of this addendum

Hazard Categories for SARA Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X	X			X

Product or Components of Product:	SARA EHS Sec. 302 RQ	TPQ	SARA Sec. 313 Chemicals Name List	Chemical Category	CERCLA Sec.103 RQ lbs	RCRA Sec. 261.3
NITRIC ACID, 70%						
Nitric acid (7697-37-2) 70%	1000	1,000	Yes	No	1000	No
Water (7732-18-5) 30%	No	No	No	No	No	No

All components listed on the TSCA Inventory.

SARA Section 302 EHS RQ:
Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.

SARA Section 302 EHS TPQ:
Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle

size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.

SARA Section 313 Chemicals:

Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.

CERLCA Sec. 103:

Comprehensive Environmental Response, Compensation and Liability Act (Superfund) Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4

RCRA:

Resource Conservation and Recovery Act. Commercial chemical product wastes designated as acute hazards or toxic under 40 CFR 261.33.

MATERIAL SAFETY DATA SHEET

HYDROCHLORIC ACID, 37%

Effective Date: 12-08-95 Supersedes 09-10-86

MALLINCKRODT

A Division of Mallinckrodt Baker, Inc. • 222 Red School Lane • Phillipsburg, NJ 08865 • Telephone: (908) 859-2151 • Fax: (908) 859-9318

Emergency Phone: 908-859-2151 • CHEMTREC: 202-483-7616 • CANUTEC: 613-996-6666

PRODUCT IDENTFICATION:

Synonyms: Muriatic acid
CAS No.: 7647-01-0
Molecular Weight: 36.46 (HCl)
Chemical Formula: HCl
Hazardous Ingredients: Hydrogen chloride

PRECAUTIONARY MEASURES:

POISON. DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

- Do not get in eyes, on skin, or on clothing.
- Avoid breathing mist.
- Use only with adequate ventilation.
- Wash thoroughly after handling.
- Store in a tightly closed container.
- Remove and wash contaminated clothing promptly.
- This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY FIRST AID:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician. SEE SECTION 5.

SECTION 1 - Physical Data

Appearance: Clear, colorless fuming liquid.
Odor: Pungent odor of hydrogen chloride.
Solubility: Infinite in water with slight evolution of heat.
Boiling Point: 53 C (127 F); Azeotrope (20.2%) boils at 109 C (228 F)
Melting Point: -74 C (-101 F)
Specific Gravity: 1.18
Odor Threshold: 1 to 5 ppm
Volatiles by volume: 100%
Vapor Pressure (mm Hg): 190 @ 25 C (77 F)
Vapor Density (Air=1): No information found.
Evaporation Rate: No information found.
NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0

SECTION 2 - Fire and Explosion Information

Fire:

Extreme heat or contact with metals can release flammable hydrogen gas.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

If involved in a fire, use water spray.

Special Information:

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

SECTION 3 - Reactivity Data

Stability:

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

Hazardous Decomposition Products:

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

Hazardous Polymerization:

Will not occur.

Incompatibilities:

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

SECTION 4 - Leak/Spill Disposal Information

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 6. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e.g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. US Regulations require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Gaurd National Response Center is (800) 424-8802. Reportable Quantity (RQ)(CWA/CERCLA) : 5000 lbs.

Dispose of container and unused contents in accordance with federal, state, and local requirements.

SECTION 5 - Health Hazard Information

A. Exposure/Health Effects

Inhalation:

Corrosive! Inhalation of vapors can cause coughing, choking, inflamation of the nose, throat, and upper respiratory tract. Inhalation of higher concentrations may cause lung damage.

Ingestion:

Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea. Swallowing may be fatal.

Skin Contact:

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

Eye Contact:

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

Chronic Exposure:

Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggravation of Pre-existing Conditions:

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

B. FIRST AID

Inhalation:

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

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:

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

Eye Exposure:

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

C. TOXICITY (RTECS, 1994)

Inhalation rat LC50: 3124 ppm/1H; oral rabbit LD50: 900 mg/kg (Hydrochloric acid concentrated); investigated as a tumorigen, mutagen, reproductive effector.

SECTION 6 - Occupational Control Measures

Airborne Exposure Limits:

-OSHA Permissible Exposure Limit (PEL):
5 ppm Ceiling
-ACGIH Threshold Limit Value (TLV):
5 ppm Ceiling

Ventilation System:

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

Personal Respirators: (NIOSH Approved)

If the exposure limit is exceeded, a respirator with an acid gas cartridge may be worn for up to ten times the exposure limit. For emergencies or instances where the exposure levels are not known, use a positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

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

Eye Protection:

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

SECTION 7 - Storage and Special Information

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

Addendum to Material Safety Data Sheet

REGULATORY STATUS

This Addendum Must Not Be
Detached from the MSDS
Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS
must include a copy of this addendum

Hazard Categories for SARA Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X	X			

Product or Components of Product:	SARA EHS Sec. 302 RQ	SARA EHS Sec. 302 TPQ	SARA Sec. 313 Chemicals Name List	SARA Sec. 313 Chemicals Chemical Category	CERCLA Sec.103 RQ lbs	RCRA Sec. 261.3
HYDROCHLORIC ACID, 37%						
Hydrogen chloride (7647-01-0) 37%	5000	500	Yes	No	5000acid	No
Water (7732-18-5) 63%	No	No	No	No	No	No

All components listed on the TSCA Inventory.

SARA Section 302 EHS RQ:
Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.

SARA Section 302 EHS TPQ:
Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.

SARA Section 313 Chemicals:
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CERLCA Sec. 103:
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at 40 CFR 302.4

RCRA:

Resource Conservation and Recovery Act. Commercial chemical product wastes designated as acute hazards or toxic under 40 CFR 261.33.

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

MSDS *Material Safety Data Sheet*

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

National Response in Canada
CANUTEC: 613-996-6666

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

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

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

MALLINCKRODT J.T.Baker

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

METHYL ALCOHOL

MSDS Number: M2015 --- *Effective Date: 12/08/96*

1. Product Identification

Synonyms: Wood alcohol; methanol; carbinol
CAS No.: 67-56-1
Molecular Weight: 32.04
Chemical Formula: CH3OH
Product Codes:
J.T. Baker: 5217, 5370, 5794, 5807, 5811, 5842, 5869, 9049, 9063, 9067, 9069, 9070, 9071, 9073, 9075, 9076, 9077, 9091, 9093, 9096, 9097, 9098, 9263, 9893
Mallinckrodt: 3004, 3006, 3016, 3017, 3018, 3024, 3041, 3701, 4295, 5160, 8814, H080, H488, H603, V079, V571

2. Composition/Information on Ingredients

```
Ingredient                                CAS No        Percent   Hazardous
---------------------------------------   ------------  -------   ---------

Methyl Alcohol                            67-56-1         100%       Yes
```

3. Hazards Identification

Emergency Overview

POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER.

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

Health Rating: 3 - Severe (Poison)
Flammability Rating: 4 - Extreme (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Once absorbed into the body, it is very slowly eliminated. Symptoms of overexposure may include headache, drowsiness, nausea, vomiting, blurred vision, blindness, coma, and death. A person may get better but then worse again up to 30 hours later.
Ingestion:
Toxic. Symptoms parallel inhalation. Can intoxicate and cause blindness. Usual fatal dose: 100-125 milliliters.
Skin Contact:
Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure.
Eye Contact:
Irritant. Continued exposure may cause eye lesions.
Chronic Exposure:
Marked impairment of vision and enlargement of the liver has been reported. Repeated or prolonged exposure may cause skin irritation.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Skin Contact:
Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Get medical attention if irritation develops or persists.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 12C (54F) CC
Autoignition temperature: 464C (867F)
Flammable limits in air % by volume:
lel: 7.3; uel: 36
Flammable.

Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Moderate explosion hazard and dangerous fire hazard when exposed to heat, sparks or flames. Sensitive to static discharge.

Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire. Vapors can flow along surfaces to distant ignition source and flash back.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!

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

7. Handling and Storage

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

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Methyl Alcohol:
- OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA)
- ACGIH Threshold Limit Value (TLV):

200 ppm (TWA), 250 ppm (STEL) skin

Ventilation System:

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

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.

Skin Protection:

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

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Characteristic odor.

Solubility:

Miscible in water.

Specific Gravity:

0.8

pH:

No information found.

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

100

Boiling Point:

64.5C (147F)

Melting Point:

-98C (-144F)

Vapor Density (Air=1):

1.1

Vapor Pressure (mm Hg):

97 @ 20C (68F)

Evaporation Rate (BuAc=1):

5.9

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:
Strong oxidizing agents such as nitrates, perchlorates or sulfuric acid. Will attack some forms of plastics, rubber, and coatings. May react with metallic aluminum and generate hydrogen gas.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Methyl Alcohol (Methanol) Oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; Irritation data-standard Draize test: skin, rabbit: 20mg/24 hr. Moderate; eye, rabbit: 100 mg/24 hr. Moderate; Investigated as a mutagen, reproductive effector.

```
--------\Cancer Lists\------------------------------------------------------
                                         ---NTP Carcinogen---
Ingredient                               Known    Anticipated    IARC Category
---------------------------------------- -----    -----------    -------------
Methyl Alcohol (67-56-1)                  No          No             None
```

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material is expected to readily biodegrade. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into air, this material is expected to have a half-life between 10 and 30 days. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

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

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: METHANOL
Hazard Class: 3
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 350LB

International (Water, I.M.O.)

Proper Shipping Name: METHANOL
Hazard Class: 3.2, 6.1
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 350LB

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Methyl Alcohol (67-56-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Methyl Alcohol (67-56-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Methyl Alcohol (67-56-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

		-RCRA-	-TSCA-
Ingredient	CERCLA	261.33	8(d)
Methyl Alcohol (67-56-1)	5000	U154	No

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

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
New 16 section MSDS format, all sections have been revised.
Disclaimer:
****

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

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

APPENDIX D
STANDARD SAFE WORK PRACTICES

STANDARD SAFE WORK PRACTICES

1) Eating, drinking, chewing tobacco, smoking and carrying matches or lighters is prohibited in a contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.

2) Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc.).

3) All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved; i.e., presence of strong and irritating or nauseating odors.

4) Prevent, to the extent possible, spills. In the event that a spillage occurs, contain liquid if possible.

5) Field crew members shall be familiar with the physical characteristics of investigations, including:

- Wind direction
- Accessibility to associates, equipment, vehicles
- Communication
- Hot zone (areas of known or suspected contamination)
- Site access
- Nearest water sources

6) All wastes generated during activities on-site should be disposed of as directed by the project manager or his on-site representative.

7) Protective equipment as specified in the section on personnel protection will be utilized by workers during the initial site reconnaissance, and other activities.

APPENDIX E
DRILLING SAFETY GUIDE

Drilling Safety Guide

INTERNATIONAL DRILLING FEDERATION

DCDMA
The Drilling Equipment Manufacturers Association

NDCA
National Drilling Contractors Association

CDDA
Canadian Diamond Drilling Association

MOBILE DRILL

DRILLING SAFETY GUIDE

The *Drilling Safety Guide* has been prepared through the combined efforts of member delegations of the Diamond Core Drill Manufacturers Association (DCDMA), the National Drilling Contractors Association (NDCA) and the National Water Well Association-Drill Rig/Heavy Equipment Products Group (NWWA) and is published by the International Drilling Federation for the benefit of the drilling industries.

This guide contains suggested safety procedures. It is not intended to set forth any standard industry procedures or requirements. This manual is to be used as a guideline for the safe operation of drilling equipment. IDF, DCDMA, NDCA, NWWA, their officers, and members deny any liability for any injury to people or property that may occur even if these procedures are properly followed. Further, the IDF, DCDMA, NDCA, NWWA, their officers, and members do not accept responsibility for the completeness of the guide or the applicability of the statements or procedures to the use of all drilling machines and tools in all environments. Many aspects of drilling safety cannot be expressed in detail and cannot be met by mechanical means; drilling safety can only be accomplished with the exercise of intelligence, care, and common sense.

DRILLING SAFETY GUIDE

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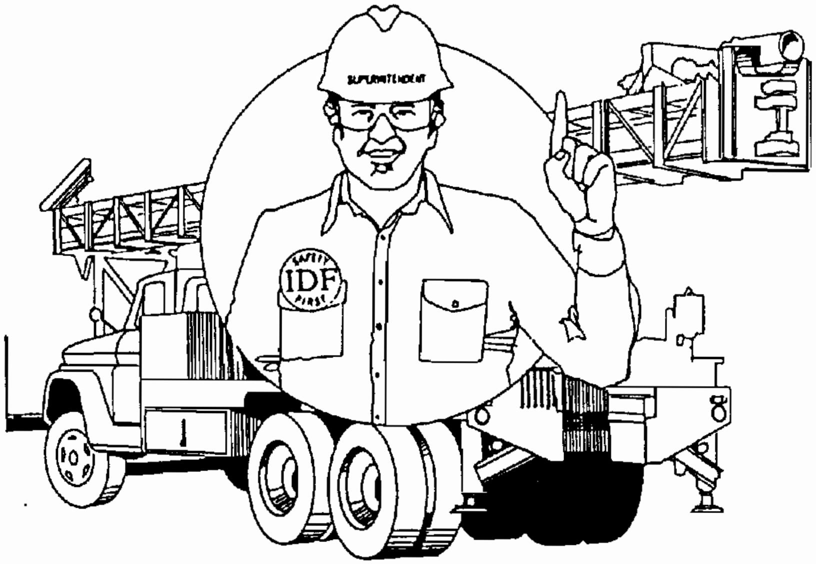
Table of Contents

DRILLING SAFETY GUIDE

1. An Introduction To Drilling Safety

The organization for which you work is interested in your safety. Your employer cares about your safety not only when you are working on or around a drill rig, but also when you are traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools. This safety guide is for your benefit. Failure to heed the safety procedures contained in this manual could result in serious injury or death.



Every drill crew should have a designated safety supervisor who has the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to obey the directions of the safety supervisor.

2. Governmental Regulations

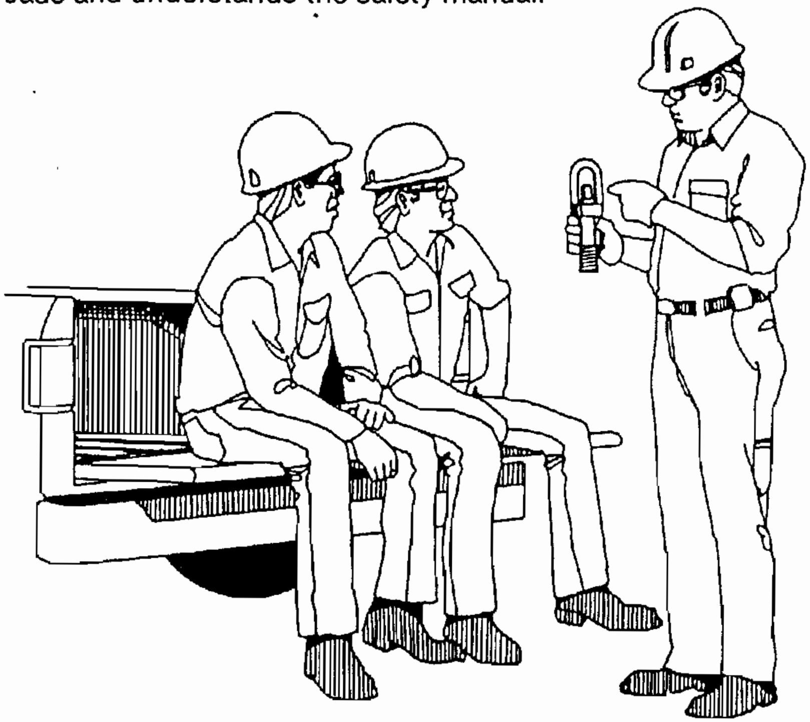
All local, state, and federal regulations or restrictions, currently in effect or effected in the future, take precedence over the recommendations and suggestions which follow. Government regulations will vary from country to country and from state to state.

3. The Safety Supervisor

The safety supervisor for the drill crew will, in most cases, be the drill rig operator. The safety supervisor must:

- Consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
- Be the leader in using proper personal safety gear and set an example in following the rules that are being enforced on others.
- Enforce the use of proper personal protective safety equipment and take appropriate corrective action when proper personal protective safety equipment is not being used.
- Understand that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide an environment that will promote and enforce safety.
- Before drilling is started with a particular drill, ensure that anyone who operates the drill has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- Inspect the drill rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and/or damaged pressure gauges and pressure relief valves.
- Check and test all safety devices, such as emergency shutdown switches, at least daily and preferably at the start of a drilling shift. Drilling must not be permitted until all emergency shutdown and warning systems are working correctly. Do not allow any emergency device to be bypassed or removed.
- Check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds each time an engine is started.
- Ensure that every drill rig worker is informed of safe operat-

ing practices on and around the drill rig. Provide every drill rig worker with a copy of the organization's drilling operations safety manual, and when appropriate, the drill rig manufacturer's operations and maintenance manual. Ensure that every employee reads and understands the safety manual.



- Carefully instruct a new worker in drilling safety and observe the new worker's progress towards understanding safe operating practices.
- Assess the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. Remove any worker from the drill site whose mental and physical capabilities might cause injury to the worker or coworkers.
- Ensure that a first-aid kit and a fire extinguisher, which are properly maintained, are on each drill rig and each additional vehicle.
- Be well trained in and capable of using first-aid kits, fire extinguishers, and all other safety devices and equipment. Train crew members.

- Maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.) and inform other members of the drill crew of the existence and location of the list.

4. Individual Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling projects, individual protective equipment must include a safety hat, safety shoes, safety glasses, and close-fitting gloves and clothing. The clothing of the individual drill rig worker is not generally considered protective equipment; however, the worker's clothing should be comfortable but must be close fitting, without loose ends, straps, draw strings, belts or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry must not be worn during a work shift.

- *Safety Head Gear.* Safety hats (hard hats) must be worn by everyone working or visiting at or near a drilling site. All safety hats must meet the requirements of ANSI Z89.1. All safety hats must be kept clean and in good repair with the headband and crown straps properly adjusted for the individual drill rig worker or visitor.
- *Safety Shoes or Boots.* Safety shoes or boots must be worn by all drilling personnel and all visitors to the drill site that observe drilling operations within close proximity of the drill rig. All safety shoes or boots must meet the requirements of ANSI Z41.1.
- *Gloves.* All drilling personnel must wear gloves for protection against cuts and abrasions that could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods and other drilling or sampling tools. All gloves must be close fitting and not have large cuffs or loose ties that can catch on rotating or translating components of the drill rig.
- *Safety Glasses.* All drilling personnel must wear safety glasses. All safety glasses must meet the requirements of ANSI Z87.1.
- *Other Protective Equipment.* For some drilling operations, the environment or regulations may dictate that other protective equipment be used. The requirement for such equipment must

be determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face or ear protection or reflective clothing. Each drill rig worker must wear noise-reducing ear protectors when appropriate.

When drilling is performed in chemically or radiologically contaminated ground, special protective equipment and clothing may, and probably will, be required. The design and composition of the protective equipment and clothing must be determined jointly by the management and the client who requests the drilling services, and under some circumstances, with the concurrence of a health and safety professional.

5. Housekeeping On and Around the Drill Rig

The first requirement for safe field operations is that the safety supervisor understand and fulfill the responsibility for maintenance and "housekeeping" on and around the drill rig. The safety supervisor must:

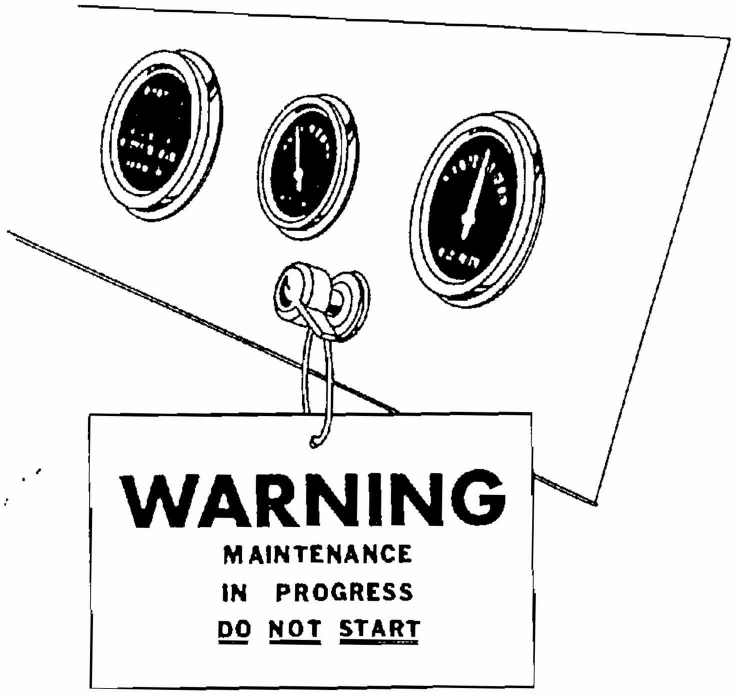
- Provide suitable storage locations for all tools, materials, and supplies so that these items can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.
- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig, unless designed for this purpose.
- Stack pipe, drill rods, casing, augers, and similar drilling tools in orderly fashion on racks or sills to prevent spreading, rolling, or sliding.
- Place penetration or other driving hammers at a safe location on the ground or secure them to prevent movement when not in use.
- Keep work areas, platforms, walkways, scaffolding, and other accessways free of materials, debris, obstructions, and substances such as ice, grease or oil that could cause a surface to become slick or otherwise hazardous.
- Keep all controls, control linkages, warning and operation lights and lenses free of oil, grease, and/or ice.
- Store gasoline only in a non-sparking, red container with a flame arrester in the fill spout and having the word "gasoline" easily visible.

6. Maintenance

Good maintenance will make drilling operations safer. Also, maintenance must be performed safely. The following points are essential to safety:

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.
- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidental starting of an engine during maintenance by removing or tagging the ignition key.

- Block the wheels or lower the leveling jacks or both and set hand brakes before working under a drill rig.
- Release all pressure on the hydraulic systems, the drilling fluid system and the air pressure systems of the drill rig — when possible and appropriate — prior to performing maintenance. In other words, reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Do not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have had adequate time to cool.



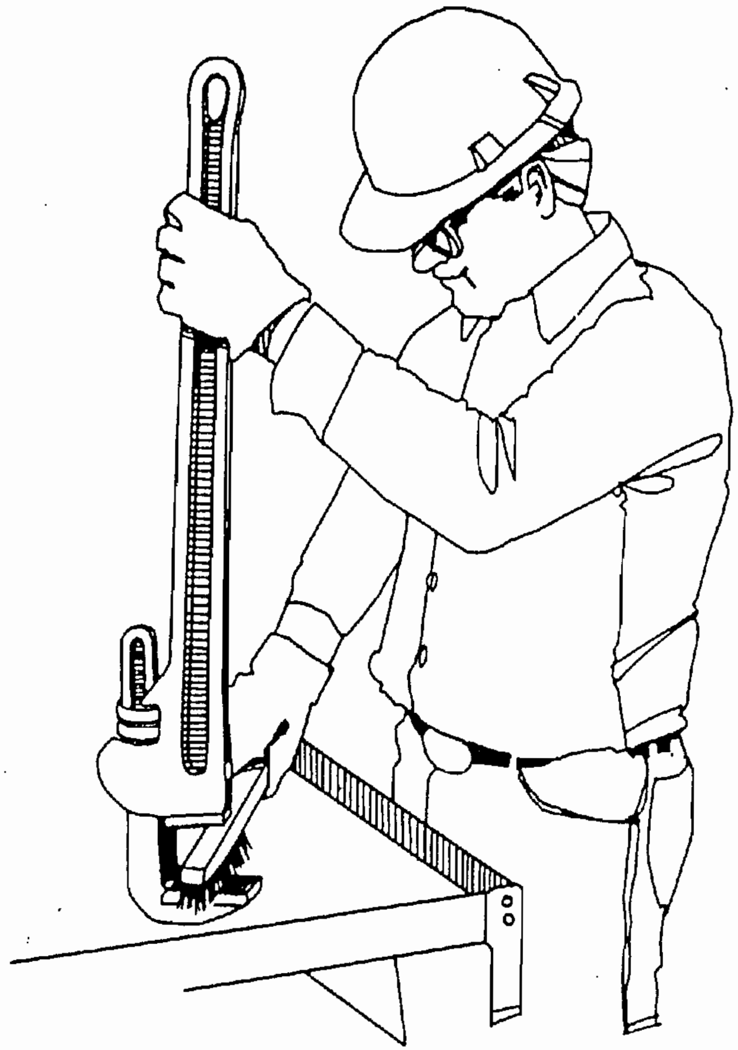
- Never climb the mast (derrick) to do maintenance or make repairs. Lower mast, stop engine and deenergize rig before starting maintenance or repair on mast.
- Never weld or cut on or near a fuel tank.
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig.

- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils and/or coolants.
- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed for maintenance before returning the drill rig to service.

7. Hand Tools

Since there are almost an infinite number of hand tools that can be used on or around a drill rig and in repair shops, there are an equal number of instructions for proper use. "Use the tool for its intended purpose" is the most important rule. The following suggestions apply to safe use of several hand tools that frequently are used on and around drill rigs:

- When a tool becomes damaged, either repair it before using it again or get rid of it.
- When using a hammer, any kind of hammer for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- When using any kind of chisel or punch, for any purpose, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and stored appropriately when not in use.
- Use wrenches — not pliers — on nuts.
- Use screwdrivers with blades that fit the screw.
- When using a wrench on a tight nut, first use some penetrating oil and then use the largest wrench available that fits the nut. When possible pull on the wrench handle rather than push on it; apply force to the wrench with both hands when possible and with both feet firmly placed. Always assume that you may lose your footing; check the place that you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. Use a wire brush frequently to clean the jaws of pipe wrenches. An accumulation of dirt and grease can cause wrenches to slip.
- Never use pipe wrenches in place of a rod-holding device.
- Replace hook and heel jaws when they become visibly worn.



- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform if the wrench should slip or the tool joint suddenly let go.

8. Clearing the Work Area

Prior to drilling, adequately clear and level the site to accommodate the drill rig and supplies and provide a safe working area.

Do not begin drilling if tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

9. Start-Up

Instruct all drill rig personnel and visitors to "stand clear" of the drill rig immediately prior to starting the engine.

- Make sure all brakes are set, all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers or air controls are in the correct positions, and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

10. Drilling Operations

Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick), look up to check for overhead obstructions. (Refer to Section 11 on Overhead and Buried Utilities.)
- Before raising the mast (derrick), clear all drill rig personnel (with exception of the operator) and visitors from the areas immediately to the rear and the sides of the mast. Inform all drill rig personnel and visitors that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is begun, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. Relevel the drill rig if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- Before starting drilling operations, secure, and/or lock the mast (derrick) if required, according to the drill manufacturer's recommendations.
- Do not stand on the elevated deck of a truck-mounted or all-terrain-mounted drill rig while the drill rig is in operation unless necessary for special tasks and the operator has been notified.
- Only operate a drill rig from the position of the controls. Before leaving the area of the controls, shift the transmission

controlling the rotary drive into neutral and place the feed lever in neutral. Before leaving the vicinity of the drill, shut down the drill engine.

- Throwing or dropping tools must not be permitted. Carefully pass tools by hand between personnel or use a hoist line.
- Do not consume alcoholic beverages, other depressants, or chemical stimulants prior to starting work on a drill rig or while on the job.
- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes are toxic and some cannot be detected by smell.
- Clean mud and grease from boots before stepping on a drill platform and use hand holds and railings. Watch for slippery ground when stepping down from the platform.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Drain all air and water lines and pumps when not in use if freezing weather is expected.
- Adequately cover or protect all unattended boreholes to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. Cover, protect or backfill all open boreholes according to local or state regulations on completion of the drilling project.
- Never allow "horsing around" within the vicinity of the drill rig and tool and supply storage areas — even when the drill rig is shut down.
- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.
- Terminate drilling operations during an electrical storm and move the complete crew away from the drill rig.

An elevated derrick platform should be used with the following precautions:

- When working on a derrick platform, use a safety belt and a lifeline. The safety belt must be at least 4 in. (100 mm) wide and should fit snugly but comfortably. The lifeline, when attached to the derrick, must be less than 6 ft. (2 m) long. The safety belt and lifeline must be strong enough to withstand the dynamic force of a 250 lb. (115 kg) weight (contained within the belt) falling 6 ft. (2 m).

- Use a safety device when climbing to a derrick platform that is higher than 20 ft. (6 m).
- When on a derrick platform, fasten the lifeline to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- When first arriving at a derrick platform, immediately inspect for broken members, loose connections, loose tools, or other loose materials.
- Securely attach tools to the platform with safety lines. Do not attach a tool to a line attached to one's wrist or any other part of the body.
- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Do not leave loose tools and similar items on the derrick platform or on structural members of the derrick.
- A derrick platform over 4 ft. (1.2 m) above ground surface must have toe boards and safety railing that are in good condition.
- Avoid being under rig workers on elevated platforms whenever possible.

If heavy objects must be manually lifted, exercise care to avoid injury.

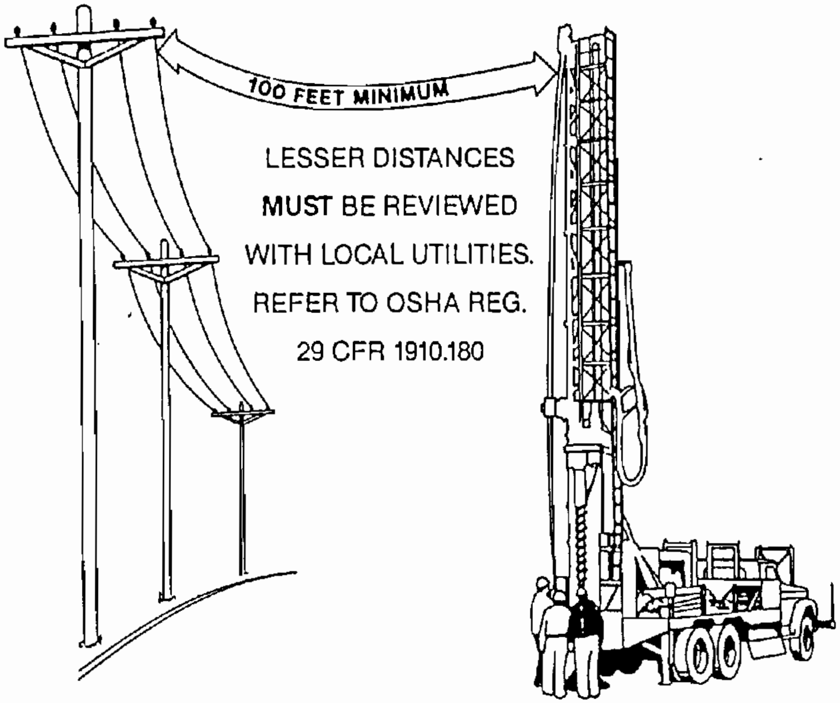
- Before lifting an object without using a hoist, make sure that the load is within your personal lifting capacity. If it is too heavy, ask for assistance.
- Before lifting a relatively heavy object, approach the object by bending at the knees, keeping the back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping the back vertical and unarched. In other words, perform the lifting with the muscles in the legs, not with the muscles in the lower back.
- If a heavy object must be moved some distance without the aid of machinery, keep the back straight and unarched. Change directions by moving the feet, not by twisting the body.

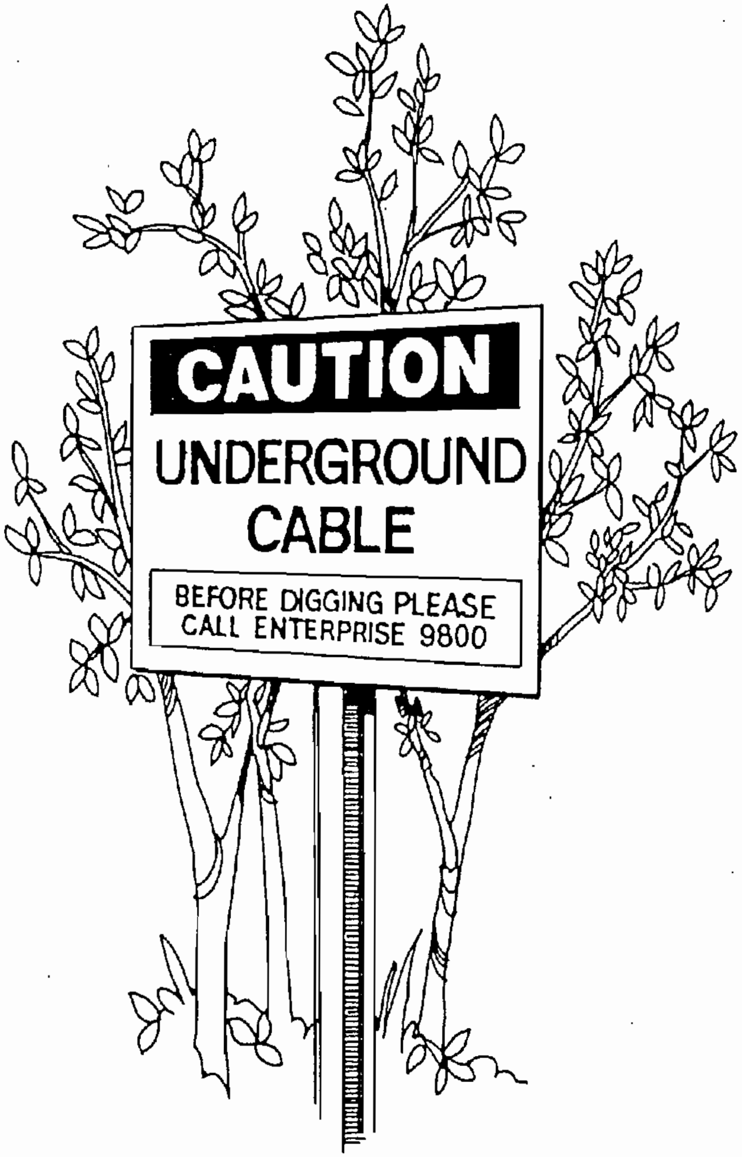
- Move heavy objects with the aid of hand carts whenever possible.

11. Overhead and Buried Utilities

Both supervisors and members of the exploration crew must take special precautions when a drill rig will be used on a site or project within the vicinity of electrical power lines and other utilities. Electricity can shock, it can burn, and it can cause death.

- Locate, note, and emphasize overhead and buried utilities on all boring location plans and boring assignment sheets.
- When overhead electrical power lines exist at or near a drilling site or project, consider all wires to be alive and dangerous.





- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or deenergize (turn off) the power.
- Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine the minimum horizontal distance from any point on the drill rig

to the nearest power line when the mast is raised and/or being raised. If this horizontal distance is less than 100 ft. (30 m), first consult the local utility company and refer to OSHA REG 29 CFR 1910.180 before commencing operations.

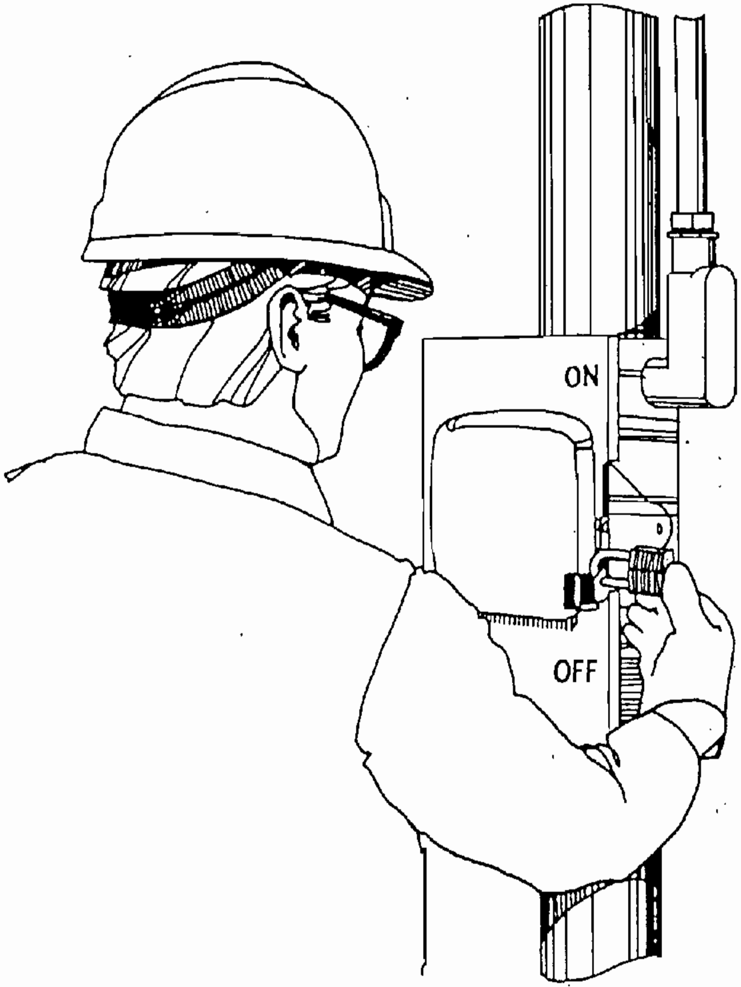
- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.
- In order to avoid contact with power lines, only move the drill rig with the mast (derrick) down.
- If there are any questions concerning the safety of drilling on sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.

Electricity is as dangerous underground as overhead. Be aware of and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer and water.

- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign. Call the utility and check it out. The underground utilities may be a considerable distance away from the warning sign.
- Always contact the owners of utility lines or the nearest underground utility location service before drilling. Determine jointly with utility personnel the precise location of underground utility lines, mark and flag the locations, and determine jointly with utility personnel what specific precautions must be taken to ensure safety.

12. Supplying Power to the Job Site

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFPA70-1984) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned so that the work area and operating positions are well lighted without shadows or blind spots. The following are specific recommendations for land-based drilling operations:



- Before working on an electrical power or lighting system, lock-out the main panel box with your own lock and keep the key on your person at all times.
- Install all wiring using high quality connections, fixtures and wire. Be sure that the wiring is insulated and protected with consideration for the drilling environment. Do not use makeshift

wiring and equipment.

- Place all lights positioned directly above working areas in cages or similar enclosures to prevent loose or detached lamps or vaportight enclosures from falling on workers.
- Install lights so as to eliminate glare or "blind spots" on tools, ladders, walkways, platforms, and the complete working area.
- Locate and guard electrical cables to prevent damage by drilling operations or by the movement of personnel, tools, or supplies.
- Use only three-prong, U-blade, grounded type plug receptacles and have adequate current carrying capacity for the electrical tools that may be used.
- Use only electrical tools that have three-prong, U-blade, ground wire plugs and cords.
- Do not use electrical tools with lock-on devices.
- Provide adequate grounding for all electrical welders, generators, control panels, and similar devices.
- Provide secure protective enclosures on control panels, fuse boxes, transformers, and similar equipment.
- Avoid attaching electrical lighting cables to the derrick or other components of the drill rig. If this must be done, use only approved fasteners. Do not "string" wire through the derrick.
- Do not use poles used to hold wiring and lights for any other purpose.
- Turn power off before changing fuses or light bulbs.
- Require all workers in a drilling area illuminated with electrical lighting to wear safety head gear that protects the worker's head, not only against falling or flying objects, but also against limited electrical shock and burns according to ANSI Z89.1 and Z89.2.
- Allow only trained, designated personnel to operate electrical equipment.
- Do not permit unqualified field personnel to work on or near electric lines or devices.

13. Contact with Electricity

If a drill rig makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, if the human body simultaneously comes in contact with the drill rig and the ground, electrocution can result, causing death or serious injury. If a drill rig or a drill rig carrier makes contact with overhead or underground electrical lines:

- Under most circumstances the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. They should not move or touch any part, particularly a metallic part, of the vehicle or the drill rig.
- If it is determined that the drill rig should be vacated, all personnel must jump clear and as far as possible from the drill. Personnel must not step off — but must jump off. Do not hang on to the vehicle or any part of the drill when jumping clear.
- If you are on the ground, stay away from the vehicle and the drill rig; do not allow others to get near the vehicle and the drill rig. Seek assistance immediately from local emergency personnel such as the police or a fire department.
- When an individual is injured and in contact with the drill rig or with power lines, attempt rescue with extreme caution. If a rescue is attempted, use a long, dry, unpainted piece of wood or a long, dry, clean rope. Keep as far away from the victim as possible and do not touch the victim until the victim is completely clear of the drill rig or electrical lines.
- Do not attempt to administer first aid unless the victim is completely clear of the electrical source. Begin cardiopulmonary resuscitation (CPR) immediately if a heart beat (pulse) cannot be detected.

14. Wire Line Hoists, Wire Rope, and Hoisting Hardware

Use wire line hoists, wire rope, and hoisting hardware only as stipulated by the American Iron and Steel Institute *Wire Rope Users Manual.*

- Visually inspect all wire ropes and fittings during use and thoroughly inspect them at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and/or damage to lifting hardware. Replace wire ropes when inspection indicates excessive damage, as described in the *Wire Rope Users Manual.*

- Thoroughly inspect all wire ropes that have not been used for a period of a month or more.
- Install all connections and end fittings, which consist of spliced eyes and various manufactured devices, according to the manufacturer's specifications. Do not exceed ratings specified by manufacturer.
- If a ball-bearing type hoisting swivel is used to hoist drill rods, inspect and lubricate swivel bearing daily to assure that the swivel freely rotates under load.
- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device; do not hoist more than 1 ft. (0.3 m) of the drill rod column above the top of the mast (derrick); do not hoist a rod column with loose tool joints; and do not make, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods by hand or by tensioning the slipping device.
- Most sheaves on exploration drill rigs are stationary with a single part line. Never increase the number of parts of line without first consulting with the manufacturer of the drill rig.
- Wire ropes must be properly matched with each sheave. If the rope is too large, the sheave will pinch the wire rope. If the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger-sized wire ropes.

The following procedures and precautions must be understood and implemented for use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist of the drill if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or to the feed mechanism of the drill.

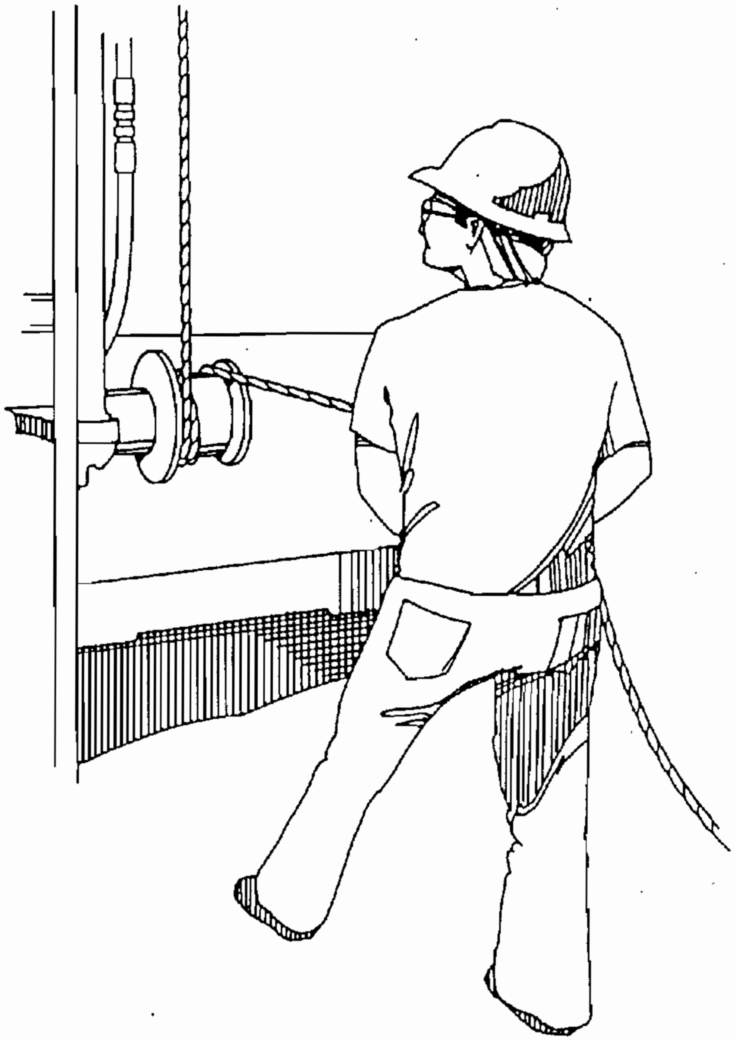
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Apply loads smoothly and steadily to minimize shock loading of a wire rope.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Replace damaged latches on hooks before using.
- Know the working load of the equipment and tackle being used. Never exceed this limit.
- Periodically inspect and test hoist clutches and brakes.
- Know and do not exceed the rated capacity of mast hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not use hands to guide wire rope on hoist drums.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never conduct any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep hands away from hoists, wire rope, hoisting hooks, sheaves, and pinch points while slack is being taken up or when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Use replacement wire ropes that conform to the drill rig manufacturer's specifications.

15. Cathead and Rope Hoists

Follow these procedures when using a cathead hoist:

- Keep the cathead clean and free of rust, oil and grease. Rust should be removed from the cathead with a wire brush having a handle.
- Check the cathead periodically, when the engine is not running, for rope wear grooves. If a rope groove forms to a depth greater than 1/8 in. (3 mm), replace the cathead.
- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel, including the operator, to rapidly back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. Keep careful watch on the suspended tools and quickly back away after turning off the engine.
- Always protect the rope from contact with chemicals. Chemicals can cause deterioration of the rope that may not be detected visibly.
- Never wrap the rope from the cathead (or any other rope, wire rope, or cable on the drill rig) around a hand, wrist, arm, foot, ankle, legs, or any other part of the body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing, or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.

- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.



- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.

- Only operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

16. Augers

Follow these general procedures when starting a boring with continuous flight or hollow-stem augers:

- Start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or on the rotation control at all times until the auger has penetrated about one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or a pavement.

Establish a system of responsibility for the operator and tool handler to follow during the series of various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation. In addition:

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.
- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not use an over-length pin or bolt. Do not touch the coupling or the auger with hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- Use a long-handed shovel to move auger cuttings away from the auger. Never use hands or feet to move cuttings away from the auger.
- Do not attempt to remove earth from rotating augers. Clean augers only when the drill rig is in neutral and the augers are stopped from rotating.

17. Rotary and Core Drilling

Check rotary drilling tools prior to drilling:

- Lubricate and check for frozen bearings before using water/air swivels and hoisting plugs. Water/air swivel bearings must be free before using, and stay clear of water/air swivel hose when rotating.
- Check drill rod chuck jaws periodically and replace when necessary.
- Check the capacities of hoists and sheaves against the anticipated weight to the drill rod string plus other expected hoisting loads.

During rotary or core drilling, follow these special precautions that involve chucking, joint break, hoisting, and lowering of drill rods:

- Only the operator of the drill rig should be allowed to brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.
- Do not lower drill rods into the hole with pipe wrenches.
- If a string of drill rods is accidentally or inadvertently released into the hole, do not attempt to grab the falling rods by hand or with a wrench.
- In the event of a plugged bit or other circulation blockage, relieve the high pressure in the piping and hose between the pump and the obstruction before breaking the first tool joint.

- When drill rods are hoisted from the hole, clean them only with a wiper made of rubber or other suitable material. Do not use hands to clean drilling fluid from drill rods.
- If work must progress above a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. Equip the mud pit with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Do not lift or lean unsecured drill rods against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

18. Transporting a Drill Rig

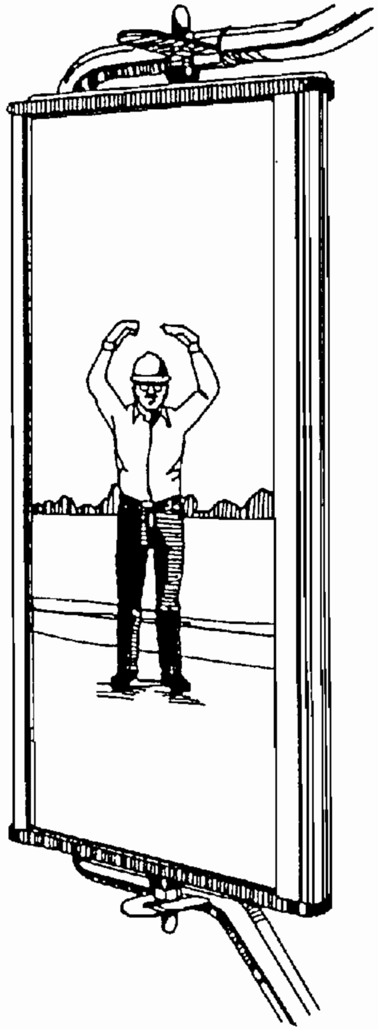
When transporting a drill rig on and off a drilling site:

- Allow only licensed individuals to operate the vehicle. Comply with all federal, state, and local regulations.
- Know the traveling height (overhead clearance), width, length, and weight of the drill rig with carrier and know the highway and bridge load, width, and overhead limits. Allow adequate margins and make sure that they are not exceeded.
- Never move a drill rig unless the vehicle brakes are in sound working order.
- Allow for mast overhang when cornering or approaching other vehicles or structures.
- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
- Watch for low hanging electrical lines, particularly at the entrances to drilling sites, restaurants, motels, or other commercial sites.
- Never travel on a street, road, or highway with the mast (derrick) of the drill rig in the raised or partially raised position.
- Remove all ignition keys when a drill rig is left unattended.

19. Loading and Unloading

When loading or unloading a drill rig on a trailer or a truck:

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the drill rig with carrier — including tooling.
- Load and unload on level ground.
- Use the assistance of someone on the ground as a guide.
- Check the brakes on the drill rig carrier before approaching loading ramps.



- Distribute the weight on the drill rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the hitch of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.

- Secure the drill rig and tools to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

20. Off-Road Movement

Follow these procedures during off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gulleys, ruts, and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely rather than at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- Set all brakes and/or locks after the drill has been moved to a new drilling site. When grades are present, block the wheels.
- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

21. Tires, Batteries, and Fuel

Check tires on the drill daily for safety and, during extended travel, for loss of air. Maintain air pressures for travel on streets, roads, and highways according to the manufacturer's recommendations. Only repair truck and off-highway tires with the required special tools and follow the recommendations of a tire manufacturer's repair manual.

If tires on all-terrain drills are deflated to reduce ground pressure for movement on soft ground, reinflate the tires to normal pressures before movement on firm or hilly ground or on streets, roads, and highways. Underinflated tires are not stable on firm ground.

During air pressure checks, inspect for:

- Missing or loose wheel lugs.
- Objects wedged between duals or embedded in the tire casing.
- Damaged or poorly fitting rims or rim flanges.
- Abnormal or uneven wear and cuts, breaks, or tears in the casing.

Batteries contain strong acid. Use extreme caution when servicing batteries.

- Service batteries only in a ventilated area and while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Loosen cell caps before charging to permit the escape of gas.
- Spilled battery acid can burn skin and should be immediately flushed with lots of water. If battery acid gets into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte, use a flashlight (not an open flame) to check electrolyte levels and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted or smoking materials and flames away from batteries.

Take special precautions for handling fuel and refueling the drill rig or carrier.

- Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.

- Do not fill fuel tanks while the engine is running. Turn off all electrical switches.
- Do not spill fuel on hot surfaces. Clean any spills before starting an engine.
- Wipe up spilled fuel with cotton rags or cloths; do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, flames, or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- During travel store fuel containers and hoses so they are in contact with a metal surface. This should prevent the buildup of static charge.

22. First Aid

Train at least one member of the drill crew, and if only one, preferably the drilling and safety supervisor, to perform first aid. First aid must be taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. Courses provided or sponsored by the American Red Cross or a similar organization best satisfy the requirements of first aid training for drill crews.

For drilling operations it is particularly important that those responsible for first aid should be able to recognize the symptoms of and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crew members by instructors qualified by an agency such as the American Red Cross.

Keep first aid kit available and well maintained on each drill site.

23. Drill Rig Utilization

Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes for which they are intended and designed.

24. Drill Rig Alterations

Alterations to a drill rig or drilling tools must only be made by qualified personnel and only after consultation with the manufacturer.

APPENDIX F

SITE-SPECIFIC INFORMATION

APPENDIX F
SITE SPECIFIC INFORMATION

EKONOL FACILITY
WHEATFIELD, NIAGARA COUNTY
NEW YORK

EKONOL FACILITY
WHEATFIELD, NIAGARA COUNTY
NEW YORK

EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations, contact should first be made with the field team leader (or designee) who will notify emergency personnel who will then contact the appropriate response teams. This emergency contacts list must be in an easily accessible location at the site.

Contingency Contacts

Phone Number

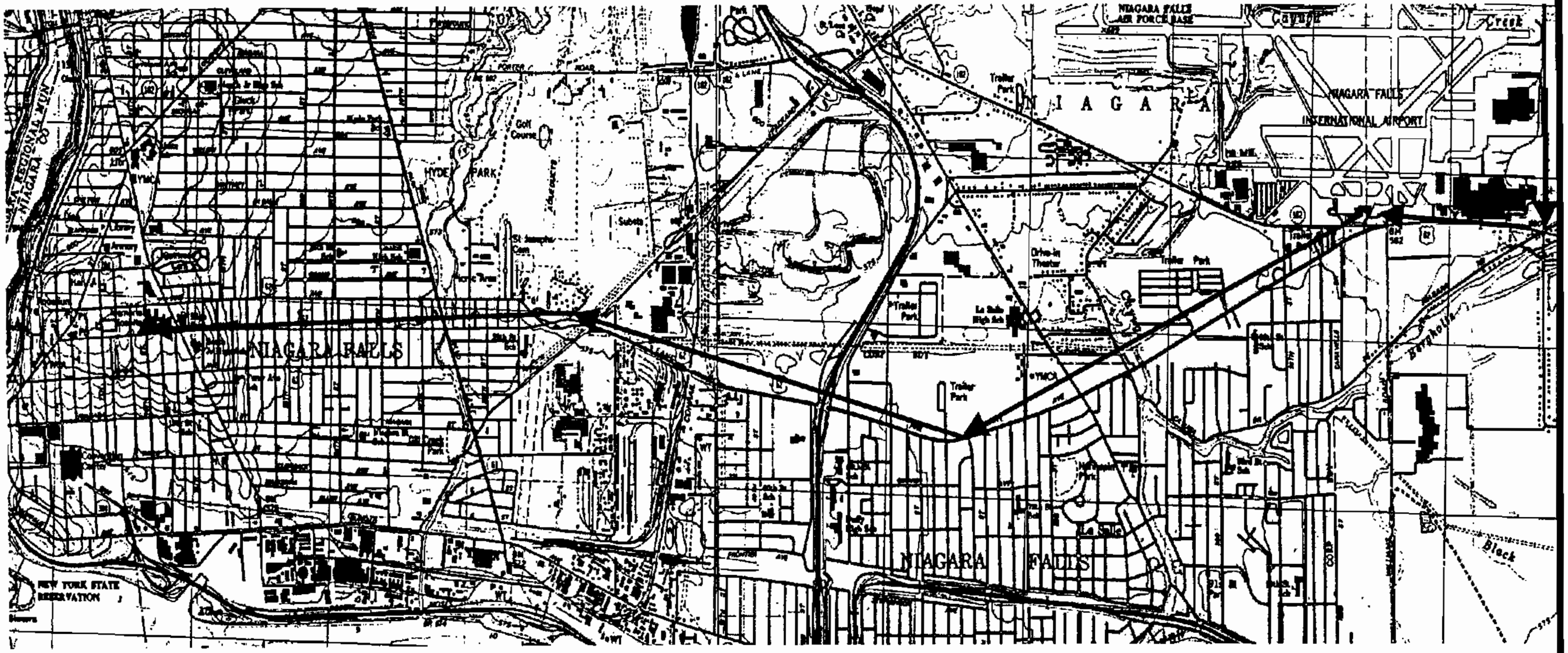
Fire Department:	911
Police:	911
Poison Control Center:	(800) 888-7655
Parsons ES Contract Physician:	HealthWorks (716) 874-7474

Medical Emergency

Hospital Name:	Niagara Falls Memorial Medical Center
Hospital Phone Number:	(716) 278-4394
Hospital Address:	621 10th
Map to Hospital:	SEE NEXT PAGE
Travel Time From Site:	20 Minutes
Route to Hospital:	1. Walmore Rd. to Nia. Falls Blvd. 2. Turn right(west) 3. Proceed to Walnut Ave. Turn Right 4. Take 10th Street to 621 10th. 5. Hospital in on 10th.

Parsons ES Contacts

Project Manager: George Hermance	(716) 633-7074
Health and Safety Officer: Brian Powell	(315) 451-9560



Walmore Road to Niagara Falls Boulevard, Turn Right

Proceed to Walnut Avenue off Niagara Falls Blvd.

Turn right off Walnut onto 10th.

Memorial Hospital on the right.

N

Appendix F

Route To Hospital

PARSONS ENGINEERING SCIENCE, INC.
DESIGN * RESEARCH * PLANNING
180 LAWRENCE BELL DRIVE - SUITE 100 * WILLIAMSVILLE, N.Y. 14221 * 716 / 633-7074
OFFICES IN PRINCIPAL CITIES

SITE DESCRIPTION

The primary objective of the project is to obtain information that can be used to determine whether the site can be closed with no further action, or whether remedial action is required. The site is located at 6600 Walmore Road, Niagara Falls, (Wheatfield), Niagara County, New York.

A concrete storage tank, formerly used as secondary containment for process water, was removed in October 1999. Following removal of the tank and surrounding soils, soil sampling of the walls and floor of the excavation was conducted. Results of the sampling indicated the presence of several organic compounds, including trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, and phenol.

FIELD INVESTIGATION

Soil Borings and Soil Sampling

An anticipated 5 soil borings will be advanced in the vicinity of the former settling pit using a Geoprobe™ direct push sampling unit. Each soil boring will be advanced to the top of bedrock, to depths of approximately 10 to 15 feet below ground surface. Field techniques, such as flame ionization detector (FID) headspace readings, and visual observations, will be used to screen the soil samples retrieved from the borings. Using the results of the field screening, a total of 5 soil samples will be submitted for laboratory analysis. These 5 samples, in conjunction with the results of the field screening, are expected to be sufficient to define the extent of impacts from the former settling pit. Analytical parameters will include TCE, 1,2-DCE, 1,1-DCA, 1,1,1-TCA (EPA Method 8260), phenol, aniline (EPA Method 8270), zinc, and lead (Method 6010B). For QA/QC purposes, one field duplicate sample will be collected, along with one trip blank.

After the soil boring has reached its total depth, a groundwater sample will be collected from each borehole. The groundwater sample will be field screened for volatile organic halides using EPA method 8535. This is a colorimetric screening procedure and is intended for on-site use. The method is not specific to any one halogenated hydrocarbon compound. The testing product is based on a photochemical reaction involving UV light. Generally, the three-point calibration curve is generated using TCE covering the range from 5 to 190 micrograms per liter (ug/L) and the total concentration of the volatile organic halides is reported in concentrations of TCE. The method detection limit has been calculated by the manufacturer at 4 ug/L.

Groundwater Sampling and Analysis

Eight monitoring wells (4 shallow and 4 deep) will be installed as well pairs consisting of one overburden well and one bedrock well at each location. The proposed location of these wells is shown in Figure 2. One well pair will be installed at a location upgradient of the former containment tank. One well pair will be installed at a location adjacent to the former containment tank location and its service lines. The remaining two well pairs will be installed at hydraulically down-gradient locations. Actual locations for the well pairs will be determined following completion of the soil boring program and receipt of soil analytical results from the laboratory. The installation of the well pairs will enable an assessment of bedrock and overburden groundwater quality, a determination of off-site contaminant migration, if any, in shallow and deep groundwater, definition of the horizontal extent of groundwater contamination and the potential presence of DNAPL in bedrock.

After the monitoring wells are installed, the wells will be developed to ensure the hydraulic connection between the well and surrounding formation, to remove fine-grained sediment from the wells, and to allow the collection of representative groundwater samples. This will be followed by purging the well to ensure a representative sample of shallow or deep groundwater is collected. Following well development and purging, groundwater samples will be collected from each well. Samples will be collected in accordance with NYSDEC protocols and guidance using dedicated, disposable bailers, a submersible pump, or a peristaltic pump.

Eight groundwater samples will be collected and submitted for laboratory analysis. Groundwater samples will be analyzed by EPA Method 8260 for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target SVOC parameters include phenol and aniline using EPA Method 8270. Analysis for zinc and lead will be performed using EPA Method 6010B. For QA/QC purposes, one field duplicate sample will be collected and analyzed. One trip blank will be analyzed for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA).

After receiving the analytical results from the laboratory, the results of the VOC parameters will be evaluated to determine if the levels of each identified VOC is close to the effective solubility of the compound in water. This will provide an estimate of whether dense non-aqueous phase liquid (DNAPL) is present in the well. An additional groundwater/DNAPL sample will then be collected from the sump of the well using dedicated tubing and a peristaltic pump. The groundwater sample will then be mixed with Sudan IV, a hydrophobic dye that will be used to identify free phase VOCs which are difficult to observe visually without the aid of dye. Sudan IV will dye any free-phase liquid but will leave water clear.

All soil boring and well locations will be surveyed for location and elevation, following installation.

All investigation derived waste (IDW), including excess soils, decontamination rinsates, well development water, purge water, and personal protective equipment, will be placed in Department of Transportation- (DOT) approved 55-gallon 17-H type drums. Alternately, a plastic wastewater tank (approximately 1,000 gallon) may be used to stage liquid IDW (development water, purge water, and decontamination liquids).

Sewer Investigation

To evaluate potential preferential pathways for offsite migration of contaminants, the sewers in the vicinity of the site will be investigated. The storm and sanitary sewer lines in the vicinity of the containment tank will be measured for invert elevations. This will be conducted at the manholes and at the catch basins. The direction of flow in the pipe will then be established, based on this information. This information will also be used to determine the best areas to conduct test pits. The test pits will reveal the condition of the sewer bedding, if any, and if the pipelines are above or below the water table. Pipelines below the water table would be much more likely to provide a preferential pathway for groundwater migration than a pipeline above the water table. The proposed test pit locations are shown on Figure 2. This distribution will confirm if there are any preferential pathways for contaminant migration. Locations may be changed based on information collected prior to test pit excavation.

After each test pit is completed, a soil sample will be collected from beneath the pipeline, if possible. It is important to note that this soil sample will be collected from the native soil, not the pipe line bedding. The soil sample will be submitted for laboratory analysis by EPA Method 8260 for the target VOC parameters (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target SVOC parameters include phenol and aniline, using EPA Method 8270. Analysis for zinc and lead will be performed using EPA Method 6010B.

PROJECT TEAM ORGANIZATION

The Parsons ES field team will consist of at least two persons. A senior staff member will serve as Field Team Leader and Site Health and Safety Officer. Key personnel involved with onsite activities are:

Project Manager:	George Hermance, Parsons -Buffalo
ES Health and Safety Officer:	Brian Powell, Parsons -Syracuse
Field Team Leader:	Andrew Janik, Parsons -Buffalo
Site Health and Safety Officer:	Andrew Janik, Parsons -Buffalo

CHEMICAL HAZARDS

The contaminants known to exist at the site include trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, and phenol. The source of the contamination is thought to be the former secondary containment immediately south of the Ekonol faciltiy. The health hazards associated with these chemicals are outlined on Table F-1.

PHYSICAL HAZARDS

No non-routine physical hazards have been identified.

SITE SPECIFIC HEALTH AND SAFETY REQUIREMENTS

The general health and safety requirements presented in Sections 1 through 6 of this plan are modified as described below to provide for specific conditions on-site.

Airborne Contaminants

Volatile organic compounds are the primary chemical hazards identified on the site. A flame ionization detector (FID) will be used to monitor the breathing zone for detectable volatile and semivolatile vapors. This portion of the HASP will be updated to address field investigation issues following NYSDEC approval of the Work Plan and prior to start of field work.

Based on a review of the potential chemical hazards at the site, the following conditions will determine the level of protective equipment that will be used by personnel while onsite:

Conditions for Level D:

- FID readings less than 2 ppm (based on vinyl chloride) or the total organic vapor readings in the breathing zone are less than 5 for 30 seconds.

Conditions for Level B or retreat:

- FID readings greater than 2 ppm in the breathing zone for more than 30 seconds (based on vinyl chloride).

Direct Contact

Nitrile outer and nitrile or PVC latex inner gloves will be used to provide adequate protection from direct contact hazards.

If necessary, polyethylene coated-tyvek will be warn to protect from to protect from splash hazards.

TABLE F-1 HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL [a/] (ppm)	TLV [b/] (ppm)	IDLH [c/] (ppm)	Odor Threshold[d/] (ppm)	Ionization Potential[e/] (eV)	Physical Description/Health Effects/Symptoms
Aniline	2 (skin)	2 (skin)	100	0.5-70	7.70	Colorless to brown, oily liquid (solid<21° F) with an aromatic, amine-like odor. Irritates eyes. Causes headaches, weakness, dizziness, blue skin, incoordination, shortness of breath on effort, tachycardia, methemoglobinemia[mm/], and cirrhosis. In animals, causes tumors of the spleen. Carcinogen.
Carbon Tetrachloride	2	5 (skin)	200	21.4-200	11.47	Colorless liquid with characteristic, ether-like odor. Irritates eyes and skin. Causes CNS depression, nausea, vomiting, liver/kidney damage, drowsiness, dizziness, and incoordination. In animals, causes liver cancer. Mutagen, experimental teratogen, and carcinogen.
1,1-Dichloroethane (DCA)	100	100	3,000	120	11.06	Colorless, oily liquid with chloroform-like odor and hot saccharine taste. Irritates skin. Causes CNS depression and kidney, lung, and liver damage. Experimental teratogen and questionable carcinogen.
1,2-Dichloroethene (DCE) (cis- and trans-isomers)	200	200	1,000	0.085-500	9.65	Colorless liquid (usually a mixture of cis- and trans- isomers), with a slightly acrid, chloroform-like odor. Irritates eyes and respiratory system. CNS depressant. Cis- isomer is a mutagen.
Phenol	5 (skin)	5 (skin)	250	0.05-5	8.50	Colorless to light-pink, crystalline solid with a burning taste and a sweet acrid odor. Irritates eyes, nose, and throat. Causes anorexia, low-weight, weakness, muscle aches and pain, dark urine, blue skin, skin burns, dermatitis, tremors, twitching, convulsions, and damage to the liver, kidneys, pancreas, spleen, and lungs. Ingestion can cause gangrene and corrosion of the lips, mouth, throat, esophagus, and stomach. Mutagen, experimental teratogen, and questionable carcinogen.
Perchlorethylene (Tetrachloroethene or PCE)	25 [z/]	25	150	5-50	9.32	Colorless liquid with a mild chloroform odor. Eye, nose, skin and throat irritant. Causes nausea, flushed face and neck, vertigo, dizziness, headaches, hallucinations, incoordination, drowsiness, coma, pulmonary changes, and skin redness. Cumulative liver, kidney, and CNS damage. In animals, causes liver tumors. Mutagen, experimental teratogen, and carcinogen.
1,1,1-Trichloroethane (TCA) (Methyl Chloroform)	350	350	700	20-500	11.00	Colorless liquid with a mild chloroform-like odor. Irritates eyes and skin. Causes headaches, exhaustion, CNS depression, poor equilibrium, dermatitis, liver damage, cardiac arrhythmia, hallucinations or distorted perceptions, motor activity changes, aggression, diarrhea, and nausea or vomiting. Mutagen, experimental teratogen, and questionable carcinogen.

TABLE F-1 HEALTH HAZARD QUALITIES OF HAZARDOUS SUBSTANCES OF CONCERN

Compound	PEL [a/] (ppm)	TLV [b/] (ppm)	IDLH [c/] (ppm)	Odor Threshold[d/] (ppm)	Ionization Potential[e/] (eV)	Physical Description/Health Effects/Symptoms
1,1,2-Trichloroethane (TCA)	10 (skin)	10 (skin)	100	NA	11.00	Colorless liquid with a sweet, chloroform-like odor. Irritates eyes, skin, lungs, and nose. Causes dermatitis, liver and kidney damage, and CNS depression. In animals, causes liver cancer. Mutagen and carcinogen.
Trichloroethene (TCE)	50	50	1,000	21.4-400	9.45	Clear, colorless or blue liquid with chloroform-like odor. Irritates skin and eyes. Causes fatigue, giddiness, headaches, vertigo, visual disturbances, tremors, nausea, vomiting, drowsiness, dermatitis, skin tingling, cardiac arrhythmia, and liver injury. In animals, causes liver and kidney cancer. Mutagen, experimental teratogen, and carcinogen.
Vinyl Chloride	1 STEL = 5 (29 CFR 1910.1017) [dd/]	1	NA	260	9.99	Colorless gas (liquid<7°F) with a pleasant odor at high concentrations. Severe irritant to skin, eyes, and mucous membranes. Causes weakness, abdominal pain, gastrointestinal bleeding, enlarged liver, pallor or blue skin on the extremities, liver cancer, and frostbite (liquid). Also attacks lymphatic system. Mutagen, experimental teratogen, and carcinogen.

a/ PEL = Permissible Exposure Limit. OSHA-enforced average air concentration to which a worker may be exposed for an 8-hour workday without harm. Expressed as parts per million (ppm) unless noted otherwise. PELs are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997. Some states (such as California) may have more restrictive PELs. Check state regulations.

b/ TLV = Threshold Limit Value - Time-Weighted Average. Average air concentration (same definition as PEL, above) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH), *1999 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*.

c/ IDLH = Immediately Dangerous to Life or Health. Air concentration at which an unprotected worker can escape without debilitating injury or health effects. Expressed as ppm unless noted otherwise. IDLH values are published in the *NIOSH Pocket Guide to Chemical Hazards*, 1997.

d/ When a range is given, use the highest concentration.

e/ Ionization Potential, measured in electron volts (eV), used to determine if field air monitoring equipment can detect substance. Values are published in the *NIOSH Pocket Guide to Chemical Hazards*, June 1997.

h/ NA = Not available.

j/ (skin) = Refers to the potential contribution to the overall exposure by the cutaneous route.

m/ (STEL) = Short Term Exposure Limit, a 15 minute time-weighted average that should not be exceeded at any time during the work day.

dd/ Refer to expanded rules for this compound.