Work Plan for:

PHASE III INVESTIGATION
AT
EKONOL POLYESTER RESINS
WHEATFIELD, NEW YORK

NYSDEC SITE # V00653-9

Submitted to:

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

Submitted by:

Group Environmental Management Company

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

Prepared By:

PARSONS

180 Lawrence Bell Drive, Suite 104
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August 2003

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PROJECT OBJECTIVES AND BACKGROUND

The former Ekonol Polyester Resins facility 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 trichloroethene (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 (Phase I) 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 Phase I work was summarized and presented to the NYSDEC in a report, dated March 2001. The NYSDEC reviewed the report and requested further characterization of soil and groundwater.

To address the NYSDEC comments on the Phase I report, Phase II site characterization activities were undertaken. Phase II field activities included soil borings, soil sampling with groundwater field screening, overburden and bedrock monitoring well installation, two groundwater sampling events, and an investigation of site sewers.

Field and analytical data from the Phase II investigation showed impacts to groundwater including a dense non-aqueous phase liquid (DNAPL). The data further indicated that additional investigation activities are necessary to define the extent of impacts to groundwater in the bedrock aquifer. After reviewing the data, NYSDEC concurred that additional work of similar scope to Phase II is warranted for groundwater.

Previous field and analytical data from the Phase II investigation warrant investigation work to define the extent of impacts to groundwater in the bedrock aquifer. In general, the Phase III scope of work described herein is similar to that of the NYSDEC-approved investigation performed onsite.

PHASE III INVESTIGATION SCOPE OF WORK

This investigation effort includes onsite and offsite reconnaissance, groundwater screening from temporary bedrock borings, and installation of bedrock monitoring wells. Prior to constructing the well in each cored borehole, packer testing and discrete-zone water quality sampling will be completed. At the completion of packer testing, the bedrock monitoring wells will be installed. After well installation, groundwater samples will be collected and analyzed. The monitoring wells and offsite property boundaries will also be surveyed. This investigation scope of work also includes a qualitative risk assessment, and an assessment of the potential for ecological impacts. The Phase III investigation will be completed using the following tasks.

Task 1 – Site Reconnaissance

Site reconnaissance will include a review of Town of Wheatfield tax maps, zoning maps, and other records to determine property owner and contact information, zoning ordinance information, and the current use of the properties within one-half mile of the site. The site reconnaissance will be completed for property within one-half mile of the site. A public notification mailing list will be developed with the information obtained.

During site reconnaissance, a search (within one-half mile) will be conducted for surface features that have the potential to pose a threat to ecological receptors. The search will look for surface water bodies (creeks, streams, ponds), and wetlands. If found, an evaluation of the potential impacts to threatened or endangered species, exceptional value wetlands, habitats of concern, and species of concern will be made (see Task 5 – Qualitative Risk Assessment).

Onsite Reconnaissance

The onsite reconnaissance will include an inspection of interior of building #4. The inspection will focus on identification of potential discharge locations including, sumps, sewers, floor drains, pits, dry wells, sludge, or any other features that have or potentially have provided a pathway for release to the environment outside of building #4. If necessary during this inspection, sampling of the sumps, sewers, floor drains, pits, dry wells, sludge, or any other features may be performed. Any samples collected will be analyzed by EPA Method 8260 for the target volatile organic compounds (VOCs) (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target semi-volatile organic compounds (SVOCs) include phenol and aniline and will be analyzed using EPA Method 8270.

Offsite Reconnaissance

The offsite reconnaissance will focus on the identification of both residential and non-residential property owners within one-half mile of the subject property. The address of the contact or owner of the property will be determined from Town of Wheatfield records. The current use of the properties within one-half mile of the subject property will be identified. Information will be obtained from the Town of Wheatfield

tax maps. Offsite reconnaissance will include the identification of buildings with basements.

Task 2 – Bedrock Investigation

To define the extent of impacts to groundwater in bedrock, four additional bedrock monitoring wells are proposed. To determine the horizontal extent of groundwater impacts and appropriate locations for the bedrock monitoring wells, temporary borings will be installed. The temporary borings will enable collection of bedrock groundwater samples for screening purposes.

Groundwater Screening

Locations for bedrock groundwater screening holes will be selected based on previous onsite results and the expected groundwater flow direction. The proposed locations the four screening boreholes is as follows:

- in the right-of-way adjacent to Walmore Road east-southeast of MW-11D;
- in the right-of-way adjacent to Walmore Road east of MW-5S;
- south of the Saint-Gobain Abrasives building, west of MW-13D; and
- approximately 200 feet south of MW-13D.

The proposed locations of the initial screening boreholes are shown on Figure 2. Initially, temporary borings will be installed at the four proposed locations by advancing 4-inch inner diameter spin casing to the top of rock. After reaching the top of bedrock, spin casing, equipped with a diamond shoe, will be seated 6 to 12 inches into the competent bedrock. After seating the casing, a pneumatic rock drill will be used to advance the boring. Using filtered, compressed air as the drilling lubricant, the pneumatic drill will be advanced a maximum of 25 feet into competent bedrock or until a water-bearing zone is encountered, whichever occurs first. Once the total depth of the boring is reached, the drill stem will be removed, and groundwater allowed to recharge to the boring.

Once groundwater has recharged sufficiently, a groundwater screening sample will be collected from the open borehole. The groundwater sample will be field-screened for total volatile organic halides (VOHs), using EPA Method 8535. If the screening results reveal a VOH concentration in groundwater that is greater than 50 parts per billion (ppb), alternate borehole locations will be considered. If an alternate borehole location is selected, the groundwater screening process will be repeated at the alternate location. A maximum of two alternate boring locations will be selected for each proposed monitoring well location. Unless limited by buildings, roadway, or property boundaries, alternate boring locations will be located 100 ft. from the original boring. In the event that the two alternate locations are completed and screening data is still greater than 50 ppb, the data will be evaluated to determine further options. The groundwater screening borings will be properly abandoned using bentonite holeplug and cement-bentonite grout.

Bedrock Well Installation

Once a suitable location for each bedrock monitoring well is selected using the screening method, a bedrock monitoring well will be installed at a location adjacent to the abandoned borehole. Presently, four bedrock monitoring wells are proposed.

The bedrock wells will be installed by advancing 6.25-inch hollow-stem augers (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 competent bedrock. After drilling the rock socket, a permanent four-inch casing will be placed to the bottom of the boring. The casing will be sealed in place by tremie grouting with cement-bentonite grout from the bottom up. After allowing the grout to set for a minimum of 24 hours, an HQ-sized core barrel (nominal 4-inch outside diameter) will be advanced a maximum of 25 feet into competent bedrock or until a water-bearing zone is encountered, whichever occurs first.

After each core run, typically five feet in length, packer testing will be performed on that section of the boring (total of three tests per borehole). The packer test will use water injection methods to estimate the hydraulic conductivity of that section of the corehole. Packer testing in the open boring with periodic water level monitoring in adjacent borings or wells will enable identification of higher permeability zones and connectivity of fractures between holes. Packer testing will be performed over the entire section of bedrock that was cored.

At the completion of packer testing, a 2-inch ID, stainless steel well screen and riser will be installed in the boring. The screen length will be a maximum of ten feet with 0.010-inch slots. The well will be screened over the most permeable section of the bedrock. Below the screen, a 2-foot section of casing will be installed as a sump to collect any DNAPL, if present. The bedrock wells will be completed as described in the NYSDEC-approved Additional Phase II Site Investigation Work Plan. Well installation will be in accordance with the NYSDEC guidelines outlined in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (December 2002).

All boring and well locations will be surveyed for location and elevation, following installation. Monthly, for a period of 12 months, water levels will be collected from the overburden and bedrock monitoring wells and used with survey elevation data to determine the local direction of groundwater flow in the overburden and bedrock aquifers.

Task 3 - Groundwater Sampling and Analysis

Dissolved Phase Sampling and Testing

After the offsite bedrock monitoring wells are installed, the wells will be developed and purged following standard NYSDEC guidelines outlined in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (December 2002). Groundwater samples will be collected in accordance with the NYSDEC protocols and

guidance using dedicated bailers, disposable bailers, a submersible pump, or a peristaltic pump. During development and purging, field parameters including pH, temperature, conductivity, dissolved oxygen (DO), and oxidation reduction potential (ORP) will be collected. Colorimetric field test kits may be utilized to test for nitrate, ferrous iron, and sulfate. Measurement of these field parameters will provide valuable information for plume delineation, and evaluation of intrinsic biodegradation. In addition to the offsite monitoring wells, the onsite monitoring wells installed during previous onsite Phase II field activities will be sampled.

A total of 21 groundwater samples (9 overburden, 12 bedrock) will be collected and submitted for laboratory analysis in accordance with the NYSDEC-approved Phase II Site Characterization Work Plans. Groundwater samples will be analyzed by EPA Method 8260 for the target volatile organic compounds (VOCs) (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target semi-volatile organic compounds (SVOCs) include phenol and aniline and will be analyzed using EPA Method 8270. For the offsite investigation analysis for zinc and lead will not be performed. 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).

Separate-Phase Liquid Monitoring and Testing

During well development and purging, the water will be checked for the presence of dense non-aqueous phase liquids (DNAPL) using visual observation and a hydrophobic dye. If DNAPL is observed in any of the new offsite monitoring wells (three onsite wells contain separate-phase liquid), the DNAPL will be sampled and submitted for physical and chemical analysis. Physical properties to be determined for the separate-phase liquid include surface tension, density and viscosity. Chemical analysis will include testing for the full suite of VOCs and SVOCs by EPA Method 8260 and 8270. Physical and chemical testing of the DNAPL will be useful in determining the potential mobility of the DNAPL.

All field activities will be conducted in accordance with the project Quality Assurance Project Plan (Appendix A) and site-specific Health and Safety Plan (Appendix B). All 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 may be used to stage liquid IDW (development water, purge water, and decontamination liquids).

Task 4 – Waste Handling

Disposal of the IDW created during the installation of the monitoring wells will be required. The IDW will be evaluated as hazardous or non-hazardous, and will be disposed of in accordance with the appropriate regulations. The scope of work for this waste disposal event includes composite sampling to characterize the wastes for disposal and proper disposal of waste. Waste streams will include drill cuttings, groundwater, decontamination water, and personal protective equipment.

Task 5 - Qualitative Risk Assessment

A qualitative risk assessment (exposure assessment) will be completed using available onsite and offsite soil and groundwater data. The qualitative risk assessment will use an exposure scenario assessment to define complete and potentially complete pathways to receptors. The scenario assessment is one part of the NYSDEC Exposure Assessment Procedure which is used to better quantify any impact of residual contamination. Potential human receptors will be identified based on information provided by the site characterization activities. Onsite and offsite receptors to be evaluated include, as appropriate, commercial workers, construction workers, resident children, and resident adults. The exposure assessment will be completed as described in the August 1998 NYSDEC Exposure Assessment Procedure.

As part of the qualitative risk assessment, an assessment of ecological risk will be performed. This component of the qualitative risk assessment will evaluate whether the surface features identified during site reconnaissance, have the potential to pose substantial ecological impacts. The evaluation will discuss the potential impacts to threatened or endangered species, exceptional value wetlands, habitats of concern, and species of concern. If the results of the ecological assessment show potential ecological impacts, additional ecological assessment will be evaluated.

Task 6 - Report Preparation

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. Analytical data received from the laboratory will be reviewed to identify any potential deviations from specified protocols. The compliance review will consist of an assessment of whether or not holding times were met and a review of laboratory Quality Control (QC) blank results in accordance with United States Environmental Protection Agency (USEPA) Region II Standard Operating Procedures (SOPs) for Organic and Inorganic Data Review. The data evaluation will be completed in accordance with NYSDEC Data Usability Summary Report (DUSR) guidelines. The DUSR is discussed in the Quality Assurance Project Plan (see Appendix A). Following the data quality review, the data will be reduced, tabulated, evaluated and incorporated into the site investigation report.

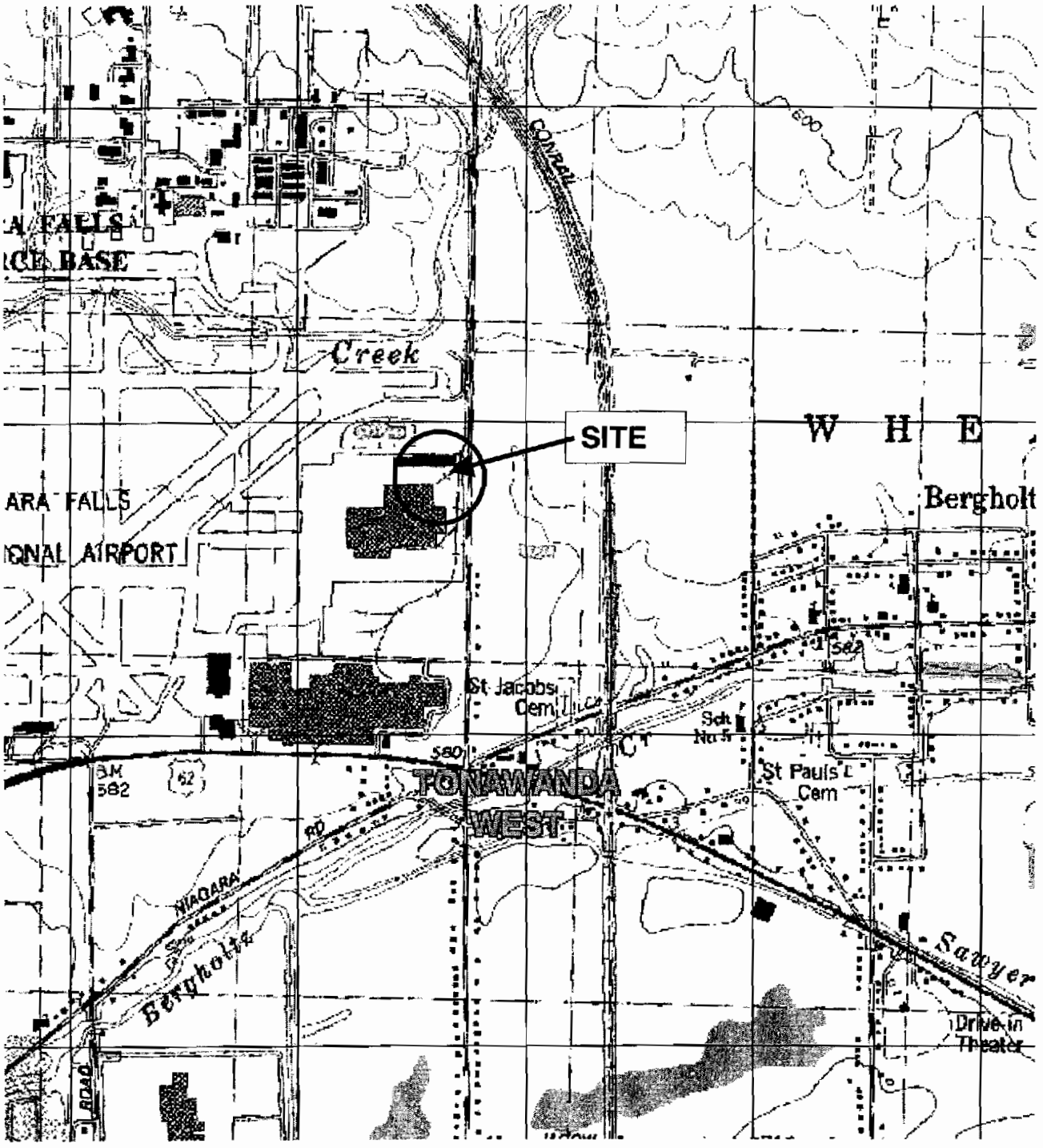
After the QA/QC data review is complete, the offsite investigation report will be prepared. The report will document all field investigation activities, including screening borings, screening sampling, well installation, and groundwater sampling. The report will summarize the data collected during the offsite investigation and present the results of the qualitative risk assessment. Water level contour maps for overburden and bedrock wells, showing groundwater flow direction, will be presented in the report.

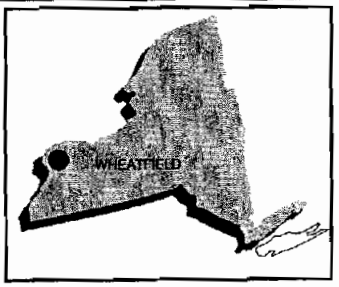
Schedule

Following approval of this Phase III Investigation Work Plan by the NYSDEC, the investigation can be completed within 28 weeks. Approximately seven months will be

required to conduct the site reconnaissance, complete the field investigation, collect groundwater samples, obtain laboratory analytical results, complete the qualitative risk assessment, and submit the Phase III Investigation Report to the NYSDEC. A more detailed schedule is presented on Figure 3.

FIGURES





New York Quadrangle

LATITUDE: N43° 06' 21"
LONGITUDE: W78° 55' 46"

N

SOURCE: DeLORME 3-D TOPOQUAD PROGRAM

FIGURE 1

GROUP ENVIRONMENTAL MANAGEMENT CO
EKONOL FACILITY
WHEATFIELD, NEW YORK

SITE LOCATION MAP

PARSONS
180 LAWRENCE BELL DRIVE* WILLIAMSVILLE, NEW YORK 14221 (716) 633-7074

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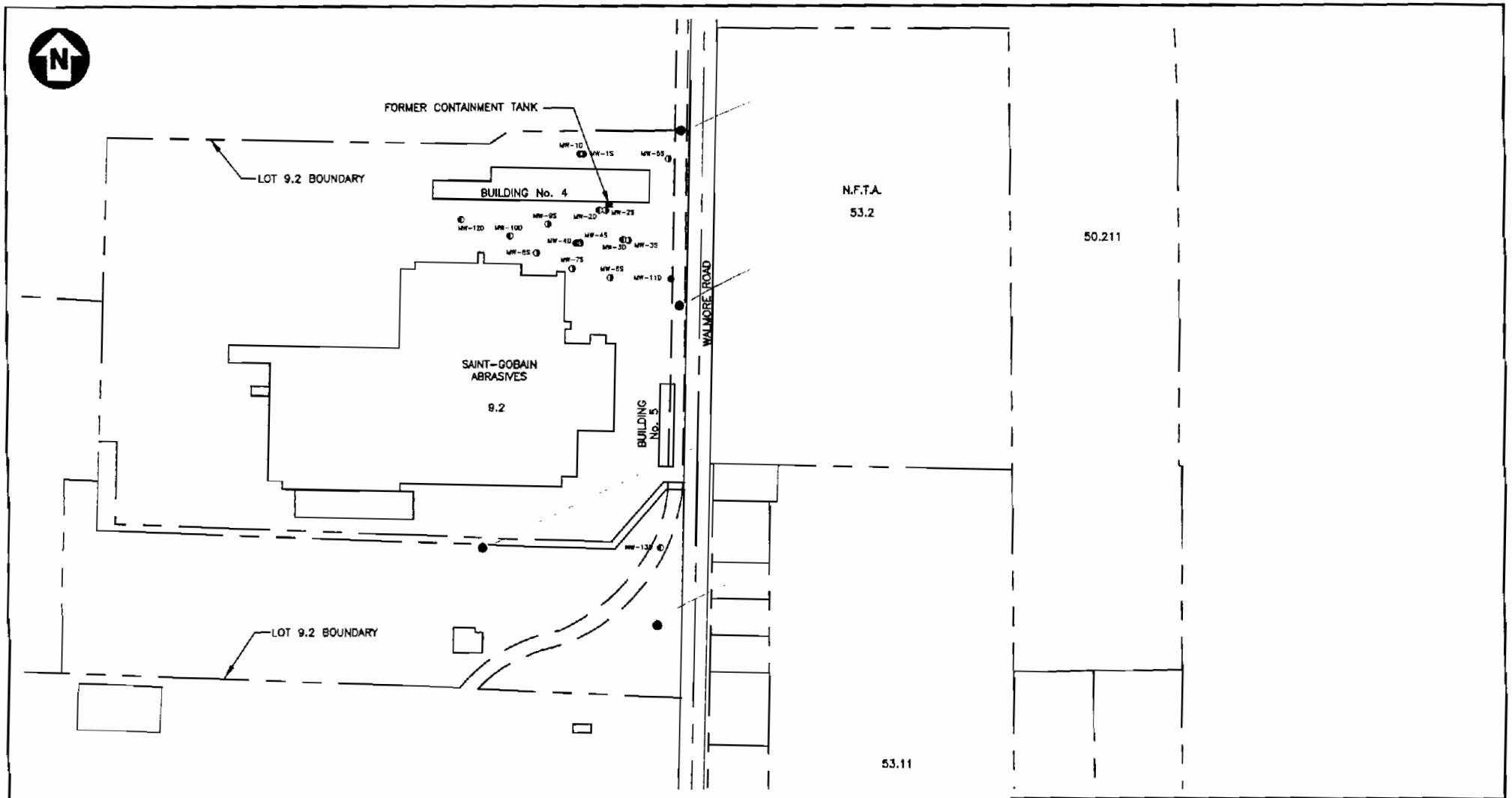


FIGURE 2

EKONOL POLYESTER
RESINS FACILITY
WHEATFIELD, NEW YORK

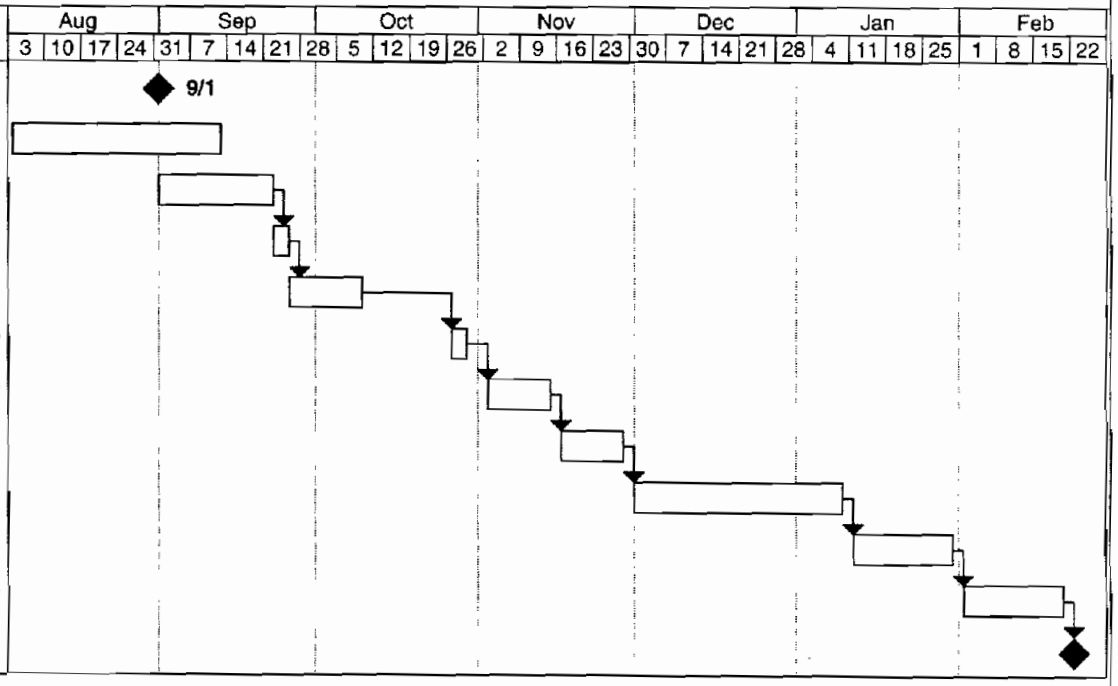
PROPOSED BORING LOCATION PLAN

PARSONS
180 LAWRENCE BELL DRIVE, SUITE 104, WILLIAMSVILLE, N.Y. 14221, PHONE: 716-633-7074

P:\737515\BPEkonol\cad\515C049.dwg, 07/30/03 at 07:53, MAB, 1=1

Figure 3
Anticipated Project Schedule
Phase III Site Investigation
at Ekonol Polyester Resins

ID	Task Name	Duration	Start	Finish
1	Work Plan Approval	1 day	9/1/03	9/1/03
2	Site Reconaissance	30 days	8/4/03	9/12/03
3	Bedrock Investigation	16 days	9/1/03	9/22/03
4	Groundwater Sampling Round 1	3 days	9/23/03	9/25/03
5	Laboratory Analysis	10 days	9/26/03	10/9/03
6	Groundwater Sampling Round 2	3 days	10/27/03	10/29/03
7	Laboratory Analysis	10 days	11/3/03	11/14/03
8	Qualitative Risk Assessment	10 days	11/17/03	11/28/03
9	Draft Report	30 days	12/1/03	1/9/04
10	NYSDEC Review	15 days	1/12/04	1/30/04
11	Respond to Comments	15 days	2/2/04	2/20/04
12	Submit Final Report to NYSDEC	1 day	2/23/04	2/23/04



Project: BP Ekonol
Date: 7/30/03

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan For:

PHASE III INVESTIGATION
AT
EKONOL POLYESTER RESINS
WHEATFIELD, NEW YORK

NYSDEC SITE # V00653-9

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SECTION 1

PROJECT DESCRIPTION

1.1 INTRODUCTION AND OBJECTIVES

Field and analytical data from the Phase II investigation showed impacts to groundwater including a dense non-aqueous phase liquid (DNAPL). The data further indicated that additional investigation activities are necessary to define the extent of impacts to groundwater in the deep, bedrock aquifer. After reviewing the data, NYSDEC concurred that additional work of similar scope to Phase II is warranted for groundwater.

Previous field and analytical data from the Phase II investigation warrant investigation work to define the extent of impacts to groundwater in the bedrock aquifer. In general, the Phase III scope of work described herein is similar to that of the NYSDEC-approved investigation performed onsite.

1.2 PHASE III INVESTIGATION - SCOPE OF WORK

This investigation effort includes onsite and offsite reconnaissance, groundwater screening from temporary bedrock borings, and installation of bedrock monitoring wells. Prior to constructing the well in each cored borehole, packer testing and discrete-zone water quality sampling will be completed. At the completion of packer testing, the bedrock monitoring wells will be installed. After well installation, groundwater samples will be collected and analyzed. The monitoring wells and offsite property boundaries will also be surveyed. This investigation scope of work also includes a qualitative risk assessment, and an assessment of the potential for ecological impacts. The Phase III investigation will be completed using the following tasks.

Task 1 – Site Reconnaissance

Site reconnaissance will include a review of Town of Wheatfield tax maps, zoning maps, and other records to determine property owner and contact information, zoning ordinance information, and the current use of the properties within one-half mile of the site. The site reconnaissance will be completed for property within one-half mile of the site. A public notification mailing list will be developed with the information obtained.

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Onsite Reconnaissance

The onsite reconnaissance will include an inspection of interior of building #4. The inspection will focus on identification of potential discharge locations including, sumps, sewers, floor drains, pits, dry wells, sludge, or any other features that have or potentially have provided a pathway for release to the environment outside of building #4. If necessary during this inspection, sampling of the sumps, sewers, floor drains, pits, dry wells, sludge, or any other features may be performed. Any samples collected will be analyzed by EPA Method 8260 for the target volatile organic compounds (VOCs) (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target semi-volatile organic compounds (SVOCs) include phenol and aniline and will be analyzed using EPA Method 8270.

Offsite Reconnaissance

The offsite reconnaissance will focus on the identification of both residential and non-residential property owners within one-half mile of the subject property. The address of the contact or owner of the property will be determined from Town of Wheatfield records. The current use of the properties within one-half mile of the subject property will be identified. Information will be obtained from the Town of Wheatfield tax maps. Offsite reconnaissance will include the identification of buildings with basements.

Task 2 – Bedrock Investigation

To define the extent of impacts to groundwater in bedrock, four additional bedrock monitoring wells are proposed. To determine the horizontal extent of groundwater impacts and appropriate locations for the bedrock monitoring wells, temporary borings will be installed. The temporary borings will enable collection of bedrock groundwater samples for screening purposes.

Groundwater Screening

Locations for bedrock groundwater screening holes will be selected based on previous onsite results and the expected groundwater flow direction. The proposed locations the four screening boreholes is as follows:

- in the right-of-way adjacent to Walmore Road east-southeast of MW-11D;
- in the right-of-way adjacent to Walmore Road east of MW-5S;
- south of the Saint-Gobain Abrasives building, west of MW-13D; and
- approximately 200 feet south of MW-13D.

Initially, temporary borings will be installed at the four proposed locations by advancing 4-inch inner diameter spin casing to the top of rock. After reaching the top of bedrock, spin casing, equipped with a diamond shoe, will be seated 6 to 12 inches into the competent bedrock. After seating the casing, a pneumatic rock drill will be used to advance the boring. Using filtered, compressed air as the drilling lubricant, the pneumatic drill will be advanced a maximum of 25 feet into competent bedrock or until a

water-bearing zone is encountered, whichever occurs first. Once the total depth of the boring is reached, the drill stem will be removed, and groundwater allowed to recharge to the boring.

Once groundwater has recharged sufficiently, a groundwater screening sample will be collected from the open borehole. The groundwater sample will be field-screened for total volatile organic halides (VOHs), using EPA Method 8535. If the screening results reveal a VOH concentration in groundwater that is greater than 50 parts per billion (ppb), alternate borehole locations will be considered. If an alternate borehole location is selected, the groundwater screening process will be repeated at the alternate location. A maximum of two alternate boring locations will be selected for each proposed monitoring well location. Unless limited by buildings, roadway, or property boundaries, alternate boring locations will be located 100 ft. from the original boring. In the event that the two alternate locations are completed and screening data is still greater than 50 ppb, the data will be evaluated to determine further options. The groundwater screening borings will be properly abandoned using bentonite holeplug and cement-bentonite grout.

Bedrock Well Installation

Once a suitable location for each bedrock monitoring well is selected using the screening method, a bedrock monitoring well will be installed at a location adjacent to the abandoned borehole. Presently, four bedrock monitoring wells are proposed.

The bedrock wells will be installed by advancing 6.25-inch hollow-stem augers (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 competent bedrock. After drilling the rock socket, a permanent four-inch casing will be placed to the bottom of the boring. The casing will be sealed in place by tremie grouting with cement-bentonite grout from the bottom up. After allowing the grout to set for a minimum of 24 hours, an HQ-sized core barrel (nominal 4-inch outside diameter) will be advanced a maximum of 25 feet into competent bedrock or until a water-bearing zone is encountered, whichever occurs first.

After each core run, typically five feet in length, packer testing will be performed on that section of the boring (total of three tests per borehole). The packer test will use water injection methods to estimate the hydraulic conductivity of that section of the corehole. Packer testing in the open boring with periodic water level monitoring in adjacent borings or wells will enable identification of higher permeability zones and connectivity of fractures between holes. Packer testing will be performed over the entire section of bedrock that was cored.

At the completion of packer testing, a 2-inch ID, stainless steel well screen and riser will be installed in the boring. The screen length will be a maximum of ten feet with 0.010-inch slots. The well will be screened over the most permeable section of the bedrock. Below the screen, a 2-foot section of casing will be installed as a sump to collect any DNAPL, if present. The bedrock wells will be completed as described in the

NYSDEC-approved Additional Phase II Site Investigation Work Plan. Well installation will be in accordance with the NYSDEC guidelines outlined in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (December 2002).

All boring and well locations will be surveyed for location and elevation, following installation. Monthly, for a period of 12 months, water levels will be collected from the overburden and bedrock monitoring wells and used with survey elevation data to determine the local direction of groundwater flow in the overburden and bedrock aquifers.

Task 3 - Groundwater Sampling and Analysis

Dissolved Phase Sampling and Testing

After the offsite bedrock monitoring wells are installed, the wells will be developed and purged following standard NYSDEC guidelines outlined in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (December 2002). Groundwater samples will be collected in accordance with the NYSDEC protocols and guidance using dedicated bailers, disposable bailers, a submersible pump, or a peristaltic pump. During development and purging, field parameters including pH, temperature, conductivity, dissolved oxygen (DO), and oxidation reduction potential (ORP) will be collected. Colorimetric field test kits may be utilized to test for nitrate, ferrous iron, and sulfate. Measurement of these field parameters will provide valuable information for plume delineation, and evaluation of intrinsic biodegradation. In addition to the offsite monitoring wells, the onsite monitoring wells installed during previous onsite Phase II field activities will be sampled.

A total of 21 groundwater samples (9 overburden, 12 bedrock) will be collected and submitted for laboratory analysis in accordance with the NYSDEC-approved Phase II Site Characterization Work Plans. Groundwater samples will be analyzed by EPA Method 8260 for the target volatile organic compounds (VOCs) (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target semi-volatile organic compounds (SVOCs) include phenol and aniline and will be analyzed using EPA Method 8270. For the offsite investigation analysis for zinc and lead will not be performed. 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).

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During well development and purging, the water will be checked for the presence of dense non-aqueous phase liquids (DNAPL) using visual observation and a hydrophobic dye. If DNAPL is observed in any of the new offsite monitoring wells (three onsite wells contain separate-phase liquid), the DNAPL will be sampled and submitted for physical and chemical analysis. Physical properties to be determined for the separate-phase liquid include surface tension, density and viscosity. Chemical analysis will include testing for the full suite of VOCs and SVOCs by EPA Method 8260 and 8270. Physical and

chemical testing of the DNAPL will be useful in determining the potential mobility of the DNAPL.

All field activities will be conducted in accordance with the project Quality Assurance Project Plan (Appendix A) and site-specific Health and Safety Plan (Appendix B). All 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 may be used to stage liquid IDW (development water, purge water, and decontamination liquids).

Task 4 – Waste Handling

Disposal of the IDW created during the installation of the monitoring wells will be required. The IDW will be evaluated as hazardous or non-hazardous, and will be disposed of in accordance with the appropriate regulations. The scope of work for this waste disposal event includes composite sampling to characterize the wastes for disposal and proper disposal of waste. Waste streams will include drill cuttings, groundwater, decontamination water, and personal protective equipment.

Task 5 - Qualitative Risk Assessment

A qualitative risk assessment (exposure assessment) will be completed using available onsite and offsite soil and groundwater data. The qualitative risk assessment will use an exposure scenario assessment to define complete and potentially complete pathways to receptors. The scenario assessment is one part of the NYSDEC Exposure Assessment Procedure which is used to better quantify any impact of residual contamination. Potential human receptors will be identified based on information provided by the site characterization activities. Onsite and offsite receptors to be evaluated include, as appropriate, commercial workers, construction workers, resident children, and resident adults. The exposure assessment will be completed as described in the August 1998 NYSDEC Exposure Assessment Procedure.

As part of the qualitative risk assessment, an assessment of ecological risk will be performed. This component of the qualitative risk assessment will evaluate whether the surface features identified during site reconnaissance, have the potential to pose substantial ecological impacts. The evaluation will discuss the potential impacts to threatened or endangered species, exceptional value wetlands, habitats of concern, and species of concern. If the results of the ecological assessment show potential ecological impacts, additional ecological assessment will be evaluated.

Task 6 - Report Preparation

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. Analytical data received from the laboratory will be reviewed to identify any potential deviations from specified protocols. The compliance review will consist of an

assessment of whether or not holding times were met and a review of laboratory Quality Control (QC) blank results in accordance with United States Environmental Protection Agency (USEPA) Region II Standard Operating Procedures (SOPs) for Organic and Inorganic Data Review. The data evaluation will be completed in accordance with NYSDEC Data Usability Summary Report (DUSR) guidelines. The DUSR is discussed in Section 8 of this Quality Assurance Project Plan. Following the data quality review, the data will be reduced, tabulated, evaluated and incorporated into the site investigation report.

After the QA/QC data review is complete, the offsite investigation report will be prepared. The report will document all field investigation activities, including screening borings, screening sampling, well installation, and groundwater sampling. The report will summarize the data collected during the offsite investigation and present the results of the qualitative risk assessment. Water level contour maps for overburden and bedrock wells, showing groundwater flow direction, will be presented in the report.

SECTION 2
PROJECT ORGANIZATION

2.1 GROUP ENVIRONMENTAL MANAGEMENT CO. PROJECT MANAGER

William B. Barber, CPG
Environmental Manager
4850 49th Street
MBC3-147
Cuyahoga Heights, OH
(216) 271-8038 –phone
(216) 271-8937 -fax

2.2 PARSONS PROJECT TEAM

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

2.3 LABORATORY

The laboratory identified to provide analytical support for this project is Severn Trent Laboratories, Inc. in Buffalo, New York. The laboratory will provide analysis of the 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 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.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) – MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes.

Table 4.1
Chemical Analysis Summary
Ekonol Polyester Resins
Wheatfield, New York

Matrix	Parameter	Analytical Method	Field Samples					Total
			Number of Samples*	Field Duplicate	MS/MSD	Sub-Total	Trip Blank	
Groundwater	tce; 1,2-dce; 1,1-dca; 1,1,1-tca	8260	21	1	2	24	1	25
	aniline, phenol	8270	21	1	2	24		24
								49

* per round of sample collection

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

[a] All samples to be preserved in ice after 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 via 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

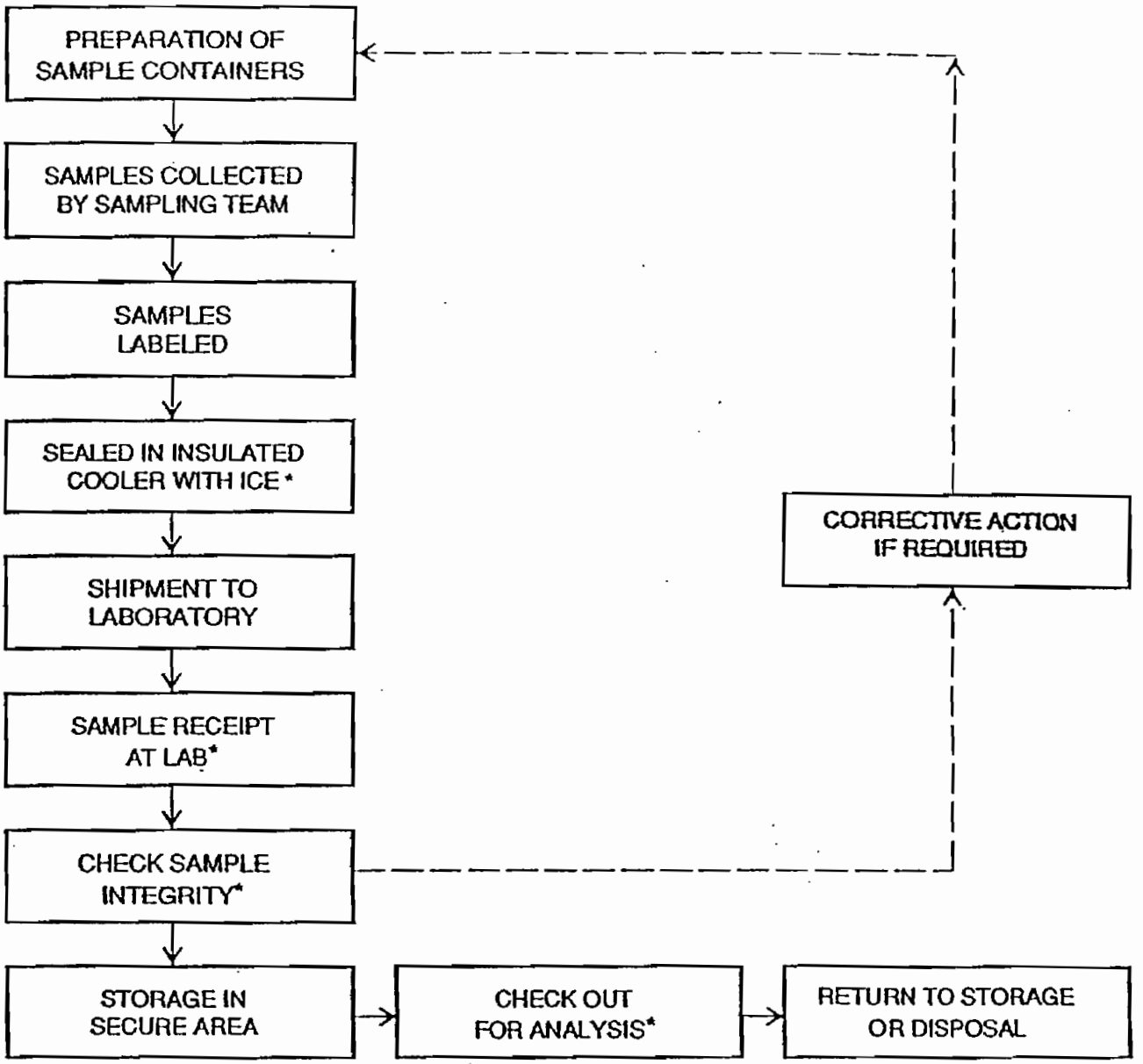
The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped, as well as the anticipated date of arrival.

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.

SAMPLE CUSTODY



* REQUIRES SIGN-OFF ON CHAIN OF CUSTODY FORM.

Chain of Custody Record

bp

Project Name _____

BP BU/GEM CO Portfolio: _____

BP Laboratory Contract Number: _____

Date: _____ **Requested Due Date (mm/dd/yy)** _____

On-site Time:	Temp:
Off- site Time:	Temp:
Sky Conditions:	
Meteorological Events:	
Wind Speed:	Direction:

Send To:	BP/GEM Facility No.:	Consultant/Contractor:
Lab Name:	BP/GEM Facility Address:	Address:
Lab Address:	Site ID No.	
	Site Lat/Long:	e-mail EDD:
	California Global ID #:	Consultant/Contractor Project No.:
Lab PM:	BP/GEM PM Contact:	Consultant/Contractor Tele/Fax:
Tele/Fax:	Address:	Consultant/Contractor PM:
Report Type & QC Level:		Invoice to: Consultant/Contractor or BP/GEM (Circle one)
BP/GEM Account No.:	Tele/Fax:	BP/GEM Work Release No:

Lab Bottle Order No:

Item No.	Sample Description	Time	Matrix: Soil/Solid	Matrix: Water/Liquid	Matrix: Sediments	Matrix: Air	Laboratory No.	No. of containers	Preservatives: Unpreserved	Preservatives: H_2SO_4	Preservatives: HNO_3	Preservatives: HCl	Preservatives:	Preservatives:	Requested Analysis: BTEX 8021	Requested Analysis: BTEX/TPH	Requested Analysis: EPA 8260	Requested Analysis: EPA 8270	Requested Analysis:	Requested Analysis:	Requested Analysis:	Requested Analysis:	Requested Analysis:	Requested Analysis:	Sample Point Lat/Long and Comments
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									

Sampler's Name:	Relinquished By / Affiliation	Date	Time	Accepted By / Affiliation	Date	Time
Sampler's Company:						
Shipment Date:						
Shipment Method:						
Shipment Tracking No:						

Special Instructions:

Custody Seals In Place Yes____ No____ Temperature Blank Yes____ No____ Cooler Temperature on Receipt ____°F/C Trip Blank Yes____ No____

LABORATORY

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. The use of field analytical equipment is 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 described in the instrument manual.

6.2 LABORATORY INSTRUMENTS

For the analytical methods given in section 7, the laboratory will follow all instrument calibration procedures and schedules as specified in the applicable sections of the analytical method description.

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 (8260 and 8270) were selected because they attain the Contract Required Quantitation Limits (CRQLs).

Table 7.1 defines the practical quantitation limits for the reflected analytical methods.

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]
	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	Ethylbenzene	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

	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, 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. An "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 impacts to the Site.

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. However, a data usability summary report (DUSR) will be completed in accordance with this project Quality Assurance Project Plan and the NYSDEC's Data Usability Summary Report (DUSR) guidelines. The DUSR is developed by reviewing and evaluating the analytical data package. The DUSR will be used to determine whether or not the data, as presented, meet the project specific criteria for data quality and data use. The DUSR will be developed from full NYSDEC Analytical Services Protocol (NYSDEC ASP) Category B or a United States Environmental Protection Agency Contract Laboratory Protocol (USEPA CLP) deliverable packages. Data packages will be reviewed and evaluated for items such as completeness, holding times, compliance with QC limits and specifications, analytical protocols, raw data conversion to correctly summarized results, and confirmation that the correct data qualifiers have been used. If the DUSR indicates that significant problems with some or all of the data in the package, the data will be either rejected or validated to determine if it can be used. The DUSR will discuss data deficiencies, analytical protocol deviations, and QC problems and the effect on the data. Recommendations on reanalysis and/or resampling will be included.

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 corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon Parsons 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 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 SUMMARY

EMERGENCY CONTACTS

Emergency contacts for the Site are provided in Appendix C.

EMERGENCY PROCEDURES

Emergency procedures are described in Section 6.

SITE SPECIFIC HAZARDS AND TRAINING

Site-specific Hazards are described in Appendix C.

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.
- Safe work practices by which the employee can minimize risk from hazards.
- Acute effects of compounds at the site.
- Decontamination procedures.

Prior to working at the site all personnel will be required to sign and date the Site-specific Training Form provided in Appendix B.

GENERAL HEALTH AND SAFETY REQUIREMENTS

All 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 C. Level D protection will consist of:

- Standard work clothes;
- Steel-toe safety boots;
- Safety glasses or goggles must be worn at all times;
- Nitrile outer gloves and PVC or nitrile inner gloves must be worn during all sampling activities;

- Hearing protection as necessary;
- Splash goggles or face shield where splash hazard is present;
- Hardhat must be worn during all drilling or sampling activity.

Level C protection, unless otherwise specified in Appendix C, 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 C);
- Tyvek coveralls;
- PVC or nitrile inner and nitrile outer gloves; and
- 5-minute escape self-contained breathing apparatus (SCBA).

Level B protection will consist of the following equipment:

- Positive Pressure SCBA or positive pressure air line and respirator with escape SCBA;
- Polyethylene (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 that are inadequately monitored by a photoionization detector (See Appendix D). 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 groundwater sampling, well development, and well installation.

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) (2)	
0-1	D
1-5	C
>5	Retreat (B)
Explosimeter (% LEL)	
0-10	None
>10	Retreat

(1) Unless otherwise specified in Appendix C .

(2) Sustained reading 25-30 seconds in breathing zone.

TABLE OF CONTENTS

LIST OF TABLES

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 goal of this project is to perform the required work with zero incidents/accidents, and promptly report any incidents or near misses in accordance with the GEM Incident/Near Miss Notification and Reporting Guidance Manual included in Appendix A. Every site worker has the authority to stop work if he/she believes work activity presents a safety hazard. All field tasks shall be designed and rehearsed for zero incident/accident performance.

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 Health and Safety Officer.

1.2 SITE DESCRIPTION

A site description is provided in Appendix C.

1.3 SCOPE OF WORK

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

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 H&S Officer:	Andrew Soos (Parsons -Somerset)
Field Team Leader:	Andrew Janik (Parsons –Buffalo)
Site Safety Officer:	Andrew Janik (Parsons –Buffalo)

All Parsons 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.
- Coordinates health and safety program activities with the project health and safety officer.
- Maintains safety awareness of project personnel.

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:

- Constantly maintains safety awareness of field staff.
- 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 party 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.
- Knows emergency procedures, evacuation routes, and can readily provide 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.
- Reports incidents and near misses.

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:

- Constantly maintains safety awareness of field staff.
- 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 C.

2.2 RADIATION HAZARDS

No radiation hazards are known at the site.

2.3 PHYSICAL HAZARDS

2.3.1 Explosion

Concerns associated with explosion hazards at the site are discussed in Appendix C.

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 semi permeable 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 is conducted 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.

2.4 Vehicular Traffic Hazards

If offsite work is necessary, public vehicular traffic safety precautions will be taken and enforced. Personnel exposed to vehicular traffic shall be provided with and shall wear warning vests or other suitable garments marked with or made of high-visibility material. Guidance information for traffic safety is provided in Appendix E.

While working in or near public vehicular throughways, personnel will adhere to the following guidelines:

- Always wear appropriate safety garments;
- When stopped in the street to conduct work, always have the four-way flashers on your vehicle, and traffic cones out around the work area;
- Be aware of the traffic and direct it around the work area, if necessary;
- Never park a vehicle so as to completely block a street. Be aware of vehicles surrounding the work area, and how traffic will move around your vehicles at all times;
- In high traffic areas, or times of high traffic, one or more crew members will be assigned solely to traffic control;
- When assigned to traffic control, orange flags will be used to direct traffic around the work site in accordance with the guidance information for traffic safety in Appendix E.

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 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, 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. The physician provides 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. 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 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.
- Road Safety Risk Assessment and Recommendations.

- BP's Golden Rules of Safety.
- 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 flame ionization detector (FID). The FID will be used to monitor suspected organic compounds that are inadequately monitored by a PID (See Appendix C). 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 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, 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 FID readings will be taken in the breathing zone. In the event that sustained 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 SUSTAINED READINGS TAKEN AT THE PERIMETER OF THE SITE EQUAL OR EXCEED 5 PPM, WORK AT THE SITE MUST STOP, AND THE PARSONS 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 C.

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).
- Hearing protection as necessary.
- Safety goggles or safety glasses must be worn all of the time.

3.4.2 Level C

The level of personal protection will be upgraded to Level C if the concentration of volatile organic compounds that 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 that can be detected with a 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 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 FID readings reached or exceeded 50 ppm at a site where benzene is the contaminant of concern and

the MUL 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 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 will 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 C.

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. The site health and safety officer depending upon the extent of contamination can make modification to the twelve-station decontamination process.

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 most likely 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 logbook. 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 picnic cooler that 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

If collected, drum samples, tank samples, sludge samples, and grossly contaminated soil samples may be shipped as DOT Hazardous Materials (See IATA and/or CFR 49 for details). The designation "Flammable Liquid" or "Flammable Solid" may be used for example. The samples would then be 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. (name of constituent(s)) UN 1993"

   (Or "Flammable Solid N.O.S. (name of constituent(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. (constituent name) UN 1993" or "Flammable Solid, N.O.S. (constituent name) 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 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, a regular meeting should be held. Discussion should include, but not be limited to:

- 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.
- Vehicle and equipment safety operation and use.
- Emergency procedures.
- Open lines of communication to discuss safe work practices, near miss incidents, and other topics relevant to the work being performed.

6.1.2 Drilling

In accordance with the Parsons Predrilling/Subsurface Intrusive Policy, all boring locations will be hand-cleared to a depth of five feet below ground surface. This policy is an additional measure taken in underground utility avoidance. A Predrilling/Subsurface Intrusive form is provided in Appendix F. This form is to be completed prior to commencing with any intrusive means.

Drilling procedures will be consistent with procedures provided in Appendix F. Hard hats, safety glasses, and safety boots must, as a minimum, be worn within 50 feet of the drill rig or Geoprobe® vehicle. The drilling rig cannot be operated within 15 feet of power lines. Workers should focus special attention on the potential hazards associated with drilling equipment.

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.

6.1.3 Vehicle and Heavy Equipment Safety

Working with large motor vehicles and heavy equipment could be a hazard during this project. All vehicle operators, upon entering the site, will complete vehicle inspection forms provided in Appendix G. Injuries can result from the use of heavy equipment vehicles, equipment hitting vehicles or personnel, and impacts from drilling equipment parts or materials. The following precautions will be used to help prevent near misses, injuries, or accidents.

- Daily inspection of brakes, hydraulic lines, turn/light signals, fire extinguishers, fluid levels, steering, tires, horn, emergency shut-offs, and other safety devices;
- Heavy equipment or motor vehicles will be kept free of all nonessential items, and all loose items will be secured;
- Heavy equipment vehicles will not be backed up unless:
  - The vehicle has a reverse signal alarm audible above the surrounding noise level; or
  - The vehicle is backed up only when an observer signals that it is safe to do so.

6.1.4 Fire Prevention

All work potentially calling for the use of a torch, open flame, or comparable procedure will require that the following be taken into consideration:

- Give adequate consideration of alternative procedures (e.g., metal cutting saw instead of a torch).
- Notify the SHSO, and discuss the safety procedures to be used;
- Assign at least two workers dedicated to the task through to completion. One worker will conduct the heating or cutting, while the second worker will serve as a "fire watch". The fire watch will standby equipped with a fully-charged fire extinguisher, observing worker safety, and the surrounding potential for a fire, while being prepared to stop all work and immediately suppress any uncontrolled fire. The fire watch is required to inspect the fire extinguisher to insure that it is fully charged prior to starting work;

- Every attempt shall be made to clear away as much combustible material from the work zone as possible. Wind direction, velocity, and the potential for work zone changes will be taken into consideration.

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, emergency eyewash 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 Section 6.2.3). In addition, chemical exposure incidents must be reported to the Facility Emergency Coordinator.

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.

6.2.4 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.

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

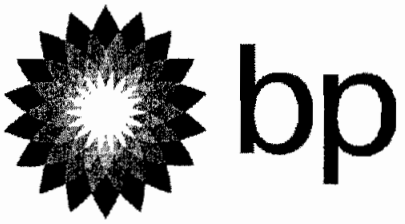
- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep the area surrounding the problem source clear after the incident occurs;
- Complete accident report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

APPENDIX A

GEM INCIDENT / NEAR MISS NOTIFICATION AND REPORTING GUIDANCE MANUAL

GEM Co. Incident & Near Miss Notification and Reporting Guidance Manual

(Revision 6 – November 2002)



Prepared by the HSE Sub Committee

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"Our goals are simply stated ... no accidents, no harm to people, and no damage to the environment."

John Browne, Group Chief Executive,
HSE Policy, January 1999

Section 1: Overview and Expectations

The Global Environmental Management Company (GEM Co.) is committed to distinctive Health, Safety, and Environmental (HSE) performance through a comprehensive management system - getting HSE right (gHSEr). A key component of this system is Element 12: Incidents Analysis and Prevention which describes the expectations for reporting, investigation and analysis of incidents and near misses to prevent recurrence and improve performance.

BP Incident Notification & Reporting Expectations
This guidance document describes the GEM Co. incident and near miss internal notifications and reporting procedures to be followed and provides guidance to GEM Co. portfolios for the implementation of practices and tools to meet the expectations as prescribed in gHSEr Element 12. External notification and reporting procedures, e.g. regulatory, are specific to the portfolios and the locations of the sites and are not addressed in this document. Emergency response notifications and actions are addressed in Element 11, Crisis and Emergency Management guidance.

Incident and near miss performance requirements apply to all GEM Co. activities at closed and divested sites to include those performed by contractors and subcontractors. It is the responsibility of the GEM Co. portfolios to develop and communicate specific instructions for incident notification and reporting. Procedures for incident and near miss investigation (Root Cause Analysis) and the prioritization of corrective and preventive actions are incorporated by reference in this document.

GEM Co. at Operating Sites
For GEM Co. portfolios that have employees and contractors working at BP operating sites, it is the responsibility of the site and portfolio management (Portfolio Manager, EBMs, HSE Coordinators) to discuss and implement the incident and near miss notification requirements and procedures for that respective BP operating site with all GEM Co. employees and contractors. All efforts should be coordinated with the Operating Site HSE Contact and GEM Co. Operating sites should:

1. First and foremost, meet the expectations of the BP operating facility HSE team, and
2. In lieu of any expectations from the BP operating facility, implement your own requirements with guidance from GEM Co.'s existing operating procedures to improve your HSE performance.

Major and High Potential Incidents
Major and High Potential Incidents are subject to BP Group reporting requirements (Key HSE Process 5 & Key HSE Process 6). Instructions for Major and High Potential incidents have been developed by GEM Co. and are included in this document (see Appendix B and C).

Tr@ction System
Tr@ction is the standard framework and data management tool to record and track HSE incidents and near misses for GEM Co. All incidents and near miss/HSE opportunities are to be reported in GEM Co.'s Tr@ction system. Reports must be accurately filled-out and be used as the primary tool for incident analysis and prevention. For GEM Co. portfolios with operations at BP operating facilities/sites, it is important to work with the respective BP operating facility HSE contact to identify the requirements and process for entering incident and near miss data into the operating facility Tr@ction system.

It is expected that incident/near miss analysis, prevention programs, and lessons learned sharing are the responsibility of all GEM Co. HSE teams. Lessons learned sharing is critical to incident prevention. The practice for sharing learnings within and among the GEM Co. portfolios has started and should continue through on-going communications of incident reports and analysis as they may occur. More information is provided in Section 8: Introduction into Tr@ction and on the Tr@ction home page.

Section 2: GEM Co. Key HSE Reporting Definitions and Guidance

Data requirements differ slightly by Business Stream, but data definitions are common across BP. Reporting of injuries and illness requires good understanding of how to differentiate between:

- Whether or not it is work-related, and
- Whether it is a recordable injury or a first aid treatment

Definitions for parameters reported monthly and other key indicators are included in this key process.

The following definitions and criteria provide guidance for the classification of incidents, near misses, and health, safety, and environmental (HSE) opportunities for entry into the GEM Co. Tr@ction system to ensure consistency in the type and content of reports being entered into the database. Each project should assign an individual and alternate (such as the project manager or HSE contact) who is familiar with this guidance, and responsible for determining the classification of any HSE report and whether or not the report is appropriate for entry into the Tr@ction database. A summary of incident notifications is provided in Appendix D. Additional HSE Reporting definitions can be found in Appendix F.

Major Incident

Definition: An incident, including a security incident, involving any one of the following:

1. A fatality associated with BP operations
2. Multiple serious injuries
3. Significant adverse reaction from authorities, media, NGO's, or the general public
4. Cost of accidental damage exceeding US $500,000
5. Oil spill of more than 100 barrels, or less if at a sensitive location (1 barrel = 42 US gallons)
6. Release of more that ten tons of a classified chemical

High Potential Incident

Definition: An incident or near miss, including a security incident, where the most serious probable outcome is a Major Incident.

Non-Major Incident

Definition: Any event resulting in any occupational injury or illness (including first aid), vehicle incident ($0 cost threshold), any spill or release, regulatory notices of fine or violation, unplanned business interruption, fire/explosion, threat to security, and/or property damage greater than $500.

Criteria for entry into Traction database. All incidents will be reported in Tr@ction including:

- Any vehicle incident (zero threshold for damage)
- Spills <100 bbl
- Any notice of fine or NOV
- Any injury or illness
- Property damage > $500 (exception for vehicle incident)

First Aid Case

Definition: A work related injury that requires one time treatment and subsequent observations (for example, Non-Major scratches, burns, cuts, splinters which do not ordinarily require medical care) and

does not result in a DAFW or RI case. Such treatment and observation are considered first aid even if provided by a physician or registered medical professional.

Criteria for entry into Tr@ction database: First aid incidents should be filled out as an "Injury" report in Tr@ction. When prompted, users should select "first Aid" as the Injury classification in the injury report.

Near Miss

Definition: A significant unsafe condition, unsafe action, and/or breach in HSE protocol, policies or procedures that, under slightly different circumstances, would have resulted in an injury, occupational illness, property damage, vehicle incident environmental spill or release, or fire/explosion.

Criteria for entry into Tr@ction database: All near misses will be reported in Tr@ction including (but no exclusively):

- Any contractor vehicle incident involving light vehicles (<3.5 tons)
- Any potential for spill or release
- Any risk of fire or explosion
- Any potential for an injury or illness

Note: It is at the discretion of the EBM or Portfolio Manager whether to enter a Near Miss that is NOT at a GEM site or involves GEM employees or contractors.

HSE Opportunity

Definition: An observation or realization that action can be taken to enhance the HSE conditions or standards under which we work.

Criteria for entry into Tr@ction database: HSE opportunities include observations of positive actions and ideas for improvement as well as minor unsafe conditions/actions that, under circumstances of moderate to low likelihood, could result in a near miss or minor incident.

HSE opportunities will always be shared within the project team from which they are reported. These opportunities will be entered into the Tr@ction database and shared beyond the project team if they meet the following criteria:

- Minor deficiencies or limitations on equipment common to GEM Co. remediation projects that, through redesign or recall, could improve HSE performance.
- Identification, elimination, and/or modification of "at risk" work practices commonly implemented throughout GEM Co., or that pertain to HSE areas of emphasis identified by GEM Co. (e.g., hand safety or road safety).
- Substantive best practices from which a broad array of GEM Co. projects could benefit, including:
  - Information on innovative technologies or new equipment that could streamline or improve work
  - Work processes or administrative tools that could simplify or increase the effectiveness of HSE policies and systems.

Positive Safety Observations

Definition: An observation of a positive process, practice or behavior that warrants sharing of Best Practices.

Criteria for entry into Tr@ction: Positive safety Observations should be entered into Tr@ction as an "Other Event."

Vehicle Incidents

Definition: Accidents involving vehicles which occur on the road and result in damage or a work-related injury. Includes work-related operation of vehicles by BP employees and product delivery vehicles or vehicles over 3.5 tons unladen operated by BP contractors.

- A zero threshold is applied and reporting is irrespective of whether the accident was judged preventable or non-preventable.
- A BP operated vehicle is a delivery, or other vehicle driven by a BP employee for work related purposes, although the vehicle may be owned, hired, or leased.
- A contractor operated delivery vehicle is either a company branded vehicle or a vehicle under a BP term contract (i.e. – for more than one year) where the same driver is employed on a regular basis.

Criteria for entry into Tr@ction: Vehicle Accidents should be entered as Transportation accidents with the classification of either "Road" or "Third Party Transport."

Material Releases

Definition: Incident involving GEM employee or contractors where products or materials are released from their primary containment in an uncontrolled unplanned fashion. Material releases include those of "impacted" ground water of unknown release material concentrations.

- **Spill** - Loss of primary containment from a BP or contractor operation, irrespective of any secondary containment or recovery. When discovered, leakage from vessels is included in spill reporting, but may be reported separately.
  Major Spill - > 100 barrels of oil, fuel, other hydrocarbon or condensate escapes primary containments or less in a sensitive area. These reports also include a release of 10 tons of classified chemicals or >1 barrel of classified chemical with a high potential.
  Minor Spill - < 100 barrels escapes primary containments.

- **Leak**- loss of primary containment, has or may have an environmental impact, requires immediate action to repair released as a liquid (what does released as a liquid mean, can we clarify this further?).

- **Waste Disposal** - No worldwide definition of waste disposal. Refer to local regulations.

- **Atmospheric Release** - loss of primary containment with release directly to air, requires immediate action to repair, release of a material as a gas (rather than vaporized from a liquid). If you hold a gas liquefied under refrigeration, report the release as a liquid spill.

Criteria for entering Tr@ction: All material releases should be entered into Tr@ction with one of the 4 Material Release Types: Spill, Leak, Waste Disposal, and Atmospheric Release. Oil spills require the following fields to be filled in:

IR Type: Material Release
Release Type: Spill or Leak
Secondary Containment Breached: Yes
Material Type: Fuel, oil/other hydrocarbon or condensate
Spill Volume: >1 barrel and <100

Quantity Released: barrels/gallons
Release to: Containment area, ground sub surface, ground surface etc.
Reportable Quantity Exceeded: Yes

NOTE: All oil spills should be reported as a material release with one of these material release types: spill or leak.

Unplanned Releases

Definition: Release of any amount (volume) in a spill, Leak, or Atmospheric Release involving the chemicals - fuel, oil/other hydrocarbon, or condensate (hydrocarbon), where a **REGULATORY BODY was notified**.

Criteria for entry into Tr@ction: Unplanned releases are entered into Tr@ction under the incident type Material Release. The type of release is a Spill, Leak, or Atmospheric release (regardless of amount) and the agency notified has to be indicated in the Incident Report (General Information 3 Screen).

Notice of Violations & other Regulatory Events

Definition: Please contact your HSE Coordinator for detailed definitions of these types of incidents and how to enter them appropriately into the Tr@ction system..

Occupational Injury vs. Illness?

The potential outcome of any 'insult' to the body, for example the consequences of a fall or exposure to a hazardous agent, is an adverse health effect. These are differentiated as either an injury or illness/disease for analysis of causal factors. In a working environment, this is determined by the nature of the original event or exposure, which caused the effect rather than the resulting condition of the affected employee.

Injury

Injuries are caused by instantaneous identifiable events in the working environment. Illnesses are caused by anything other than identifiable instantaneous events e.g. - if repeated or prolonged exposure is involved the outcome is considered an illness. Additionally, a judgment needs to be made as to whether this exposure was work-related. Differentiation is not always straightforward and clear definitions are necessary. Some conditions could be classified as either an injury or an illness but not both. For example:

- Hearing loss resulting from an explosion (an instantaneous event) is classified as an injury, whereas if it results from exposure to noise over a period of time it is classified as an illness.
- Contact with a hot surface or caustic chemical causing an instantaneous burn is an injury.
- Sunburn, frostbite and welding flash burns are normally classified as illnesses because they usually result from prolonged or repeated exposure.
- Tendonitis resulting from a one-time blow to the tendons of the hand is considered an injury, whereas repeated trauma or repetitive movement resulting in the same condition is considered an illness.
- Back cases should be classified as injuries because they are usually triggered by an instantaneous event. Classifying back cases as injuries is appropriate not only for cases resulting from identifiable events, but also for cases where the specific event cannot be pinpointed, since back cases are usually triggered by some specific movement (such as a slip, trip, fall, sharp

twist, etc.). Such generalizations are necessary to keep record keeping determinations as simple and equitable as possible.

Illness

Unlike injuries, illnesses may not be easily recognized and evaluation by trained medical personnel is desirable for confirmation both of diagnosis and attribution to occupational or non-occupational causation in accordance with the OSHA Guidelines. Once a work-related illness is diagnosed, managers are responsible for ensuring that they are reported.

Illnesses frequently involve factors such as multiple causation, historic exposures totally unrelated to the current working environment and may also not result in time away from work or require modified job duties. They may also recur or result in a chronic condition. Occupational illnesses are therefore reported only once - at the time of diagnosis or recognition. As a consequence, the calculation of meaningful severity or frequencies is more complicated than for injuries.

Section 3: Incident/Near Miss Notification and Reporting Procedures

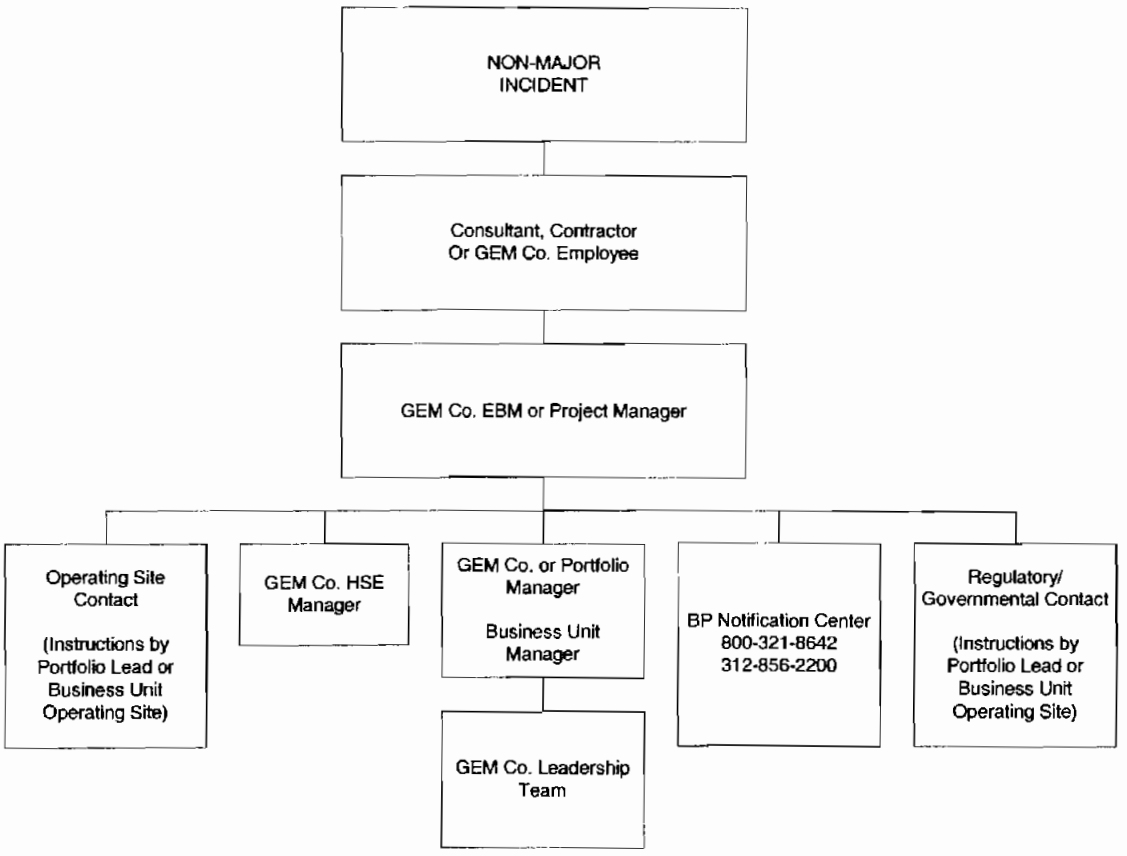
Notification of Major Incidents and High Potential Incidents

- Whenever a Major Incident or High Potential Incident occurs, GEM Co. management (BUL, HSE Manager, Portfolio Manager), operating facilities management (if applicable), and the BP Notification Center must be notified as specified in *HSE Process 5: Major and High Potential Incident Reporting Requirements* (see Appendix B) and the *GEM Co. Incident Notification and Reporting Process Table* (see Appendix E). Reporting GEM Co. staff/contractors should also prepare an initial Incident Announcement and forward to the appropriate parties.
- GEM Co. management (BUL or designee) immediately notifies BP Group Senior Management that a Major Incident or High Potential Incident has occurred and completes the initial Major Incident Announcement or a High Potential Incident Announcement form (see Templates for forms).
- The BP Notification Center (1-800-321-8642 or 312-856-2200) is a resource for communications as well as emergency response. If needed, the Center can be called for notification support on Non-Major Incidents when BP personnel are not immediately available and when an incident has occurred where the severity is unknown or additional support may be needed

Notification of Non-Major Incidents, Injuries, and Near Misses

- All Non-Major Incidents, Injuries and Near Misses are reported only within the GEM Co. as specified in the GEM *Co. Incident Notification and Reporting Process Table* (see Appendix E).

GEM Co. INCIDENT NOTIFICATION FLOWCHART



Reporting Major Incidents, Non-Major Incidents, and Near Misses

- Incidents are classified intro three basic types – Major (including High Potential Incidents and High Potential Near Misses), Non-Major, and Near Miss as defined in Section 2.
- When an incident occurs, GEM Co. employees/contractors must prepare the appropriate report in Tr@ction. When a Major or High Potential Incident occurs, staff and contractors should use both the required Incident Announcement form, as referenced in *Key HSE Process 5: Major and High Potential Incidents Reporting Requirements* (see Appendix B), and the GEM Co. Tr@ction System. The Incident Announcement is not required for a Non Major Incident or Near Miss/HSE Opportunity.
- The guidelines for submitting initial reports are defined in the Incident Notification & Reporting Matrix located on Page 13.
- Injuries should be reported to the appropriate GEM Co. HSE Coordinator as soon as possible (regardless of the injury classification)

The following steps outline the incident reporting process/procedure to be followed. These steps correspond with the GEM Co. Tr@ction Reporting Flowchart below.

An incident occurs...

Step 1: The employee/contractor determines the type of incident and assesses the severity based on the *GEM Co. Incident Notification and Reporting Definitions Table* (see Appendix D) and the *Actual Severity Matrix* (located in the Tr@ction System). The initial evaluation determines the appropriate notification process and appropriate Tr@ction forms to use to report the incident.

Step 2: Once the severity is assessed, the employee/contractor must notify, verbally or via email, the appropriate contacts (e.g., EBM or Project Manager, HSE Coordinator, HSE Manager, BU Leader, BP Group Senior Managers) as specified in the *GEM Co. Incident Notification and Reporting Process Table* (see Appendix E). In the case of a Major or High Potential incident, GEM Co. Management then sends the appropriate Incident Announcement. External notification and reporting procedures (e.g. regulatory) are specific to the portfolio and the locations of the sites.

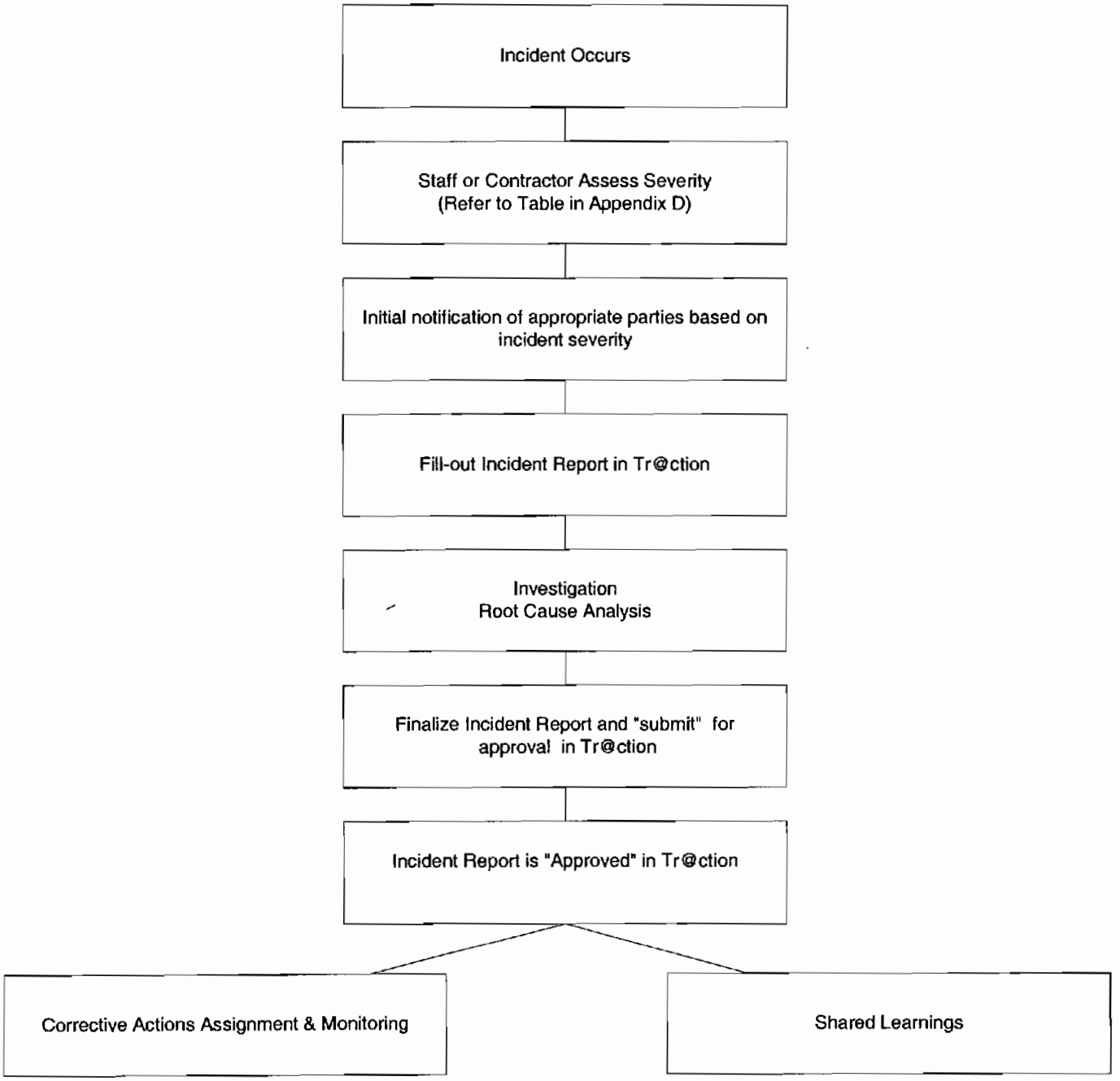
Step 3: The employee/contractor fills out the applicable incident report in Tr@ction. If there are only specific people who enter reports into Tr@ction, the employee/contractor works with those designated individuals to record the incident. This is an initial report and the report's status is still pending approval by the appropriate Tr@ction Approver.

Step 4: An incident investigation and root cause analysis should occur. Refer to the *Key HSE Process 6: Incident Investigation Guidelines* (see Appendix C) for detailed instruction.

Step 5: Upon completion of an incident investigation and determination of a root cause, the initial Tr@ction report must be finalized and submitted for approval. Once approval is obtained, corrective action(s) are identified, assigned, distributed and monitored through completion. Refer to *Section 5: Corrective and Preventive Action Reporting & Tracking, the Action Prioritization Instructions* (see Appendix G), and the *GEM Co. Nonconformance and Corrective and Preventive Action Reporting and Tracking Procedure* (located on the gHSEr web site in the view By Topics under the topic Non Conformances) for detailed guidance on identifying, prioritizing, assigning and tracking corrective and preventive actions through completion.

Step 6: The completed incident report is approved.

GEM Co. TR@CTION REPORTING FLOWCHART



NOTE: In Tr@ction, approvers for GEM Co. are set-up in the system by the GEM Co. LTSA. External notification and reporting procedures (e.g. regulatory) are specific to portfolios and the locations of the sites. Additional notification of incidents to GEM Co. Management occurs because individuals establish In-Box Rules (preferences) in Tr@ction that alert them when specific incidents occur. For additional guidance on establishing In-Box Rules, please refer to the GEM Co. Tr@ction User Manual located on the gHSEr web site.

The following matrix illustrates the different paths taken based on incident severity. More detailed information, including investigation and corrective action reporting requirements can be found in the *GEM Co. Incident Notification and Reporting Process Table* (see Appendix E).

INCIDENT NOTIFICATION AND REPORTING MATRIX

	NOTIFICATION			REPORTING		
	Notification required	Accountability * By	When	Forms / Reports	Accountability By **	When
MAJOR / HIGH POTENTIAL Refer to BP Group Major Incident and High Potential Incident Reporting Guideline	• BU Leader • HSE Manager • General Manager • Portfolio Manager • Operating Facility Contact (if applicable) • Core Distribution (see Key Process 5) • BP Notification Center	• GEM Co. Employee/ Contractor • EBM or PM (as applicable)	Immediately	Major Incident Announcement Form OSHA 300 Log (as applicable) Tr@ction Report	• Portfolio Manager	Immediately
NON-MAJOR	• BU Leader * • EBM/ GEM HSE Coordinator • HSE Manager • General Manager • Portfolio Manager • Operating Facility Contact (if applicable) • BP Notification Center (as needed)	• EBM or PM • GEM Co. Employee/ Contractor	Within 24 hours	Tr@ction Report OSHA 300 Log – as applicable	• Portfolio Manager • HSE Coordinator • Contractor HSE point of contact	Within 24 Hours
All Injuries	• EBM/ GEM Co HSE Coordinator • Operating Facility Contact (if applicable)	• GEM Co Employee/ Contractor • EBM or PM (as applicable)	Immediately	Tr@ction Report OSHA 300 Log – as applicable	• Portfolio Manager • HSE Coordinator • Contractor HSE point of contact	Within 24 Hours
NEAR MISS/ HSE Opportunities	• EBM or PM/ GEM HSE Coordinator • Operating Facility Contact (if applicable)	• EBM or PM • GEM Co Employee/ Contractor	Within 72 Hours	Tr@ction Report	• EBM or PM • HSE Coordinator • Contractor HSE point of contact	Within 72 Hours

NOTE: If EBM or PM is not available, contractor is responsible for notifying the next applicable level.

* For OSHA Recordables, DAFW Cases, or otherwise determined.
** Accountable for circulating to distribution list.
In cases of Contractor incidents requiring OSHA 300 Logs, the employer of the contractor is responsible for filling out the form (regardless of work for GEM Co./BP).

Section 4: Investigation & Root Cause Analysis

All types of incidents should be investigated, although the forms, persons responsible, and deadlines vary depending on the severity of the incident. The EBM works with relevant parties to decide what level of investigation and root cause analysis is to be performed. The procedures are outlined in the following table:

	INVESTIGATION PROCEDURES			
	Forms / Reports	**Accountability By**	**When**	**Distribution**
MAJOR / HIGH POTENTIAL Refer to BP Group Major Incident and High Potential Incident Reporting Guideline	Tr@ction Incident Report (10 day and 60 day)	• *EBM or PM* • Investigation Team Leader *(B)*	10 Days (Preliminary) 60 Days (Final)	Refer to Appendix B
NON-MAJOR	Tr@ction Incident Report	• EBM or Portfolio Manager or next level of authority (as appropriate) or HSE Coordinator	14 Days or as otherwise noted	• GMs • PMs • HSE Manager
NEAR MISS	Tr@ction Incident Report (Incident Type: Near Miss/HSE Opportunity) *(A)*	•EBM or Portfolio Manager or next level of authority (as appropriate) or HSE Coordinator	At the discretion of the EBM, PM or HSE Coordinator	• GMs • PMs • HSE Manager

***(A)** At discretion of EBM, Portfolio Manager or HSE Coordinator*
***(B)** Investigation Team Leader to be established by GEM Co. management.*

Major Incidents require a Tr@ction Incident Report in the system within 10 days and a final report with any investigations within 60 days. Non-Major Incidents and Near Miss/HSE Opportunities normally require completed GEM Co. Incident Reports in Tr@ction within 24 hours and a completed report with relevant investigations (if necessary) within 14 days.

The reports require such information as general information, comprehensive list of causes/root cause contributing factors, a thorough root cause analysis, witness statements, and a corrective action plan. In addition, they must indicate which gHSEr Expectations were failed by the occurrence.

The root cause analysis procedure is described in the *BP Comprehensive List of Causes: A Tool for Root Cause Analysis,* located on the gHSEr web site under the view By Topic in the topic area HSE Incident Information. This tool can be used to assist with the identification of root causes and potential preventive actions. Another tool is the BP Incident and Investigation Guide, located on the gHSEr web site under the topic HSE Incident Information. Additional root cause analysis training material is available from the GEM Co. HSE Manager.

Discretion should be used in deciding whether formal investigations including root cause analysis should be done in the case of Near Miss Reports.

Section 5: Corrective and Preventive Action Reporting & Tracking

All incidents and near misses are investigated to determine the root cause of the nonconformance, and a corrective and/or preventive action is generated to mitigate any impacts caused by the nonconformance and to correct and/or prevent their recurrence. The root cause analysis reviews all processes, work operations, concessions, environmental records, service reports and other documentation. For additional guidance on conducting a root cause analysis please refer to the *BP Comprehensive List of Causes: A Tool for Root Cause Analysis*, located on the gHSEr web site under the Topic HSE Incident Information. This resource can be used to assist with the identification of root causes and potential preventive actions.

The corrective and preventive actions taken shall be appropriate to the magnitude and frequency of problems experienced and commensurate with the health, safety, and environmental impacts experienced. Corrective actions are actions that will be taken to fix the problem. Preventive actions address the root causes of the problem to prevent recurrence. These action items are prioritized, assigned to responsible person(s), tracked through completion, and verified as successfully completed.

Corrective and preventive actions are tracked until closure. Tr@ction will be the tool that portfolios and sites use to document and track corrective and preventive actions. Once the work has been completed, an approved reviewer will verify the results in an appropriate manner and then sign off on the incident. The level of accountability varies with the severity of the incident.

Effective corrective and preventive action tracking involves the following activities:

(1) Identifying Action Items
(2) Prioritizing Action Items
(3) Reviewing and Approving Action Items
(4) Entering Action Items into Tr@ction
(5) Tracking Action Items to Closure and Verified Completed Actions
(6) Monitoring the Corrective and Preventive Action Tracking Process

For detailed guidance on each of the six activities identified above, please refer to the GEM Co. *Nonconformance and Corrective and Preventive Action Reporting and Tracking Procedure*, located on the gHSEr web site under the topic HSE Incident Information. The goals of this procedure are to ensure accountability and consistency in reporting and tracking actions across GEM Co. and to focus resources on the most significant risks.

In addition, instructions for the prioritization of action items can be found in Appendix G. This document provides detailed instructions on how to prioritize the corrective and preventive actions resulting form incident reports. There is also a flowchart representing the action prioritization process.

GEM Co. has created metrics to measure performance in relation to action items. Action items should be appropriately designated and all **HIGH priority** action items should be addressed and completed promptly.

Section 6: Analysis and Prevention

Shared Learnings

Incident reports contain valuable information that may help reduce the risks of similar types of incidents in the future. The Tr@ction system emphasizes expanding shared learnings.

Inbox Rules

The Rules feature of the Traction Inbox allows a user to set rules for messages to be distributed on a regular basis. This feature allows users to be notified when incidents occur that meet conditions established in the rule. Inbox Rules can also be established to assist in the distribution of lessons learned and best practices. Additional information on setting, editing and deleting is located in the Traction Welcome Page under Traction Support Materials – user manuals.

During the initial phase, investigation reports of all Major and Non-Major incidents will be reviewed by an appropriate GEM Co. management representative(s) whose roles are defined in the Investigation Procedures Matrix (page 14). Individuals should set-up their In-Box rules accordingly. Review of near miss investigations will be left to the discretion of the portfolios (HSE Coordinator and/or Portfolio Manager).

Data Aggregation and Analyses

The GEM Co. HSE Manager will compile Incident and Near Miss data quarterly, as a minimum, for review and trend analysis by the HSE Coordinators from the GEM Co. portfolios.

Section 7: Monthly GEM Co. HSE Data Reporting Process

Each calendar month, HSE data including man-hours, mileage, and incident/near miss information is entered directly by the GEM Co. portfolios into Tr@ction. This information is routinely extracted and reviewed to evaluate GEM Co.'s HSE performance and to identify areas for improvement. GEM Co. management, including the Leadership Team and the Peer Group, and the HSE Committee, typically reviews extracted data to measure GEM Co.'s progress against Performance Contract HSE Targets. BP Group HSE in London also extracts HSE data in the form of formal reports each month to measure BU performance.

GEM Co. employees and contractors working at "active" BP operating facilities/units report their man-hours, mileage, and incidents to the respective operating facility HSE Contact. This data is entered into that operating facility/unit's Tr@ction system, rather than GEM Co.'s Tr@ction system. In an effort to address GEM Co. as a whole, monthly GEM Co. status reports are created to highlight all GEM Co. activities at operating and non-operating sites. The schedule and process are highlighted below.
(Janine, doesn't this schedule change, given the recent conversations with Jim Wallace, we are now preparing the presentation at the beginning of the month, right?)

Monthly Reporting Schedule

1st – 5th Day of the Month – GEM Co. operating sites and non-operating sites report man-hours and mileage to the designated Site/Portfolio Data Collector.

5th – 11th Day of the Month - Site or Portfolio Data Collector (varies by Portfolio) enters the HSE data into the appropriate Tr@ction system. In some cases, the Data Collector reports the HSE data to the respective operating facility HSE Contact, who then enters it into Tr@ction on behalf of GEM Co..

12th Day of the Month– BP London pulls monthly reports from all BU Tr@ction systems.

13 – 21st Day of the Month – GEM Co. pulls HSE data from GEM Co.'s Tr@ction system and all appropriate BU Tr@ction systems where GEM Co. employees and contractors work and are reporting man-hours and mileage.

3rd week of month – GEM Co. distributes Monthly HSE Status PowerPoint Presentation, email summary and Web Intelligence Reports to GEM Co. distribution list.

Monthly Reporting Process

STEP 1: GEM Co. employees and contractors at operating and non-operating sites submit man-hours and mileage to the designated Site Data Collector.

STEP 2: Site Data Collectors enter man-hours and mileage for GEM Co. employees at BP operating facilities/units into the appropriate BU Tr@ction system.

STEP 3: Site Data Collectors then report HSE Data for both operating facilities and non-operating facilities to the appropriate Portfolio Data Collector. The Portfolio Data Collector reports HSE data for **ONLY** non-operating sites into GEM Co.'s Tr@ction system and enters and tracks the HSE Data for operating sites into a stand alone tracking tool (e.g., Excel spreadsheet, table, etc.).

STEP 4: The Portfolio Data collector sends an email to GEM Co. indicating the HSE Data has been entered into Tr@ction. In addition, the Portfolio Data Collector provides an email or other specific mechanism (e.g., Excel spreadsheet) for communicating man-hours or mileage for

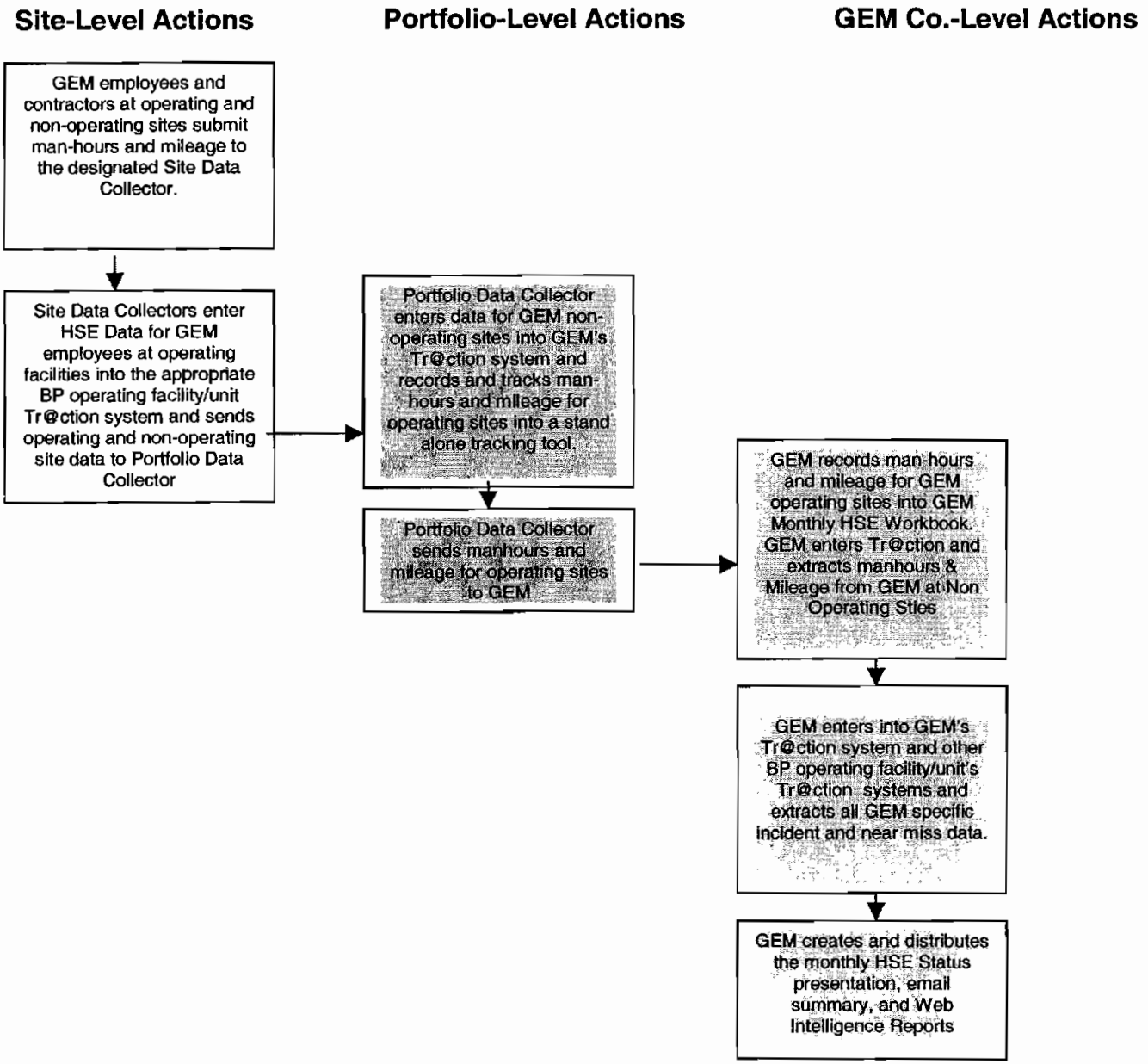
GEM Co. employees and contractors working at BP operating facilities.

STEP 5: GEM Co. enters collected operating facilities man-hours and mileage into the GEM Co. Monthly HSE Workbook.

STEP 6: GEM Co. extracts all incident information from GEM Co.'s Tr@ction system into the GEM Co. Monthly HSE Workbook. GEM Co. also extracts specific incident and near miss data from each BP operating facility Tr@ction system for GEM Co. employees and contractors and enters into the GEM Co. Monthly HSE Workbook. This data collectively provides the total man-hours, mileage, and incident analysis for GEM Co.

STEP 7: GEM Co. then creates the monthly HSE Status presentation, email summary, and Web Intelligence Reports for GEM Co. and distributes the presentation and posts the presentations on the gHSEr web site.

The following process diagram illustrates the Monthly Reporting Process:



Section 8: Tr@ction Overview

This section provides a high-level overview of GEM Co.'s Tr@ction System, for additional detailed user guidance; please refer to the GEM Co. Tr@ction User Manual. Or the GEM LTSA In addition, the following templates are available to aid users:

- GEM Co. Incident/Near Miss Field Report Card
- Primary Tr@ction Form
- Supplementary Tr@ction Form

Tr@ction is a web-based tool that helps GEM Co. and other Business Units (BUs) of BP fulfill our commitment to:

- Report our performance, both good and bad (accessible across BP)
- Document and analyze incidents and near misses
- Document root causes and corrective and preventive actions
- Monitor trends and develop prevention programs
- Share lessons learned across the business to prevent recurrence of incidents
- Provides efficient access to data, thus enabling an expeditious response to regulatory and internal reporting requirements

The Tr@ction database application is an integral component of our business assurance process for "Getting HSE Right" Element 12, Incident Analysis and Prevention and is the principal system for the collection of safety and spill performance data for the BP Group. Tr@ction also furnishes a tool to track actions associated with Advanced Safety Audits (ASAs), general HSE Audits and HazOp Reviews.

BP HSE Reporting Guidelines

Guidelines outlining the HSE reporting requirements in BP are included in the *Key HSE Process 5: Major Incident and High Potential Incident Reporting* and *Key HSE Process 6: Incident Investigation Guidelines* (see Appendix B & C). Traction should be used to record details of Major Incidents or High Potential Incidents, but should accompany, NOT replace the notification requirements in HSE Processes 5 & 6.

Personal Confidential Aspects of Tr@ction

Information held in the Tr@ction database is confidential to the BP Group of Companies. Such information can include personal details specific to named individuals employed, contracted or involved in BP Group activities. Thus it is necessary to treat information held in the Tr@ction database with the same level of confidentiality as normally applied to paper or other computer records containing medical, safety, environment or security data. A detailed description of specific and confidential information is provided at length in the on-line *Traction Support Materials – User Manuals* located on the Tr@ction Welcome Page.

Roles and Responsibilities

The following table defines the key roles in Tr@ction. For additional detail, please refer to the *Tr@ction Supporting Materials – User Manuals* located on the Tr@ction Welcome Page.

Tr@ction Role Definitions Table

	Restricted User	General User	Approver	LTSA & GTSA
Incident Records (IR's)	• Create own IRs. • Edit and view own IR • Delete own IR (until approved) • Enter and submit an investigation	• Create IRs • View all IRs and Standard IR Action Item • Edit and delete own IR (until approved) • Enter and submit an investigation	• Create IRs • View IRs/edits IR's • Approve IRs and investigations • Delete IRs (until approved) • Enter and submit an investigation • All Approvers in the BU may view the investigation • View occupational injury and illness (OI & I) details	• Create the IR • View IRs • Edit IRs • Delete IRs • Approve IRs and investigations • View occupational injury and illness (OI & I) details
	Restricted User	General User	Approver	LTSA & GTSA
Actions Items	• Create Action Items • View and close own Action Items created	• Create Action Items • View any Action Items created, except those that are part of an investigation • View and close any Action Items assigned to the individual user	• Create Action Items • View and close any Action Items created • View and close all non-confidential Action Items for the BU/Site • View, close and approve any Action Items assigned to the individual approver • Edit or delete any Action Item	• Create Action Items • View all Action Items • Edit any Action Items • Delete any Action Items

Each role signifies responsibilities within GEM Co. and is assigned a specific access level within the system. Roles and their respective access levels (aside from default access) are assigned on an individual basis (by the LTSA) and are dependent upon the user's function within GEM Co. Data access and responsibilities expand with each role beyond the default access.

Tr@ction Required Information

GEM Co.'s Tr@ction System has several required fields in the Incident and Near Miss/HSE Opportunity Reports. It is the responsibility of all GEM Co. employees and contractors entering incident and near miss data into Tr@ction to ensure that required information is accurately entered. The following chart identifies the required fields.

Note: GEM Co. discourages the use of individual's names in Incident Reports to the extent possible.

Incident Report Type	Required Fields
All Incident Reports	• Date Occurred • Time Occurred • Reported By • Contact Number • Date Reported • Time Reported • Short Description • Event Description • Site Number/Site Name

	• Specific Location f Incident or Address • City, State, Country • Failed Expectation #1 • Critical Factor for CLC Chart • Potential Risk Probability of Re-occurance
Injury/Illness	• Worker Type • Classification
Road	• Vehicle Class • Vehicle Operator
Pipeline	• Damage Caused
Material Release	• Release Type • Secondary Breach Contained? (Y/N) • Material Released, Quantity Release & Quantity Recovered • Release To
Public/Third Party Complaint	• Complainant Name • Complainant Address • Nature of Complaint • Complaint Received By
Near Miss/HSE Opportunity	• Incident Date • Site Number/Site Name • Specific Location of Incident or Address • City, State, Country • Near Miss Category #1

IMPORTANT NOTE: Other Business Unit's Tr@ction systems may not look like GEM's system. Customization of fields including required fields may be catered by each Business Unit.

APPENDICES

A. GEM Co. Portfolio Notification Template

B. Key HSE Process 5: Major Incident and High Potential Incident Reporting

C. Key HSE Process 6: Incident Investigation Guidelines

D. Incident Notification and Reporting Definitions Table

E. Incident Notification and Reporting Process Table

F. HSE Reporting Definitions and Guidance

Appendix A
GEM Co. Portfolio Notification Form

Business Unit Leader	Name	Office phone	
		Cell phone	
		Home phone	
HSE Manager	Name	Office phone	
		Cell phone	
		Home phone	
General Manager	Name	Office phone	
		Cell phone	
		Home phone	
Portfolio Manager	Name	Office phone	
		Cell phone	
		Home phone	
HSE Coordinator	Name	Office phone	
		Cell phone	
		Home phone	
Incident Notification Center	Name	Phone	

GEM Co. Portfolio Notification Form Continued

Env. Bus. Manager / Project Manager

Name

Office phone

Cell phone

Home phone

Contractor / HSE Point of Contact

Name

Office phone

Company

Cell phone

Home phone

Contractor / HSE Point of Contact

Name

Office phone

Company

Cell phone

Home phone

Contractor / HSE Point of Contact

Name

Office phone

Company

Cell phone

Home phone

Contractor / HSE Point of Contact

Name

Office phone

Company

Cell phone

Home phone

Appendix B

HSE Process 5: Major and High Potential Incident Reporting Requirements

The purpose of this document is to discuss notification and the reporting requirements for major and/or high potential incidents involving GEM Co. employees, consultants and contractors conducting field work at sites managed by GEM Co. GEM Co. manages environmental assessments and remediation projects for orphan sites, operating sites, and divested operating sites. All incidents related to GEM CO. activities are required to be reported to GEM Co. management, operating facilities management (if applicable), and the BP Notification Center.

What is a Major or High Potential Incident?

A **major incident** is an incident, including a security incident, involving any one of the following:

- A fatality associated with BP operations
- Multiple serious injuries
- Significant adverse reaction from authorities, media, NGO's, or the general public
- Cost of accidental damage exceeding US $500,000
- Oil spill of more than 100 barrels, or less if at a sensitive location (1 barrel = 42 US gallons)
- Release of more that ten tons of a classified chemical

A **high potential incident** is an incident or near miss, including a security incident, where the most serious probable outcome is a Major Incident.

The purpose of High Potential incident reporting is to encourage learning from serious incidents. If, after investigation, an incident is found to fit these definitions, it should be reported, even if it is outside the nominated reporting time frame, or does not explicitly meet these definitions.

Reporting Major and High Potential Incidents

The reporting structure and requirements for Major and High potential Incidents is a set formalized process. GEM Co. senior management reporting for a Major and High Potential Incident requires the following:

- BP Major Incident Announcement is initiated immediately by the BUL (or designee) and is provided to a predetermined list of employees or contractors established by the BUL.
- For fatalities, in addition to the BP Major Incident Announcement, the BUL (or designee) must also provide the appropriate management (GVP) with a verbal report immediately. Criminal fatalities are exempt from this additional verbal reporting requirement. However, for GEM Co., criminal fatalities are not exempt from this additional verbal reporting requirement.
- An investigation team is formed within 24 hours. This includes outside team leader and staff for the team along with written instructions.
- Fact-Finding Update within 10 days. This summary describes the basic facts and preliminary recommendations.
- Final Reports are due within 60 days. This report describes the basic causes final recommendations and action to be taken.

The BP Major Incident Announcement notification process is currently accomplished via e-mail with the words **MAJOR INCIDENT ANNOUNCEMENT** or **HIGH POTENTIAL INCIDENT ANNOUNCEMENT** in the e-mail subject area per the attached GEM Co. Incident Reporting flowchart. Copies of the form can be found in the Templates section of this manual and should accompany the e-mail where applicable. The distribution list for Major Incident Announcement (MIA) is also attached which contains contacts across the business units and should ONLY be used for Major Incident Reporting. This list can be found

in addition to reiterations of these procedures at the following website: http://gbc.bpweb.bp.com/hse/major_incidents.asp. The Portfolio Manager, General Manager, BUL and Operating Facility Contact will distribute the High Potential Incident Announcement to the list of MIA representatives as appropriate.

The attached GEM Co. Incident Reporting flow chart outlines the reporting requirements for the GEM Co. The reporting requirements are designed to alert senior management of the incident. The notifications should be made immediately (within one hour). Reports should include basic facts about the incident, actions being taken, agencies and BP personnel notified, and any requests for assistance.

The BP Notification Center is available to help notify management and obtain assistance. Operators will report incidents to the Naperville Crisis Center, which maintains a list of GEM Co. management and available recourses. Incidents at sites within operating facilities should also be reported to the operating facility. The reporting criteria should be used for incidents at both orphan sites still owned by BP as well as divested sites. If the current owner of the divested site does not have the ability to manage and respond to an incident, caused by BP's remediation activities, BP may want to take an active role.

Preplanning for Field Work

Reporting requirements and definitions should be discussed with facility contacts, consultants and contractors prior to the start of field programs. This ensures that the GEM Co. project manager will be notified in a timely manner. This also allows the facility contact to provide GEM Co. with names and contacts of management they might want to have GEM Co. notify. In addition, all employees, contractors and subcontractors should carry on their person - the Incident Field Card (Template included).

SPECIAL NOTE ON SECURITY INCIDENTS:

Security incidents, such as overt attack against a location or aircraft, siege with BP hostages, bomb attack, etc. that are public knowledge should be reported as above.

In the event of kidnapping, extortion, product contamination threat or covert attack against a BP employee or facility, or any similar incident that may not be in the public domain, the Business Unit Leader or Emergency Coordinator should communicate immediately with the relevant Executive Committee member or the Rota Executive Vice President privately, and if possible, securely. The Exco member will inform those who need to know or can advise or help.

An Incident Announcement Report should be completed for every Major and or High Potential incident and distributed to the Portfolio Manager, General Manager, BUL, HSE Manager, Core Distribution, BP Notification Center and Operating Facility Contact, per the attached GEM Co. Incident Reporting flow chart, immediately as referenced above. These representatives will distribute to the list of MIA representatives as appropriate.

MAJOR Core Distribution List for GEM Co.

- Chief Executive Officer
- Executive Vice Presidents
- Group Vice President – Government and Public Affairs
- Vice President and Head of Group Press Relations
- Group Vice President – HSE
- Vice President – Group Security

HIGH POTENTIAL Core Distribution List for GEM Co.

- Business Stream Group Vice President
- Group Vice President – HSE

- Vice President – Group Security

Appendix C

Key HSE Process 6: Incident Investigation Guidelines

It is essential to discover the root causes of incidents, so that:

- Effective preventive actions can be decided and implemented locally
- 'Lessons Learned' can be identified, implemented and shared with other operations which have similar risks
- Trends can be uncovered through valid statistical analysis

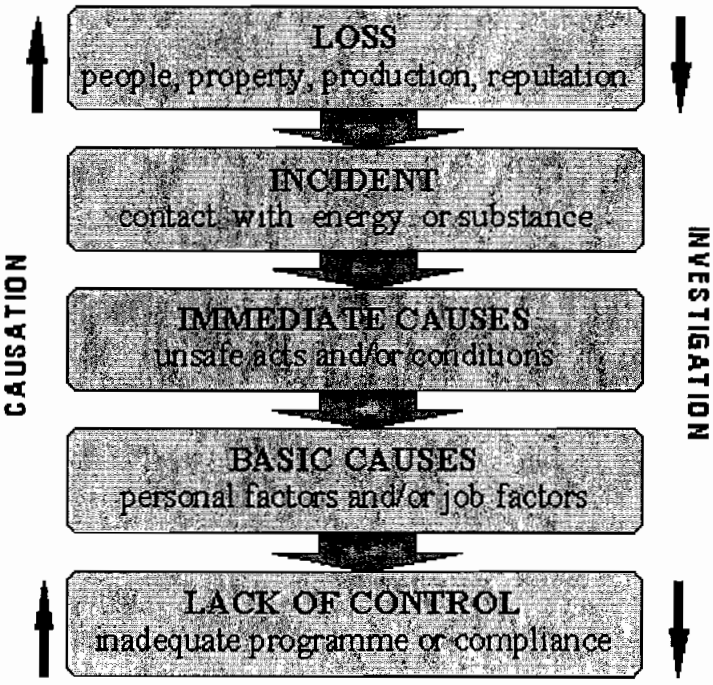
Detailed investigations should be carried out for all major incidents *(injury or damage)* and any minor incident or Near Miss with a high potential of being a major one. Less serious incidents should be investigated with a degree of rigor appropriate to the potential for loss or injury. The principles employed are nonetheless the same

It is very unusual for an incident to have one single cause. Normally incidents result from a chain or combination of actions or errors, some going quite far back in time. This is why it is essential to have a systematic and thorough investigation, following a consistent methodology, so that the chain of causes can be tracked right back to its origins.

Investigation Procedure

All BP operations should have a detailed procedure to assist in this process, which takes the investigation back through the chain of events that eventually resulted in the incident.

At each stage it is important to determine why these occurred and in which areas management control was deficient.



The linkages are tracked at each stage by asking the question 'why' to establish the factors that allowed the condition to occur. At each stage there is seldom a single cause, and the investigator must search thoroughly to ensure that none are missed.

Procedure for Major Incident Investigations*

Following a major incident, an investigation should be initiated immediately by the Business Unit Manager along the following lines:

Step 1 - Appoint and fully brief team members, including appropriate technical experts, and a chairman with sufficient seniority and independence from the involved operation to reflect the seriousness of the incident.

Step 2 - Issue terms of reference. These define the scope of the investigation and should include tracking the causation chain as well as other related factors, e.g. performance of emergency response and external services. Consider at what point legal advice may be required.

Step 3 - Specify timing of the report. It may be appropriate to issue an interim report within a few days of the incident to provide a factual account of events and some immediate recommendations for corrective action. It may also be necessary to alter the composition of the investigating team at this point if some particular expertise is found to be needed.

Step 4 - Issue the final report, which will be fully detailed with in-depth technical analysis and a fully considered set of short and long-term recommendations. Ideally the report should be issued within 14 days.

Once the report is available, Business Unit management should review the findings and recommendations and agree on their course of action. The final report should contain management responses to all recommendations with clear delegation of responsibilities for action. A timescale for review or completion is essential.

The Business Unit Leader will decide on the distribution of the full report, in particular which findings and 'lessons learned' are to be shared with others both inside and possibly outside BP.

* For incidents involving occupational fatalities, the Group Fatal Accident Investigation process will be activated.

Appendix D
Incident Notification and Reporting Definitions Table

Incident Category	Transportation	Material Release	Environmental Event	Loss of Damage		Security	Injury/Illness	Complaints
Incident Severity	**Road/Third Party Transport (i.e. - Vehicle Incidents)**	**Material Release**	**(i.e. Agency Action or OTHER Event)**	**Unplanned Business Interruption**	**Equip/Prop/Fire / Explosion**	**Security (i.e. theft, assault, fraud)**	**Personal Injury / Illness**	**Public/3rd Party**
MAJOR / HIGH POTENTIAL Refer to BP Group Major Incident and High Potential Incident Reporting Guideline	Any incident resulting in a fatality or multiple serious injuries	Any spill or release > 100 barrels or less in a sensitive area, RQ, off site impact, any spill on navigable water, release of 10 tons of classified Chemical material, or any spill > 1 barrel and has a High Potential	SIGNIFICANT Adverse reaction from authorities	Any accidental damage having a cost exceeding US $500,000	Any fire or explosion with offsite or significant onsite impact / any use of fire fighting equipment – High Potential Property Damage >$500,000	Any serious threats to security, bomb threats, or kidnapping threats – High Potential	Any injuries or illnesses resulting in fatalities or multiple serious injuries	SIGNIFICANT Adverse reaction from media, NGO's or the general public
NON-MAJOR INCIDENTS	Any incident involving a BP vehicle including under the influence of D&A ($0 Cost Threshold) Any contractor incident involving vehicle over 3.5 tons	Any spill < 100 barrel	Any notice of fine, NOV, consent order, citations, penalties, or regulatory audits	Any unplanned business interruption including hitting underground utilities, product lines, or claim, impact on operating facility business.	Any other fire / explosion not categorized as a Major Incident Property Damage of $500 - $499,000)	Any non-serious, threat to security including vandalism.	Any injury or illness resulting in a DAFWC, BP exposure, OSHA Recordable or First Aid	Any incident that causes adverse reaction from the public, or received significant media attention
NEAR MISS / UNSAFE CONDITION or Behavior and/or doesn't meet the definitions of a Major or Non-Major Incident	Any contractor light vehicle or incident without injury or property damage Any potential BP employee or Contractor vehicle incident (actual accident did NOT occur)	Any potential for spill or release	Any adverse reaction from authorities	Any complaint filed by an Operating Facility Business	Any risk of fire or explosion (i.e. working in LEL conditions, etc.) Property Damage less than <$500 (Does not include vehicle Damage for accidents involving BP employees)	N/A	Any potential for an injury/illness.	N/A

Appendix E
INCIDENT NOTIFICATION AND REPORTING PROCESS TABLE

	NOTIFICATION			INITIAL REPORTING			INVESTIGATION				CORRECTIVE ACTION		
	Notification required	Accountability By **	When	Forms / Reports	Accountability By **	When	Forms / Reports	Accountability By **	When	Distribution To	Forms / Reports	Accountability By **	Distribution To
MAJOR/ HIGH POTENTIAL Refer to BP Group Major Incident and High Potential Incident Reporting Guideline	• BU Leader • HSE Manager • General Manager • Portfolio Manager • Operating Facility Contact (if applicable) •Core Distribution (see Key Process 5) • BP Notification Center (as needed)	• GEM Co. Employee • EBM or PM (as applicable)	Immediately	Major/High Potential Incident Announcement Forms OSHA 300 Log (as applicable) (B)	• Portfolio Manager	Immediately	(10 day and 60 day) Incident Report in Tr@ction	• Investigation Team Leader	10 Days (Preliminary) 60 Days (Final)		BP Major Incident Announcement Incident Report in Tr@ction	• General Manager	
NON-MAJOR	• BU Leader * • HSE Manager • General Manager • Portfolio Manager • Operating Facility Contact (if applicable) • BP Notification Center (as needed)	• EBM or PM • GEM Co.. Employee	Within 24 hours	Incident Report in Tr@ction OSHA 300 Log – as applicable (B)	• Portfolio Manager • HSE Coordinator • Contractor HSE point of contact	Within 24 Hours	Incident Report in Tr@ction	• Portfolio Manager or next level of authority (as appropriate) or HSE Coordinator	14 Days or as otherwise noted	GM * FMS HSE Manager	Incident Report in Tr@ction	• Portfolio Manager / HSE Coordinator	GM * FMS HSE Manager
INJURY	• EBM/ GEM Co. HSE Coordinator • Operating Facility Contact (if applicable)	• EBM or PM • GEM Co. Employee	Within 24 hours	Incident Report in Tr@ction OSHA 300 Log – as applicable (B)	• Portfolio Manager • HSE Coordinator • Contractor HSE point of contact	Within 24 Hours	Incident Report in Tr@ction	• Portfolio Manager or next level of authority (as appropriate) or HSE Coordinator	14 Days or as otherwise noted	GM * FMS HSE Manager	Incident Report in Tr@ction	• Portfolio Manager / HSE Coordinator	GM * FMS HSE Manager
NEAR MISS	• Portfolio Manager / HSE Coordinator	• EBM or PM • GEM Co.. Employee	Within 72 Hours	Incident Report in Tr@ction	• Portfolio Manager • HSE Coordinator • Contractor HSE point of contact	Within 72 Hours	Incident Report in Tr@ction	• Portfolio Manager or next level of authority (as appropriate) or HSE Coordinator	At the discretion of the EBM, PM or HSE Coordinator	HSE Manager	Incident Report in Tr@ction	• Portfolio Manager / HSE Coordinator	HSE Manager

NOTE: If EBM or PM is not available, Contractor is responsible for notifying the next applicable level.

* For OSHA Recordables, DAFW Cases, or otherwise determined.

** Accountable for circulating to distribution list.

(A) At Discretion of Portfolio Manager / HSE Coordinator

(B) Contractor's Employer regardless of work being done for GEM Co./BP fills out OSHA 300 Logs.

Appendix F

Additional HSE Reporting Definitions

Additional HSE Reporting Definitions

BP's injury and illness definitions are the US Occupational Safety and Health Administration (OSHA) definitions as found in the document *'Record Keeping for Occupational Injuries and Illnesses'* ("Blue Book") and in subsequent interpretation from OSHA. The definitions in the following table are based on the OSHA definitions.

Detailed definitions supporting the calculation of environmental data are set out in the BP document entitled *'Environmental Performance - Group Reporting Guidelines'*.

The definitions associated with these key processes are used to ensure international comparability of data for internal BP reporting. Using the definitions may lead to differences between BP reports and locally reported HSE performance data using other guidelines, often required by legislation.

These definitions have been modified or enhanced to meet the intent of the GEM Co.

Reporting Unit	The name of Business Unit or Regional Services Unit or Site, which is reporting data. *For GEM Co. the reporting unit is the Functional Unit or Stream.*
Business or Business Stream	Chemicals, Exploration & Production (E&P), Refining & Marketing (R&M), or Other, (e.g. Solar)
Employee	A person directly employed by a BP company.
Contractor	A contractor is any non-BP person who is on BP premises under contract, for business purposes or anyone providing materials, personnel, or services that directly benefit BP and relate to a contract or subcontract. The contract may be with BP or another contractor who is working on behalf of BP. **For group injury and illness reporting purposes, the following "contractors" are excluded except in the event of a fatal accident when any contractor fatality must be reported:** · persons delivering goods, products or materials at a BP site. · someone engaged in the delivery of products by road in execution of a contract with a BP company that runs for less than one year (i.e. short term or spot contractors). · a crewmember of a vessel on short term or spot charter to a BP company (i.e. not on time charter). · retail service station dealers and their staff at Company Owned Dealer Operated (CODO) sites. · crew of a non-BP tanker loading or discharging crude oil or product for its own account at a marine terminal. · Injuries to workers in third party fabrication yards or toll-manufacturing sites will not be recorded at BP Group level. However, Business Unit and/or Project management should monitor them, and significant events reported through the Major Incident Announcement system.
Third Party	Any person who is not an employee or contractor of BP as defined above
BP Premises	A site operated by a BP company or a marine vessel owned or operated by a BP company *(including all sites of activities involving contractors)*

BP Company	A company wholly owned by the BP Group, or a company or joint venture where BP has equity and is responsible for HSE. Normally this is where BP is considered to be the operator, (e.g. where BP has a management or technical service agreement)
Establishing a 'work relationship'	The work relationship is established when the injury or illness results from an event or exposure in the work environment. The work environment primarily consists of: • the employer's premises, and • other locations where employees are engaged in work-related activities or are present as a condition of their employment. When an employee is on the employer's premises (generally excluding parking lots) the work relationship is presumed; when off the premises the relationship must be established. • travel on Company business should be considered work-related. • a hotel or motel while being used on company business should be considered a "home away from home" and evaluated as such. • travel between home and work is not work-related. • Injuries or illnesses that occur to employees or contractors while participating in voluntary activities (i.e. those that are provided or made possible by BP but in which participation is voluntary and for personal benefit, such as use of a fitness center) shall not be included in the BP Group internal reporting. However, local recording, follow-up etc. is essential, as is compliance with all legal requirements.
Recordable Fatality (number)	An employee or contractor fatality is deemed recordable if the incident is found to be work-related or related to the wider activities of BP. Fatalities arising, for example, from suicide, inexplicable personal behavior or natural causes would normally be excluded. ***All** fatalities associated with BP, whether recordable or not, are reported within 24 hours through the Major Incident Announcement procedure.* ****GEM requires fatalities be reported immediately*****
Days Away From Work Case (DAFWC) (number)	A work-related injury or illness that causes the injured person to be away from work for at least one normal shift after the shift on which the injury occurred, because he/she is unfit to perform any duties. All DAFW Cases should be reported by the reporting unit at which they occurred.
Recordable Injury/Illness (RI) Case (number)	RI cases are all work-related deaths and illnesses, together with injuries that result in loss of consciousness, restriction of work or motion, transfer to another job, or require treatment beyond first aid.
Recordable Injury/Illness Frequency (RIF)	RIF is expressed as the number of recordable injuries and illnesses per 200,000 hours worked.
First Aid Cases	A work related injury that requires one time treatment and subsequent observation (for example minor scratches, burns, cuts, splinters which do not ordinarily require medical care) and does not result in a DAFW or RI Case. Such treatment and observation are considered first aid even if provided by a physician or registered medical professional.
Hours Worked (number)	Total hours worked within a reporting unit, including office staff, part-time employees, apprentices and trainees and personnel from other BP sites or centers working within the unit for more than one month. *For GEM Co., Hours Worked includes contractor and subcontractor Hours Worked on BP projects, both in the field and in the office.* *Where a person is using Company property as a temporary home (e.g. on the Alaskan North Slope and offshore platforms) 12 hours should be taken as the working day. For ship operations at sea, a 24-hour working day should be taken.*

Occupational Illness and Industrial Disease (number)	An abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases, which may be caused by inhalation, absorption, ingestion or direct contact. Chronic conditions should be reported once, in the period during which the condition was first diagnosed. *See note at the end of this Key Process to differentiate between illness and injury*
Road Accidents (number)	Accidents involving vehicles, which occur on the road and result in damage or a work related injury. Includes work related operation of vehicles by BP employees and product delivery vehicles or vehicles over 3.5 tons unladen operated by BP contractors • A zero-cost threshold is applied and reporting is irrespective of whether the accident was judged preventable or non-preventable. • A BP operated vehicle is a delivery, or other vehicle driven by a BP employee for work related purposes, although the vehicle may be owned, hired or leased. • A contractor operated delivery vehicle is either a company branded vehicle or a vehicle under a BP term contract (i.e. for more than one year) where the same driver is employed on a regular basis.
Distance Driven (kilometers)	Total work related kilometers traveled by BP operated or contractor vehicles, whether empty or laden, should be reported. These may be estimated where appropriate.
Road Accident Rate	The number of road accidents per million vehicle kilometers traveled
Distribution incidents (number)	Include transport incidents (all modes) resulting in • a DAFW Case • loss of material (exceeding 500 kg of non-classified material, or exceeding 50 kg of classified material or any loss from air freight) • any environmental damage from material loss • any property damage or other costs exceeding US $50,000. Data to be split by those incidents occurring during transportation and those occurring at customer premises. *Reported to London by BP Chemicals transportation units only*
Spills	A spill is defined as a loss of primary containment from a BP or contractor operation, irrespective of any secondary containment or recovery. When discovered, leakage from vessels is included in spill reporting, but may be reported separately. Details of spills less than 1 barrel need not be reported, but should be held locally. ***All spills or materials are required to be reported to GEM Co. regardless of volume.***
Total Volume of Oil Spilled (liters)	The volume in liters of oil escaping primary containment, for spills equal to or greater than 1 barrel. * 1 barrel = 159 liters = 42 US gallons **** All spills or materials are required to be reported to GEM Co. regardless of volume.***

Total Oil Spilled and Unrecovered (liters)	The volume in liters of spilled oil, for spills equal to or greater than 1 barrel, that remains in the 'environment' i.e. the ground, water, atmosphere or food chain. **** All spills or materials are required to be reported to GEM Co. regardless of volume.***
Oil Spills to Land or Water	If an oil spill reaches surface water (fresh, salt or brackish) it is defined as a spill to water, otherwise it is a spill to land. Spills to snow or ice should be categorized according to their proximity to a shoreline - offshore is classified as "to water" and on-shore as "to land".
Spills which reach the environment	An oil spill greater than 1 barrel, where there is no secondary containment, or where any liquid breaches or leaks from secondary containment, to come into contact with the ground, snow, ice or water.*
Chemical Releases (number)	The number of chemical releases that are reportable to local agencies under local regulations for BP Chemicals operations. *For GEM Co. chemical releases exceeding state reportable quantities will be reported.*
Loss of Containment (number)	Any unplanned event where gaseous hydrocarbons are released from primary containment and results in the need for action such as shutdown, evacuation or maintenance, to mitigate the effects of the loss of containment. Fugitive emissions should not be included.
Waste, Discharges and Emissions	Measurement and estimation protocols for wastes, discharges to water and emissions to air are published in '*Environmental Performance - Group Reporting Guidelines*'. Waste, discharges and emissions will be reported in metric tons. One ton = 1000 kilograms, or 2200 pounds

For London reporting only.

Appendix G
Action Prioritization Detailed Instructions & Flowchart

This document provides detailed instructions on how to prioritize the corrective and preventive actions resulting from incident reports and audit reports. The following sub-steps correspond to Step 2: Prioritizing Action Items in the GEM Co. *"Nonconformance and Corrective and Preventive Action Reporting and Tracking Procedure"*, located in the gHSEr web site under.HSE Incident Information. The process is also represented in the attached Action Prioritization Flowchart.

Step 2a: Determine the Severity of the Incident or Audit Finding Itself.
Step A in prioritizing action items is to determine the type of impact and Severity Level of the overall incident or audit finding. The primary types of impact may be health, safety, environment, property, reputation, business interruption/unit outage, or security/criminal act. The Severity rating may be between 1 and 5, with 1 being the most severe and 5 being the least severe.

For incidents and audit findings that are associated with real HSE impacts, use the *Actual Severity Matrix* located in the Tr@ction system to determine the type of impact and Severity Level. For near misses and audit findings that are associated with potential HSE impacts in the future, use the *Potential Risk Matrix* in the Tr@ction system.

Step 2b: Determine the Likelihood of the Incident or Audit Finding Occurring.
Step B is to determine the Likelihood of the incident, near miss, or audit finding occurring in the future. The following table should be used as a guide.

Table I: LIKELIHOOD DEFINITIONS

Likelihood	Definition
High	Expected to occur at least once per year.
Medium	Expected to occur from time to time (at least once every 5 years).
Low	Expected to occur not more than once in about 30 years, however, similar incidents have been known to occur in the industry.

Step 2c: Determine the Priority of the Total Incident or Audit Finding
Step C is to prioritize the incident or audit finding based on the Likelihood (see Step 2b) and Severity Levels (see Step 2a). The following table shows how to determine the Priority rating (A, B, or C) based on the Likelihood (High, Medium, or Low) and Severity Level (1-5).

Table II: TOTAL INCIDENT PRIORITY

	Likelihood (see Step 2b)		
Severity (see Step 2a)	**High**	**Medium**	**Low**
1			B
2			B
3		B	C
4	B	C	C
5	C	C	C

The next table shows what the priorities A, B, and C signify.

Table III: PRIORITY DEFINITIONS		
Priority	**Tr@ction Entry**	**Definition**
A	**High**	1st Priority – Requires immediate attention and notification of senior management.
B	**Medium**	2nd Priority – Requires prompt attention by site management (normally within three months).
C	**Low**	3rd Priority –Requires attention during normal course of business activities, but after A's and B's are resolved.

Step 2d: Classify Individual Corrective and Preventive Actions.
In Step D, each corrective and preventive action associated with the incident or audit will be classified using the following classification scheme.

Table IV: INDIVIDUAL ACTION ITEM CLASSIFICATION		
Classification	**Definition**	**Examples**
Class 1	Immediate action to eliminate immediate causes with safeguards and to prevent incident recurrence. Control of accident scene.	Barricades/Tape, shutdown unit/equipment, Safety Alert, Roadblocks, Change process variable, Housekeeping, PPE
Class 2	Prompt action to eliminate "contributing or indirect causes", minimize consequences and to prevent incident recurrence.	Signs, Engineering out hazard, Reconfigure control systems, Safety Talks, Obtain/update MSDS, Change alarm setting, Revise/implement procedure, Repair/replace equipment, Instructions & Rotation of personnel.
Class 3	Requires action during the normal course of business activities and is necessary to complete the safety management long term process of ensuring incident cannot recur under same circumstances.	Survey industry, Sharing lessons learned, Management system changes, Engineering study, Critique of training module, Organizational changes, Job Task Observations, Routine inspections.
Class 4	No requirement for priority action and is not necessary to prevent recurrence of incident. Recommendation is made as a result of the incident investigation, but is not connected to the incident.	As-found drawing revisions not related to the incident, Typos on procedures.

Step 2e: Determine Priority of Individual Corrective and Preventive Actions.
Finally, in Step E, the priority of each individual corrective and preventive action will be prioritized based on the total incident or audit finding Priority (see Step 2c) and the individual action item Classification (see Step 2d), using the following table:

Table V: INDIVIDUAL ACTION ITEM PRIORITIES				
	Class 4	**Class 3**	**Class 2**	**Class 1**
Total Incident/Audit Finding Priority C			B	B
Total Incident/Audit Finding Priority B		B	B	
Total Incident/Audit Finding Priority A	B	B		

The A, B, and C priority ratings correspond to the priority definitions provided in Table III above

TEMPLATES/TOOLS

GEM Co. Incident/Near Miss Field Card Template & Example Reporting Forms

Primary & Secondary Tr@ction Supplemental Reporting Forms

BP Major Incident Announcement

BP High Potential Incident Announcement

GEM Co. HSE Incident/Near Miss Field Card Template & Example Reporting Forms

Use of the Tr@ction Reporting Field Card and Example Reporting Forms at GEM Co. portfolios and sites is optional, as this form has only been developed to attempt to make the loading of information into the Tr@ction system easier. The Field Card is designed to be a handy field tool to immediately capture initial information, whereas the example Tr@ction reporting forms have been developed to an EMS or Project Manager to make sure all the information required by Tr@ction can be easily captured for data entry.

bp

GEM HSE Incident or Near Miss Report

Report Title: _____

Reported By: _____

Incident Date/Time: _____

Site Name (required): _____

Primary Company Involved (required): _____

Incident Type:

☐ Near Miss/HSE Opportunity ☐ Material Release/Spill
☐ Injury/Illness ☐ Transportation Incident
☐ Property Loss/Damage ☐ Security or Crime
☐ Other _____

Incident Description:
Use keywords like those listed below:

- *Operation (drilling, lifting, maintenance, driving, sampling, etc.)*
- *Worker experience (new employee, 5-years experience, etc.)*
- *Potential result of incident (hand or back injury, slip, fall, property damage, spill)*
- *Contributing conditions (weather, lighting, ground conditions)*

_____

_____

_____

_____

_____

_____

_____

_____

_____

Continued other side

Incident Description (contd.):

_____

_____

Potential Immediate Cause:

☐ 1. Not following procedures ☐ 5. Protective System (PPE)
☐ 2. Improper use of tool/equip. ☐ 6. Defective tools/equip.
☐ 3. Improper protective methods ☐ 7. Exposure to conditions
☐ 4. Inattention/lack of awareness ☐ 8. Workplace layout
☐ Other _____

Critical Factor(s) Contributing to Incident:

_____

Immediate Action Taken:

_____

_____

_____

Severity Level:

☐ Actual Severity ☐ Potential Risk

Circle One: *High* *Low*
1 2 3 4 5

Probability of Reoccurrence:

Circle One: Low Med. High

Low – Expected to occur not more than once in about 30 years.
Medium – Expected to occur from time to time (at least once every 5 years).
High – Expected to occur at least once per year

Reviewed by/Date: _____

Corrective Actions Identified by Reviewer:

_____

_____

Rev. 2, 8-04-02

Primary Tr@ction Reporting Form

GEM HSE Incident or Near Miss Report

SECTION 1 - GENERAL INFORMATION

Reference Information

Incident Date/Time:

Report Title:

Reported By:

Organization Information

Site Name/Information (required database field)

Site Number or Name:

City, State, Country:

Location Information

Location 1:	Location 2:
☐ Active BP field site	☐ Borrow area
☐ Active non-BP field site	☐ Confined space
☐ Airplane	☐ Creek
☐ Airport	☐ Dike
☐ BP office building	☐ Ditch
☐ Non-BP office building	☐ Dry Closure
☐ Residential area	☐ Field Trailer
☐ Vacant BP field site	☐ Haul Road
☐ Vacant non-BP field site	☐ Maintenance bldg.
☐ Vehicle	☐ Other

Incident Type - Complete only Sections listed in parantheses

- ☐ Near Miss/HSE Opportunity (Sections 1, 2*, 3)
- ☐ Occupational Injury (Section 1, 2, 3)
- ☐ Occupational Illness Sections (1,2,3)
- ☐ Transportation - Road (Section 1,2**, 3, 4))
- ☐ Transportation - 3rd Party (Sections 1,2**, 3, 5)
- ☐ Transportation - Pipeline (Sections 1, 2**, 3, 6)
- ☐ Transportation - Air (Sections 1, 2**, 3, 7)
- ☐ Material Release (Section 1, 3, 8)
- ☐ Security - Robbery (Sections 1, 2**, 3, 12)
- ☐ Security - Theft (Section 1, 2**, 3, 12)
- ☐ Security - Burglary (Section 1, 2**, 3, 12)
- ☐ Security - Fraud (Section 1, 2**, 3, 12)
- ☐ Security - Terrorism (Sections 1, 2**, 3, 12)
- ☐ Security - Assault/Threat (Sections 1, 2**, 3, 12)
- ☐ Security - Criminal Property Damage (Sections 1, 2**, 3, 12)
- ☐ Security - Drug/Alcohol Abuse/Possession (Sections 1, 2**, 3, 12)
- ☐ Public/3rd Party Complaint (Sections 1, 2**, 3, 10)
- ☐ Equipment/Property Loss/Damage/Explosion/Fire (Sec. 1, 2**, 3, 9)
- ☐ Reputation/Business Loss (Section 1, 2**, 3, 11)

2* First Aid Case 2** If Injury Occurs

Note: Sections 4 through 12 provided on supplemental forms

Primary Company Involved (required database field)

- ☐ BP
- ☐ Contractor (name):
- ☐ Subcontractor (name):

Potential/Actual Impacts

☐ Health	☐ Quality
☐ Safety	☐ Security
☐ Environment	

INCIDENT DESCRIPTION - use keywords like those listed below:

- *Operation (drilling, lifting, maintaining, driving, sampling, etc.)*
- *Worker experience (new employee, 5-years experience, etc.)*
- *Potential result of incident (hand or back injury, slip, fall, spill)*
- *Contributing conditions (weather, lighting, ground conditions)*

Category

☐ Application to Deviate	☐ Quality Issue
☐ Control of Work Issue	☐ Reputation Issue
☐ Defective Equipment	☐ Security Issue
☐ Dropped/Falling Object	☐ Seep
☐ Environment Issue	☐ Unsafe Act
☐ Non Compliance	☐ Unsafe Condition

Lighting Conditions

☐ Artificial - Good	☐ Natural - Poor
☐ Artificial - Poor	☐ Not Relevant
☐ Natural - Good	

Weather Conditions

☐ Clear/Fair	☐ Rain
☐ Foggy	☐ Sleet
☐ Freezing Temperatures	☐ Snow
☐ Hail	☐ Sunny
☐ Mist	☐ Thunderstorm
☐ Not Relevant	☐ Windy
☐ Overcast	☐ Other

Operation in Progress

☐ Commissioning	☐ Shipping Operations
☐ Construction	☐ Shutdown/Turnaround
☐ Demolition	☐ Shutting Down
☐ Domestic	☐ Testing
☐ Drilling	☐ Transporting
☐ Inspection	☐ Fracking/Cavitation
☐ Maintenance	☐ Discharging Products
☐ Material Handling	☐ Monitoring
☐ Normal Operation	☐ Other (describe below)
☐ Product Loading	

Ground Conditions

☐ Bitouminous Based	☐ Muddy
☐ Concrete	☐ Not Relevant
☐ Dry	☐ Rocky
☐ Gravel	☐ Sandy
☐ Icy	☐ Slippery
☐ Inclined	☐ Uneven
☐ Level	☐ Wet

Immediate Action Taken:

SECTION 2 - INJURY/ILLNESS INFORMATION

Given Name:

Middle Name:

Family Name:

Date of birth (DD/MM/YYY)

Occupation:

Company:

Address

Employee Number:

National I.D. Number:

Gender: ☐ Male ☐ Female

Continous Days Worked

Type of Contact:

Experience

☐ < 1 year ☐ 1-4 years ☐ 5-9 years ☐ 10-14 years ☐ 15-19 years
☐ 20-24 years ☐ 25-29 years ☐ 30-34 years ☐ 35 and over years

Location Type

☐ Company Premises ☐ Offshore
☐ Company Vehicle ☐ Other
☐ Retail Site ☐ Ship

Worker Type

☐ BP
☐ Contractor
☐ Third Party

Classification

☐ Not Job Related ☐ Restricted Work/Job Transfer
☐ No Treatment ☐ Days Away from Work
☐ First Aid ☐ Fatality
☐ Medical Treatment

Treatment

☐ Medivac ☐ Primary Care
☐ Medrescue ☐ Secondary Care
☐ No Treatment ☐ Tertiary Care
☐ On-Site

Nature of Injury/Illness:
Body Part Effected:
Trauma Counseling?: ☐ Yes ☐ No
Medic Comments:
Medic Name:
Hospital attended?: ☐ Yes ☐ No
Hospital Name:
Hospital Address:
Number of Days Away from Work:
Number of Days Restricted/Job Transfer:
Medic Address:
Incident Function: ☐ Construction ☐ Fab Yards and Construction ☐ Other ☐ Drilling Wells ☐ Production Maintenance

SECTION 3 - INCIDENT ANALYSIS

Severity Level

☐ Actual Severity or ☐ Potential Risk

Severity Level	Health	Safety	Environment	Property Damage	Reputation	Business Interruption/ Unit Outage	Security/ Criminal Act
(Highest)	A	B	C	D	E	F	G
1	☐	☐	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐	☐	☐
Probability of Reoccurrence							
High	☐	☐	☐	☐	☐	☐	☐
Medium	☐	☐	☐	☐	☐	☐	☐
Low	☐	☐	☐	☐	☐	☐	☐

Incident Critical Factors, Causes, and Failed Expectations

Critical Factors Contributing to Incident/Near Miss:
Possible Immediate Causes (refer to CLC):
Possible System Causes (refer to CLC):
Failed gHSEr Expectations: #1: #2: #3:

Corrective Actions

Corrective Action 1:
Action Type: ☐ Post Incident Response ☐ Preventative
Action Priority ☐ Hi ☐ Med ☐ Low
Responsible Party:
Target Completion Date:

Corrective Action 2:
Action Type: ☐ Post Incident Response ☐ Preventative
Action Priority ☐ Hi ☐ Med ☐ Low
Responsible Party:
Target Completion Date:

Submitted/Review Information

Submitted By: Date:
Reviewed By: Date:
(PM review required before entry into traction)
Entered into Traction by: Date:

Supplemental Tr@ction Reporting Form

Supplemental Information Forms for GEM Tr@ction Report

(to accompany primary incident/near miss report form)

Report Title	Site Name/Information
Incident Date/Time:	Site Number:
Report Title:	Site Name:
Reported By:	City, State, Country:

Section 4 - Transportation-Road Incident Information

Vehicle Class: ☐ Heavy Vehicle (>3.5 Te) ☐ Light Vehicle (<3.5 Te)

Vehicle Type: ☐ Articulated Truck ☐ Car ☐ Motorbike ☐ Tracked Vehicle
☐ Bicycle ☐ Drawbar Vehicle ☐ Pickup ☐ Truck
☐ Bus ☐ Flatbed Truck ☐ Tanker ☐ Van

License Plate: Tactor Number: Trailer Number:

Damage Description:

Product Transported: ☐ Air Permit Exceedences ☐ Crude Oil ☐ Motor Oil
☐ Benzene ☐ Gasoline ☐ Other

Road Type: ☐ Dirt or Unsurfaced Road ☐ Freeway/Motorway ☐ Major Road
☐ Minor Road ☐ Private Road ☐ Residential Road ☐ Single Track Road

Accident Type: ☐ 'T' Vehicle/Vehicle Collision ☐ Collision with Fixed Object ☐ Cyclist Accident
☐ Head on Vehicle Collision ☐ Nose to Tail Vehicle Collision ☐ Sideswipe ☐ Vehicle Rollover

Location Description:

Vehicle Operator: ☐ BP ☐ Contractor ☐ Joint Venture Partner ☐ Third Party

Driver Name - First: Middle: Last:

Driver Statement:

Third Party Details:

Emergency Response? ☐ No ☐ Yes Total Years Driving? # of Vehicles Involved:

Professioanl Driver? ☐ No ☐ Yes Haz. Materials Transported? ☐ No ☐ Yes

Section 5 - Transportation 3rd Party Information

Caller Name: Contact Number:

Emergency Type: ☐ Collision and Product Loss ☐ Collision Only ☐ Vehicle/Cyclist Accident
☐ Collision Product Loss and Fire/Explosion ☐ Rollover ☐ Vehicle/Pedestrian Accident

Location Description:

Product Involved: ☐ Air Permit Exceedences ☐ Crude Oil ☐ Motor Oil
☐ Benzene ☐ Gasoline ☐ Other

Vehicle ID: Operator Involved:

Details:

Professional Dirver? ☐ No ☐ Yes

Section 6 - Transportation Pipeline Information

Pipeline Affected: ☐ Gas ☐ Oil ☐ Remediation System Line
☐ Sewer ☐ Stormdrain

Location Description:

Land Owner:

Damage Caused: ☐ Agricultural Equipment ☐ Anchor ☐ Chemicals
☐ Electrical ☐ Falling/Flying Object ☐ Fire ☐ Hand Tools
☐ Other ☐ Mobile Plant/Equipment ☐ Over Pressure ☐ Radiant Heat
☐ Steam ☐ Severe Environmental Conditions ☐ Temperature Extreme ☐ Wind

Pipeline Protection: ☐ Bituminous Coating ☐ Cathodic Protection ☐ Electrical Current Protection
☐ Metal Jacketed Lagging ☐ No Protection ☐ Tape Lagging

Pipeline Diameter (with units): Pipeline Thickness (with units):

Normal Pressure (with units): Third Party Caused? ☐ No ☐ Yes

Nature of Work: ☐ Excavation ☐ Lagging Removal ☐ Laying
☐ Non-Routine Maintenance ☐ Re-Piling ☐ Routine Maintenance

Equipment Involved:

Pipeline Marking: ☐ Buried Tape ☐ Field Markers ☐ No Markings ☐ Pipeline Above Grade

Prenotification: ☐ Freephone ☐ Letter ☐ No Notification ☐ Telephone

Information Previously Given? ☐ No ☐ Yes

Section 7 - Transportation Air Information

Type of Aircraft: ☐ Fixed Wing ☐ Other ☐ Rotary Wing

Model of Aircraft: Flight Number:

Purpose of Flight: ☐ Business ☐ Crew Change ☐ Freight ☐ Inspection

Reason for Report: ☐ Bird Strike ☐ Cancellation ☐ Crash ☐ Delay
☐ Emergecny Landing ☐ Near Miss ☐ Other ☐ Turn Back

Section 8 - Material Release Information

Release Type: ☐ Atmospheric ☐ Leak ☐ Spill ☐ Waste Disposal

Specific Location:

Secondary Containment Breached? ☐ No ☐ Yes Wind Direction:_____ Wind Speed (with units):_____

Barometric Pressure (with units): Temperature:_____ F or _____C Humidity (%):

Material Released: ☐ Air Permit Exceedences ☐ Crude Oil ☐ Motor Oil
☐ Benzene ☐ Gasoline ☐ Other

Quantity Released (with units): Quanitity Recovered (with units):

Released To: ☐ Groundwater ☐ None ☐ Water-Subsurface
☐ Tundra ☐ Sea ☐ Water-Surface

Released From: ☐ Process Vessel ☐ Pump ☐ Relief Valve ☐ Storage Vessel Below Ground
☐ Transfer Hose ☐ Valve ☐ Wellhead ☐ Storage Vessel Above Ground

Duration (minutes): Stability Classification:

Clean Up Action:

Reportable Quantity Exceeded? ☐ No ☐ Yes Surface Area (with units):

Compliance Breach: ☐ Air Discharge License ☐ Discharge License ☐ EPA Regulatory Standards
☐ No Compliance Breach ☐ Water Discharge License

Compliance Breach Comments:

Community Offsite Impacts: ☐ Discomfort ☐ Evacuation ☐ Fatality ☐ Environmental Damage
☐ Injury ☐ Medical Treatment ☐ No Impact ☐ Shelter In Place

Environmental Impact:

How was release discovered?

Comments with respect to below tank information:

Number of Tanks:	Tank Size:	Are Tanks Cathodicaly Protected?	Is Piping Cathodically Protected?
Tank Construction:	☐ Steel ☐ Fiberglass	Tank Wall:	☐ Single ☐ Double
Piping Construction:	☐ Steel ☐ Fiberglass	Piping Wall:	☐ Single ☐ Double
Leak Detection:	☐ ESIR ☐ Simplicity		☐ IM

Section 9 - Equipment/Property/Explosion Information

Damage Type: ☐ Collision ☐ Contamination ☐ Corrosion/Erosion
☐ Equipment ☐ Explosion ☐ Fire ☐ High Temperature Exposure

Property Damaged (BP):

Property/Equipment Damaged (3rd Party):

Fire/Explosion Type: ☐ BLEVE ☐ Class A ☐ Class B
☐ Class C ☐ Class D ☐ Explosion

Equipment Involved: Equipment ID:

Nature of Failure				
☐ Bearing Failure	☐ Control Failure	☐ Corroded/Eroded	☐ Degraded	☐ Derailment
☐ Electric Fault	☐ Erratic	☐ Excavation Damage	☐ Fatigue	☐ Fouled/Blocked
☐ Fractured	☐ Gland Leak	☐ High/Low Vibration	☐ Joint Leak	☐ Other Failure
☐ Other Leakage	☐ Out of Calibration	☐ Over Heated	☐ Passing Valve	☐ Process Upset
☐ Seal Leak	☐ Seized	☐ Software Error	☐ Supply Failure	☐ Weather Damage
☐ Weld Failure				

Section 10 - Public / Third Party Complaint Information

Complainant Name:
Complainant Address:
Nature of Complaint: ☐ Light Pollution ☐ Noise Pollution ☐ Odour ☐ Other
Complaint received by:
Wind Direction: Wind Speed (with units):
Claimed Damage:
Coincident Activity:
Investigation Team: ☐ No ☐ Yes Dispatched Date (DD/MM/YYYY) Dispatched Time:
Personnel Dispatched:
Report Back Date (DD/MM/YYYY): Dispatched Time:
Comments:

Followup Contact: ☐ E-mail ☐ Letter ☐ Other
☐ Telephone ☐ Through Government ☐ Through Police ☐ Office/Visit
Contact Name: Contact Date (DD/MM/YYYY)
Contact Comment:

Section 11 - Reputation/Business Loss Information

Reputation/Business Loss Type: ☐ Adverse Reaction from Authorities ☐ Adverse Reaction from Media
☐ Adverse Reaction from Media and Authorities ☐ Adverse Reaction from Public ☐ Loss of Ability to Operate
Public Image:

Section 12 - Security Information

Theft - Property Owner: ☐ BP Company ☐ Contractor ☐ Other ☐ Personal
Robbery - Armed? ☐ No ☐ Yes If yes, indicate weapon below.
Assault/Threat - Incident Type: ☐ Assault ☐ Threat If weapon used, indicate below.
Weapon: ☐ Bomb/Explosive Device ☐ Concealed Weapon ☐ Firearm - Handgun
☐ Firearm - Rifle ☐ Firearm - Shotgun ☐ Other ☐ Physical (Strike, Punch, Kick)
☐ Syringe ☐ Threat ☐ Weapon - Blunt Instrument ☐ Weapon - Knife, Sword, etc.
Burglary - Point of Entry: ☐ Exterior Door ☐ Fire Door ☐ Other
☐ Roof ☐ Unknown ☐ Walls Fence ☐ Window
Fraud - Person Involved: ☐ BP Employee ☐ Contractor ☐ Customer ☐ Third Party ☐ Vendor
Fraud Type: ☐ Bribery/Corruption ☐ Cash ☐ Conflict of Interest
☐ Credit Card ☐ Embezzlement ☐ Expense Account Fraud
☐ Merchandise ☐ Other ☐ Procurement
Terrorist Incident: ☐ Threat ☐ Actual
Terrorist Type: ☐ Attack ☐ Bomb ☐ Kidnapping ☐ Other ☐ Shooting
Incident Location: ☐ Facility ☐ BP Facility ☐ Hotel Room ☐ Office Building ☐ Other
☐ Residence ☐ Retail Site ☐ Secure Facility ☐ Staff Member ☐ Vehicle
Additional Property Description:
Items Taken:
$ Amount per items stolen:
Criminal Property Damage - Property Type: ☐ BP Equipment ☐ BP Property
☐ Stock/Merchandise ☐ Third Party Equipment ☐ Third Party Property
Method of Damage: ☐ Arson ☐ Collision ☐ Explosive Device ☐ Vandalism
Alcohol/Drug Incident - Drug Type: ☐ Alcohol ☐ Cocaine ☐ Heroin
☐ LSD ☐ Marijuana ☐ Mephamphetimine ☐ Other
Drug Activity: ☐ Other ☐ Possesion ☐ Sale ☐ Use

Persons Involved - Section 12 Continued (Fill out an additional form for each person involved)

Persons Involved Type: ☐ BP Employee ☐ Contractor ☐ Customer ☐ Third Party ☐ Vendor
Name:
Title:
Address:
Contact Number: Employment Status: ☐ Regular ☐ Part-time
Sex: ☐ Male ☐ Female Age: Height (with units): Weight (with units):
Race: ☐ American/Alaskan Indian Descent ☐ Asian Descent ☐ Black or African Descent
☐ Other Descent ☐ European Descent (White Caucasion) ☐ Hispanic Latino Descent ☐ Middle Eastern Descent
Unusual Features:

Investigation Team Members:

Send by E-mail to the MIA distribution list. Add other addressees as necessary to meet BU or Regional requirements e.g. local Management Team, Joint Venture partner

Business Unit:		**Issued by:**	
Country:		**Location of incident:**	
Date of incident:		**Time of incident:**	

Brief account of incident (Report as fact only what you are clear is fact. Specify the status of anything else which you report, e.g., a belief or an estimate):

People:	**No. of injuries**	**No. of fatalities**	**Description / details**
Employee			
Contractor			
Third party			

Business impact/damage/loss:

External agencies involved:

News media coverage:

What assistance has been requested:

BP person in charge of response/ investigation		**Business Unit Leader**	
Office telephone:		Office telephone:	
Mobile telephone:		Mobile telephone:	
Home telephone:		Home telephone:	

Issued at: << time, date >>

BP High Potential Incident Announcement URGENT

Business Unit: _____ **Contact:** _____

Country: _____ **Location of Incident:** _____

Date of Incident: _____ **Time of Incident:** _____

Brief Account of Incident:

_____

_____

_____

Potential Outcome:

_____

_____

_____

Likely Cause:

_____

_____

_____

Action Taken:

_____

_____

_____

BP person in charge of Response/Investigation:

_____

_____

_____

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

Washington, DC
1995 (Reprinted)
OSHA 2203

Robert B. Reich, Secretary of Labor

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

Accident Report Form

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, not 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

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 that 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 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 that describes the fieldwork 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 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
- Safe 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
- Road Safety Risk Assessment and Recommendations.
- BP's Golden Rules of Safety.
- 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

SITE SPECIFIC INFORMATION

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 Contract Physician:	HealthWorks (716) 874-7474

Medical Emergency

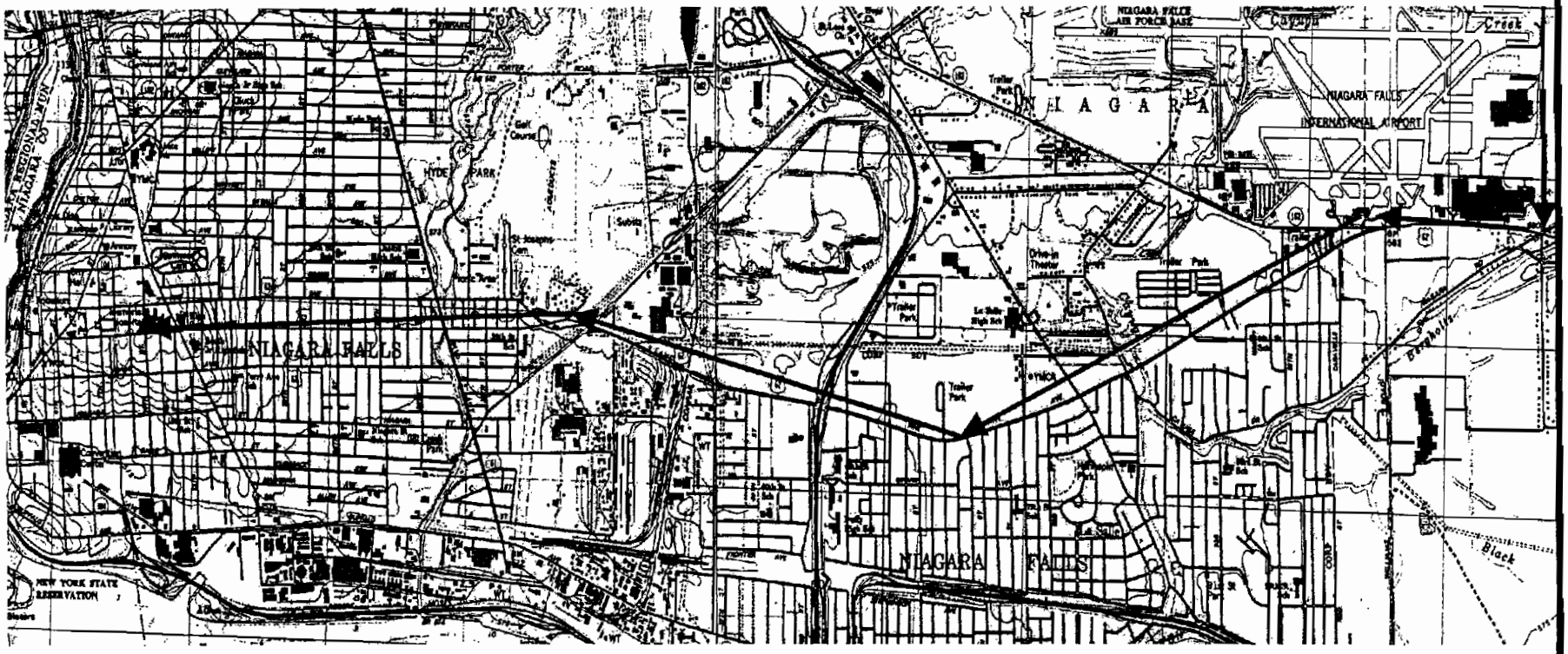
Hospital Name:	Niagara Falls Memorial Medical Center
Hospital Phone Number:	(716) 278-4394
Hospital Address:	621 10th Street
Map to Hospital:	SEE NEXT PAGE
Travel Time From Site:	20 Minutes
Route to Hospital:	1. Walmore Rd. to Nia. Falls Blvd. 2. Turn right(west) 3. Proceed to Walnut Ave. Turn Right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

Parsons Contacts

Project Manager: George Hermance	(716) 633-7074 ext. 244
Health and Safety Officer: William Bradford	(315) 451-9560
Technical Director: William Hughes	(216) 486-9005

Group Environmental Management Company Contacts

William B. Barber - Project Manager	(216) 271-8038 office (888) 605-1491 pager (330) 296-8498 home
Richard M. Frankowski	(216) 271-8035 office



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

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 site is located at 6600 Walmore Road, Niagara Falls, (Wheatfield), Niagara County, New York. The site is south of the Ekonol building, in an open, paved area.

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.

PHASE III INVESTIGATION

This investigation effort includes onsite and offsite reconnaissance, groundwater screening from temporary bedrock borings, and installation of bedrock monitoring wells. Prior to constructing the well in each cored borehole, packer testing and discrete-zone water quality sampling will be completed. At the completion of packer testing, the bedrock monitoring wells will be installed. After well installation, groundwater samples will be collected and analyzed. The monitoring wells and offsite property boundaries will also be surveyed. This investigation scope of work also includes a qualitative risk assessment, and an assessment of the potential for ecological impacts. The Phase III investigation will be completed using the following tasks.

Task 1 – Site Reconnaissance

Site reconnaissance will include a review of Town of Wheatfield tax maps, zoning maps, and other records to determine property owner and contact information, zoning ordinance information, and the current use of the properties within one-half mile of the site. The site reconnaissance will be completed for property within one-half mile of the site. A public notification mailing list will be developed with the information obtained.

During site reconnaissance, a search (within one-half mile) will be conducted for surface features that have the potential to pose a threat to ecological receptors. The search will look for surface water bodies (creeks, streams, ponds), and wetlands. If found, an evaluation of the potential impacts to threatened or endangered species, exceptional value wetlands, habitats of concern, and species of concern will be made (see Task 5 – Qualitative Risk Assessment).

Onsite Reconnaissance

The onsite reconnaissance will include an inspection of interior of building #4. The inspection will focus on identification of potential discharge locations including, sumps,

sewers, floor drains, pits, dry wells, sludge, or any other features that have or potentially have provided a pathway for release to the environment outside of building #4. If necessary during this inspection, sampling of the sumps, sewers, floor drains, pits, dry wells, sludge, or any other features may be performed. Any samples collected will be analyzed by EPA Method 8260 for the target volatile organic compounds (VOCs) (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target semi-volatile organic compounds (SVOCs) include phenol and aniline and will be analyzed using EPA Method 8270.

Offsite Reconnaissance

The offsite reconnaissance will focus on the identification of both residential and non-residential property owners within one-half mile of the subject property. The address of the contact or owner of the property will be determined from Town of Wheatfield records. The current use of the properties within one-half mile of the subject property will be identified. Information will be obtained from the Town of Wheatfield tax maps. Offsite reconnaissance will include the identification of buildings with basements.

Task 2 – Bedrock Investigation

To define the extent of impacts to groundwater in bedrock, four additional bedrock monitoring wells are proposed. To determine the horizontal extent of groundwater impacts and appropriate locations for the bedrock monitoring wells, temporary borings will be installed. The temporary borings will enable collection of bedrock groundwater samples for screening purposes.

Groundwater Screening

Locations for bedrock groundwater screening holes will be selected based on previous onsite results and the expected groundwater flow direction. The proposed locations the four screening boreholes is as follows:

- in the right-of-way adjacent to Walmore Road east-southeast of MW-11D;
- in the right-of-way adjacent to Walmore Road east of MW-5S;
- south of the Saint-Gobain Abrasives building, west of MW-13D; and
- approximately 200 feet south of MW-13D.

Initially, temporary borings will be installed at the four proposed locations by advancing 4-inch inner diameter spin casing to the top of rock. After reaching the top of bedrock, spin casing, equipped with a diamond shoe, will be seated 6 to 12 inches into the competent bedrock. After seating the casing, a pneumatic rock drill will be used to advance the boring. Using filtered, compressed air as the drilling lubricant, the pneumatic drill will be advanced a maximum of 25 feet into competent bedrock or until a water-bearing zone is encountered, whichever occurs first. Once the total depth of the

boring is reached, the drill stem will be removed, and groundwater allowed to recharge to the boring.

Once groundwater has recharged sufficiently, a groundwater screening sample will be collected from the open borehole. The groundwater sample will be field-screened for total volatile organic halides (VOHs), using EPA Method 8535. If the screening results reveal a VOH concentration in groundwater that is greater than 50 parts per billion (ppb), alternate borehole locations will be considered. If an alternate borehole location is selected, the groundwater screening process will be repeated at the alternate location. A maximum of two alternate boring locations will be selected for each proposed monitoring well location. Unless limited by buildings, roadway, or property boundaries, alternate boring locations will be located 100 ft. from the original boring. In the event that the two alternate locations are completed and screening data is still greater than 50 ppb, the data will be evaluated to determine further options. The groundwater screening borings will be properly abandoned using bentonite holeplug and cement-bentonite grout.

Bedrock Well Installation

Once a suitable location for each bedrock monitoring well is selected using the screening method, a bedrock monitoring well will be installed at a location adjacent to the abandoned borehole. Presently, four bedrock monitoring wells are proposed.

The bedrock wells will be installed by advancing 6.25-inch hollow-stem augers (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 competent bedrock. After drilling the rock socket, a permanent four-inch casing will be placed to the bottom of the boring. The casing will be sealed in place by tremie grouting with cement-bentonite grout from the bottom up. After allowing the grout to set for a minimum of 24 hours, an HQ-sized core barrel (nominal 4-inch outside diameter) will be advanced a maximum of 25 feet into competent bedrock or until a water-bearing zone is encountered, whichever occurs first.

After each core run, typically five feet in length, packer testing will be performed on that section of the boring (total of three tests per borehole). The packer test will use water injection methods to estimate the hydraulic conductivity of that section of the corehole. Packer testing in the open boring with periodic water level monitoring in adjacent borings or wells will enable identification of higher permeability zones and connectivity of fractures between holes. Packer testing will be performed over the entire section of bedrock that was cored.

At the completion of packer testing, a 2-inch ID, stainless steel well screen and riser will be installed in the boring. The screen length will be a maximum of ten feet with 0.010-inch slots. The well will be screened over the most permeable section of the bedrock. Below the screen, a 2-foot section of casing will be installed as a sump to

collect any DNAPL, if present. The bedrock wells will be completed as described in the NYSDEC-approved Additional Phase II Site Investigation Work Plan. Well installation will be in accordance with the NYSDEC guidelines outlined in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (December 2002).

All boring and well locations will be surveyed for location and elevation, following installation. Monthly, for a period of 12 months, water levels will be collected from the overburden and bedrock monitoring wells and used with survey elevation data to determine the local direction of groundwater flow in the overburden and bedrock aquifers.

Task 3 - Groundwater Sampling and Analysis

Dissolved Phase Sampling and Testing

After the offsite bedrock monitoring wells are installed, the wells will be developed and purged following standard NYSDEC guidelines outlined in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (December 2002). Groundwater samples will be collected in accordance with the NYSDEC protocols and guidance using dedicated bailers, disposable bailers, a submersible pump, or a peristaltic pump. During development and purging, field parameters including pH, temperature, conductivity, dissolved oxygen (DO), and oxidation reduction potential (ORP) will be collected. Colorimetric field test kits may be utilized to test for nitrate, ferrous iron, and sulfate. Measurement of these field parameters will provide valuable information for plume delineation, and evaluation of intrinsic biodegradation. In addition to the offsite monitoring wells, the onsite monitoring wells installed during previous onsite Phase II field activities will be sampled.

A total of 21 groundwater samples (9 overburden, 12 bedrock) will be collected and submitted for laboratory analysis in accordance with the NYSDEC-approved Phase II Site Characterization Work Plans. Groundwater samples will be analyzed by EPA Method 8260 for the target volatile organic compounds (VOCs) (TCE, 1,2-DCE, 1,1-DCA, and 1,1,1-TCA). Target semi-volatile organic compounds (SVOCs) include phenol and aniline and will be analyzed using EPA Method 8270. For the offsite investigation analysis for zinc and lead will not be performed. 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).

Separate-Phase Liquid Monitoring and Testing

During well development and purging, the water will be checked for the presence of dense non-aqueous phase liquids (DNAPL) using visual observation and a hydrophobic dye. If DNAPL is observed in any of the new offsite monitoring wells (three onsite wells contain separate-phase liquid), the DNAPL will be sampled and submitted for physical

and chemical analysis. Physical properties to be determined for the separate-phase liquid include surface tension, density and viscosity. Chemical analysis will include testing for the full suite of VOCs and SVOCs by EPA Method 8260 and 8270. Physical and chemical testing of the DNAPL will be useful in determining the potential mobility of the DNAPL.

All field activities will be conducted in accordance with the project Quality Assurance Project Plan (Appendix A) and site-specific Health and Safety Plan (Appendix B). All 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 may be used to stage liquid IDW (development water, purge water, and decontamination liquids).

Task 4 – Waste Handling

Disposal of the IDW created during the installation of the monitoring wells will be required. The IDW will be evaluated as hazardous or non-hazardous, and will be disposed of in accordance with the appropriate regulations. The scope of work for this waste disposal event includes composite sampling to characterize the wastes for disposal and proper disposal of waste. Waste streams will include drill cuttings, groundwater, decontamination water, and personal protective equipment.

Task 5 - Qualitative Risk Assessment

A qualitative risk assessment (exposure assessment) will be completed using available onsite and offsite soil and groundwater data. The qualitative risk assessment will use an exposure scenario assessment to define complete and potentially complete pathways to receptors. The scenario assessment is one part of the NYSDEC Exposure Assessment Procedure which is used to better quantify any impact of residual contamination. Potential human receptors will be identified based on information provided by the site characterization activities. Onsite and offsite receptors to be evaluated include, as appropriate, commercial workers, construction workers, resident children, and resident adults. The exposure assessment will be completed as described in the August 1998 NYSDEC Exposure Assessment Procedure.

As part of the qualitative risk assessment, an assessment of ecological risk will be performed. This component of the qualitative risk assessment will evaluate whether the surface features identified during site reconnaissance, have the potential to pose substantial ecological impacts. The evaluation will discuss the potential impacts to threatened or endangered species, exceptional value wetlands, habitats of concern, and species of concern. If the results of the ecological assessment show potential ecological impacts, additional ecological assessment will be evaluated.

Task 6 - Report Preparation

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. Analytical data received from the laboratory will be reviewed to identify any potential deviations from specified protocols. The compliance review will consist of an assessment of whether or not holding times were met and a review of laboratory Quality Control (QC) blank results in accordance with United States Environmental Protection Agency (USEPA) Region II Standard Operating Procedures (SOPs) for Organic and Inorganic Data Review. The data evaluation will be completed in accordance with NYSDEC Data Usability Summary Report (DUSR) guidelines. The DUSR is discussed in the Quality Assurance Project Plan (see Appendix A). Following the data quality review, the data will be reduced, tabulated, evaluated and incorporated into the site investigation report.

After the QA/QC data review is complete, the investigation report will be prepared. The report will document all field investigation activities, including screening borings, screening sampling, well installation, and groundwater sampling. The report will summarize the data collected during the investigation and present the results of the qualitative risk assessment. Water level contour maps for overburden and bedrock wells, showing groundwater flow direction, will be presented in the report.

PROJECT TEAM ORGANIZATION

The key Parsons personnel involved with Phase III activities include the Project Manager, Mr. George Hermance, and the Project Health and Safety Officer, Mr. William Bradford. Mr. Andrew Janik will perform field activity oversight and function as the Field Team Leader and Site Health and Safety Officer. Group Environmetal Management Company personnel include the Project Manager, Mr. William B. Barber and Mr. Richard Frankowski.

CHEMICAL HAZARDS

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

PHYSICAL HAZARDS

Site vehicle traffic and well drilling activity will be taken into consideration while performing field activities. Work areas will be sufficiently barricaded during all work activities and during the off work hours.

EXPLOSION HAZARDS

Explosion hazards are not expected at the site. If an explosion should occur, the steps outlined in Section 6.2.1 will be followed.

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.

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 C 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 in Level D, polyethylene coated-tyvek will be warn to protect from to protect from splash hazards.

TABLE C-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 s 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 dama 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 skir Causes headaches, exhaustion, CNS depression, poor equilibrium, dermatitis, liver damage, cardiac arrhythmia, hallucinations or distorte perceptions, motor activity changes, aggression, diarrhea, and nausea or vomiting. Mutagen, experimental teratogen, and questionable carcinogen.

TABLE C-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 a 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.

APPENDIX D

AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

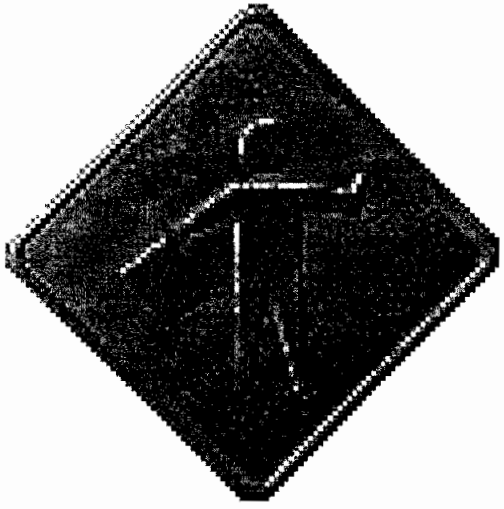
AIR MONITORING EQUIPMENT CALIBRATION AND MAINTENANCE

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) or Flame Ionization Detector (FID) 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 E

TRAFFIC SAFETY GUIDE

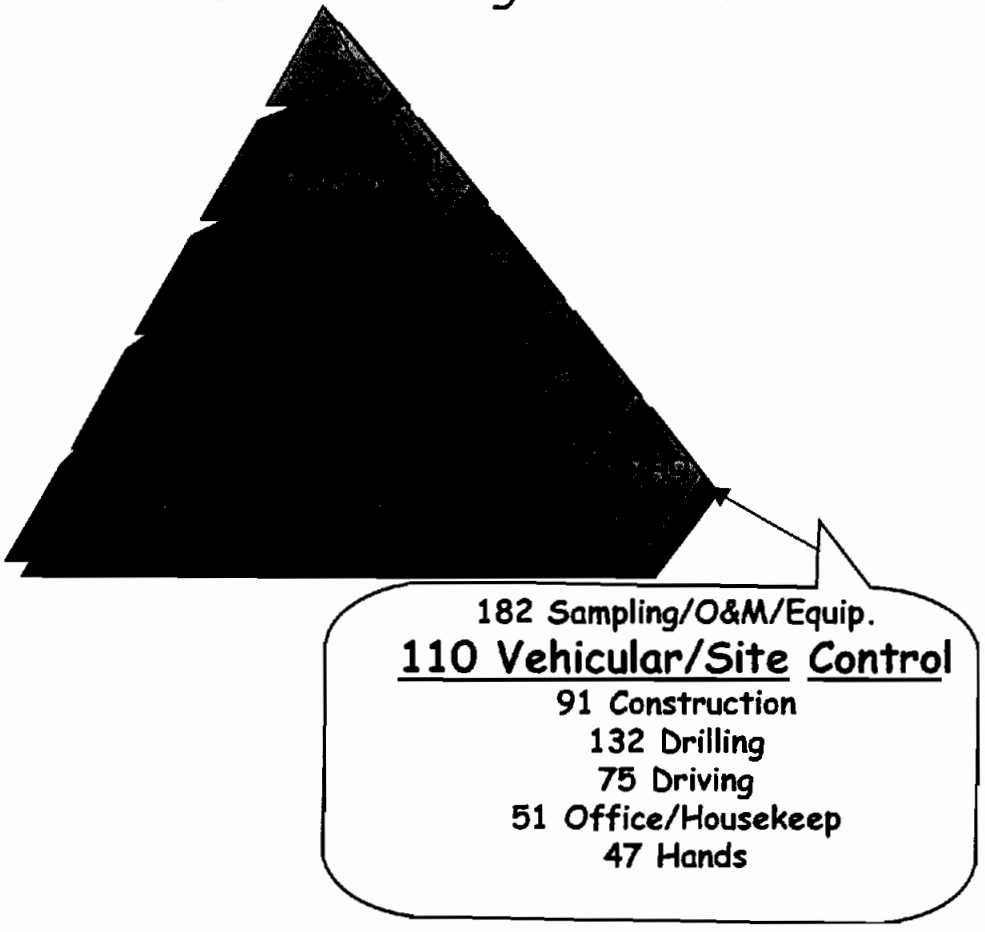
Why the "Drive" for Traffic Safety Awareness?



- The objective of the "guidance" is to remind all employees working on BP retail sites of this potential workplace hazard and to understand the various levels of protection that are available for personal workspace protection. It is our collective responsibility to select and apply the right level of protection....much like OSHA levels A, B, C, D.

Why the "Drive" for Traffic Safety Awareness (Cont.)?

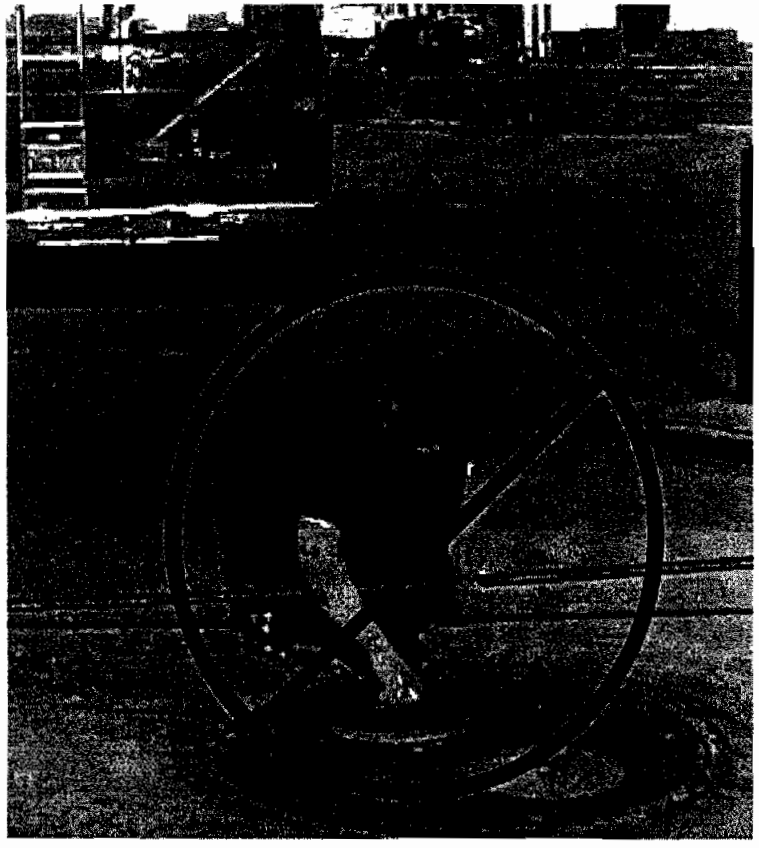
2002 GEM Marketing HSE Performance



- Over 110 near misses were workspace protection or site control related.
- Or roughly 10% of the total categorized near misses or incidents.
- In the past BP suppliers have had OSHA incidents associated with workspace protection.
- There is always opportunity to improve performance in this area.

Job Site Traffic Protection Guide

- The following proposed practices will help develop a traffic control plan and protect YOU from vehicles that may enter the work area.



NOT ACCEPTABLE

Job Site Traffic Protection Levels

- BP and their consultants have developed a system to help guide on-site traffic; evaluate job hazards and choose the level of protection.
- The levels of protection should be used as a guide for onsite personnel based on the field conditions at the time of use. It may be necessary to upgrade or downgrade the levels of protection throughout any given day.
- Coordination (in advance and during field work) by the consultant with the Site Manager/owner may be required and documented in the Site specific Health & Safety Plan. Basic Work Team discussions may also be needed.
- Levels of Traffic Protection are described in categories 1, 2, 3 and 4.

Job Site Traffic Awareness PPE

- Level D.
- Visibility part of "D":
  - Hard Hat.
  - High visibility traffic vest (or garment) on outermost garment (neon green or orange).
- Review of BP GEMM Site Safety Guidance.

Job Site Traffic Control Device Options

- Traffic Cones in combination with warning flags (total height = min. 42").
- 42" Traffic Delineators, Cones or Posts.
- Molded Plastic Barricades.
- Field Vehicle to block traffic.
- Flashing yellow lights.
- Buddy System and or "Watchperson".
- Plastic "Safety Fence" (min 48").
- Caution Tape.
- Barrels with caution tape and or Plastic orange barrels.
- DOT required devices.

Level of Protection Selection

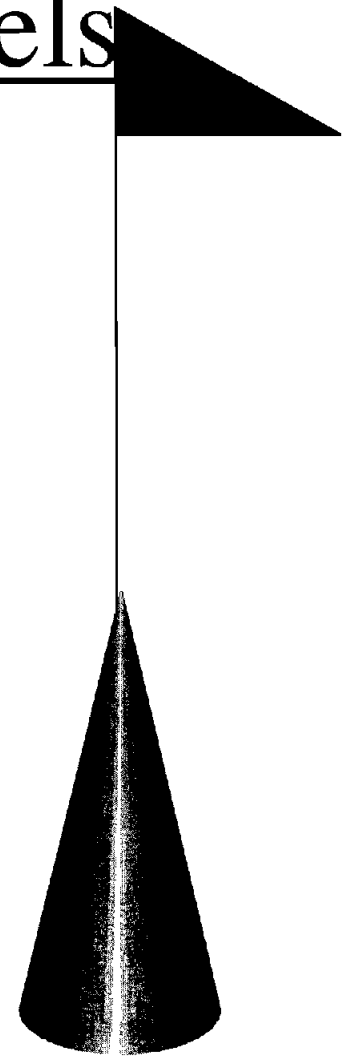
	Level 1	Level 2	Level 3	Level 4
Traffic Volume or Activity	none-low	moderate	high	high
Duration of Activity	short	short	extended	extended
3rd Party Concerns	low	medium	high	high
Size of Work Area	small	medium	large	large
Use of Heavy Equipment	no	no	yes	yes
DOT Requirements	no	no	no	yes

NOTE: The Level of Protection selection should be based on a site specific traffic evaluation.

Job Site Traffic Protection Guide

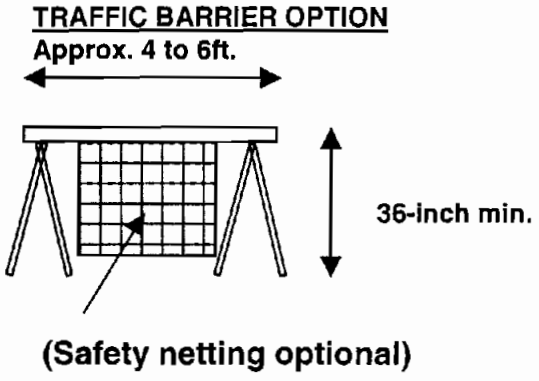
Examples of the Four Levels

- Level 1.
  - High visibility traffic cones with flags and/or delineators (total height 42-inch min.) , use of field vehicle to block potential traffic flow:
  - Useful in No or Low flow traffic areas and for temporary protection of small tripping hazards.

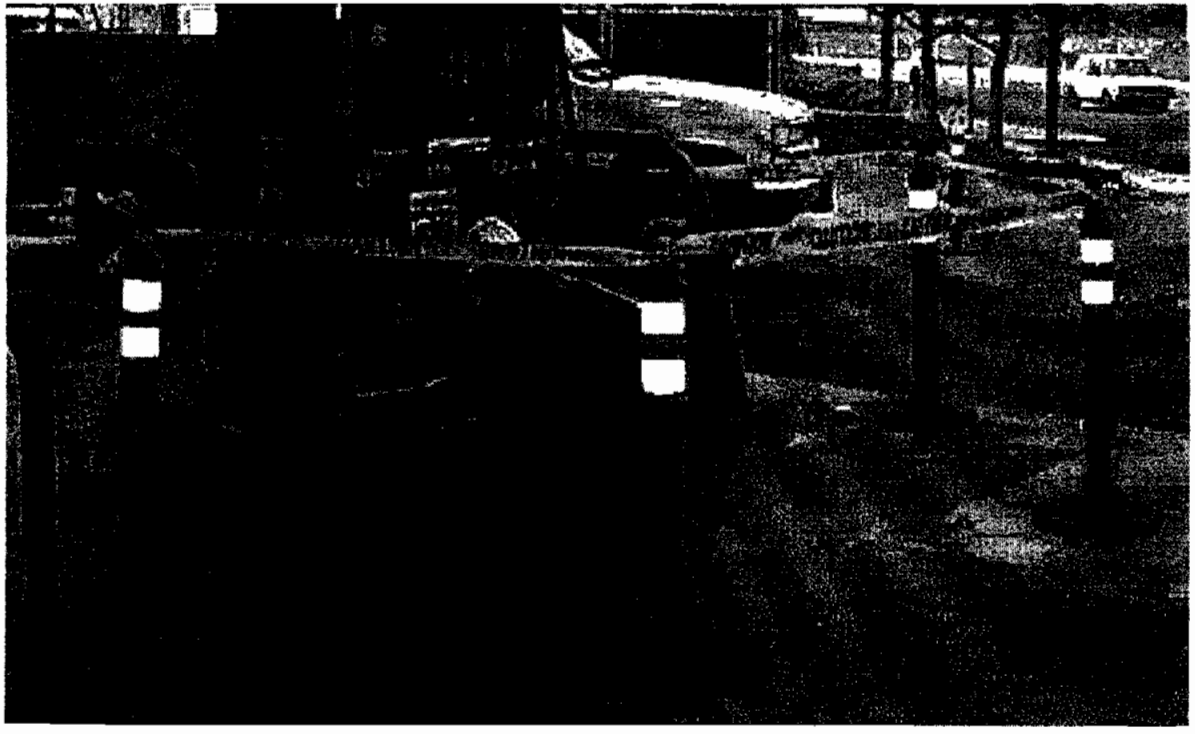


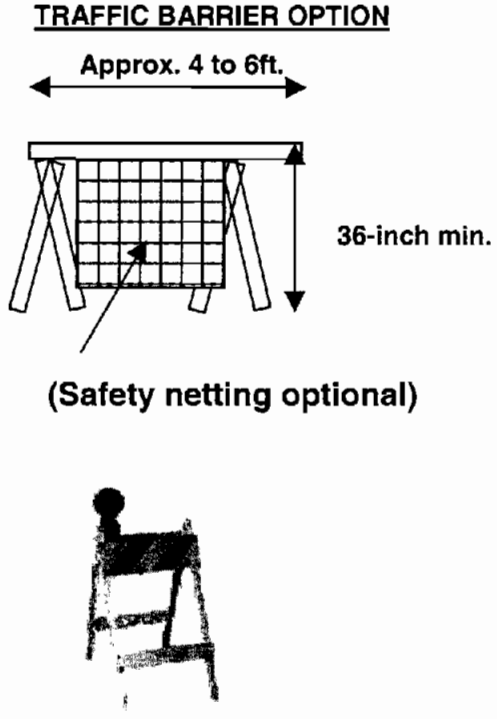
Job Site Traffic Protection Guide

- Level 2.
  - Barrier Tape on Posts (42" delineators) and the use of field vehicles (with flashing yellow light) and\or other lane control devices. A-frame (plastic molded) blockades may also be used in conjunction with level 2.
  - Low to Moderate flow traffic conditions.
  - Temporarily securing of an area (for gauging/sampling ground water, hand digging, etc.). Temporary isolation of an area for storing or moving equipment/supplies.



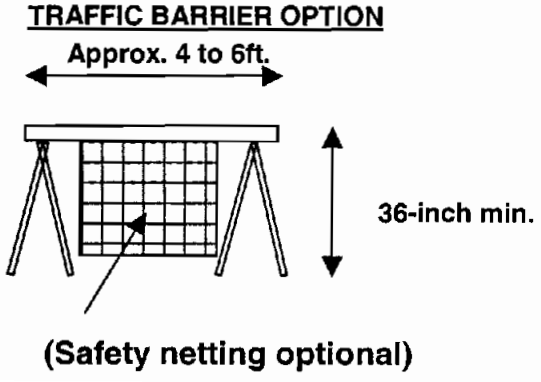
Level 2 Job Site Traffic Protection





Job Site Protection Guide

- Level 3.
  - Plastic Security Fencing and or traffic blockades. A flashing yellow light on the vehicle may be used for additional visibility.
  - Use of heavy equipment, power tools, areas near electrically energized or rotating equipment, protection for workers or public near slow moving traffic or with high traffic volume, tripping hazards, and may control foot traffic.



Level 3 Job Site Traffic Protection

Level 3 Job Site Traffic Protection

– Traffic blockades on worker side and on the street side (not shown) with high visibility cones with caution tape on low-flow side. A flashing yellow light on the front of the vehicle (not shown) for additional visibility.

–Vacuum truck on an Enhanced Fluid Recovery event.

Job Site Traffic Protection Guide

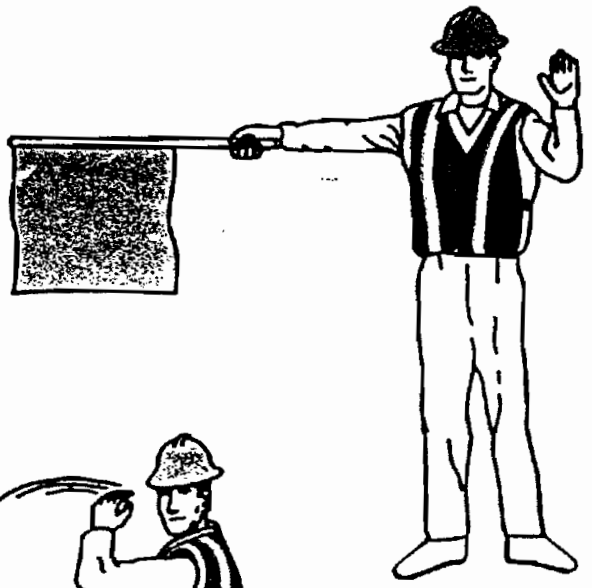
- Level 4.
  - DOT required signage and protection devices (these devices should be reviewed to assure worker protection);
  - On any public street or Right-of-Way.
- All Levels 1, 2, 3 and 4.
  - The use of a Buddy System and or "Watchperson"can be used in conjunction with any of the above Levels to add protection and help prevent the disruption of normal business. Basic Work Team discussion is advised.

Job Site Traffic Precaution Measure/Control Considerations

(various measures to be considered for safe coexistence of traffic & employees)

- Place wells in safe locations;
- Traffic Control Plan (site specific);
- Consult with Site Manager\Owner and discuss the traffic evaluation;
- Be alert, scan for safety, listen for cars;
- Upright position, facing traffic when possible;
- Trust no one, even if they see you;
- Work during non-peak hours;
- Minimize work time in traffic;
- Use "Buddy or Watchperson System";
- Use traffic control devices;
- Park field vehicle to block traffic with flashing yellow light.
- Use of 5' flags inside cones;
- Use Plastic Safety Fencing;
- Use floodlights in darkness;
- Obtain police assistance in traffic;
- Wear high visibility PPE.

MAINTENANCE AND CONSTRUCTION FLAGGER SIGNALS

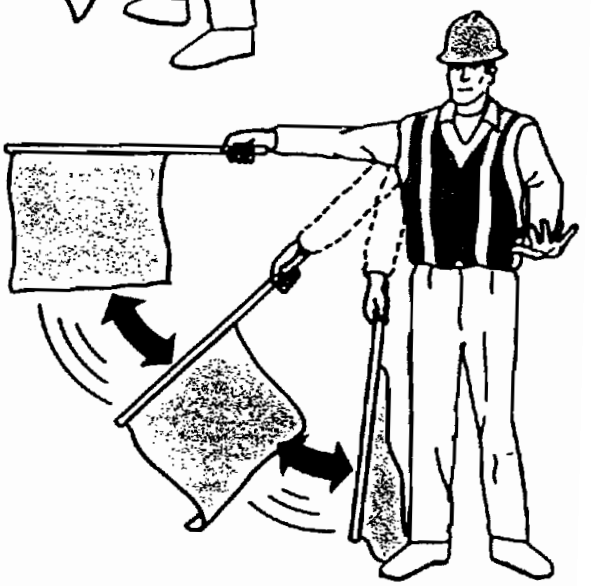


TO STOP TRAFFIC

To stop traffic, the flagger shall face traffic and extend the flag horizontally across the traffic lane in a stationary position so that the flag is visible hanging below the staff. For greater emphasis, the free arm may be raised with the palm toward approaching traffic.

TRAFFIC PROCEED

When it is safe for traffic to proceed, the flagger shall stand parallel to the traffic movement and, with flag lowered from view, motion traffic ahead with his free arm. The flag shall not be used to signal traffic to proceed.



TO ALERT AND SLOW TRAFFIC

To alert or slow traffic, the flagger shall face traffic and wave the flag slowly in a sweeping motion of the arm, without raising the arm above a horizontal position. For added emphasis, the free hand may be slowly raised and lowered, with palm down.

Each flagger shall use a 24" x 24" red flag securely fastened to a staff 3' long. Each flagger shall wear an orange safety vest and hard hat. The vest should be reflectorized if used at night and shall be worn outside all other clothing. Wands and flares are available for night time operations.

FLAGGERS

APPLICATION. Consideration should always be given to the need for flaggers to control traffic on a maintenance or construction project where traffic is permitted to travel through or adjacent to the work area. However, the decision to use or not to use a flagger in a particular situation rests with the person in charge of the operation.

Channelization is preferred to flagging operations when two-way traffic can be maintained.

(1) **Flags.** Flags used for signaling purposes shall be red in color, be a minimum of 24 x 24 inches in size and fastened to a staff approximately 3 feet in length.

(2) **Vests.** The use of an orange vest shall be required for flaggers. For nighttime conditions it shall be reflectorized.

FLAGGER STATIONS.

(1) Flagger stations should be located far enough from the work site so that vehicles will have sufficient distance to slow down before entering the project but not so far that vehicles will tend to speed up into the work site.

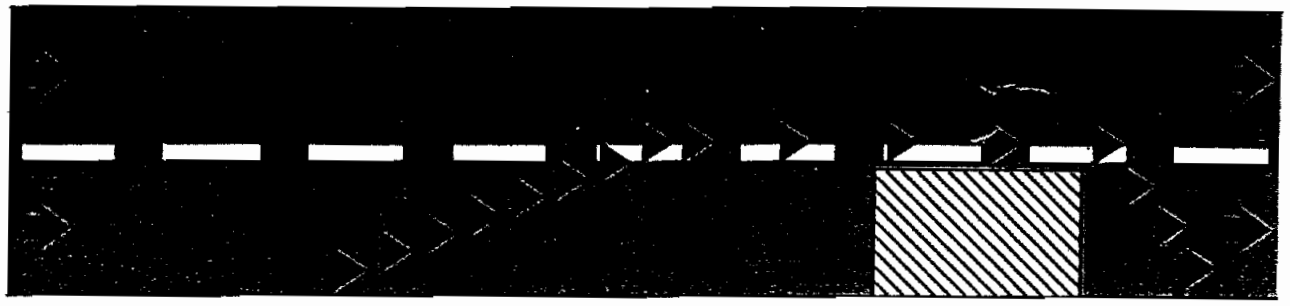
(2) Normally the flagger will be positioned adjacent to the traffic lanes being controlled either on the shoulder or in the barricaded lane. At a "spot" obstruction the flagger should stand on the shoulder opposite the barricaded section.

(3) The flagger should stand alone, never permitting a group of workers to congregate around him or her. The flagger should be stationed sufficiently in advance of the work area to warn workers of approaching danger, such as out-of-control vehicles.

(4) A flagger warning sign shall be used facing each direction of traffic. These advance warning signs are optional for very brief periods of traffic control.

ONE LANE CONTROL. Where traffic in both directions must, for a limited distance, use a single lane, provision should be made for alternate one-way movement to pass traffic, through the constricted section. However, where the one-lane section is of any significant length, there should be some means of coordinating movements (for example, walkie-talkies, hand signals, etc.) at each end so that vehicles are not simultaneously moving in opposite directions in the section and so that delays are not excessive at either end. Control points at each end of the route should be chosen so as to permit easy passing of opposing lines of vehicles.

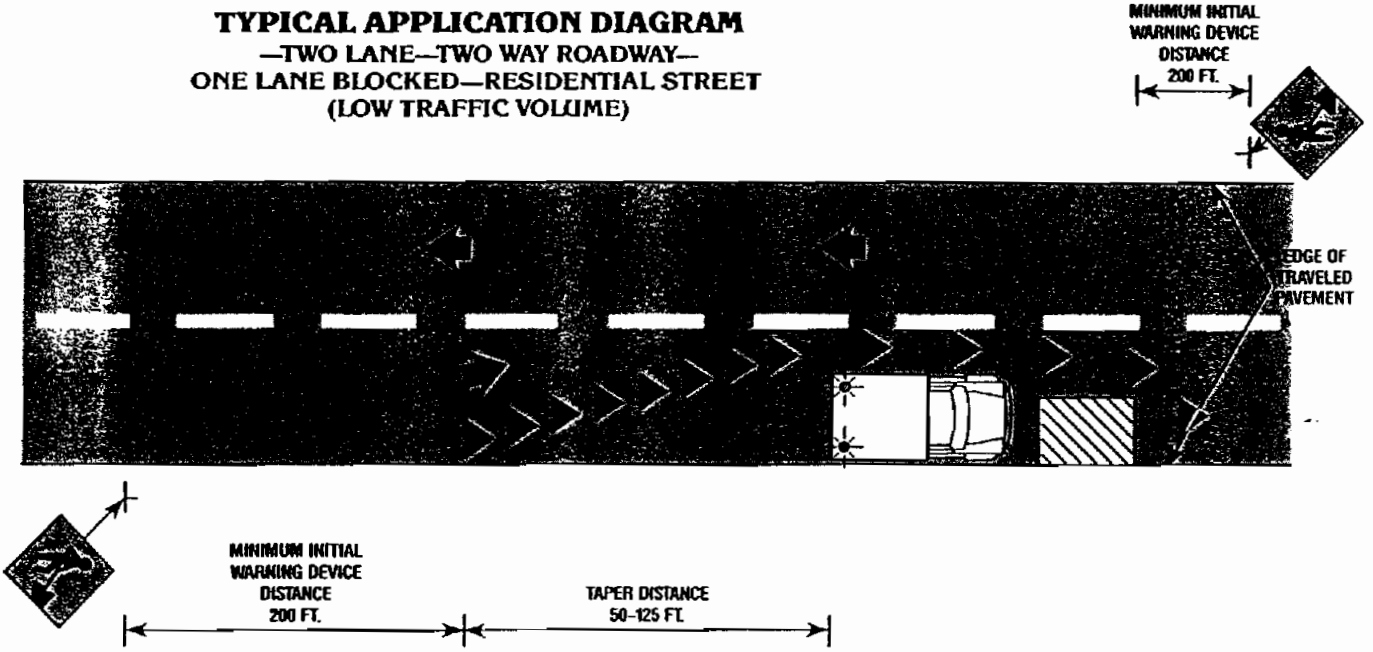
AREAS IN TRAFFIC ZONE



ADVANCE WARNING AREA	TRANSITION AREA	BUFFER SPACE	WORK AREA	TERMINATION AREA
tells traffic what to expect ahead.	(taper length) moves traffic out of its normal path.	provides protection for traffic and workers.		lets traffic resume normal driving.

LEGEND:
Work area
Channeling device
Barricade
Flagger
Warning sign
Flashing vehicle light
Flashing light

TYPICAL APPLICATION DIAGRAM
—TWO LANE—TWO WAY ROADWAY— ONE LANE BLOCKED—RESIDENTIAL STREET (LOW TRAFFIC VOLUME)



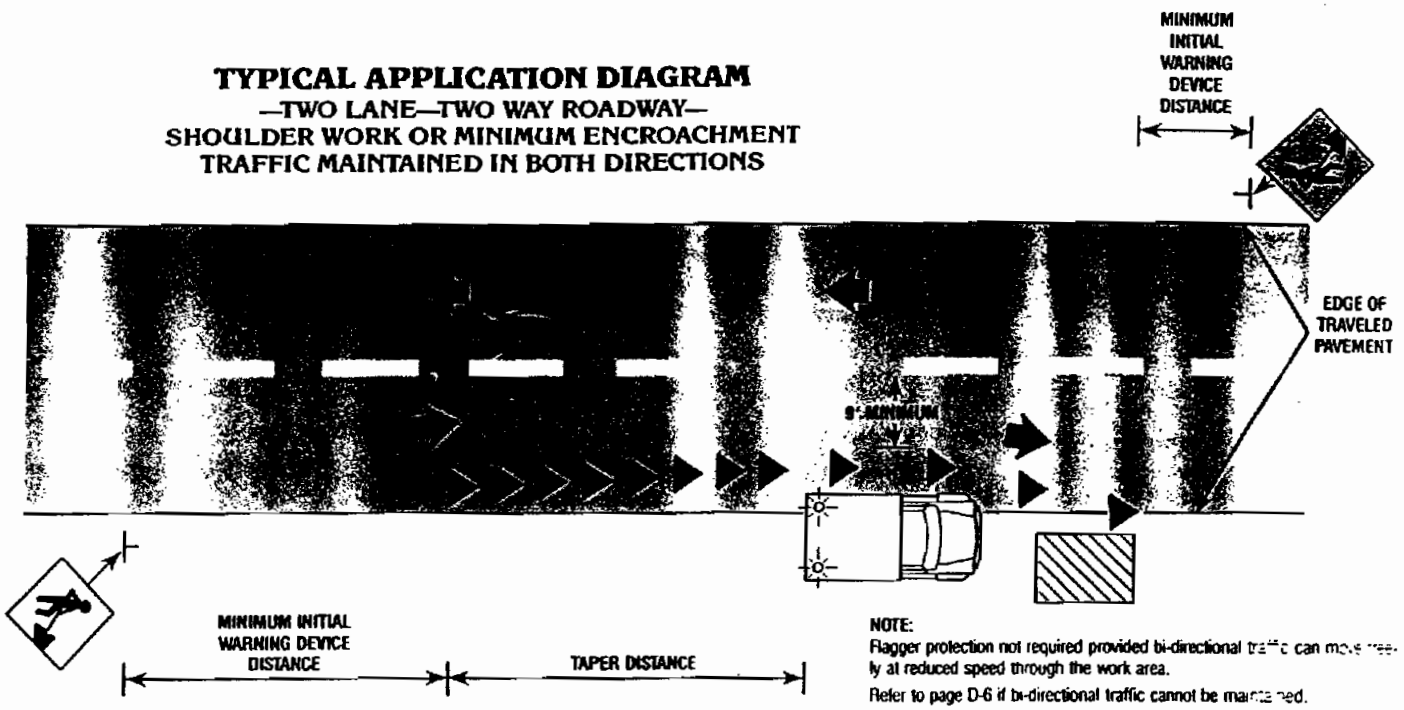
NOTE 1: Limited to urban streets with speed limit of 30 MPH or less.

NOTE 2: Where a flagger is required because of traffic volume or visibility, refer to Page D-6 for set up.

Example diagram presents general requirements for a typical field situation.

LEGEND:
Work area
Channeling device
Barricade
Flagger
Warning sign
Flashing vehicle light
Flashing light

TYPICAL APPLICATION DIAGRAM
—TWO LANE—TWO WAY ROADWAY—
SHOULDER WORK OR MINIMUM ENCROACHMENT
TRAFFIC MAINTAINED IN BOTH DIRECTIONS



NOTE:
Flagger protection not required provided bi-directional traffic can move freely at reduced speed through the work area.

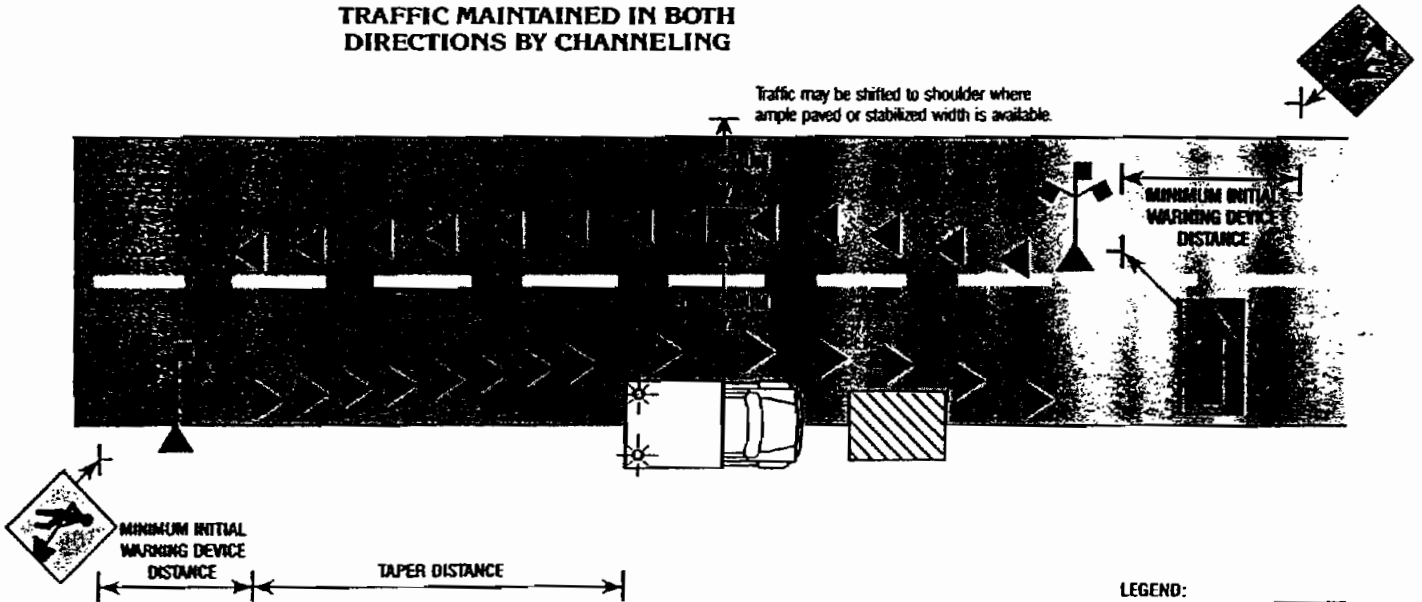
Refer to page D-6 if bi-directional traffic cannot be maintained.

SPEED LIMIT	MIN. INITIAL WARNING DEVICE DISTANCE	TAPER DISTANCE
0 – 35	150′ – 300′	125′
over 35	300′ – 750′	Width of encroachment into traffic lane X speed limit.

Example diagram presents general requirements for a typical field situation. See Table 2 (page 8) for taper channelizing device requirement details.

LEGEND:
Work area
Channeling device
Barricade
Flagger
Warning sign
Flashing vehicle light
Flashing light

TYPICAL APPLICATION DIAGRAM
—TWO LANE—TWO WAY ROADWAY—
TRAFFIC MAINTAINED IN BOTH DIRECTIONS BY CHANNELING

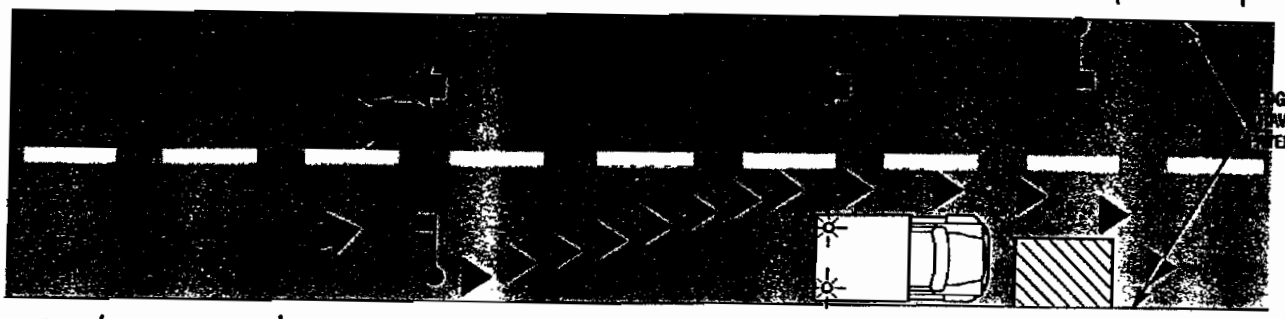


SPEED LIMIT	MIN. INITIAL WARNING DEVICE DISTANCE	TAPER DISTANCE
0 – 35	150′ – 300′	125′
over 35	300′ – 750′	Width of encroachment into traffic lane X speed limit.

Example diagram presents general requirements for a typical field situation. See Table 2 (page 8) for taper channelizing device requirement details.

LEGEND:
Work area
Channeling device
Barricade
Flagger
Warning sign
Flashing vehicle light
Flashing light

TYPICAL APPLICATION DIAGRAM
—TWO LANE—TWO WAY ROADWAY—
ONE LANE BLOCKED—FLAGGER REQUIRED



For a small work area one flagging station may be adequate. It should be located on the shoulder opposite the work area.

MINIMUM INITIAL WARNING DEVICE DISTANCE — TAPER DISTANCE

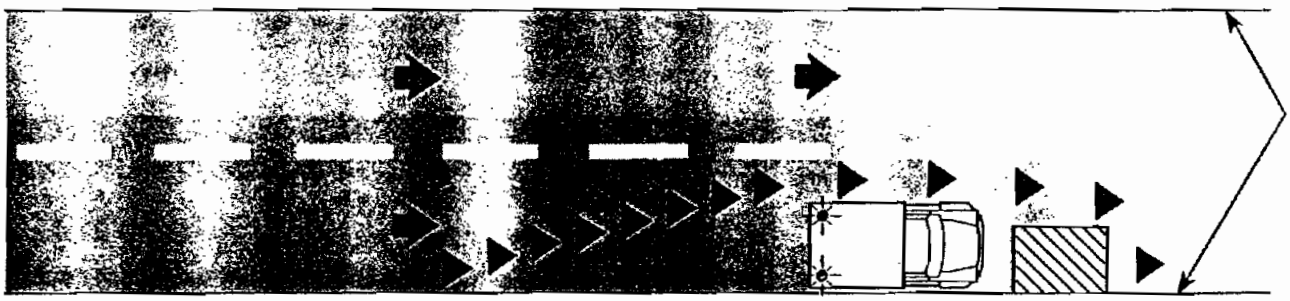
SPEED LIMIT	*MIN. INITIAL WARNING DEVICE DISTANCE	TAPER DISTANCE
0 - 35	150' - 600'	125'
over 35	600' - 2500'	See table 2 (page 8)

*Place flagger warning device mid-way between advance warning device and beginning of taper.

Example diagram presents general requirements for a typical field situation. See Table 2 (page 8) for taper channelizing device requirement details.

LEGEND:
- Work area
- Channeling device
- Barricade
- Flagger
- Warning sign
- Flashing vehicle light
- Flashing light

TYPICAL APPLICATION DIAGRAM
—TWO LANE—ONE WAY ROADWAY—
ONE LANE BLOCKED



Place supplemental warning device mid-way between initial warning device and beginning of taper.

MINIMUM INITIAL WARNING DEVICE DISTANCE — TAPER DISTANCE

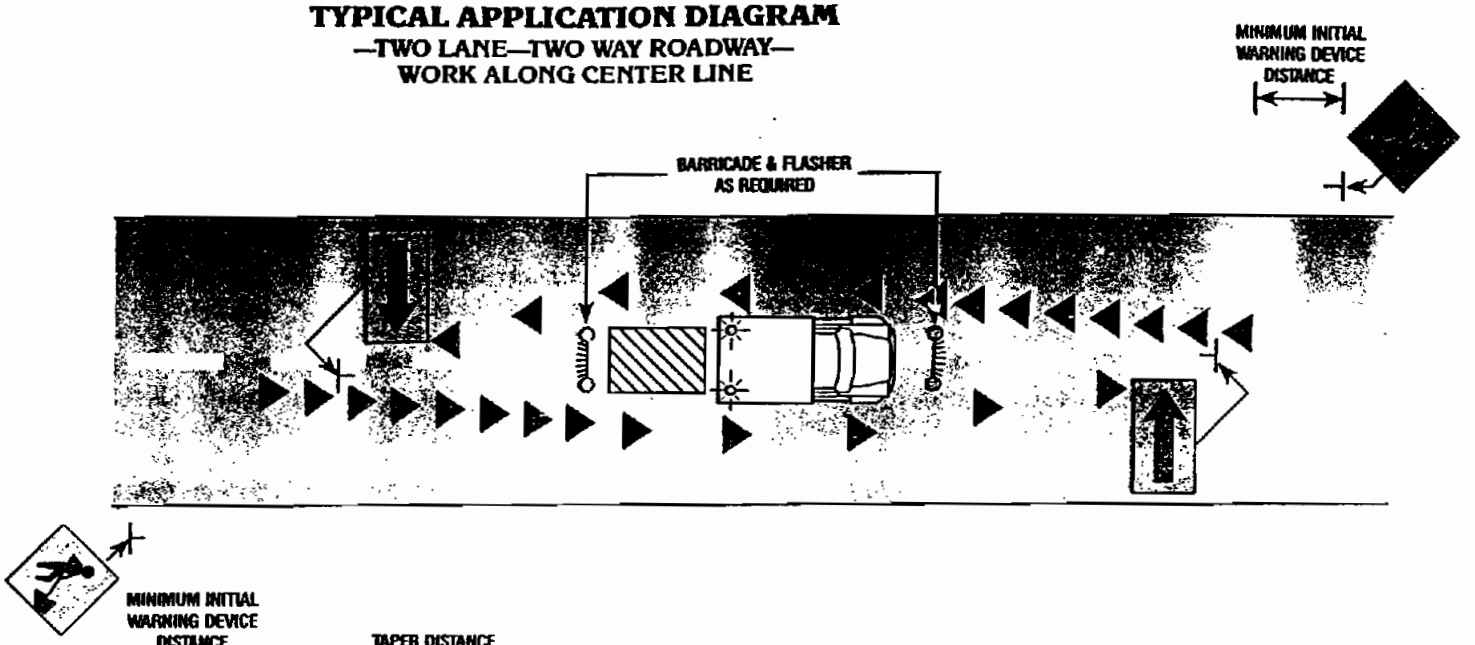
SPEED LIMIT	*MIN. INITIAL WARNING DEVICE DISTANCE	TAPER DISTANCE
0 - 35	150' - 600'	125'
over 35	600' - 2500'	See table 2 (page 8)

*MUTCD requires an advance warning distance of 1500 feet to 5000 feet on freeways or expressways.

Example diagram presents general requirements for a typical field situation. See Table 2 (page 8) for taper channelizing device requirement details.

LEGEND:
- Work area
- Channeling device
- Barricade
- Flagger
- Warning sign
- Flashing vehicle light
- Flashing light

TYPICAL APPLICATION DIAGRAM
—TWO LANE—TWO WAY ROADWAY—
WORK ALONG CENTER LINE

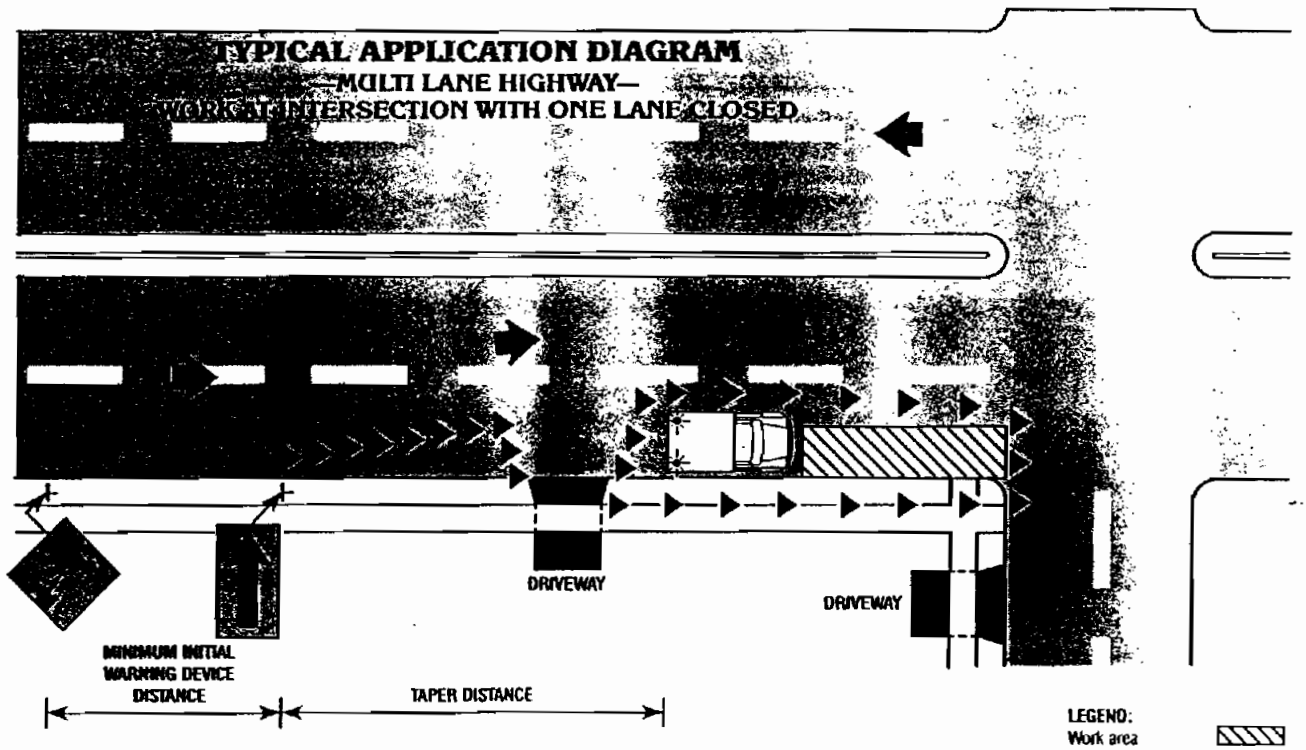


SPEED LIMIT	MIN. INITIAL WARNING DEVICE DISTANCE	TAPER DISTANCE
0 – 35	150′ – 600′	125′
over 35	600′ – 2500′	See table 2 (page 8)

Example diagram presents general requirements for a typical field situation. See Table 2 (page 8) for taper channelizing device requirement details.

LEGEND:
- Work area
- Channeling device
- Barricade
- Flagger
- Warning sign
- Flashing vehicle light
- Flashing light

TYPICAL APPLICATION DIAGRAM
—MULTI LANE HIGHWAY—
WORK AT INTERSECTION WITH ONE LANE CLOSED

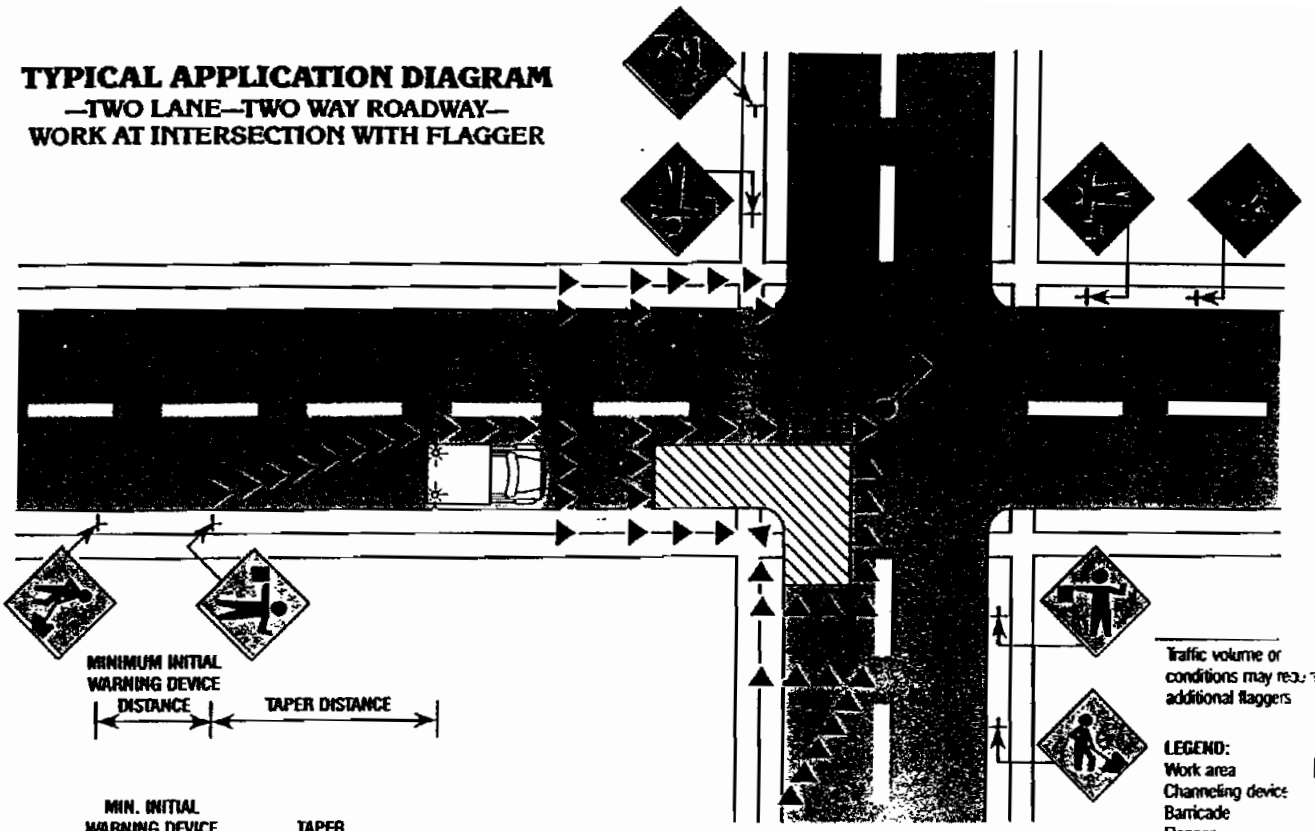


SPEED LIMIT	MIN. INITIAL WARNING DEVICE DISTANCE	TAPER DISTANCE
0 – 35	150′ – 600′	125′
over 35	600′ – 2500′	See table 2 (page 8)

Example diagram presents general requirements for a typical field situation. See Table 2 (page 8) for taper channelizing device requirement details.

LEGEND:
- Work area
- Channeling device
- Barricade
- Flagger
- Warning sign
- Flashing vehicle light
- Flashing light

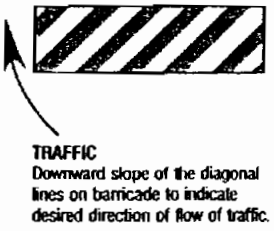
TYPICAL APPLICATION DIAGRAM
—TWO LANE—TWO WAY ROADWAY— WORK AT INTERSECTION WITH FLAGGER



SPEED LIMIT	MIN. INITIAL WARNING DEVICE DISTANCE	TAPER DISTANCE
0 - 35	150' - 600'	125'
over 35	600' - 2500'	See table 2 (page 8)

Example diagram presents general requirements for a typical field situation. See Table 2 (page 8) for taper channelizing device requirement details.

TYPICAL APPLICATION DIAGRAM
—OPEN CUTS—LONG DURATION— STATIONARY WORK



In addition to standard work area protection:

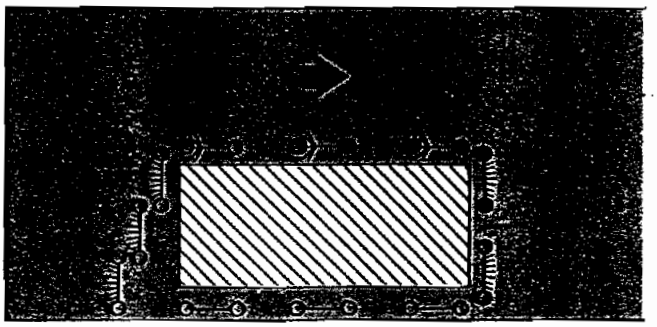
Barricades with flashing yellow lights should be used at spot obstructions.

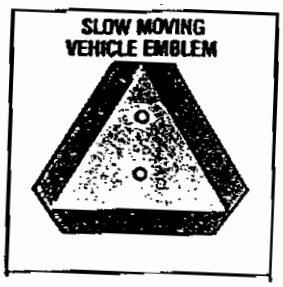
Channeling devices should be used whenever possible. Cones or barricades may be used during daytime hours. Barricades with yellow warning lights should be used overnight. **The first two warning lights used in longitudinal series may be flashed; the remainder should be steady burning.**

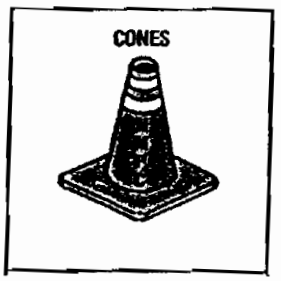
NOTE:

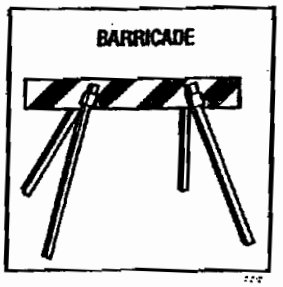
For further information on long duration stationary work, refer to page 3, item 3-b.

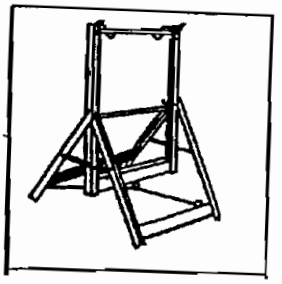
For further information on "Barriers and Channelization", refer to page 7.

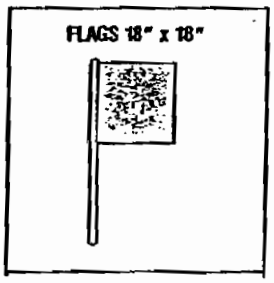


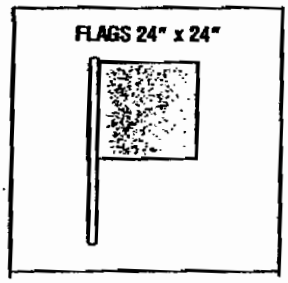


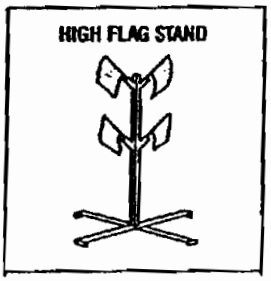


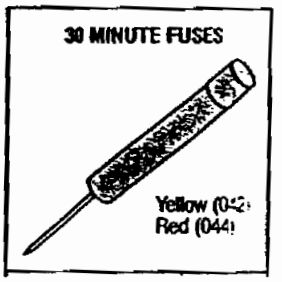


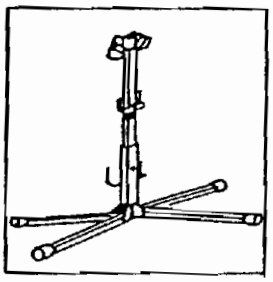


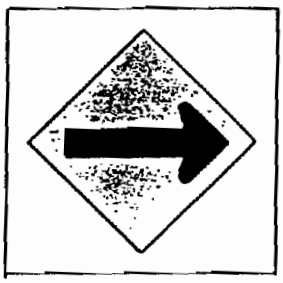


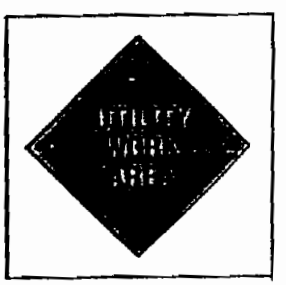


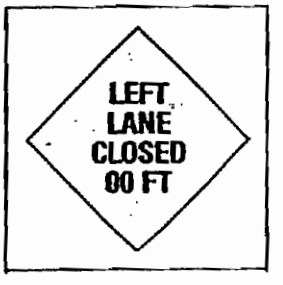












Equipment Guidelines

APPENDIX F

DRILLING SAFETY GUIDE

Group Environmental Management Company

PRECAUTIONARY PROCEDURES AND GUIDELINES DOCUMENT FOR DRILLING, SUBSURFACE INVESTIGATIONS AND REMEDIAL CONSTRUCTION ACTIVITIES FOR GEM MARKETING OPERATIONS

1.0 Objective

The objective of this document is to provide standard practices and procedures to avoid and/or eliminate the potential of encountering, puncturing, compromising or disrupting service to buried on-site utility service lines, municipal or third party owned off-site utility services, UST system components and other subsurface property service lines or systems (e.g., septic leach fields, etc.) during intrusive activities performed on behalf of GEM Marketing. These standard practices and procedures are precautionary measures *recommended* for all drilling and subsurface investigation work including soil sampling, geoprobe sampling, ground water sampling, well installation and any other intrusive or construction activities performed for environmental work conducted at BP, BP–divested and third party properties where BP may have an interest (e.g., acquisition properties). Where applicable, the governing regulatory agency requirements shall supersede.

Although presented as recommendations, it is fully expected that the Primary Contractor is responsible for implementation of these guidelines and procedures at all GEM Marketing investigation sites. Deviations from these guidelines and procedures on a site-specific basis will require communication and agreement between the BP Environmental Business Manager (EBM) and the Primary Contractor Project Manager during the pre-investigation planning period. Should regional conditions exist that warrant alternative precautionary procedures, alternative methods shall be clearly communicated between the BP EBM and the Primary Contractor; however, the implementation of the alternative methodologies will require approval from the Regional Area Manager. Additionally, a written description of the alternative procedure shall be included as an addendum to the drilling and procedures guidelines and submitted to the GEM Prevention Team for posting in the Prevention Toolbox as a best practice and to capture shared learnings.

2.0 Pre- Investigation Planning

Prior to the advancement of any intrusive data collection or excavation activities, the Primary Contractor is responsible for non-intrusive investigative and property inspection activities to determine the location(s) for intrusive data collection, taking into consideration potential for encountering underground utilities, UST system components and other underground human-made structures as well as meeting regulatory compliance sampling requirements. The Primary Contractor shall also have regional subsurface knowledge of general soil conditions that may be encountered in the area to distinguish between native soils and fill materials that may be indicative of utility trenches, UST system trenches and backfill materials, etc.

2.1 Facility and Third Party Work Notification

The Primary Contractor is responsible for contacting the appropriate facility personnel in advance prior to the startup of the work. For third party or divested properties, the Primary Contractor is responsible for making all appropriate site notifications in accordance with the terms and conditions of the access agreement (s) entered into between BP and the third party. The Primary Contractor MUST also notify the BP Environmental Business Manager prior to

beginning any field activities. The Primary Contractor shall be responsible for meeting all regulatory and utility locating notification requirements.

2.1.1 Third Party Investigations

The Primary Contractor is responsible for providing oversight during all 3rd Party intrusive investigations. The 3rd Party shall submit for review and approval all boring locations and agree to implement BP's precautionary drilling techniques. No soil boring or investigation point shall be installed within 10 feet of any UST system component.

2.2 Soil Boring, Well Placement and Subsurface Excavation Considerations

The BP Environmental Business Manager and the Primary Contractor project manager, prior to the commencement of drilling, must agree on *High Risk (e.g., near UST system Components, off-site utility corridors, etc.)* locations of soil borings, wells, sampling points, and other excavation or construction activities, unless otherwise specified in the site-specific project scope. Traffic control devices must be utilized to secure work area when performing intrusive work or investigations. No soil boring or investigation point shall be installed within 10 feet of any UST system component. The Primary Contractor is responsible for having a contingency plan in effect when drilling or excavating in a *High Risk* area that will include prior station notification and planning, dispenser shutdown, etc.

Note: It is highly desirable that off-site delineation soil borings/monitoring wells NOT be installed in public right-of-ways, streets, and highways or near municipal or third party owned utility corridors. It is the Primary Contractor's responsibility to evaluate all alternative off-site drilling locations and risks associated with these off-site locations including regulatory requirements. The Primary Contractor must receive authorization and soil boring/monitoring well location approval from the BP EBM prior to installing any off-site soil boring/monitoring well at these locations. BP recognizes that in some circumstances it will be necessary to investigate these areas, such as public streets, utility corridors and right of ways along public and private property boundaries.

2.3 Property, Utility Clearance and Pre-Investigation Checklist

The Primary Contractor is responsible for all property, utility clearances and confirming all necessary access agreements have been secured prior to the start of work. Additionally, the Primary Contractor is responsible for identifying and obtaining all local government and governing regulatory agency permits, right-of-way and all underground line and utility clearances. The following property and utility clearance procedures and attached Pre-Investigation Checklist will be completed by the Primary Contractor prior to the start of work:

- The Primary Contractor project manager is responsible for notifying of all applicable persons of the work and the proposed schedule (e.g., property owner and/or tenant, BP facility manager and/or maintenance supervisors).
- The Primary Contractor is responsible for obtaining and reviewing all available sources for site plans. These may include BP as-build plans; historical and current typical UST system layouts, contractor files, and county and city files (e.g. utility drawings). Additionally, construction diagrams and plans will be requested from owners, tenants and developers of former BP properties.

- Public utility mark-outs will be performed and the Pre-Investigation Preliminary Checklist (attached) will be completed for all Intrusive Fieldwork. The State-specific Utility Notification services will be contacted to request utility mark-outs. **As part the utility mark-outs, the** Primary Contractor will **perform a near site point of origin investigation for the purpose of locating utility lines entering the property from the point of origin (i.e., utility main and/or right of way corridor) by** locating all utility service line(s) entry points to the **property** and evaluate potential utility trench locations with respect to municipal mains and services. **These activities may include off-site utility clearance, direct communication with private and public utility owners, municipal engineering and service departments, local emergency response personnel, etc. Extreme caution shall be exerted in areas where utilities were installed utilizing non-conventional trenching activities (e.g., horizontal drilling).** A copy of the Pre-Investigation Preliminary Checklist will be attached to the site-specific Health and Safety Plan and accompany field personnel during site investigation activities. A comprehensive list of state-specific Utility Notification services is attached; however, the list is intended for reference only and the supplier is responsible for verifying the appropriate service for each work location. Additionally, all utility companies not participating in the state-specific Utility Notification service will be contacted for utility information.
- BP **requires** the Primary Contractor utilize a private on-site utility locating company or equivalent at all properties. BP encourages and prefers each Primary Contractor to obtain equipment and training to perform the on-site utility mark-outs in house by properly trained technicians familiar with intrusive investigations at retail facilities (Regional preference may be adopted). **In determining on-site boring locations where the 10 feet clearance cannot be met, the Primary contractor will utilize the same tolerance distances from privately located lines as observed by the State-Specific Utility locating service. The results of the private on-site utility investigation will be accurately recorded, retained for future subsurface investigations, and be on-site during any intrusive investigations as part of the Site Health and Safety Plan. It will be the sole responsibility of the Primary Contractor project manger to determine if additional private on-site utility investigations are required for subsequent investigations at the same property. However, where it is questionable whether an additional private on-site utility investigation is warranted, the Primary Contractor shall err on the conservative side (repeat the private on-site utility investigation) and involve the EBM in the decision making process.** Additionally, Primary Contractors will identify and actively participate in any proactive partnerships, groups or counsels designed to prevent damage to utilities (e.g., "The Utilities Council of Northern Ohio").

- **Pre Investigation Site Walk Over (Operating Service Station Facilities):** A Predrilling site walkover will be performed by an experienced Primary Contractor personnel with a maintenance representative and/or BP station employee who has inherent knowledge of the site when possible, taking into account all physical features of the site, including utility mark-outs and proposed boring locations. Prior to the Predrilling site walkover, Primary Contractor will request that a station representative familiar with the UST system and historical upgrades be available. Primary Contractor

will **perform an on-site point of origin investigation by** visually locating all utility service line(s) entry points to the station building and evaluate potential utility trench locations with respect to municipal mains and services. Primary Contractor will review location of all emergency UST system shutoff switches w/station representatives. On-site utility service line data will be hand sketched on a site diagram, **supplement the private utility locating investigation**, retained by the Primary Contractor and **be on-site during any intrusive investigations as part of the Site Health and Safety Plan.**

- **Pre Investigation Site Walk Over (Divested/Redeveloped Service Station Facilities):** A Predrilling site walkover will be performed by an experience Primary Contractor personnel with a property owner/tenant representative who has historical knowledge of the site when possible, taking into account all physical features of the site, including utility mark-outs and proposed boring locations. Prior to the Predrilling site walkover, Primary Contractor will request that a property owner/tenant representative familiar with any post sale development activities be available for the walkover. Primary Contractor will **perform an on-site point of origin investigation by** visually locating all utility service lines entry points to the station building and evaluate potential utility trench locations with respect to municipal mains and services. On-site utility service line data will be hand sketched on a site diagram, **supplement the private utility locating investigation**, retained by the Primary Contractor and **be on-site during any intrusive investigations as part of the Site Health and Safety Plan.**

- If it is determined during the site walkover that the proposed work may be in close proximity to a subsurface utility or other hazard(s), the Primary Contractor will re-evaluate the necessity of the boring. The Primary Contractor will communicate liability versus necessity of data collection whenever potential exists for a possible drilling incident to occur. If revised sampling or excavation locations are required, the Primary Contractor will review the modified locations with the BP EBM.

- Any contact with a subsurface utility will be immediately communicated to BP EBM (and BP station personnel as conditions warrant) and all appropriate incident reporting procedures shall be initiated. If contact with a utility results in a release and/or hazardous or unsafe conditions, appropriate emergency authorities will be contacted. Refer to site Health & Plan for appropriate HSE and emergency response communications and procedures. Additionally, all applicable BP HSE and Emergency Response communications and responses shall be initiated.

3.0 Drilling/Sampling Technology and Considerations

The following Drilling and Sampling Technology Considerations will be adhered to all Sites:

All drilling is recommended to occur a minimum of 10 feet from any known or suspected location of an underground structure or utility to ensure the integrity of these structures are not compromised. Unless required for corrective action (e.g. recovery of free product; for regulatory

compliance and/or as otherwise necessary to maintain operational integrity e.g. investigation of a suspected release).

Special operating procedures must be followed when drilling within the recommended 10 feet exclusion zone. Such procedures include specific approval of the BP EBM and could include: having a Retail Maintenance technician on-site; shut down of product pumps and/or power; and use of specialized clearance or drilling techniques (e.g. vacuum drilling).

All boreholes and sampling points will be advanced utilizing a precautionary drilling technique (e.g. a hand auger, posthole digger, air knife, pressurized water knife and/or high vacuum extraction, etc.) through the initial five-(5) feet of the subsurface to minimize impacts to unknown or abandoned buried utilities. The selected drilling technique must account for exploring all subsurface soils through the initial five feet of advancement at a minimum diameter greater than the maximum **operating diameter** of the auger flights, well casing or sampling points that will be required to complete the sampling point. The Primary Contractor shall utilize best professional judgment and select the best available technology to minimize the risk of encountering underground utilities based on site soil conditions, regulatory sampling requirements, cost effectiveness and scope of work. Additionally, the Primary Contractor will recognize that it may be necessary to extend the five feet precautionary drilling technique based on information (e.g., municipal utility maps depicting utility mains constructed at a depth greater than five feet) collected during the planning phases of the investigation. The Primary Contractor will communicate and advise the BP EBM where such additional precautions are warranted. Regardless of the precautionary drilling techniques selected, Primary Contractor shall have the responsibility for satisfying state specific regulatory compliance sampling requirements.

As previously indicated, it is highly desirable that off-site delineation soil borings/monitoring wells NOT be installed in public right-of-ways, streets, highways or near municipal or third party owned utility corridors. However, in those circumstances that require installation of borings/wells in these high-risk areas where utility mains may be present, the supplier will request that utility owner representatives be present during installation of the intrusive borings. No soil borings/wells will be installed in these areas without prior approval of the BP Environmental Business Manager.

Primary Contractor field personnel will immediately notify the Primary Contractor project manager when unexpected soil or fill conditions (e.g., pea gravel) are encountered that may indicate the presence of buried utility or product lines. The Primary Contractor project manager will evaluate the field conditions with the field personnel and determine an appropriate course of action (e.g., terminate and offset, proceed, etc.). The Primary Contractor Project Manager is encouraged to consult with the BP Environmental Business Manager, when field conditions are uncertain. If the BP Environmental Business Manager is unavailable, the Primary Contractor is encouraged to proceed on the side of caution (i.e., stop work or terminate sampling point and select an alternative location that will satisfy the work scope).

4.0 Health and Safety Requirements

The Primary Contractor is responsible for ensuring that a Health and Safety Plan (HASP) is prepared in accordance with all OSHA and other applicable Federal, State and local regulations for each site. The terms of this HASP must be clearly communicated and formally agreed to by all personnel involved in performance of the work. The HASP must remain on site at a clearly identified, easily accessible location until the project is completed. The HASP shall remain in the consultant's permanent project file. BP Terminal, Distribution and Process facilities may have additional health and safety requirements. Additional site-specific requirements must be discussed in advance with the BP EBM, preferably during project scope development. The Primary Contractor is responsible for ensuring all required traffic control is provided and Strictly adhered to. Note: Predrilling checklist shall be included in the Site Specific Health and Safety Plan.

bp

A BP affiliated company

STATE UTILITY LOCATING SERVICE DIRECTORY

AL	Alabama Line Location Center	800-292-8525		OR	Douglas Utilities Coordinating Council	503-673-6676	
AK	Locate Call Center of Alaska, Inc.	907-278-3121		OR	Josephine Utilities Coordinating		
AZ	Arizona Blue Stake, Inc.	602-263-1100	602-279-5342		Council	503-476-6676	503-476-4527
AZ	Arizona Blue Stake Center	800-782-2211	602-263-1100	OR	Rogue Basin Utility Coordinating		
CA	Underground Service Alert North	800-442-4133	510-798-1683	OR	Malheur Utility Coordinating Council	503-889-2468	
CA	Underground Service Alert South	800-442-4133	714-528-3423	OR	Utilities Notification Center	503-246-6699	503-293-0826
CO	Utility Notification Center of Colorado	800-922-1987	303-234-1712	PA	Pennsylvania One Call System, Inc.	800-242-1776	412-464-7104
CT	Call Before You Dig	800-922-4455	203-248-6448	RI	Dig Safe - Road Island	800-225-4977	617-273-2811
DE	Miss Utility of Delmarva	800-282-8555		SC	Palmetto Utility Protection Service, Inc.	800-922-0983	
FL	Call Sunshine	800-432-4770	305-720-5918	TN	Tennessee One-Call System	800-351-1111	615-366-5021
GA	Utilities Protection Center, Inc.	800-282-7411	404-623-4566	TX	Texas One-Call System	800-245-4545	214-323-7170
ID	Palouse Empire Underground			TX	Austin Area Utility Coordinating		
	Coordinating Council	800-822-1974	208-882-2031		Council	512-472-2822	512-499-7329
ID	Utilities Underground Protection Center	800-424-5555	206-451-2385	TX	Texas Excavation Safety System	800-344-8377	214-690-1291

ID	Dig Line	800-342-1585	208-342-8907	TX	Lone Star Notification Center	713-223-4567	713-432-0998
ID	One Call Concepts	800-626-4950	316-687-3753	UT	Blue Stakes Location Center	800-662-4111	801-487-7410
IL	Julie, Inc.	800-892-0123	815-741-5958	VT	Dig Safe – Vermont	800-225-4977	617-273-2811
IL	Digger	312-744-7000	312-744-4627	VA	Miss Utility of Virginia	800-552-7001	804-530-2179
IN	Indiana Underground Plant Protection			VA	Miss Utility	800-257-7777	
	Services	800-382-5544	317-849-2176	VA	Miss Utility of Delmarva	800-282-8555	
IA	Underground Plant Protection Service	800-292-8989		WA	Utilities Underground Location Center	800-454-5555	206-451-2385
KS	Kansas One-Call Center	800-DIG-SAFE	316-687-3753	WA	Grays Harbor & Pacific County Utility		
KY	Kentucky Underground Protection, Inc.	800-752-6007	502-266-5743		Coordinating Council	206-532-3550	206-533-7659
LA	Louisiana One Call System, Inc.	800-272-3020	504-769-9171	WA	Utilities Council of Cowlitz County	206-425-2506	206-636-0073
ME	Dig Safe-Maine	800-225-4977	617-273-2811	WA	Chelan-Douglas Utilities Coordinating		
MD	Miss Utility	800-257-7777			Council	509-663-6111	509-663-1719
MD	Miss Utility of Delmarva	800-282-8555		WA	Upper Yakima County Underground		
MA	Dig Safe-Massachusetts	888-344-7233	781-273-2811		Utilities Council	509-248-0202	
MI	Miss Dig Utility Communication			WA	Inland Empire Utility Coordinating		
	System	800-482-7171	810-332-7523		Council	509-456-8000	509-624-0220
MN	Gopher State One Call	800-252-1166	612-454-0170	WA	Palouse Empire Underground		
MS	Mississippi One Call System, Inc.	800-227-6477	601-362-7533		Coordinating Council	800-822-1974	509-883-8487
MO	Missouri One Call System, Inc.	800-344-7483	314-635-8402	WA	Utilities Notification Center	206-696-4848	503-293-0826
MT	Utilities Underground Protection Center	800-424-5555	206-451-2385	WV	Miss Utility of West Virginia, Inc.	800-245-4848	304-345-3959
NE	Nebraska Underground Hotline, Inc.	800-642-8434	402-331-3857	WI	Diggers Hotline, Inc.	800-982-0299	414-259-1453
NE	Diggers Hotline	800-331-5666		WY	Wyoming One-Call	800-348-1030	316-687-3753
NV	Underground Service Alert North	800-227-2600	510-798-1683	WY	West Park Utility Coordinating Council	307-587-4800	
NH	Dig Safe - New Hampshire	800-225-4977	617-273-2811	WY	Call-In Dig-In Safe Commission	307-682-9811	307-682-4396
NJ	Garden State Underground Plant			WY	Fremont County Utility Coordinating		
	Location Service	800-272-1000	908-232-1930		Council	307-856-7555	
NM	New Mexico One Call System, Inc.	505-260-1990	505-260-0968	WY	Central Wyoming Utilities		
NY	Underground Facilities Protective				Coordinating Council	307-265-5252	
	Organization	800-962-7962	315-437-2621	WY	Sweetwater County One-Call	307-362-8888	
NY	Utility Call Center c o Lilco Facilities	516-661-6000	516-677-4739	WY	Underground Utility Coordinating		
NY	NY City - Long Island One Call Center	800-272-4480	718-631-8395		Council	307-324-6666	
NC	The North Carolina One Call Center	800-632-4949	919-299-1914	WY	Albany County Utility Coordinating		
ND	Utilities Underground Location Center	800-454-5555	206-451-2385		Council	307-742-3615	
OH	Ohio Utilities Protection Service	800-362-2764	216-759-2745	WY	Southeast Wyoming Utilities		
OK	Call Okie	800-522-6543	405-848-9325		Coordinating Council	307-638-6666	
OR	Utilities Underground Location Center	800-454-5555	206-451-2385	WY	Utilities Underground Location Center	800-454-5555	206-451-2385
				DC	Miss Utility	800-257-7777	

PREDRILLING/SUBSURFACE CHECKLIST FOR INTRUSIVE FIELDWORK

Site Name: _____ Job Number: _____
Site Phone Number: _____
Site Address: _____ County: _____
Client Proj. Mgr.: _____ Phone: _____
Site Manager Contacted Date: _____ By: _____
Site Drawings (yes / no / NA) _____ (please attach) Historical Drawings (yes / no / NA) _____
Third Party Construction/Redevelopment Plans (Yes/No/NA)

***ATTACH SITE FIGURE WITH PROPOSED BORING LOCATIONS

Subcontractor's (drillers, concrete, etc...) Company _____
Subcontractor's Contact Person _____ Phone _____
Meeting / Start Date _____ Time _____

1) Health and Safety Signoff Form Completed? (Yes/No) Date _____

2) Utility Protection Services (Minimum 48 Hrs. Advance Notice, State Specific Notification Period Supercedes)
Called: Date _____ Time _____ Initials _____
Reference # _____
Proposed Drilling Locations Premarked for Locating Service. Y / N

3) Private or In-House Utility Locating Service Performed? Y / N _____
Called: Date _____ Time _____ Initials _____
Name of Locating Service: _____
Telephone #/ contact: _____
Name of Supplier Locating Technician: _____
Type of sensing equipment used: _____
Proposed Drilling Locations Premarked Y / N

4) Other Potential Underground Structures
Name of City Engineer/Utility Representative: _____
Telephone #: _____
Date Notified _____ Maps: Y / N
Cleared: Y / N

5) COMPLETED SITE WALKOVER W/ SITE MANAGER/DESIGNEE OR OWNER/TENANT REP. Y / N
Name of Site Manager: _____
Name of Property Owner/Tenant Representative: _____
Cleared: Yes / No
Building Utility Service Line Connections Identified: Y / N
(Hand sketch on site map w/proposed boring locations and most likely utility trench locations)

6) Utility Inventory: Y / N

Utility	Name	Depth (ft) (If Available)	Phone	Notified - Date	Marked
Above Ground Services:					
Electric		NA		Y / N	Y / N
Telephone		NA		Y / N	Y / N
Cable		NA		Y / N	Y / N
Overhead Supports		NA		Y / N	Y / N
Traffic light cables		NA		Y / N	Y / N

PREDRILLING/SUBSURFACE CHECKLIST FOR INTRUSIVE FIELDWORK

6) Utility Inventory Continued:

Below Ground Services:

Electric				Y / N		Y / N
Telephone				Y / N		Y / N
Cable				Y / N		Y / N
Gas				Y / N		Y / N
Water				Y / N		Y / N
UST System				Y / N		Y / N
Storm				Y / N		Y / N
Sanitary				Y / N		Y / N
Steam				Y / N		Y / N
Pipeline Companies				Y / N		Y / N

Other:

				Y / N		Y / N
				Y / N		Y / N
				Y / N		Y / N

7) Site-Specific Emergency Contingency Plan Incorporated in Health & Safety Plan Y / N

8) Drilling Locations Approved by Client Project Manager Named Above? Y / N

9) Signature of Parsons' Project Mgr. (required to begin fieldwork):

Name of Project Manager	Signature of Project Manager
Name of Parsons Field Personnel	Signature of Field Personnel

(This document to be included with the site H&S Plan and should be available upon request.)

ADDITIONAL COMMENTS / NOTES:

DRILLING SAFETY GUIDE

National Drilling Association

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 Association (NDA) and the National Ground Water Association - Drill Rig/Heavy Equipment Product Group and Safety Subcommittee (NGWA) and is published by the National Drilling Association (NDA) 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. DCDMA, NDA, NGWA, 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 DCDMA, NDA, NGWA, 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.

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Drilling Safety Guide

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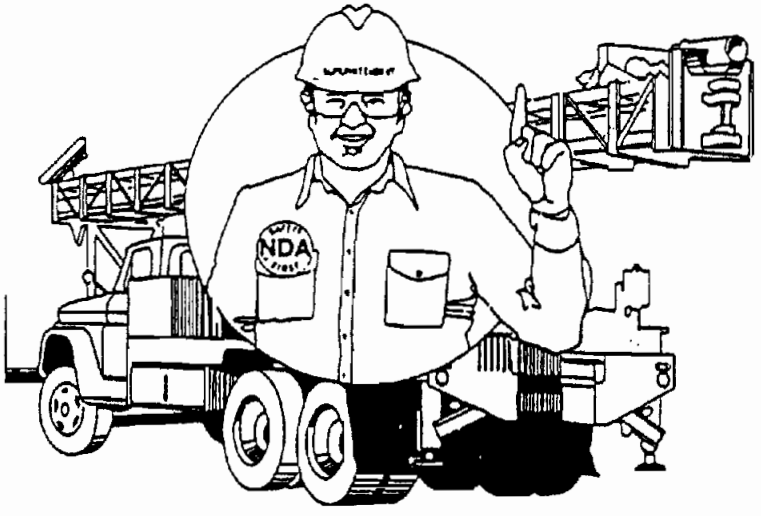
Continued

National Drilling Association

DRILLING SAFETY GUIDE

1. An Introduction To Drilling Safety

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



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

2. Governmental Regulations

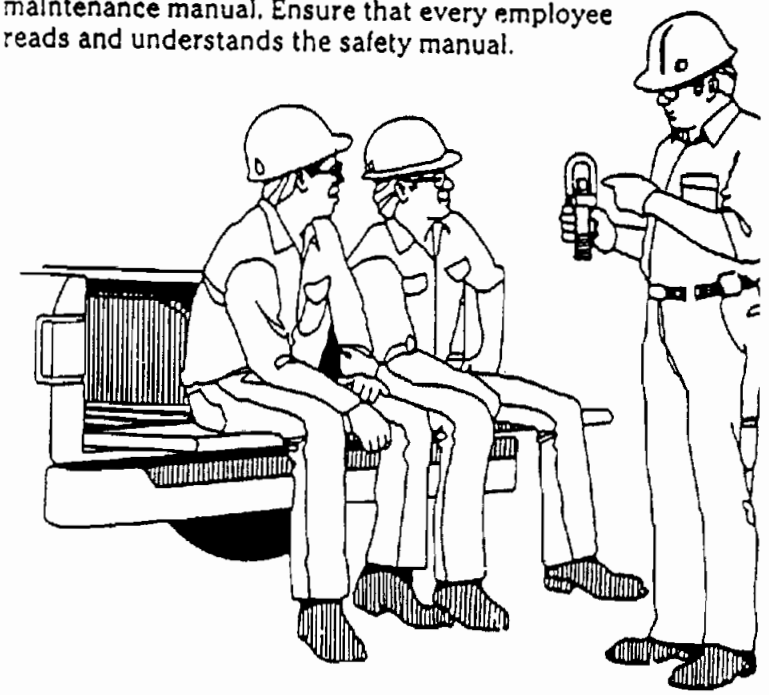
All local, state, and federal regulations or restrictions, currently in effect or effected in the future, take precedence over the recommendations and suggestions which follow. Government regulations will vary from county to county and from state to state. Those who operate, maintain, and work on drill rigs must be trained in the operation and maintenance of the drill. They must have read and understood the manufacturer's instruction manual, and know the ratings and capabilities of the drill they are using. They must be licensed if required by law.

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 enhance 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, it's controls, and it's capabilities.

- Inspect the drill rig at least daily for structural damage, loose and nuts, proper tension in chain drives, loose or missing gua or protective covers, fluid leaks, damaged hoses, and/or dama pressure gauges and pressure relief valves.
- Check and test all safety devices, such as emergency shut-dov switches, at least daily and preferably at the start of a drilling Drilling must not be permitted until all emergency shut-down 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 engine is started.
- Ensure that every drill rig worker is informed of safe operating practices on and around the drill rig. Provide every drill rig w with a copy of the organization's drilling operations safety ma and when appropriate, the drill rig manufacturer's operations 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 crewmembers.

- 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.

- In order to mitigate emergency situations, it may be appropriate to coordinate communication methods (cellular telephone, two-way ratio, etc.) at remote sites.

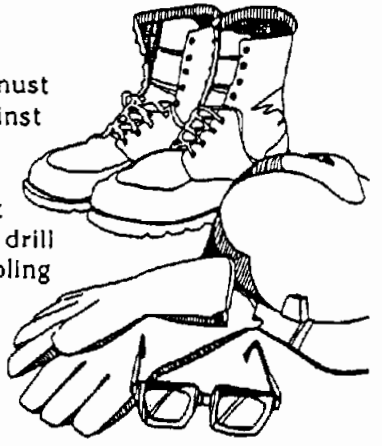
4. Individual Protective Equipment

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. addition to loose clothing, hair should be tied back; as loose/l hair can catch in mechanical equipment.

- **Safety Head Gear.** Safety hats (hard hats) must be worn by everyone working or visiting at or near a drilling site. All safe hats must meet the requirements of ANSI Z89.1. All safety ha must be kept clean and in good repair with the headband anc crown straps properly adjusted for the individual drill rig wo or visitor.

- **Safety Shoes or Boots.** Safety shoes or boots must be worn b drilling personnel and all visitors to the drill site that observ drilling operations within close proximity of the drill rig. All s 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 glasse General prescription glasses and/or sunglasses are not safety glasses. All safety glasses must meet the requirements of ANS Z87.1 - 1989.

- **Other Protective Equipment.** For some drilling operations, tl environment or regulations may dictate that other protective equipment be used. The requirement for such equipment mu

determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face shield, respirator, reflective clothing and hearing protection. When appropriate, each drill rig worker must wear noise-reducing hearing protection that meets the requirements of ANSI S3.19 - 1974.

When drilling is performed in chemically or radiologically contaminated environments, 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 othe accessways free of materials, debris, obstructions, and subs such as ice, grease or oil that could cause a surface to becor slick or otherwise hazardous.
- Keep all controls, control linkages, warning and operation lig and lenses free of oil, grease, and/or ice.
- Store gasoline only in a non-sparking, red container with a fl arrester in the fill spout and having the word "gasoline" easil visible.
- All fluid and material containers should be clearly labeled to improper use. Hazardous materials should be labeled and h accordingly. Refer to MSDS sheets.
- Keep all cabs clean. Mud, cans, bottles, tools, and other deb can jam pedals and other controls and can cause falls.

6. Maintenance

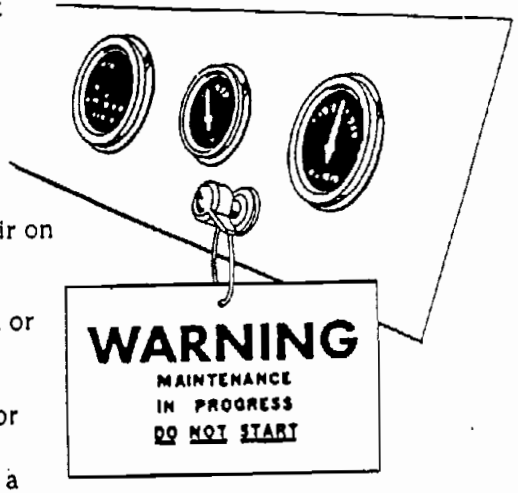
Good maintenance will make drilling operations safer. Also, maintenance must be performed safely. The following points essential to safety:

- Wear safety glasses when performing maintenance on a drill r on drilling tools.
- Shut down the drill rig engine to make repairs or adjustments drill rig or to lubricate fittings (except repairs or adjustments can only be made with the engine running). Take precautions prevent accidental starting of an engine during maintenance b removing or tagging the ignition key. Refer to lock-out/tag-out spelled out by OSHA.
- Block the wheels or tracks and set parking brakes before wor 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 de-energize 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.

- Watch for broken hydraulic or air hoses. Replace them before they cause damage or a fire.

- Tighten or replace loose or broken fittings, bolts, or other connections before operating the drill.

- Do not replace a hose with one of lesser strength or capacity. Breakage or leakage could result.

- Never remove cooler fan guards unless the drill is shut down a locked out.

- When testing fan speed, do so with the guard in place.

- Relieve all pressure in receiver tank and lines before working c compressor system.

7. Hand Tools

Since there are almost an infinite number of hand tools that ca 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 it intended purpose" is the most important rule. The following suggestions apply to safe use of several hand tools that freque are used on and around drill rigs:

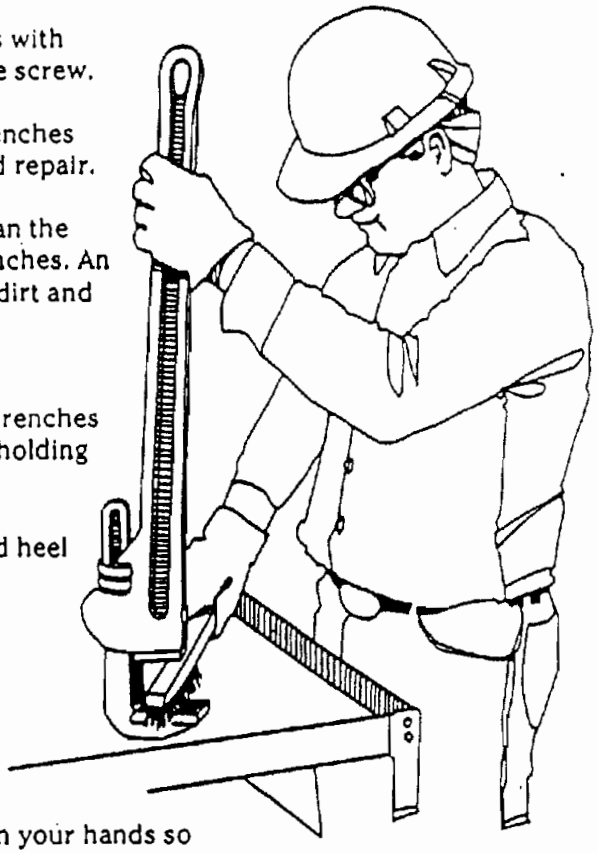
- When a tool becomes damaged, either repair it before using it again or get rid of it.

- When using a hammer, any kind of hammer for any purpose, w 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 us

- Use wrenches — not pliers — on nuts.
- Use screwdrivers with blades that fit the screw.
- 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 pinched 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 tl drill rig immediately prior to starting the engine.
- Make sure all brakes are set, all gear boxes are in neutral, all h levers are disengaged, all hydraulic levers or air controls are i 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.
- Check for warning or lockout tags on the controls. If there is a attached to the switch, do not start the engine until the warnir tag has been removed by the person who installed it.

10. Drilling Operations

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

- Do not drive the drill rig from hole to hole with the mast (derri in the raised position.
- Before raising the mast (derrick), look up to check for overhea obstructions. (Refer to Section 11 on Overhead and Buried Utilities.)
- Before raising the mast (derrick), clear all drill rig personnel (v exception of the operator) and visitors from the areas immedi to the rear and the sides of the mast. Inform all drill rig person 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 lev jacks and/or solid cribbing. Re-level the drill rig if it settles afte 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 project.

- Never allow "horsing around" within the vicinity of the drill tool and supply storage areas, even when the drill rig is shu

- When using a ladder on a drill rig, face the ladder and grasp the side rails or the rungs with both hands while ascending descending. Do not attempt to use one or both hands to car tool while on a ladder. Use a hoist line and a tool "bucket" o safety hook to raise or lower hand tools.

- Terminate drilling operations during an electrical storm and the complete crew away from the drill rig.

- Check all safety devices. Report any defect immediately.

- Never drill without having another person present.

- Before raising the mast (derrick), make sure it is clear of all c that could fall. Check that all hydraulic and air hoses do not become snagged during raising. Watch all hoist cables and k them clear or unspooled properly while raising derricks.

- Use the proper tools for the job. Do not attempt to lift pipes, stabilizers, or bits without the proper lifting devices.

- Use the proper technique in loading and unloading the drill p If a lifting ball is used, make sure it can be detached while sta on the ground. Use a pipe handling tool if the carousel needs filled. Make sure the safety clip is in place (if so equipped).

- Never ride the rotary head for any reason!!! It is not meant to elevator.

- If heavy objects must be manually lifted, exercise care to avoi 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.

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

- When working on a derrick platform, use a safety harness and refer to OSHA REG CFR 1926.502 for specific requirements.

- Use a safety device when climbing to a derrick platform that is higher than 6 ft. (1.8 m) refer to OSHA REG CFR 1926.501 for specific requirements.

- 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 pipe into racks or other supports by taking hold of a moving line or a traveling block.

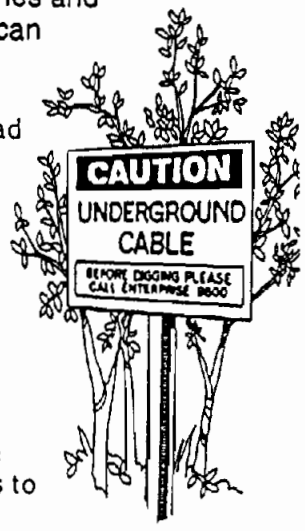
- Do not leave loose tools and similar items on the derrick plat or on structural members of the derrick.

- A derrick platform or operators platform over 4 ft. (1.2 m) ab ground surface must have toe boards and safety railing that good condition, refer to OSHA REG CFR 1910.23 for specific requirements.

- Avoid being under rig workers on elevated platforms whenev possible.

11. Overhead and Buried Utilities

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

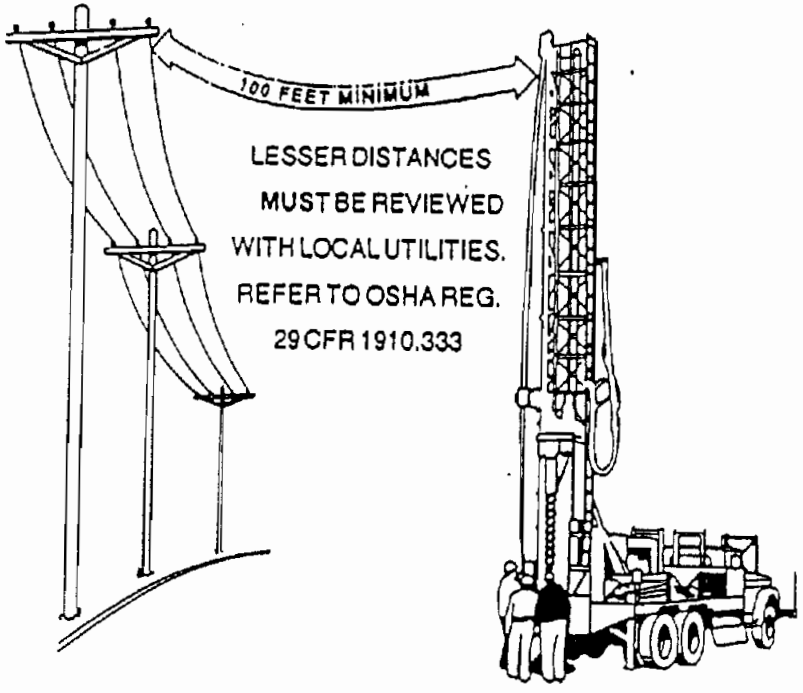


- Locate, note, and emphasize overhead and buried utilities on all boring location plans and boring assignment sheets.

- 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 de-energize (turn off) the pow

- 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 1910.333 before commencing operations.



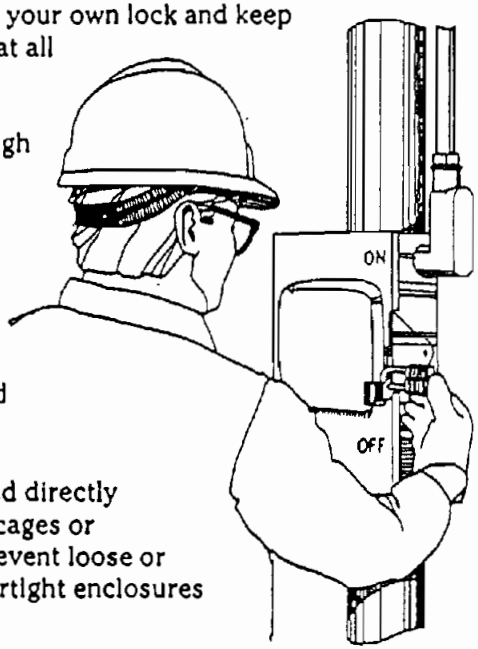
- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.
- In order to avoid contact with power lines, only move the drill rig with the mast (derrick) down.

- If there are any questions concerning the safety of drilling on si in the vicinity of overhead power lines, call the power company The power company will provide expert advice at the drilling si as a public service and at no cost.
- Electricity is as dangerous underground as overhead. Be aware and always suspect the existence of underground utilities such 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 locatec 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 undergrou utility lines, mark and flag the locations, and determine jointly 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 operation and, therefore, require temporary electrical lighting. In general wiring and fixtures used to provide electricity for drilling operat should be installed by qualified personnel in accordance with t National Electrical Code (NFPA70-1999) with consideration of 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 bli spots. The following are specific recommendations for land-ba drilling operations:

- Before working on an electrical power or lighting system, lockout 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 oth 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 electric lighting to wear safety head gear that protects the worker's h not only against falling or flying objects, but also against limi electrical shock and burns according to ANSI Z89.1 and Z89.2

- Allow only trained, designated personnel to operate electrica 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 be insulated from the ground by the tires of the carrier. Unde either circumstance, if the human body simultaneously come contact with the drill rig and the ground, electrocution can res causing death or serious injury. If a drill rig or a drill rig carrie makes contact with overhead or underground electrical lines:

- Under most circumstances the operator and other personnel the seat of the vehicle should remain seated and not leave th vehicle. They should not move or touch any part, particularl 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 non-conductive material, such as a dry nylon 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, & 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 fc period of a month or more.

- Install all connections and end fittings, which consist of splic eyes and various manufactured devices, according to the manufacturer's specifications. Do not exceed ratings specifie manufacturer.

- If a ball-bearing type hoisting swivel is used to hoist drill rod: inspect and lubricate swivel bearing daily to assure that the s 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 n hoist more than 1 ft. (0.3 m) of the drill rod column above the of the mast (derrick); do not hoist a rod column with loose tc joints; and do not make, tighten, or loosen tool joints while th column is being supported by a rod slipping device. If drill ro should slip back into the borehole, do not attempt to break th of the rods by hand or by tensioning the slipping device.

- Most sheaves on drill rigs are stationary with a single part lin Never increase the number of parts of line without first consu with the manufacturer of the drill rig.

- Wire ropes must be properly matched with each sheave. If th rope is too large, the sheave will pinch the wire rope. If the rc too small, it will groove the sheave. Once the sheave is groov will severely pinch and damage larger-sized wire ropes.

- Always use proper lifting devices.

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

- Use tool handling hoists only for vertical lifting of tools (excep when angle hole drilling). Do not use tool handling hoists to p on objects away from the drill rig; however, drills may be mov 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 hook 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 lo 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, shea and pinch points while slack is being taken up or when the loa being hoisted.
- Never hoist the load over the head, body, or feet of any perso
- Never use a hoist line to "ride" up the mast (derrick) of a drill
- 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 handle.
- Check the cathead periodically, when the engine is not runnin rope wear grooves. If a rope groove forms to a depth greater t 1/8 in. (3 mm), replace the cathead.
- Always use a clean, dry, sound rope. A wet or oily rope may "g 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, leg, or any other part of the body.

- Always maintain a minimum of 18 inches (46 cm) 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 operators legs.

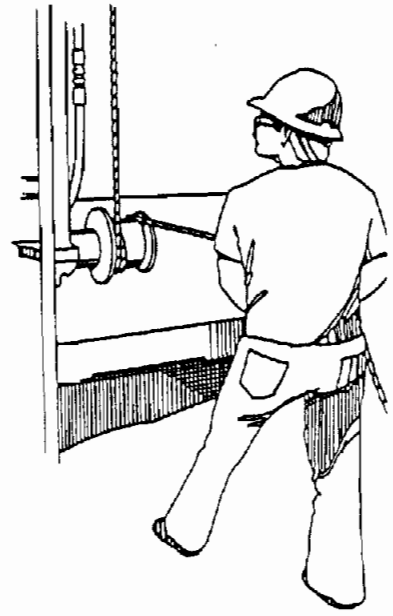
- Do not use more rope wraps than are required to hoist a load.

- Do not leave a cathead unattended with the rope wrapped on the drum.

- Position all other hoist lines to prevent contact with the opera 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. Auger Drilling

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 hyd rotation control disengaged, the transmission in low gear, and engine running at low RPM.

- Apply an adequate amount of down pressure prior to rotation 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 ap down pressure. Keep one hand on the clutch or on the rotatic control at all times until the auger has penetrated about one f 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.
- 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 whatsoever.
- Only use the manufacturer's recommended method for securing the auger or drive adapter 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-handled 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/a swivels and hoisting plugs. Water/air swivel bearings must be before using, and stay clear of water/air swivel hose when rot
- Check drill rod chuck jaws periodically and replace when necessary.
- Check the capacities of hoists and sheaves against the anticip weight to the drill rod string plus other expected hoisting loa

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

- Only the operator of the drill rig should be allowed to brake c a manual chuck so that rotation of the chuck will not occur p to removing the wrench from the chuck.
- Drill rods should not be braked during lowering into the hole 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 release the hole, do not attempt to grab the falling rods by hand or w wrench.
- In the event of a plugged bit or other circulation blockage, rel the high pressure in the piping and hose between the pump a the obstruction before breaking the first tool joint.
- When drill rods are hoisted from the hole, clean them only wi wiper made of rubber or other suitable material. Do not use h 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. Air Drilling

Compressed air is dangerous and explosive in nature. High pressure air can cause serious injuries.

- Do not allow tools or air powered equipment to be connected to the drill hoses. They must be attached to the service regulator and the pressure adjusted to the working capacity of the tool being used.

- Turn off drill air and exhaust drill string before unscrewing drill pipe at the table.

- Do not turn on high pressure air too quickly when air hoses are in the vicinity of people. Hoses can jump and injure people, especially if there is water or oil inside them.

- Make sure air line safety cables or chains are in good working order on all lines that could whip in event of fitting failure.

- Do not remove or alter air system safety valve.

- Do not operate compressed air system at pressure above rated pressure.

- Do not operate compressed air system with broken or inoperable safety controls.

- Never point an air nozzle at anyone.

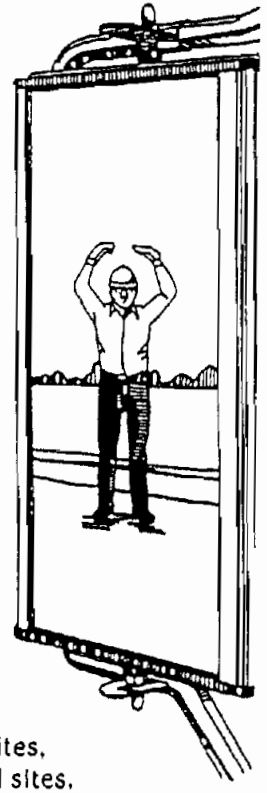
- Warning - Exposure to crystalline (free) silica during rock drilli can cause serious or fatal respiratory disease.

19. 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, local, and DOT 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.
- Do not permit passengers to ride on the drill rig.
- Driving equipment with a high center of gravity, such as a portable drill rig, requires special precautions, especially in turning and stopping. Allow for the increased and higher weight by slowing down while turning and allowing for more stopping distance.
- Know where your helper or oiler is at all times. Do not move drill if they are not in sight.
- Know and use proper signals when moving a drill. Establish signals in advance of operations.

20. 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.

21. Off-Road Movement

Follow these procedures during off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecti for depressions, stumps, gullies, 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 l or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or l terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain. If equipped with multiple speed transfer case, operate in low range. (Refer to manufacturer's recommendations.)
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs because the arbitrary addition o drilling tools may raise the center of mass. When possible, trav directly uphill or downhill. Increase tire pressures before trave in hilly terrain (do not exceed rated tire pressure).
- Attempt to cross obstacles, such as small logs and small erosio 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 n 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.

22. 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.

- In addition to safety glasses, it is recommended personnel wear protective clothing, gloves, and acid resistant apron when servicing batteries.

- 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 l

- When charging a battery with a battery charger, turn off the p source to the battery before either connecting or disconnecti 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 flush immediately with large amounts of water and see a medi physician at once.

- To avoid battery explosions, keep the cells filled with electrol use a flashlight (not an open flame) to check electrolyte level avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted or smoking materials and flame away from batteries.

- Keep battery covers in place at all times.

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

- Only use the type and quality of fuel recommended by the eng manufacturer.

- Use only a DOT approved portable fuel container.

- 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 startir 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.
- Never mix any other fuel with diesel fuel, as an explosion may result.

23. 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 sympt of and be able to provide first aid for electrical shock, heart att stroke, broken bones, eye injury, snake bite, and cuts or abras to the skin. Again, first aid for these situations is best taught tc crew members by instructors qualified by an agency such as t American Red Cross.

Keep a first aid kit available and well maintained on each drill : This kit should meet DOT specifications for Interstate Commer Commission requirements.

24. Drill Rig Utilization

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

25. Drill Rig Alterations

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

26. Shut-Down

- Before shutting drill down, move drill away from high wall or fa before shutting down for the day.
- Don't leave drill parked near an unstable slope or overhang.

- Never park drill on an incline without carefully blocking to prevent movement.
- Place all controls in neutral or park position before leaving the drill.
- Lock the ignition, remove keys or install panel cover before leaving the drill.

27. Welding and Cutting Torch Safety

- Welding or cutting should never be performed in a confined location.
- Never weld or cut near a fuel tank.
- Wear protective clothing including flame resistant gloves, aprons, safety shoes, welding helmets, goggles and shaded glasses.
- When arc welding, insure work and equipment is properly grounded. Check condition of cables, clamps, and electrode holder. Damp clothing and wet working conditions should be avoided.
- Electrode stubs should be disposed of in a fire-resistant container.
- Only welding and cutting equipment in first class operating condition should be used.
- Store gas welding cylinders in an upright position and away from heat, flames, sparks, ice and snow.
- Always secure cylinders to prevent tipping.
- Protective cap should be in place over valves and the valve turned to the closed position when being stored or transported.

28. Fire on the Rig

Always carry an approved Class ABC fire extinguisher on the drill rig that meets the requirements of DOT regulation 49 CFR 393.95. The fire extinguisher should be located to permit visual determination of whether it is fully charged and is readily accessible for use.

29. Drilling Equipment Safety Labels

Drilling equipment safety labels have been developed through the combined efforts of NDA and its DCDMA Committee with input from the NGWA Heavy Equipment Product Group and Safety Subcommittee and in accordance with the American National Standards Institute (ANSI) guidelines for Product Safety Signs ar Labels, specifically ANSI Z535.

Each safety label kit consists of 18 labels of 10 different types tha provide a uniform and consistent visual layout for safety signs an labels in the drilling industry. These labels are compatible with all makes and models of drilling equipment and warn against the most common and most dangerous hazards.

Safety Label Kits are available for purchase from the NDA. Visit the NDA web site at www.nda4u.com to view examples.

APPENDIX G

VEHICLE SAFETY

VEHICLE INSPECTION

FREQUENCY: Pool vehicles - inspect prior to usage
Light duty vehicles - inspect once a week

Date:____/____/____ Time:_____ Unit #_____ Mileage/Hrs:_____

	Good	Need Repair	N/A
Glass condition			
Gasoline or diesel			
Headlights, high and low beam			
Tail lights			
Brake lights			
Turn signals			
Backup lights			
Brake condition			
Fire extinguisher condition			
Engine oil			
Transmission fluid			
Brake fluid			
Cooling system fluid			
Windshield wipers			
Exhaust system			
Tire condition			
Spare tire			
Vehicle clean			
New body damage			

Defects and repairs needed:_____

_____

_____

_____

General safety condition:_____

_____

_____

Operator's signature:_____

HEAVY-EQUIPMENT INSPECTION

FREQUENCY: Heavy equipment - inspect daily and prior to use on site.

Inspection Date:____/____/____ Time:_____ Equipment Type:_____ Unit#_____

Required Daily and Prior to Use on Site:

	Good	Need Repair	N/A
Tires or tracks			
Hydraulic oil and hose condition			
Oil leak/lube			
Cab, mirrors, seat belt and glass			
Horn and gagues			
Lights			
Turn signals			
Backup lights and alarm			
Brake condition (dynamic, park, etc..)			
Fire extinguisher condition			
Engine oil			
Transmission fluid			
Brake fluid			
Cooling system fluid			
Windshield wipers			
Coupling devices and connectors			
Exhaust system			
Blade/Boom/Ripper condition			
Frame, ladder(s) and walkway			
Power cable and/or hoist cable			
Steering (standard and emergency)			

Additional Inspection Required Prior to Use on Site:

1) Does equipment emit noise levels above 90 decibels? Yes or No
2) If so, has an 8-hour noise dosimetery test been performed?

Document results of noise dosimetry:_____

Defects and repairs needed:_____

_____

_____

General safety condition:_

_____

Operator's or mechanic's signature:_____

JOB SPECIFIC TASK TRAINING

Employee Name:_____

Project:_____

Date:____/____/____

Description of Equipment to Operate:_____

Status *(Circle One)*

Newly Hired Experienced New Machine

Task Training

I: Complete an Equipment Specific Performance Evaluation (attach to this sheet)

II: If experienced, estimate years of experience on machine.

_____years. Both foreman and employee initial here _____ _____
(If operator is experienced go to skip part III)

III. If no experience on this piece of equipment, both the supervisor and employee initial here and continue with "a" through "c" below. _____ _____

a. *Explain to the operator how the machine works and how the machine operates; both the supervisor and the operator initial* _____ _____

b. *Explain all hazards associated with the machine (The DO's and the DONT's); both the supervisor and the operator initial* _____ _____

c. *Give the employee hands on training on the machine with supervision; both the supervisor and the operator initial that this was done* _____ _____

As the employee's supervisor, I acknowledge that I have watched this operator during the shift and feel that he/she can operate this equipment by his/her demonstrated ability.

_____
Contractor Supervisor/Company

_____
Employee's Signature/Company

EQUIPMENT SPECIFIC PERFORMANCE EVALUATION

Date:_____

Employee Name:_____

Supervisor:_____

Job classification: **LABORERS**

Description:

A laborer works with all crews doing everything from pick and shovel work to removal of structures. This may consist of fence repairs, liner removals, water line placements, cleanup operations, decontamination of equipment, and traffic control duties.

STEPS	KEYPOINTS	SATISFACTORY
I.	Company	Yes ( ) No ( )
	A. Company policy	
	1. PPE	
	2. Transportation & communicatious	
	3. Introduction to work cnvironment & hazard recognition	
	4. Pamphlets given to employees	
	5.	
	B. Safety orientation	
	1. Use of proper PPE	
	a) Gloves (rubber, cloth, leather)	
	b) Tyvek (white and yellow)	
	c) Face shields	
	d) Steel toed boots	
	e) Rubber steel toed boots	
	f) Traffic vests	
	g) Dust Masks	
	2. Emergency showers and eye wash stations	
	3. Proper dress	
	4. Hand tool operations with regards to " the do's and don'ts "	
	a) Right tool for the job	
	5. Working around heavy equipment	
	a) Back up alarms	
	6. Deconning equipment	
	7. Electrical hazards	
	8. Lifting hazards	
	9.	
II.	Demonstrated abilities	Yes ( )
	No ( )	
	A. Lifting techniques	
	1. Lifting Techniques	
	a) Knees instead of back	
	b) Team efforts	
	c) Using equipment to do the lifting	
	d) Can demonstrate simple pre-work stretching exercise	
	2. Identification of supervisor	
	3. Knows when and how to report an accident to the supervisor	
	B. Can identify dangerous situations	

EQUIPMENT SPECIFIC PERFORMANCE EVALUATION

Date:_____

Employee Name:_____

Supervisor:_____

Job classification: **WATER TRUCK OPERATOR**

Description:

Drives a heavy duty gasoline or diesel powered truck used in hauling water to moisture condition haul roads and fill areas and fills the truck with water when needed. The truck is either a taudem rear axle type, or is a tractor truck, single or tandem axle, pulling a tanker. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

STEPS	KEYPOINTS	SATISFACTORY
I.	Company	Yes ( ) No ( )
	A. Company policy	
	1. PPE	
	2. Transportation & communications	
	3. Introduction to work environment & hazard recognition	
	4. Pamphlets given to employees	
	B. Safety orientation	
	1. Use of safety belts	
	2. Proper dress	
	3. Equipment operation with regards to " the do's and don'ts "	
	a) Ground speed to haul road conditions	
	b) Loading & unloading procedures regarding the use of water on haul roads and ramps	
	c) Different traffic patterns	
	d) Engine over-speeding	
	4. Loaded and dumping vehicles have the right of way	
	5. Load, grade and terrain limitations of equipment	
II.	Demonstrated abilities	Yes ( )
	No ( )	
	A. Pre-shift inspection check list	
	1. Check equipment for loose bolts, leaks; oil, air , hydraulic and water	
	2. Make sure area around the equipment is clear of people and other equipment	
	3. Check for fire extinguisher	
	4. Make sure that the following equipment is operational	
	a) Brakes	
	b) Lights	
	c) Back-up alarms	
	d) Hand rails & ladders	
	e) Seat belts	
	f) Tires	
	g) Glass, wipers	
	h) Gages; temp., Oil, air, & fuel	
	5. Notify supervision of any equipment that is not operational	
	6. The operator can park or side line a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property	
III.	Identification of equipment controls	Yes ( ) No ( )
IV.	Loading techniques	Yes ( ) No ( )
	A. Start and use of water pump	
	B. Chock blocks on inclines	
V.	Shifting and hauling	Yes ( ) No ( )
VI.	Can back up using mirrors	Yes ( ) No ( )
VII.	Discharge and spreading water in rough terrain	Yes ( ) No ( )
VIII.	Proper moisture control on haul roads	Yes ( ) No ( )
IX.	Parking and shut down procedures	Yes ( )
	No ( )	
	A. Equipment line-up	
	1. Straight line	
	2. Allow easy access for service	
	B. Turn off all accessories	
	C. Park empty to prevent mud hole and freezing of lines	
	D. Use of chock blocks on inclines	
	E. Perform a general walk around looking for items for maintenance	

HEAVY EQUIPMENT SAFETY

System: Heavy Equipment

Basic Information

Inspection requirements:	Annual
Annual Inspection Performed By:	
Next Annual Inspection Due Date:	
Employee Annual Training Due Date:	
Reference:	29 CFR 1926.600-602 & .1000-1002

Compliance Item	Task	Person Responsible / Comments
General	Is glass in cabs of all equipment safety glass that causes no visible distortion affecting the safe operation of the vehicle?	
	Are all bi-directional pieced of heavy equipment equipped with an audible back-up alarm?	
	Are all belts, gears, shafts, pulleys, fly wheels and other reciprocating , rotating or moving parts guarded to ensure that workers cannot be caught on or in the machinery?	
	Is all heavy equipment equipped with approved seatbelts?	
	Are all employees required to wear seatbelts?	
	Is all heavy equipment equipped with Roll Over Protection System (ROPS)?	
	Are modification or repair of ROPS approved by a professional engineer?	
	Do all operators make a walk around inspection and operations check before start-up and operation?	
	Are all defects reported immediately to the supervisor?	
	Is all unsafe equipment taken out of service until repaired?	
	Do operators ensure the area around the equipment is clear before moving equipment?	
	Are proper working distances maintained when operating equipment near electrical lines?	
General (cont.)	Are all underground gas, electrical and	

HEAVY EQUIPMENT SAFETY

Compliance Item	Task	Person Responsible / Comments
	telephones located and marked when excavating or grading in an unfamiliar area?	
	Are steps, handrails and grab irons used when mounting or dismounting equipment, and do employees face equipment and use the three points of contact rule?	
	Are steps, handrails and grab rails clean and free from slip, trip and fall hazards?	
	Are employees prohibited from getting on or off a piece of equipment while it is moving?	
	Is freewheeling or coasting prohibited?	
	Are parking brakes, chocks or other preventative measures used to secure equipment from movement?	
	Are chocks always used to secure heavy equipment parked on inclines?	
	Do employees lower bucket or blade to the ground and set the parking brake on loaders, shovels, dozers and other similar types of equipment before dismounting the vehicle?	
	Do employees have an unobstructed area before backing a haul truck?	
Road Rules	Do operators understand and adhere to the site traffic right-of-way rules?	
	Are haul road/traffic hazards adequately communicated by appropriate signage?	
	Are changes in haul road/traffic communicated to all affected personnel?	
	Do all elevated haul roads have berms that are axle height or greater for the largest type of equipment that normally occupies the road?	
	Do all curves have open sight lines and as great a radius as practical?	
	Are roadways constructed with a slight crown to facilitate drainage?	

Compliance Item	Task	Person Responsible / Comments
Road Rules (cont.)	Are all roadways routinely maintained in safe condition including the elimination or control of dust, ice and similar hazards?	
	Do vehicles and equipment follow at a safe distance?	
	Is passing prohibited unless adequate clearance, visibility and radio communication are available?	
	Are lights, flares or other warning devices posted when equipment is disabled or parked on the roadway where is will create a hazard?	
	Are rocks or objects that could cause tire failure or damage avoided at all times?	
	Are equipment spotters in the clear while equipment is backing , dumping or loading?	
	Are universal hand signals used by the spotter and understood by all?	
	Does the spotter wear bright reflective clothing?	
Equipment Operation	Have all employees had the proper Task Training for the equipment or task they perform?	
	Have qualifications of employees been verified by supervisor?	
Equipment Inspection	Is all equipment inspected by supervisor prior to initial site allocation, and is this documented?	
	Is all equipment inspected prior to operation daily and documented?	
Maintenance	Is equipment removed from service and tagged out of service whenever an unsafe condition is detected?	
	Are repairs documented before equipment is placed back in service?	
	Is equipment shut down while repairs or adjustments are being made unless operation is essential?	

Compliance Item	Task	Person Responsible / Comments
Maintenance (cont.)	Are equipment or parts which are suspended blocked, cribbed or lowered to a supporting surface prior to permitting employees to work in, under, or between them?	
	If equipment must be left unattended for any period, is the equipment tagged out of service following the appropriate lockout / tagout procedures?	
	Do mechanics or other workers working on equipment of 6 feet or greater use fall protection where fall hazards are present?	
	Are maintenance records kept?	

APPENDIX H

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 crewmembers 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 crewmembers 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 I

MATERIAL SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET

SULFURIC ACID 96%

MALLINCKRODT

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

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.

MATERIAL SAFETY DATA SHEET

SULFURIC ACID 96%

MALLINCKRODT

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

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

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.

MATERIAL SAFETY DATA SHEET

SULFURIC ACID 96%

MALLINCKRODT

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

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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

MALLINCKRODT

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

Explosion: Contact with moisture or water may generate enough heat to ignite combustible

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.

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

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

MALLINCKRODT

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

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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) Listed on the TSCA Inventory.	No	No	Yes	No	1000	No

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

NITRIC ACID, 70%

MALLINCKRODT

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

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.

MATERIAL SAFETY DATA SHEET

NITRIC ACID, 70%

MALLINCKRODT

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

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Addendum to Material Safety Data Sheet

REGULATORY STATUS

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Identifies SARA 313 substance(s)

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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

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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%

MALLINCKRODT

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

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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.

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

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.

MATERIAL SAFETY DATA SHEET

HYDROCHLORIC ACID, 37%

MALLINCKRODT

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

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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:
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

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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

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

MALLINCKRODT J.T.Baker

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

National Response in Canada
CANUTEC: 613-996-6666

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

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

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

METHYL 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\----------

Ingredient	---NTP Carcinogen--- 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\----------

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

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

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

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 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:
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