ExxonMobil
Refining & Supply

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Steve P. Trifiletti
Major Projects – Project Manager
Global Remediation

November 19, 2007

Mr. William Ports
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233 -7014

RE: Pre-Design Investigation Work Plan – Rev. 2
Former Tappan Terminal
Hastings on Hudson, Westchester County, New York
Site No. 3-60-015

Dear Mr. Ports:

Pursuant to your letter of October 24, 2007, following is the revised pre-design investigation work scope for the former Mobil terminal property in Hastings-on-Hudson, New York pursuant to Section 8 of the September 2006 Record of Decision (ROD) for the subject site. Revisions to the work scope are intended to address the comments in your letter of October 24th that specifically pertain to the work scope for the former Mobil terminal property, summarized as follows. For clarity, your comments are included in their entirety in bold type, followed by a summary of our responses.

Comment 3:
The site work anticipates soil excavation and storage. There needs to be a separate section or standard operating procedure to address items such as storage, containment, community air monitoring and decontamination. Excavated areas should be brought back to the original surface elevation by using backfill which is uncontaminated pursuant to 6 NYCRR 375-6.7(d) and free of extraneous debris or solid waste. Documentation of the quality of the fill including sampling data may be required.

Response 3:
Bulleted sections in the enclosed, revised Field Work Scope have been expanded to include references to standard operating procedures for test pitting, community air monitoring, and decontamination as applicable. The second bulleted section in the Field Work Scope and SOP-6 in Attachment A of the Quality Assurance Project Plan (QAPP) has been revised to include expanded text for soil storage/containment and site restoration.

Comment 5:
The Quality Assurance Project Plan for the Pre-Design Investigation Work Scope for the Former Mobil Terminal Property should provide more information on the modified Tier II validation procedure or agree to submit a Data Usability Summary Report (DUSR). The Department uses the enclosed guidance for submitting DUSR on remedial projects.

Response 5:
The QAPP has been revised to indicate that data will be evaluated according to the NYSDEC DUSR guidelines.

Comment 24:
SOP – 6 – In the event that highly contaminated soil is excavated during installation of the proposed test pits; the soil will need to be characterized and properly disposed of at an appropriate facility regardless of cost-effectiveness.

Response 24:
SOP-6 in Attachment A of the QAPP has been revised to indicate that grossly contaminated soil will be characterized and properly disposed of at an appropriate facility.

Comment 29:
SOP – 9 – Particulate monitoring, as described in the enclosed New York State Department of Health's Community Air Monitoring Plan must be adhered to during all ground intrusive work.

Response 29:
SOP-9 has been revised to include provisions in the NYSDOH Generic Community Air Monitoring Plan.

This revised scope remains proposed for the former Mobil terminal property (refer to Figure 1). The results will be incorporated with the pre-design investigation for the parcel comprising the balance of the subject site, the former Uhlich Color Company, and ultimately will be incorporated into the remedial design for the two parcels comprising the Former Tappan Terminal.

This correspondence is again presented to expeditiously outline the work scope for the former Mobil terminal property. As we are in the process of negotiating a Consent Order, we are concerned that in the near future remediation activities on the neighboring ARCO site may interrupt the one remaining access way for vehicles necessary to implement work at the former terminal. Please contact me at (516) 239-5232 if we can provide any additional information to facilitate your approval of this work scope.

Sincerely,

S.P. Trifiletti

Steve P. Trifiletti
Project Manager

copy: N. Walz – NYSDOH
R. Pergadia – NYSDEC
M. Hendrickson – Chevron
G. Merritt – Fitzpatrick, Merritt & Samra-Arteaga
W. McCune – BBL

Pre-Design Investigation Work Scope
Former Mobil Terminal Property
Hastings-on-Hudson, New York
Former Tappan Terminal Site No. 3-60-015
November 19, 2007, Rev. 2

Background

Historic investigation programs and the requirements of the Record of Decision (ROD) were considered to identify data gaps and to scope a pre-design investigation for the former Mobil terminal property as required by the ROD. The following items summarize objectives for the proposed work scope.

- The 1998 sampling program conducted by Dvirka and Bartilucci (refer to Figure 1) will be augmented by completing a comparable (estimated 150 foot) grid pattern across the former Mobil terminal property.[1] Some additional sampling locations are proposed in the central area of the former tank farm to evaluate the potential presence of grossly impacted soil in that area.

- Historic data for areas of gross contamination as defined by the ROD[2]:

  > Semi-volatile Organic Compounds plus Tentatively Identified Compounds (SVOCs + TICs) greater that 500 parts per million (ppm)

  or areas of elevated total petroleum hydrocarbon (TPH) concentrations were reviewed. There are no locations on the former Mobil terminal property with SVOC concentrations in excess of 500 ppm.[1] Elevated concentrations of TPH were found in the northern portion of the parcel, with free petroleum product historically noted in well OW-5 and replacement well OW-5A, and visual petroleum impact reported at sample location SB-3.[1,3,4] Soil in the area will be investigated to confirm and evaluate the extent of grossly impacted soil in the vicinity of SB-3.

- Soil below former structures will be investigated including the concrete pad near the former Mobil terminal entrance and Tank Pad 2 (refer to Figure 1).[1,2]

- Elevated polyaromatic hydrocarbons (PAHs) in soil below pavement near the southwestern corner of the parcel have been reviewed. Total SVOCs + TICs in samples SS-11 (0-3') and SB-1 (2-6') were approximately 5 and 61 ppm, respectively; much less than the 500 ppm criteria listed in the ROD.[1,2] Though the area was sampled due to apparent vegetative stress, the deeper horizon had the greater concentration precluding a surficial source. These samples are not indicative of grossly contaminated soil and are believed to represent fill material. Therefore, no additional soil sampling or investigation is proposed for this area.

Field Work Scope

The supplemental investigation work scope to facilitate delineation of grossly contaminated soil at the former Mobil terminal property is proposed to be conducted as follows.

- Five (5) test pits constructed by backhoe (refer to Figure 1) will be incorporated into the historic body of data for the parcel. Any visual observations or soil vapor concentrations based on field screening indicative of gross impact will be noted. Unless other intervals are identified by visual observation or elevated field screening, soil samples will be collected from two feet (2') above and two feet (2') below the water table and analyzed for SVOCs + TICs by EPA Method 8270. Test pits will be constructed in accordance with SOP-6 in Attachment A of the Quality Assurance Project Plan (QAPP) provided as Appendix A to this work scope. Community air monitoring will be conducted during test pit construction in accordance with SOP-9 in Attachment A of the QAPP provided as Appendix A to this work scope. Equipment decontamination will be conducted in accordance with SOP-4 in Attachment A of the QAPP provided as Appendix A to this work scope.

- Visually impacted soil in the vicinity of SB-3, expected to extend generally toward well OW-5A, will be excavated by backhoe for characterization and proper disposal (refer to Figure 1). Limits of the excavation, side walls and bottom, will be sampled every 20 linear feet at two feet above and two feet below the water table, unless other locations or intervals are identified by visual observation or elevated field screening, and analyzed for SVOCs + TICs by EPA Method 8270. Excavated soils will be placed in roll-offs pending characterization and proper disposal at an appropriate off-site facility. The excavation will then be backfilled with uncontaminated soil pursuant to 6 NYCRR 375-6.7(d), free of extraneous debris or solid waste. The backfill will be certified clean or sampled at a frequency of one sample per 50 cubic yards. Community air monitoring will be conducted during excavation activities in accordance with SOP-9 in Attachment A of the QAPP provided as Appendix A to this work scope. Equipment decontamination will be conducted in accordance with SOP-4 in Attachment A of the QAPP provided as Appendix A to this work scope.

- Subsurface piping and structures on the former Mobil terminal property will be visually catalogued and mapped for removal during the future remedial design phase (refer to Section 8 of the ROD[2]) including the concrete pad near the former Mobil terminal entrance, tank pads, and piping runs (refer to Figure 1).

Implementation and Schedule

The above work scope and schedule below assumes vehicular access to the former Mobil terminal property and favorable weather conditions. Weather-related site conditions and access issues may become key limiting factors in scheduling site work. The Zinsser Bridge is currently closed without any known schedule for reopening. Current access to the site is only through the neighboring ARCO property, subject to remedial activities at that site. ExxonMobil is prepared to implement this work scope upon notice from the NYSDEC to proceed; verification of site access; and favorable weather conditions that enable completion of the work scope in a safe manner with necessary resources, such as readily-available sources for fill material.

Task	to be Completed by Week No.
NYSDEC Approval to Proceed	0
Prepare to Conduct Field Work Scope: (order sampling supplies, reserve field and excavation equipment)	3*
Conduct Field Work Scope	4*
Report Results	10*

Note: *Schedule subject to site access and favorable weather conditions for field tasks.

Citations

[1] “Remedial Investigation Report, Tappan Terminal Site”; Dvirka and Bartilucci Consulting Engineers; Syracuse, NY; September 1999.

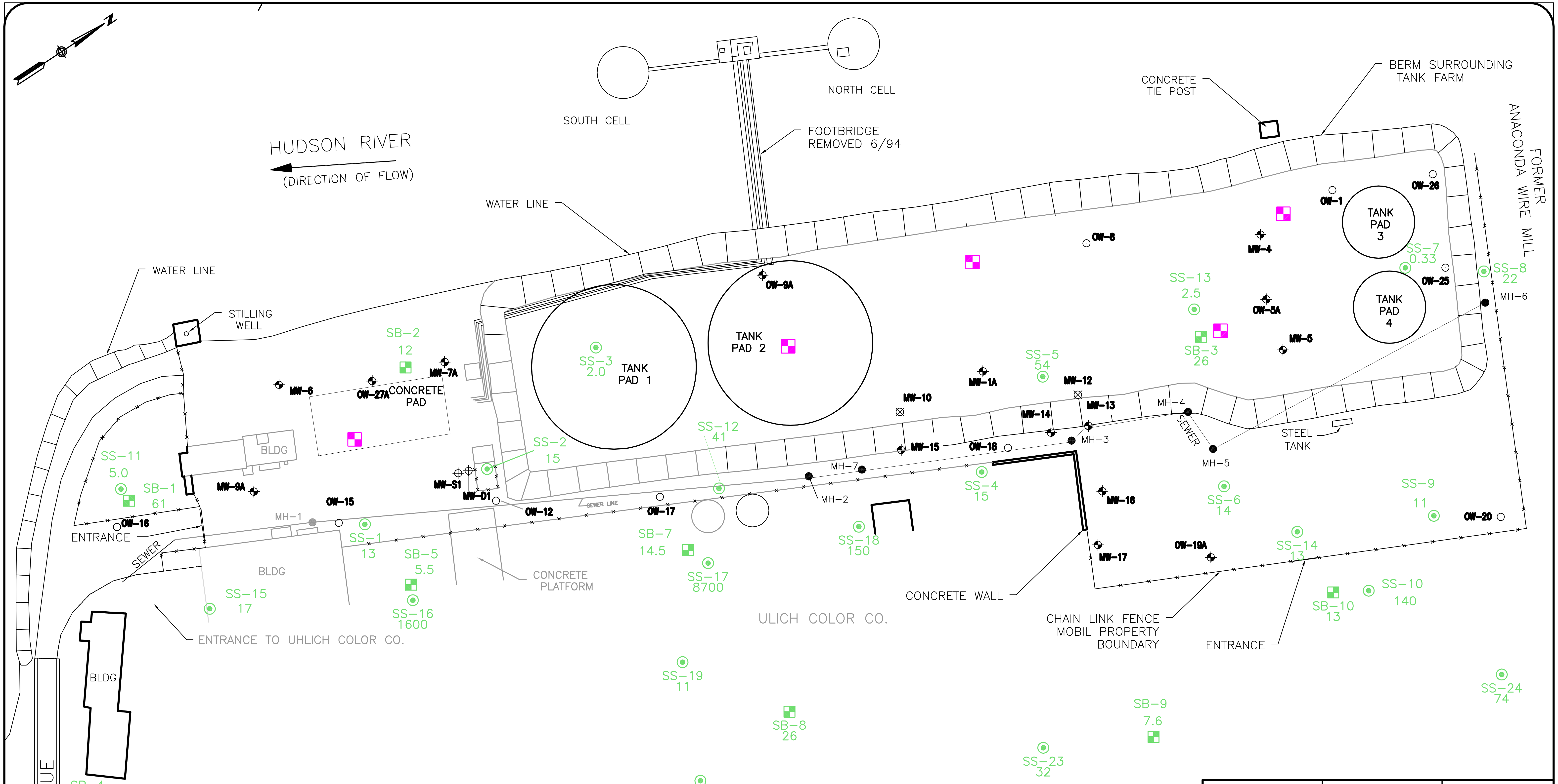
[2] “Record of Decision, Tappan Terminal Site”; New York State Department of Environmental Conservation; September 2006.

[3] “Ground-water and Soil Quality Investigation at the Mobil Oil Corp. Tappan Terminal”; Leggette, Brashears & Graham, Inc.; Wilton, CT; March 1987.

[4] “Monitor Well Replacement, Mobil Oil Corp. Tappan Terminal No. 31-020”; Leggette, Brashears & Graham, Inc.; Wilton, CT; December 1993.

Enclosures

Figure 1:	Proposed Investigation Plan
Appendix A:	Quality Assurance Project Plan
Appendix B:	Health and Safety Plan



LEGEND:

🟩 SB-8 26	SOIL BORING LOCATION (1998)
◎ SS-22 54	SOIL SAMPLING LOCATION (1998)
	TOTAL CONCENTRATION OF SVOC PLUS TICS DETECTED IN SAMPLE IN ppm
🟥	PROPOSED TEST PITS

DES.BY: LN	DR.BY: SH	CK.BY: AP

TAPPAN TERMINAL
HASTINGS-ON-HUDSON, NY

FIGURE 1

PROPOSED INVESTIGATION PLAN

SCALE: 1" = 80'	PROJECT NO: 206925.01
DATE: JULY 2007	FIGURE 1

WOODARD & CURRAN
Engineering · Science · Operations

\\Cheshire\projects\206925 ExxonMobil Tappan Terminal\wip\Soil Sampling Plan\TPN - SOIL SAMPLE 07 07.dwg, 8/2/2007 1:35:49 PM, \\Cheshire\PDFPrint - Print

206629/wip/fig

QUALITY ASSURANCE PROJECT PLAN (QAPP)

Former Tappan Terminal

Hastings-on-Hudson, New York

August 20, 2007
Rev. 1 – November 19, 2007

TABLE OF CONTENTS

SECTION **PAGE NO.**

FORM **PAGE NO.**

ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) includes the following four basic element groups: Project Management, Measurement Data Acquisition; Assessment/Oversight; and Data Validation and Usability. This QAPP follows EPA's Quality Assurance Guidance for Conducting Brownfields Site Assessments (EPA 540-R-98-038) and is incorporated within the pre-design investigation work scope ("Field Work Scope") for the former Mobil terminal property in Hastings-on-Hudson, New York.

This QAPP is applicable only to the work specified. Revisions to the QAPP for additional work or changes to the Field Work Scope will be made and approved in accordance with standard Woodard & Curran Inc. practices and submitted to ExxonMobil Refining & Supply, the present owner of the subject property, for approval. Notification and distribution of any changes will be conducted by Woodard & Curran.

2.0 PROJECT MANAGEMENT

This element group encompasses aspects of project management, objectives and background. It identifies the roles and responsibilities of project personnel, describes communication procedures and details the proposed project schedule.

FORM A

TITLE AND APPROVAL PAGE

Quality Assurance Project Plan (QAPP) for Work Associated with the former Tappan Terminal
Document Title

Anne Proctor **Woodard & Curran**
Prepared by: Preparer's Name and Organizational Affiliation)

1520 Highland Avenue
Cheshire, CT 06410 **(203) 271-0379**
Address and Telephone Number

August 1, 2007
Day/Month/Year

Project Manager: ______________________
Signature

Anne E. Proctor - Woodard & Curran
Printed Name/Date

Project Director: ______________________
Signature

Nicholas A. Hastings – Woodard & Curran
Printed Name/Date

FORM B

PROJECT ORGANIZATION AND RESPONSIBILITY/DISTRIBUTION LIST

Woodard & Curran of Cheshire, Connecticut was retained by ExxonMobil to provide environmental consulting services for the former Tappan Terminal property in Hastings-on-Hudson, New York.

ExxonMobil Refining & Supply			
Steve Trifiletti	Global Remediation	(516) 239-5232	steve.p.trifiletti@exxonmobil.com

NYSDEC			
William Ports	Div. of Environmental Remediation	(518) 402-9667	wfports@gw.dec.state.ny.us

Woodard & Curran			
Nick Hastings	Project Director, Regulatory Specialist	(203) 271-0379 Ext: 2305	nhastings@woodardcurran.com
Anne Proctor	Project Manager, Project QA Officer	(203) 271-0379 Ext: 2327	aproctor@woodardcurran.com

Roux Associates			
Therese Pitterle	Project Field Task Manager	(631) 232-2600	tpitterle@rouxinc.com

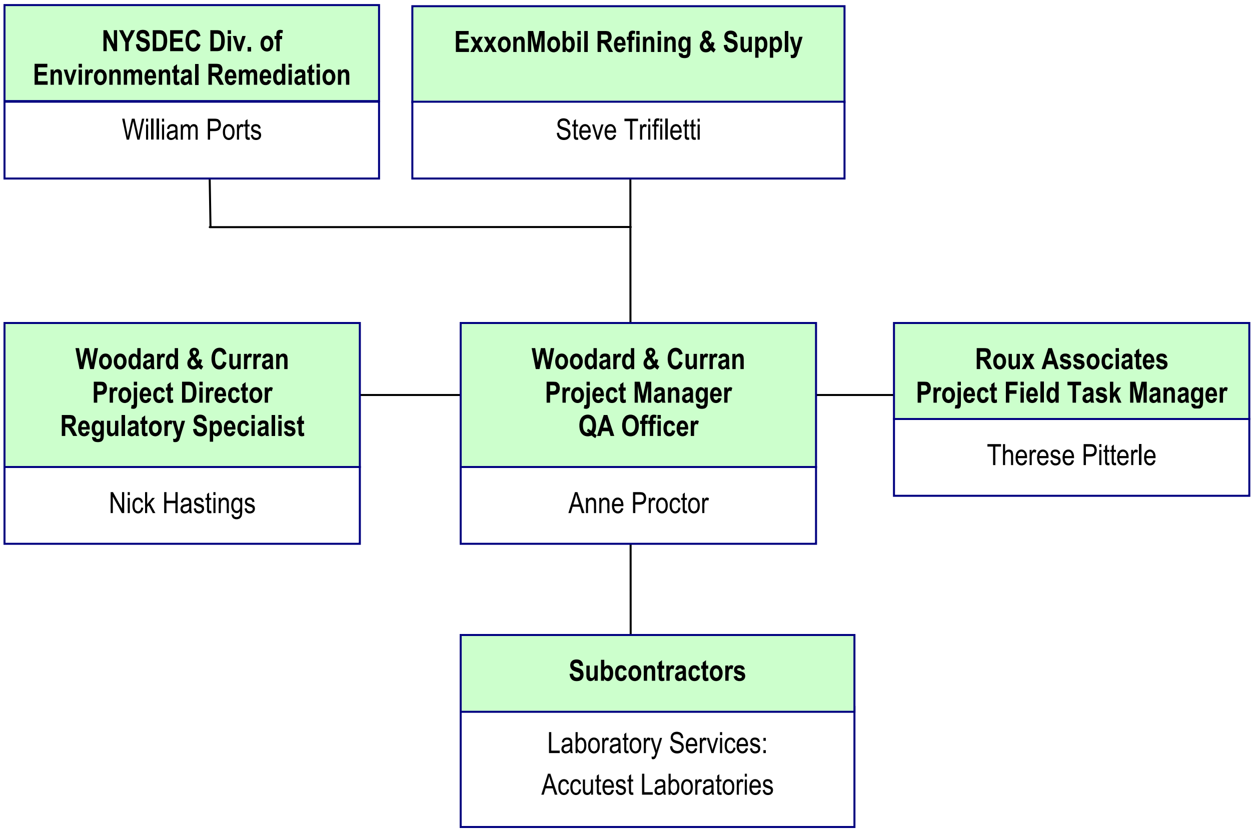
Laboratory			
Accutest Dayton, NJ	Laboratory Services	(732) 329-0200	www.**accutest**.com

Effective communication between all parties will be critical to ensure project goals are met. It will be the responsibility of the Project Manager to maintain communications internally and externally. The Project Manager will be in frequent contact with project personnel to keep the project team informed as to progress and potential changes as project activities are conducted.

All project personnel will communicate frequently to ensure field activities and reporting requirements are in accordance with this QAPP. Daily calls will be conducted to facilitate communication and evaluate progress. During field activities, field personnel will communicate with the Project Field Task Manager as needed.

Scheduling information, billing and any changes to the QAPP or work scope will be communicated to subcontractors by the Project Manager or Project Field Task Manager. Subcontractors must immediately report any problems to the Project Field Task Manager.

Project Organization and Communication Chart



FORM C

PROBLEM DEFINITION

The subject property is owned by ExxonMobil and is presently vacant, pending approval for redevelopment by NYSDEC and ExxonMobil. A Record of Decision (ROD) was issued by the NYSDEC in September 2006. Historic investigation programs and requirements of the ROD were used to identify data gaps and develop a pre-design investigation for the former Mobil terminal property. The Field Work Scope was developed to delineate and/or remove "grossly contaminated soil" as defined by the ROD; i.e., soil that is visually impacted or that contains greater than 500 parts per million (ppm) total semi-volatile compounds plus tentatively identified compounds (SVOCs + TICs) as measured by EPA Method 8270.

FORM D

PROJECT DESCRIPTION

The Field Work Scope to facilitate delineation of grossly contaminated soil at the former Mobil terminal property is proposed to be conducted as follows.

- Five (5) test pits constructed by backhoe as depicted on Figure 1 in the Field Work Scope. Any visual observations or soil vapor concentrations based on field screening indicative of gross impact will be noted. Unless other intervals are identified by visual observation or elevated field screening, soil samples will be collected from two feet (2') above and two feet (2') below the water table and analyzed for SVOCs + TICs by EPA Method 8270.
- Visually impacted soil in the vicinity of SB-3, expected to extend generally toward well OW-5A, will additionally be excavated by backhoe for characterization and proper disposal (refer to Figure 1 the Field Work Scope). Limits of the excavation, side walls and bottom, will be sampled at two feet (2') above and two feet (2') below the water table, unless other intervals are identified by visual observation or elevated field screening, and analyzed for SVOCs + TICs by EPA Method 8270.
- Subsurface piping and structures on the former Mobil terminal property will be assessed for removal during the future remedial design phase (refer to Section 8 of the ROD) including the concrete pad near the former Mobil terminal entrance, tank pads, and piping runs (refer to Figure 1 the Field Work Scope).

3.0 MEASUREMENT DATA ACQUISITION

This element group describes the design and implementation of measurement systems that will be used during the project. Sampling procedures, analytical methods/procedures, and data handling and documentation procedures are described in this section. Field sampling SOPs are included in **Attachment A**. Analytical laboratory SOPs are included in **Attachment B**.

FORM E

SAMPLING DESIGN

The proposed work scope includes investigative tasks as a result of Woodard & Curran's review of project documents. The proposed tasks include the following specific and related tasks:

- excavation of test pits;
- soil sampling; and
- assessment of subsurface piping and structures.

Soil sampling, including the number of samples and analytical parameters, are outlined in the Field Work Scope. The investigative work is designed to identify the presence/absence of areas where SVOCs + TICs exceed 500 ppm. A site map showing the proposed test pit locations is included as Figure 1 in the Field Work Scope.

Equipment and methods used will be applied consistently from one test pit to another in order to maximize data comparability. If it becomes necessary to deviate from customary methodology, the effects of such change will be examined and documented for future reference.

Individuals responsible for conducting sampling and analysis of soil will be familiar with the Field Work Scope and QAPP prior to performing their duties. Individuals conducting investigative field work will have completed OSHA 40-hour training. Training records will be provided upon request.

FORM F-1
METHOD AND SOP REFERENCE TABLE

Analytical Method Reference: **Include document title, method name/number, revision number, date**	**Project Analytical SOPs:** [1] **Include document title, date revision number, and originator's name**
1a. SW-846, Semi-Volatile Organic Compounds, Method 8270C	1b. SOP for Test Method 8270C, Rev. 3, December 1996, Accutest Laboratories

Project Sampling SOPs:[2] **Include document title, date, revision number, and originator's name**
1c. SOP for Test Pit Sampling, SOP No. S-6, Rev. 2, April 2002, W&C
2c. SOP for Equipment Decontamination, SOP No. S-4, Rev. 2, April 2002, W&C
3c. SOP for Air Monitoring, SOP No. S-9, Rev. 2, April 2002, W&C

Notes:

1. Analytical Laboratory SOPs are included in Attachment B of this document.
2. Project Sampling SOPs are included in Attachment A of this document.

FORM F-2
SAMPLING AND ANALYTICAL METHODS REQUIREMENTS

Parameter	**Matrix**	**Number of Samples (include field QC)**	**Analytical Method**(1)	**Sampling SOP**(1)	**Containers per Sample (number, size and type)**	**Preservation Requirements (temperature, light, chemical)**(2)	**Maximum Holding Time at Lab (preparation/ analysis)**
SVOCs	Soil	TBD	1a.	1c.	1, 8oz. glass jar Teflon cap	4°C	Extract in 14 days Analyze in 40 days

Notes:

1. Form F-1 contains the Method and SOP Reference Table
2. Sample containers to be pre-preserved by the laboratory

FORM G

PREVENTIVE MAINTENANCE – FIELD EQUIPMENT (1)

Instrument	Activity	Frequency	SOP Ref.[(2)]
Photo-ionization detector	Check charge/Battery Replace Filter Clean Lamp Window	Daily As needed As needed	Manual
O2/LEL Meter	Check charge/Battery Replace Filter	Daily As needed	Manual

Notes:

1. Field crews responsible for daily maintenance as per manufacturer's specifications outlined in equipment manuals.
2. All operation and maintenance procedures will be in accordance with manufacturer's specifications as outlined in the equipment manual.

FORM H

CALIBRATION AND CORRECTIVE ACTION – FIELD EQUIPMENT (1)

Instrument	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. (2)
Photo-ionization detector	Field Screening and Air Monitoring	Calibrate beginning and end of day Calibration Checks throughout the day	75 to 125% Response to 100 ppm Isobutylene Calibration Standard	Perform filter change and battery check, recalibrate instrument. If still out of range clean lamp window then recalibrate instrument. Lastly, if still out of range call vendor for troubleshooting guidance or a replacement instrument.	Manual
O2/LEL Meter	Field Screening and Air Monitoring	Calibrate once/day Calibration Checks as needed	75 to 125% Response to Calibration Standard	Perform filter change, battery check, and flow check, then recalibrate instrument. If still out of range call vendor for troubleshooting guidance or a replacement instrument.	Manual

Notes:

1. Field crews responsible for daily maintenance as per manufacturer’s specifications outlined in equipment manuals.
2. All operation and maintenance procedures will be in accordance with manufacturer’s specifications as outline in equipment manual.

FORM I

PREVENTIVE MAINTENANCE – LABORATORY EQUIPMENT

The purpose of this section is to delineate the SOPs/methods used to ensure the optimum performance of laboratory equipment. All laboratory equipment should be maintained in accordance with each respective instrument manufacturer's operating instructions with all maintenance activities recorded. The selected laboratory, Accutest, will provide the analytical support for Field Work Scope. Consequently, the analytical laboratory is responsible for performing preventative maintenance on the laboratory equipment. The analytical laboratory is required to follow their quality assurance program, including preventative maintenance. Form F-1 of this QAPP contains the Method Reference Table.

FORM J

CALIBRATION AND CORRECTIVE ACTION – LABORATORY EQUIPMENT

The purpose of this section is to define the analytical techniques that will ensure the laboratory instrumentation employed will accurately and precisely quantitate the analytes of concern. The analytical laboratory will provide this information upon request for any target compounds such that the data objectives of the Field Work Scope and QAPP are supported. Additionally, the analytical laboratory will be required to submit and follow their approved quality assurance program, including calibration and corrective action procedures for laboratory equipment. Form F-1 of this QAPP contains the Method Reference Table.

FORM K

SAMPLE HANDLING AND CUSTODY REQUIREMENTS

All samples collected will be immediately placed on ice in a sample cooler to fulfill the necessary preservation requirements. At the end of each work day, samples will be shipped to the analytical laboratory by courier.

A Chain of Custody (COC) program will be utilized during sample collection, handling and transport. The COC program is designed to ensure that each sample is properly handled and accounted for at all times from collection in the field to the analysis at the laboratory. In addition to the COC, sample collection will be documented in site-specific field log books and each sample will be individually labeled. Labeling of each sample will consist of: sample identification, source of sample, date and time collected, the initials of personnel collecting the sample, the analysis required, and the preservation method. The purpose of this program is to ensure that each sample is analyzed for the correct parameters and protected from loss, damage or contamination. COC forms will be placed in the sample coolers with the respective samples for transport to the laboratory.

FORM L

ANALYTICAL PRECISION AND ACCURACY

Analytical precision and accuracy for each method can be found in the SOP referenced in Form F-1 of this document. Applicable information includes the analytical method and equipment required, laboratory decontamination procedures, and specific performance requirements such as detection limits, quantitation limits, precision requirements and accuracy requirements. Detection limits will be based upon the laboratory-calculated detection limits.

FORM M

FIELD QUALITY CONTROL REQUIREMENTS

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Duplicate	One per every 20 samples collected (Blind duplicate)	RPD ≤ 30% for aqueous samples RPD ≤ 40% for soil/sediment samples	Review field notes and determine if data is useable and/or reanalysis is required.
Matrix Spike/ Matrix Spike Duplicate	One set per 20 samples collected	RPD ≤ 30% for soil/sediment samples	Results will be qualified or rejected.
Temperature Blank	One per sample cooler	4^0C +/- 2^0	Results will be qualified or rejected.
Equipment Inspection	Each item prior to use	Physical integrity, contains proper preservative.	Discard item.
Reagent/Method Blanks	Each group of samples (Maximum of 20 samples per group). GC/MS spiked with surrogates 1 out of 10.	Positive sample results less than two times (2X) the method detection limit.	Halt analysis. Locate the source of contamination; correct problem; reanalyze method blank.
Replicate Sample	One out of every 15 samples	Within RPD established control limits.	Reanalyzed for parameter in question.

QC Sample	Frequency	Acceptance Criteria	Corrective Action
Laboratory Control Sample (LCS)	Every 20 samples.	Laboratory and/or manufacturer established acceptance ranges.	Reanalyze associated samples.
Continuing Calibration Verification	Each group of samples.	Within % Recovery control limits.	Locate and correct source of error. Reanalyze check standard.
Matrix Spike	Every 20 samples or every batch whichever is less.	Accuracy, as defined by % Recoveries, within laboratory established quality control limits.	Sample set reanalyzed for parameter in question.
Surrogate Analysis	All method blanks and samples.	% Recovery meet laboratory established control limit acceptance criteria (established quarterly).	Locate and correct source of error. Reanalyze internal standard. Determine if reanalysis is required.
Internal Standards	All samples and method blanks.	% Recovery meet Laboratory Established control limit acceptance criteria (established quarterly).	Locate and correct source of error. Reanalyze internal standard. Determine if reanalysis is required.

FORM N

DATA MANAGEMENT AND DOCUMENTATION

Following receipt of laboratory analytical reports, each report will be reviewed to confirm that relevant laboratory quality control/quality assurance documentation is included. The laboratory will provide the following minimum data with each package:

- Data Results Sheets (include any performance evaluation sample results)
- Surrogate Recoveries and Acceptance Limits
- Matrix Spike/Matrix Spike Duplicate Results and Acceptance Limits
- Spike/Duplicate Results and Acceptance Limits
- Laboratory Control Sample Results and Acceptance Limits
- ICP Serial Dilution Results
- ICP Interference Check Sample Results
- Project Narrative which contains all observations and deviations

All laboratory results will be delivered to Woodard & Curran both electronically (i.e., Excel and GIS/Key electronic data deliverables) and in hard-copy form. Raw data including chromatograms and copies of internal COCs will be maintained by the laboratory.

Field data will be recorded in bound field log books to maintain a permanent record of all field activities. Information will include date, weather conditions, individuals on-site, field screening results, sampling observations and techniques, and any additional relevant information. All field notes and photographs will be maintained and stored in dedicated project files according to the Woodard & Curran Project Records Retention System.

4.0 ASSESSMENT/OVERSIGHT

This element group of the QAPP details procedures used to ensure implementation of the QAPP. It describes minimum requirements for quality assurance for management and final project reports.

FORM O

ASSESSMENT AND RESPONSE ACTIONS

Throughout the course of the project, Woodard & Curran will implement the following procedures to detect and correct problems that may occur:

- project management meetings (daily/weekly calls or as needed);
- peer review of all reports, documents, and correspondence; and
- ongoing communication between Woodard & Curran's project team, ExxonMobil and the NYSDEC.

As warranted, problems that occur will be communicated by project memorandums and telephone conversations. All memorandums and telephone notes will detail the problem encountered and any corrective actions taken. All documentation will be maintained in dedicated project files.

Changes to the QAPP will be made under the direction of the Project Manager and carried out by the appropriate project personnel.

FORM P

PROJECT REPORTS

Following implementation of the Field Work Scope and receipt and analysis of analytical data, a Report will be prepared to document all activities conducted during the Field Work Scope implementation as well as conclusions made and status of the various aspects of the investigation. Additional detailed reports will be prepared to document the conduct and findings of subsurface investigations performed at the site, if warranted.

5.0 DATA VALIDATION AND USEABILITY

This element group details the quality assurance activities that will be performed to ensure that the collected data are scientifically defensible, properly documented, of known quality, and meet the project objectives. Analytical data collected will be validated to 10% by an outside data validation contractor in accordance with the NYSDEC Data Usability Summary Report (DUSR) guidelines.

FORM Q-1

VERIFICATION OF SAMPLING PROCEDURES

Upon completion of the Field Work Scope, all data collected will be verified to ensure that sampling SOPs were adhered to and that specified samples were collected and analyzed for specified parameters. This evaluation will include (but is not limited to) the following:

- identify all samples;
- compare to samples documented in field log books;
- compare to Chain of Custody;
- check analytical parameters with those specified in the Field Work Scope;
- check detection limits with those specified in this QAPP; and
- review laboratory and field quality assurance and quality control (QA/QC) sample results.

FORM Q-2

DATA VERIFICATION AND VALIDATION

This section of the QAPP describes the process that will be followed to verify and validate the project data.

Internal Verification

Prior to release by the off-site laboratory, the data will be reviewed internally against all specific QA/QC parameters. The laboratory will perform analyses and review QA/QC consistent with the requirements of the specific laboratory method SOPs. Any deviations will be documented and explained in the final report. The off-site laboratory is responsible for the final results and overall quality of the data.

External Verification

Data validation to 10% of samples will be performed by an outside data validation contractor in accordance with the NYSDEC DUSR guidelines.

Validation

Validation of measurements is a systematic process of reviewing a body of data to provide assurance that the quality is adequate for the intended use. The validation process includes the following activities, as an example:

- Reviewing QC activities and results;
- Screening data sets and quality control results for outliers;
- Reviewing field sample data records and chains-of-custody;
- Reviewing sample handling and preservation procedures; and
- Verifying the above process.

Quality control results will also be compared against acceptance criteria described on Form M of this QAPP to determine completeness and to assess analytical control, precision, matrix effects or other interferences that could affect the quality of sample results. Specific quality control components, which will be evaluated in the validation procedures, include:

- Sampling and analysis date;
- Sample custody;
- Holding times;
- Sample preservation;
- Field and laboratory duplicate sample results;
- Surrogate recoveries;
- Matrix spike/matrix spike duplicate results;

- Laboratory control standards; and
- Laboratory method blanks and lot assignment reports.

The laboratory will also provide a case narrative indicating that the following parameters were reviewed as part of the sample analyses and the outcome of that review:

- Tune summaries
- Initial Calibration (ICAL)
- Continuing Calibration Verification (CCV)
- Internal standards
- Prep sheets (analytical batch sheets)
- Instrument log sheets

The laboratory case narrative will be reviewed during the data validation process and pending the outcome of that review the Project Manager will determine if additional validation activities are warranted.

DATA QUALIFIERS

Once sample concentrations have been through the data validation process, data qualifiers will be added, as necessary. Data qualifiers indicate that the reported sample concentration is below the detection limit, is estimated, or is rejected depending upon analytical conditions at the time of sample analysis. Specific data qualifiers, which may be applied as a result of data validation, include the following:

U - The analyte was not detected above the quantitation limit (QL).

J - The analyte was detected but the associated reported concentration is approximate and is considered estimated.

R - The reported analyte concentration is rejected due to serious deficiencies with associated quality control results. The presence or absence of the analyte cannot be confirmed.

UJ - The analyte was not detected above the QL. However, due to quality control results that did not meet acceptance criteria, the quantitation limit is uncertain and may not accurately represent the actual limit.

All analyte concentrations will be reported to the QL. Sample detections below the QL will be reported with a “J” qualifier.

DATA REPORTING

After data qualifiers have been added to the data set, an electronic version of the validated off-site laboratory data will be entered into a database in a format that is then available for interpretation.

Information for each sample that is entered into the database will include, but is not limited to the following:

- Sample identification number;

- Date sampled;
- Analytical method;
- Analyte name;
- Reporting units;
- Quantitation limit (QL);
- Analytical results;
- Validation qualifiers; and
- Any required footnotes.

Data validation will be performed by an entity independent of the laboratory generating the data.

FORM R

DATA USABILITY

Assessing data usability involves the process of reviewing and validating laboratory data and assessing whether it meets the prescribed project quality objectives. The environmental quality data to be collected throughout the execution of the Field Work Scope have specific end uses. For example, field screening data will be used to delineate excavation areas or to clear areas for redevelopment. Data will also be incorporated into the body of historical environmental data that has been collected for the property.

The validated data will be evaluated in terms of its precision, accuracy, representativeness, sensitivity, completeness, and comparability (PARCC).

The following subsections describe the measurement performance criteria and data usability for this investigation. In general, if issues with data quality are found in the data sets, they will be discussed and reviewed with the project team (including the laboratory, ExxonMobil and NYSDEC). If data quality is determined to be compromised for any given sampling event, a data quality assessment will be included in the applicable project reports. This assessment will evaluate the potential impact on the project, establish limitations of the data, and propose corrective actions, as appropriate.

Precision

Precision is a measure of the mutual agreement among individual measurements of the same property under prescribed conditions. Precision is measured by performing duplicate measurements in the field or laboratory and is expressed in terms of Relative Percent Difference (RPD).

Field and analytical duplicates have been incorporated into the program to assess the precision of the data. Field duplicate imprecision might be a reflection of several factors including: laboratory imprecision, sampling technique, decontamination procedures, and/or heterogeneity of contaminant distribution within the matrix. Analytical duplicates are a direct indication of laboratory precision.

The QC requirements, acceptance criteria, and potential corrective actions for field and laboratory duplicates are described on Form M. If data validation and assessment indicates that field and/or laboratory duplicates do not meet measurement performance criteria for precision, the potential impact on the project will be evaluated in the data quality assessment included in the applicable project reports. This data quality assessment will establish limitations and potential corrective actions for the affected data. If field duplicates appear to be the source of imprecision, sampling procedures may be re-evaluated and adjusted accordingly for future sampling and analysis events. If poor precision is indicated in analytical duplicates, laboratory QA/QC procedures may need to be reviewed.

Accuracy/Bias

Accuracy/Bias is the degree of agreement of a measurement with an accepted reference or true value and is usually expressed in terms of Percent Difference (%D) or Percent Recovery (%R). Accuracy is a measure of the bias of a system.

Routine calibration checks of field instrumentation are performed to assess the accuracy of field measurements. Equipment and trip blanks collected during field sampling activities measure accuracy by assessing potential contamination introduced during sample collection and transport. In the laboratory, initial calibrations, initial/continuing calibration verifications (ICVs/CCVs), sample matrix spike/matrix spike duplicates (MS/MSDs), internal standards (IS), sample surrogate recoveries, and laboratory control samples (LCS) are performed/checked to evaluate the accuracy of laboratory instrumentation. The accuracy of laboratory analytical procedures is further evaluated through the analysis of method blanks that can assess potential contamination introduced during sample preparation and/or analysis.

The QC requirements, acceptance criteria, and potential corrective actions for laboratory QC checks that measure accuracy and field and trip blank QC are described on Form M. If data validation and assessment indicates that field and/or laboratory QC checks for accuracy do not meet measurement performance criteria, the potential impact on the project will be evaluated in the data quality assessment included in the applicable project reports. Limitations and potential corrective actions for the affected data will be established in this data quality assessment. If poor accuracy is indicated by analytical QC checks, laboratory procedures may need to be reviewed.

Representativeness

Sample representativeness will be assessed through the measures of precision and accuracy. Field documentation, field duplicate analyses, and laboratory QC sample results will provide indices for the evaluation of data representativeness. Field duplicates will be used to assess heterogeneity within a sampling medium.

The representativeness of sample results will be based on the evaluation of precision and accuracy. The data quality assessment included in the applicable project reports will address any issues concerning representativeness that develop upon data review and validation. This data quality assessment will evaluate the potential impact on the project and establish limitations and potential corrective actions for the affected data.

Sensitivity and Quantitation limits

Sensitivity is the ability of the method or instrument to detect the constituents of concern and other target analytes at the project specified quantitation limits (QLs). For this project, the minimum QLs will be based on the laboratory Practical Quantitation Limit (PQL). PQLs represent the minimum concentration that can be routinely identified and quantitated above the method detection limit (MDL) by the laboratory. If problems regarding sensitivity and quantitation limits arise during data review and validation, the potential impact on the project will be evaluated in the data quality assessment included in the applicable project reports. This data quality assessment will establish limitations and potential corrective actions for the affected data.

Comparability

Comparability between data sets will be made qualitatively to indicate the extent to which comparisons among different measurements of the same quantity will yield valid conclusions. The quality assurance objective for comparability is to ensure the comparability of results from each sampling event performed. The assessment of data comparability will begin once multiple sampling events have been performed. The data quality assessment included in the applicable project reports will address any issues concerning data comparability that arise upon data review and validation. The potential impact on the project will be evaluated in this data quality assessment and will establish limitations and potential corrective actions for the affected data.

Completeness

Completeness is a measure (percentage) of the amount of valid data obtained from a measurement system relative to the amount that would be expected to be obtained under correct, normal conditions. A data set for a specific medium will be considered complete if 85% of the data packages are validatable and fully meet the data quality objectives provided in this QAPP. If data validation and assessment indicates that measurement performance criteria for completeness has not been achieved, the potential impact on the project will be evaluated in the data quality assessment included in the applicable project reports. This data quality assessment will establish limitations and potential corrective actions for the affected data.

Data Limitations and Actions

Data will be assessed with regard to the data quality objectives, measurement performance criteria, PARCC parameters, and the QC requirements included in Form M. If data quality is determined to be compromised for any given sampling event, a data quality assessment will be included in the applicable project report. This assessment will be used to describe and document data limitations based on the qualitative and quantitative performance criteria. Based on how the data are to be used, data that do not meet all the criteria will be appropriately qualified and limited in its use.

During field activities, QA/QC samples designed to assess sampling techniques (duplicates) will be collected and shipped at the frequencies provided on Form M. If the need for corrective action is identified based on data validation and evaluation, actions will be outlined in the data quality assessment included in the applicable project reports. The data assessment process is to be an on-going process, implemented by the project team and the laboratory.

ATTACHMENT A: PROJECT SAMPLING SOPS

SOP-6

Revised November 2007

STANDARD OPERATING PROCEDURE FOR TEST PIT SAMPLING

Woodard & Curran, Inc.

Test Pit Sampling Procedure

Test Pits will be excavated with backhoe equipment to provide detailed visual examination of near surface soil, groundwater, and bedrock conditions. Test Pit soil samples may be collected using stainless steel and/or Teflon-lined scoops, trowels, shovels, spoons, or spatulas.

Equipment needed:

- Bound field logbook.
- Sample tags.
- Appropriate sample containers and labels.
- Insulated cooler and ice.
- Decontamination equipment and supplies.
- Personal protective clothing and equipment as required by the site-specific Health and Safety Plan (HASP).
- Stainless steel or aluminum trays or bowls.
- Stainless steel shovels, trowels, spoons, or spatulas.
- Backhoe Equipment

Test Pit Sampling Procedure:

1. Contact DIG SAFELY.NEW YORK at (800) 962-7962 prior to any subsurface investigation. In addition, contact local utilities that may have underground services on or near the Site.
2. Follow the sampling pattern outlined in the QAPP.
3. Mark the location of potential test pits.
4. At the direction of the project staff on-site, the backhoe operator will excavate the test pit in increments.
5. Test pit excavations will cease if any of the following occurs:
    - Distinct changes in stratigraphy or materials
    - Odors
    - Groundwater or fluid phase contaminants
6. The requirements for collecting grab samples of soil are as follows:
    a. Use a clean stainless steel trowel or spoon to collect sufficient material to fill the sample containers.
    b. Fill the sample containers directly from the sampling device, removing stones, twigs, grass, etc., from the sample. Additional sample containers may be required to obtain enough material for a minimum of 30 percent solids.
    c. Immediately secure the caps on the sample container.

d. Label container with the appropriate information. NOTE: Container may be labeled prior to sample collection.
e. Record samples (e.g., sample ID, location, depth, method, etc.) in the bound field logbook.
f. Pack sample in cooler with ice. The only preservation required for soil samples is to cool them to 4 degrees Celsius. A small plastic temperature blank will be filled with water and placed in the cooler with the samples. The temperature of the samples will be determined at the laboratory by measuring the temperature of the temperature blank.
g. Use decontaminated sampling equipment at each sample location to minimize cross-contamination.
h. In the event that a duplicate sample is collected: fill duplicate jars for VOAs as described above. For other parameters, place sufficient sample quantity in a stainless steel bowl and mix. Split the mixed sample into duplicate sampling jars.
i. VOC containers will be preserved with methanol. Pre-measured vials containing the appropriate quantity of methanol will be provided by the laboratory.

Field Log Information:

At a minimum, field logs for test pit excavation will include the following documentation:

- Plan and profile sketches of the test pit showing materials encountered, the depth of material, and sample locations
- Sketch of the test pit and distance and direction from permanent, identifiable location marks as appropriate
- A description of the material removed from the excavation
- A record of samples collected
- The presence or absence of water in the test pit and the depth encountered
- Other readings, or measurements taken during excavation, including field screening reading

Unless otherwise specified and the site-specific HASP discusses appropriate procedures, no personnel will enter the test pit. In addition, all test pits will be backfilled on the day of excavation. In most cases, excavation materials will be stockpiled on polyethylene sheeting and then returned to the test pit as backfill. In the event that grossly contaminated soil is excavated, excavated soils will be placed in roll-offs pending characterization and proper disposal at an appropriate off-site facility. The excavation will then be backfilled with uncontaminated soil pursuant to 6 NYCRR 375-6.7(d), free of extraneous debris or solid waste The backfill will be certified clean or sampled at a frequency of one sample per 50 cubic yards.

QA/QC

QA/QC procedures are outlined in the sampling procedures discussed above. Duplicates, blanks, and spikes have been incorporated into the QAPP to assess potential for sampling, shipping, and laboratory impacts on data quality. Percent solids will also be analyzed for each sediment sample so that proper concentration adjustments can be made.

References

"Soil Covers and Backfill" - 6 NYCRR 375-6.7(d).

SOP-9

Revised November 2007

STANDARD OPERATING PROCEDURE FOR AIR MONITORING

Woodard & Curran, Inc.

AIR MONITORING PROCEDURES - BREATHING ZONE

Air monitoring will be performed during invasive field activities to obtain qualitative volatile organic compound (VOC) and particulate concentrations in order to protect site workers and the community. Air monitoring will be completed upwind, near the activity in the worker's breathing zone, and downwind during sampling and intrusive activities. ***If a detection of total VOCs or particulate above the action levels indicated below is observed, stop work and immediately notify the Project Field Task Manager prior to implementing actions***. Refer to the site-specific HASP for additional health and safety procedures. All monitoring records (readings) and instrument calibration sheets must be available for NYSDEC or NYSDOH personnel to review.

Equipment Needed:

- Two Photoionization Detectors (PIDs) equipped with 10.0 or greater eV lamps, one hand-held and one monitoring station, capable of calculating 15-minute running average concentrations
- Two particulate monitoring stations capable of measuring particulate matter less than 10 micrometers in size (PM-10) integrated over a period of 15 minutes (or less) and equipped with audible alarm
- Calibration Sheets
- Field Log Book
- Personal Protective Equipment as outlined in the HASP

Air Monitoring Steps - PID measurements:

1. Calibrate the PIDs using procedures outlined in the instrument operations manual. The instrument should be calibrated at the beginning of each day of use and a check calibration at the finish of each field day. Consult the instrument operations manual for troubleshooting suggestions.
2. Set-up a monitoring station at the downwind perimeter of the work area or exclusion zone.
3. Using the hand-held instrument, measure upwind/background VOC concentrations at the start of each day and every 4-hours thereafter.
4. Also using the hand-held instrument, approximately every hour near the planned activities, measure VOC concentrations in the breathing zone, approximately 2-5 feet above the ground surface.

If the ambient air concentration of total VOCs at the downwind perimeter of the exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total VOC level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

If total VOC levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total VOC level in the worker's breathing zone is in compliance with the action level in the site-specific H&SP, and 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

If the VOC level is above the action level for worker safety in the site-specific H&SP, or above 25 ppm at the perimeter of the work area, activities must be shutdown.

Particulate Monitoring Steps:

1. Calibrate the meter using procedures outlined in the instrument operations manual. The instrument should be calibrated at the beginning of each day of use and a check calibration at the finish of each field day. Consult the instrument operations manual for troubleshooting suggestions.
2. Set-up monitoring stations at the upwind/background and downwind perimeter of the exclusion zone.
3. Throughout the day, visually monitor fugitive dust migration.

If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed (for example, wetting selected areas). Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

QA/QC

See above.

References

NYSDOH Generic Community Air Monitoring Plan – Appendix D to the NYSDEC Voluntary Cleanup Program Guide, Draft May 22, 2002.

SOP-4

STANDARD OPERATING PROCEDURE FOR EQUIPMENT DECONTAMINATION

Woodard & Curran, Inc.

FIELD EQUIPMENT DECONTAMINATION PROCEDURE

Decontamination of field equipment is necessary to ensure the quality of samples by preventing cross-contamination. In addition, decontamination reduces health hazards and prevents the spread of contaminants off-site.

Equipment needed:

Large/heavy Equipment (i.e., Drill rigs, backhoes, augers, drill pipe, bits, casing, and screen):

- High-pressure pump with steam-spray unit.
- Stiff-bristle brushes.

Small/sampling Equipment (i.e., Split spoons, bailers, bowls, and pumps):

- Soap
- Polyethylene sheeting
- Stiff-bristle brushes.
- Wash bottles or manual pump sprayer.
- 10% methanol solution (optional)
- Distilled water
- Tap water

Procedure. The following steps will be followed when decontaminating large/heavy equipment:

1. The field crew or contractor will construct a decontamination area at a designated area on site of 6-mil polyethylene, large enough to capture decontamination fluids. Decontamination of equipment will be performed over the decontamination pad. Depending on site contaminants, equipment may be decontaminated at each drilling location. Decon water will be collected and drummed for proper disposal.
2. Equipment and tools will be cleaned between each location and prior to the initiation of any sampling.
3. Spray areas (rear of rig or backhoe) exposed to contaminated soils using steam or high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.
4. Document that decontamination was performed in the appropriate logbook.

Procedure. The following steps will be followed when decontaminating sampling equipment including split-spoons, spatulas, and hand tools that directly contact samples.

1. Set up a decontamination line. The decontamination line should progress from "dirty" to "clean", with an area for drying decontaminated equipment. The decontamination line should be set up on polyethylene sheeting.
2. Wash the item thoroughly in a bucket of soapy water (tap water). Use a stiff-bristle brush to dislodge any clinging dirt. Disassemble any items that might trap contaminants internally before washing. Do not reassemble until decontamination is complete.
3. Rinse the item in a bucket containing clear tap water. Rinse water should be replaced as needed.
4. Document that decontamination was performed in the appropriate logbook.
5. Disposable items will be bagged for disposal as general refuse.
6. Decontamination water will be drummed for proper disposal.

QA/QC

The Project Field Task Manager or designated alternate will oversee decontamination procedures to ensure that they have been completed according to the procedures outlined above. Equipment blanks will be collected and analyzed throughout the program to determine the effectiveness of decontamination procedures. Blank number and frequencies are presented in the QAPP.

References

None.

ATTACHMENT B: ANALYTICAL LABORATORY SOPS

Lab Manager______________

QA Manager_______________

Effective Date:________________________

TEST NAME: **METHOD 8270C, SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)**

REFERENCE: SW846 8270C (Revision 3, December 1996)

Revised Sections: ***Table 9***

1.0 SCOPE AND APPLICATION

1.1 The following method describes the analytical procedure that is utilized by Accutest to analyze semivolatile organic compounds in extracts prepared from all types of solid waste matrices, soils, and water samples. Options are incorporated for the analysis of sixteen (16) polyaromatic hydrocarbons (PAH) and other compounds listed in table 8A by selected ion monitoring GC/MS (GC/MS-SIM).

1.2 Table 1 lists the neutral, acidic, and basic organic compounds that can be determined by this method. The applicable concentration range of this method is compound and instrument dependent. Some compounds may require special treatment due to the limitations caused by sample preparation and/or chromatographic problems.

2.0 SUMMARY OF METHOD

2.1 This method is performed in accordance with the following extraction methodologies in SW846, 3rd Edition: 3510, 3520, 3540, 3550 and 3580.

2.2 The resultant methylene chloride extract is injected into a tuned and calibrated GC/MS system equipped with a fused silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph.

2.3 The peaks detected are qualitated by comparison to characteristic ions and retention times specific to the known target list of compounds.

2.4 Once identified, the compound is quantitated by internal standard techniques with an average response factor generated from the calibration curve.

2.5 Additional unknown peaks with a response greater than 10 % of the closest internal standard may be processed through a library search with comparison to a NIST98 database. An estimated concentration is quantitated by assuming a response factor of 1.

2.6 This method includes analytical options for PAHs and other selected compounds by GC/MS-SIM. The extract is fortified with an additional SIM specific internal standard mix and analyzed using selected ions that are characteristic of the compounds of interest following the analysis of lower concentration calibration standards analyzed under the same MS scan conditions. Qualitative and quantitative identification is conducted using the procedures employed for full scan analysis.

3.0 REPORTING LIMIT & METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at either method detection limit or the lowest concentration standard in the calibration curve, depending on the requirements of different regulatory programs. Detected concentrations below this concentration cannot be reported without qualification. See table 9.

3.1.1 Compounds detected at concentrations between the reporting limit and MDL are quantitated and qualified as “J”, estimated value. Program or project specifications may dictate that “J” qualified compounds are not to be reported.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

BATCH - a group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

BLANK - an analytical sample designed to assess specific sources of laboratory contamination.

CONTINUING CALIBRATION - a mid-range calibration check standard run every 12 hours to verify the initial calibration of the system.

EXTRACTED ION CURRENT PROFILE (EICP) - a plot of ion abundance versus time (or scan number) for ion(s) of specified mass (Es).

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations which cover the working range of the instrument; used to define the linearity and dynamic range of the response of the mass spectrometer to the target compounds.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, and sample extract at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds and must be analytes that are not sample components.

MATRIX - the predominant material of which the sample to be analyzed is composed.

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards, is carried throughout the entire preparatory and analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMITS (MDLs) - The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - As used to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PRIMARY QUANTITATION ION - a contract specified ion used to quantitate a target analyte.

REAGENT WATER - water in which no interferant is observed at or above the minimum detection limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph; a plot of total ion current versus retention time.

RELATIVE PERCENT DIFFERENCE (RPD) - As used to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

RELATIVE RETENTION TIME (RRT) - the ratio of the retention time of a compound to that of a standard (such as an internal standard).

RESOLUTION - also termed separation or percent resolution, the separation between peaks on a chromatogram, calculated by dividing the depth of the valley between the peaks by the peak height of the smaller peak being resolved, multiplied by 100.

SECOND SOURCE CALIBRATION CHECK STANDARD - a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run whenever an initial calibration is performed.

SURROGATES - pure analytes added to every blank, sample, matrix spike, matrix spike duplicate, and standard in known amounts before extraction or other processing; used to evaluate analytical efficiency by measuring recovery. Surrogates are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets is made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected human or mammalian carcinogens: benzo(a)anthracene, benzidine, 3,3’-dichlorobenzidine, benzo(a)pyrene, dibenzo(a,h)anthracene, N-nitrosodimethylamine, and 4,4’-DDT. Prepare primary standards of these toxic compounds in a hood. A NIOSH/Mass approved toxic gas respirator must be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 The data from all blanks, samples, and spikes must be evaluated for interferences.

6.2 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other stages of sample processing. Refer to "The Preparation of Glassware for Extraction of organic contaminants" SOP for practices utilized in the extraction department.

6.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature and diversity of the industrial complex or municipality being sampled.

6.4 To reduce carryover when high-concentration samples are sequentially analyzed, the syringe must be rinsed out between samples with solvent. Whenever an unusually concentrated sample is encountered, it should be followed by the analysis of solvent to check for cross contamination.

7.0 SAMPLE COLLECTION, PRESERVATION, & HOLDING TIMES

7.1 Water samples may be collected in 1-liter glass bottles with Teflon insert in caps. Soil samples may be collected in 250-ml widemouth amber glass bottles.

7.1.1 Sample should be taken with care so as to prevent any portion of the collected sample coming in contact with the sampler's gloves, thus avoiding possible phthalate contamination.

7.2 Test all aqueous samples for residual chlorine using test paper for free and total chlorine. If the sample tests positive for residual chlorine, add 80 mg of sodium thiosulfate to each liter of sample.

7.3 The samples must be protected from light and refrigerated at 4° C from the time of receipt until extraction and analysis.

7.4 Store the sample extracts at -10 °C in amber vials (protected from light), in sealed vials equipped with unpierced PTFE-lined septa.

7.5 HOLDING TIME

7.5.1 Aqueous samples must be extracted within 7 days of sampling.

7.5.2 Soil, sediments and concentrated waste samples must be extracted within 14 days of sampling.

7.5.3 Extracts must be analyzed within 40 days following extraction.

8.0 APPARATUS & MATERIALS

8.1 GAS CHROMATOGRAPH/MASS SPECTROMETER SYSTEM

8.1.1 Gas Chromatograph. HP-5890, HP-6890, or Agilent 6890-N which includes an analytical system that is complete with a temperature programmable gas chromatograph and all required accessories including syringes, capillary chromatographic columns, and gases.

8.1.1.1 The injection port is designed for splitless injection with capillary columns.

8.1.1.2 The capillary column is directly coupled to the source.

8.1.2 Column.

8.1.2.1 30 m x 0.25 mm fused silica (0.25 μm film thickness) DB-5MS or equivalent capillary column. Condition the column as per manufacture's directions.

8.1.3 Mass Spectrometer (HP-5972, HP-5973 or Agilent 5975).

8.1.3.1 Full Scan Mode -Capable of scanning from 35-500 amu every 1 second or less utilizing 70 volt (nominal) electron energy in the electron impact ionization mode.

8.1.3.2 SIM Mode- Capable of selective ion grouping at specified retention times for increased compound sensitivity (table 2a).

8.1.3.3 Capable of producing a mass spectrum which meets all the EPA performance criteria in Table 3 when injecting 50 ng of Decafluorotriphenyl phosphine (DFTPP).

8.2 DATA SYSTEM

8.2.1 Acquisition and Instrument Control: HP Chemstation. A computer system is interfaced to the mass spectrometer that allows the continuous acquisition and storage on machine readable media (disc) of all mass spectra obtained throughout the duration of the chromatographic program.

8.2.2 Data Processing: HP Enviroquant. The software accommodates searching of GC/MS data files for analytes which display specific fragmentation patterns. The software also allows integrating the abundance of an EICP between specified time or scan number limits. The data system includes the NIST98 spectra library for qualitative searches of non-target compounds present in the chromatogram. It flags all data files that have been edited manually by laboratory personnel.

8.2.3 Offline Magnetic Tape Storage Device (Lagato Networker) - the magnetic tape storage device copies data for long term, offline storage.

8.3 SYRINGE

8.3.1 10 μl graduated, auto sampler (Hamilton or equiv.).

9.0 REAGENTS AND STANDARDS

9.1 Solvents - Ultra pure, chromatography grade methylene chloride and acetone.

9.2 Stock Standard Solutions.

9.2.1 Certified, commercially prepared standards, from two separate sources are used.

9.2.1.1 Base Neutrals.

- Base/Neutrals Mix #1 (Absolute: Semivolatile Organics Standard Mix # 1).
- Base/Neutrals Mix #2 (Absolute: Semivolatile Organics Standard Mix # 2).
- PAH Mix (Absolute: Semivolatile Organics Standard Mix # 7).
- PAH Mixture #2 (Ultra).
- PAH Selected Ion Monitoring Mixture
- Benzidines Mix (Absolute: Semivolatile Organics Standard Mix # 6).
- Toxic Substances #2 (Absolute: Semivolatile Organics Standard Mix # 5).
- Pyridines Mixture (Ultra).
- Additonal requested compound(s) mix (Absolute).
- Base Neutral Mixture (2nd Source).

Acids.

- Phenols Mix (Absolute: Semivolatile Organics Standard Mix # 8).
- Toxic Substances #1(Absolute: Semivolatile Organics Standard Mix # 4).
- Acid Mixture (2nd Source).

9.2.2 Internal Standard Mixtures.

9.2.2.1 Ultra (or equivalent) at a concentration of 4,000 μg/ml for each of the following compounds.

Full Scan
- 1,4-Dichlorobenzene-d4
- Naphthalene-d8
- Acenaphthene-d10
- Phenanthrene-d10
- Chrysene-d12
- Perylene-d12

SIM

- 1,2-Dichlorobenzene-d4
- 1-Methylnaphthalene-d10
- Fluorene-d10
- Fluoranthene-d10
- Benzo(a)pyrene-d12

9.2.2.2 The internal standards should permit most of the components of interest in a chromatogram to have retention times of 0.8 - 1.20 relative to one of the internal standards.

9.2.2.3 Each 1 ml sample extract, and standard undergoing analysis should be spiked with 10 μl of the internal standard mixtures, resulting in a concentration of 40 μg/ml of each internal standard for full scan analysis and 4 ug/ml for SIM analysis.

9.2.3 Surrogate Standard Mixture.

9.2.3.1 B/N Surrogate Standard Mix: RESTEK (or equivalent) at a concentration of 5,000 μg/ml each surrogate compound.

- Nitrobenzene-d5.
- 2-Fluorobiphenyl.
- p-Terphenyl-d14.

9.2.3.2 Acid Surrogate Standard Mix: RESTEK (or equivalent) at a concentration of 7,500 μg/ml each surrogate compound.

- Phenol-d5.
- 2-Fluorophenol.
- 2,4,6-Tribromophenol.

9.2.4 DFTPP Tune Stock.

9.2.4.1 Protocol (or equivalent) at a concentration of 2,500 μg/ml for the following compounds.

- Decafluorotriphenylphosphine.
- 4,4'-DDT.
- Benzidine.
- Pentachlorophenol.

9.2.5 Store at -10 ^{o}C or less when not in use or according to the manufacturer's documented holding time and storage temperature recommendations. Stock standard solutions must be replaced after 1 year or sooner if manufacture's expiration date comes first or comparison with quality control check samples indicates degradation.

9.3 Surrogate Spiking Solutions.

9.3.1 Two surrogate spiking solutions, base/neutral surrogate solution and acid surrogate solution, at a concentration of 100 μg/ml are prepared in Extraction. Spike each sample, and blank with 0.5 ml of each solution, prior to extraction, for a final concentration of 50 μg/l of each surrogate compound in the extract.

9.3.2 A calibration range must be constructed for the surrogate compounds. Accordingly, appropriate amounts of surrogates are mixed with each calibration solution to define a range similar to the target compounds.

9.3.3 Store at -10 °C or less or according to the manufacturer's documented storage temperature recommendations. Prepare fresh surrogate spiking solutions every year, or sooner, if the manufacturer's expiration dates come first or if the solution has degraded or evaporated.

9.4 Intermediate Calibration Standard Solution.

9.4.1 The calibration stock solution is prepared by adding an appropriate amount of each stock and surrogate compounds into a 10 ml volumetric flask. Dilute the solution to the volume with methylene chloride and mix thoroughly. Refer to Table 7A for details.

9.5 Calibration Standards.

9.5.1 Initial Calibration Standards.

9.5.1.1 Calibration standards containing the surrogate compounds should be made by quantitative dilutions of the above intermediate solution. The calibration standards are prepared at a minimum of five concentrations to cover the range of 2 - 100 μg/ml for full scan and 0.2 – 15ug/ml for SIM, depending upon project specific requirements. Suggested levels and preparations are shown in Table 7B.

9.5.2 Continuing Calibration Verification.

9.5.2.1 The concentration of the mid range standard used for continuing calibration verification is alternated between 25 and 50 μg/ml for full scan and 2.5 and 5.0 for SIM.

9.5.3 Store the calibration standards in a refrigerator at 4 °C and prepare every 6 months or before the manufacturer's expiration date, whichever is sooner. Standards must be replaced immediately if the analysis of check standards indicates degradation.

9.6 Second Source Calibration Check Standard.

9.6.1 Second source calibration check standard is prepared per Table 7C, using the intermediate solutions prepared in Extraction.

9.6.2 A second source calibration check standard is analyzed after each initial calibration.

9.7 Daily GC/MS Performance Checks.

9.7.1 The solution is prepared at 50 μg/ml by making a 1:50 dilution of DFTPP stock solution (Section 9.2.4) in methylene chloride.

9.8 Matrix Spike Solutions.

9.9.1 The matrix spike solutions for both Base/Neutral and Acid are prepared in Acetone at a concentration of 100 μg/ml for each compound. Prepare the matrix spike, matrix spike duplicate and blank spike by spiking the selected sample and the blank with 0.5 ml of these solutions for a final concentration of 50 μg/l of each compound.

9.10 All organic new standard solutions are analyzed prior to use to verify the accuracy of the prepared concentration.

9.10.1 The prepared standard solution is analyzed using the determinative (instrumental) technique for the method.

9.10.2 The solution is analyzed following the completion of instrument calibration or a calibration check.

9.10.3 The concentration of the standard solution is determined using the software routines used in determining the acceptability of calibration verification.

9.10.4 The data is evaluated and the percent difference determined. The standard solution is approved for use if all designated compounds are present in the solution and the percent difference is less than the established criteria (±20%).

10.0 CALIBRATION

10.1 Initial Calibration.

10.1.1 The calibration range covered for routine analysis under RCRA employs standards of 2, 5, 10, , 25, 50, 80, 100 μg/ml for full scan and 0.2, 1, 2.5, 5, 10, and 15 ug/ml for SIM. A minimum of five standards must be run sequentially. The reporting limit is established by the concentration of the lowest standard analyzed during the initial calibration. Lower concentration standard may be needed to meet the reporting limit requirements of state specific regulatory program. The linear range covered by this calibration is the highest concentration standard.

10.1.2 A calibration range must be constructed for each surrogate compound. Accordingly, add appropriate amounts of surrogate spiking solutions to the calibration solution to define a range similar to the target compounds.

10.1.3 Aliquot 1 ml of each calibration standard into a 2 ml crimp top vial.

10.1.4 Prior to analysis, add 10 μl of the applicable (Full acan and/or SIM) internal standard solution (Section 9.2.2) to each standard. This results in a concentration of 40 μg/ml (Full scan) and 4ug/ml (SIM) for each internal standard.

10.1.5 Analyze the standard solutions using the conditions established in Section 11.0. Each analyte is quantitatively determined by internal standard technique using the closest eluting internal standard and the corresponding area of the major ion. See Table 6.

10.1.6 The Response Factor (RF) is defined in Section 13.1. Calculate the mean RF for each target analyte, using minimum of five RF values calculated from the initial calibration curve.

10.1.7 For the initial calibration to be valid, the following criteria must be met.

10.1.7.1 The System Performance Check Compounds (SPCCs) (Table 5) must be checked for a minimum average response factor. The minimum mean response factor for these compounds is 0.05. If the initial calibration criteria for SPCCs are not achieved, perform corrective action before completing the calibration.

10.1.7.2 The % RSD for each individual Calibration Check Compound (CCC) (Table 5) must be less than 30 %. This check is used to identify gross instrument operating problems. If the initial calibration criteria for CCCs are not achieved, perform corrective action before completing the calibration.

10.1.7.3 The percent relative standard deviation (% RSD) (see Section 13.2) of all target analytes must be less than 15 %.

10.1.7.4 If the %RSD of any individual (non CCC) compound is >15%, employ an alternative calibration linearity model. Specifically, linear regression using a least squares approach may be employed.

10.1.7.4.1 If a linear regression is employed, select the linear regression calibration option of the mass spectrometer data system. Do not force the regression line through the origin and do not employ 0,0 as a sixth calibration standard.

10.1.7.4.2 The correlation coefficient (r value) must be ≥0.99 for each compound to be acceptable.

10.1.7.4.3 Perform corrective action and recalibrate if the calibration criteria cannot be achieved.

10.1.7.5 The initial calibration criteria for this method applies to all additional compounds of concern specified by the client.

10.1.7.6 The relative retention times of each target analyte in each calibration standard should agree within 0.06 relative retention time units.

10.2 Second Source Calibration Check Standard.

10.2.1 The calibration is verified with a calibration check standard at 50 μg/ml (Full scan) or 5ug/ml (SIM) from an external source (Section 9.6). It must be analyzed immediately following the initial calibration.

10.2.2 The percent difference (% D) (Section 13.3) for this standard must meet the criteria of 20% for all the target compounds.

10.2.2.1 If % D is greater than 20%, reanalyze the second source check. If the criteria cannot be met upon re-injection, re-prepare the second source solution using a fresh ampoule and repeat the process.

10.2.2.2 If the %D criteria cannot be achieved after re-preparation of the second source, prepare a third source and repeat the process. Make fresh calibration standards using one of the two standard sources that match each other.

10.3 Continuing Calibration Verification Standard.

10.3.1 A calibration verification standard at close mid-level concentration of the initial calibration range at alternating 25 and 50ug/ml for full scan and 2.5ug/ml and 5ug/ml for SIM must be acquired every 12 hrs.

10.3.1.1 Vary the concentration of calibration verification standard on alternate verifications (i.e. every other calibration verification) using an alternative concentration standard. The standard selected must be lower than the midpoint calibration standard.

10.3.2 For the continuing calibration to be valid, all of the following specified criteria must be met.

10.3.2.1 The minimum RF for SPCC compounds must be 0.05. Each SPCC compound in the calibration verification standard must meet its minimum response factor. The percent difference (% D) for CCC compounds must be less than 20%.

10.3.2.1.1 If the CCCs are not part of the target list, then all targeted analytes must meet the 20% D criteria. All non-CCC compounds should also meet the 20% D criteria.

10.3.3 If the first continuing calibration verification does not meet criteria, a second standard may be injected after notify the team leader/manager and checking the system for defects.

10.3.3.1 A continuing calibration check is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed. In situations where the first check fails to meet the criteria, the instrument logbook should have clear documented notations as to what the problem was and what corrective action was implemented to enable the second check to pass.

10.3.4 If the verification criteria cannot be achieved, a new initial calibration must be performed.

10.3.5 If any of the internal standard areas change by a factor of two (- 50% to + 100%) or the retention time changes by more than 30 seconds from the midpoint standard of the last initial calibration, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate.

10.3.5.1 Reanalyze the continuing calibration standard. New initial calibration is required if reanalyzed standard continues to fail the internal standard requirements.

10.3.5.2 All samples analyzed while the system was out of control must be reanalyzed following corrective action.

11.0 PROCEDURE

11.1 Instrument Conditions.

11.1.1 Recommended instrument conditions are listed in Table 2 and 2a (SIM only). Modifications of parameters specified with an asterisk are allowed as long as criteria of calibration are met. Any modification should be approved by team leader/manger.

11.2 Daily GC/MS Performance Checks.

11.2.1 Mass Spectrometer Tuning. Every 12-hour, inject 1 μl of 50 ng/μl or 2 μl of 25 ng/μl DFTPP solution directly on to the column.

11.2.2 The GC/MS system must be checked to verify that acceptable performance criteria are achieved (see Table 3).

11.2.3 This performance test must be passed before any sample extracts, blanks or standards are analyzed. Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background.

11.2.3.1 Select the scans at the peak apex and one to each side of the apex.

11.2.3.2 Calculate an average of the mass abundances from the three scans.

11.2.3.3 Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peak and no more than 20 scans prior to the elution of DFTPP. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

11.2.4 If all the criteria are not achieved, the analyst must retune the mass spectrometer with team leader/manager and repeat the test until all criteria are met.

11.2.4.1 Alternatively, an additional scan on each side of the peak apex may be selected and included in the averaging of the mass scans. This will provide a mass spectrum of five averaged scans centered on the peak apex. NOTE: The selection of additional mass scans for tuning may only be performed with supervisory approval on a case by case basis.

11.2.5 The injection time of the acceptable tune analysis is considered the start of the 12-hour clock.

11.2.6 In order to assess GC column performance and injection port inertness, the DFTPP tune standard also contains appropriate amount of 4,4'-DDT, benzidine and pentachlorophenol.

11.2.6.1 Injection Port Inertness Check.

11.2.6.1.1 The injection port inertness of the GC portion of the GC/MS is evaluated by the percent breakdown of 4,4'-DDT. DDT is easily degraded in the injection port. Breakdown occurs when the injection port liner is contaminated by high boiling residue from sample injection or when the injector contains metal fittings. Check for degradation problems by injecting a GC/MS tune standard containing 4,4'-DDT every 12 hour, regardless of whether DDT is a target analyte. The degradation of DDT to DDE and DDD should not exceed 20%, in order to proceed with calibration procedures. Refer to Section 13.7 for calculation.

11.2.6.2 Column Performance Check.

11.2.6.2.1 The condition of the GC column is evaluated by the tailing of benzidine and pentachlorophenol every 12 hour. Benzidine and pentachlorophenol should be present at their normal responses, with no visible peak tailing, as demonstrated by the peak tailing factors. The tailing factor criteria for benzidine (base-neutral fraction) must be < 3 and for pentachlorophenol (acid fraction) must be < 5.

11.2.6.3 If degradation is excessive and/or poor chromatography is observed, the injector port may require cleaning. It may also be necessary to break off the first 6-12 in. of the capillary column.

11.3 Initial Calibration

11.3.1 Refer to Section 10.1.

11.4 Second Source Calibration Check

11.4.1 This standard must at least be analyzed when initial calibration provided. Refer to Section 10.2.

11.5 Continuing Calibration Checks

11.5.1 Refer to Section 10.3.

11.6 Sample Analysis.

11.6.1 Allow the sample extract to warm to room temperature. Spike 10 µl of the appropriate internal standard mix (4,000 µg/ml for full scan and 400ug/ml for SIM) into 1 ml sample extract, just prior to analysis. This is equivalent to a concentration of 40 µg/ml (full scan) and 4ug/ml (SIM) of each internal standard.

11.6.2 Inject 1 µl aliquot of the sample extract into the GC/MS system. A splitless injection technology is used.

11.6.3 If the response for any ion of interest exceeds the working range of the GC/MS system, dilute the extract and reanalyze.

11.6.4 When the extracts are not being used for the analyses, store them at -10^{o}C, protected from light, in sealed vials equipped with unpierced PTFE-lined septa.

11.7 Sample Dilution

11.7.1 Establish dilution of sample in order to fall within calibration range or to minimize the matrix interference.

- Utilize screen data (specific project only).
- Utilize acquired sample data.
- Utilize the history program or approval from client/project.
- Sample characteristics (appearance, odor).

11.7.2 If no lower dilution has been reported, the dilution factor chosen should keep the response of the largest peak for a target analyte in the upper half of the initial calibration range of the instrument.

11.7.3 Preparing Dilutions.

11.7.3.1 Prepare sample dilutions quantitatively. Dilute the sample extract with methylene chloride using logical volume to volume ratios, i.e., 1:5, 1:10, 1:50, etc. Large dilutions may require serial dilutions or the use of a Class A 10 ml volumetric flask.

11.7.3.2 Syringe dilutions. – Calibrated syringes are used to prepare dilutions. Add the appropriate amount of methylene chloride to a clean autosampler vial. Add the proper amount of sample using a calibrated syringe of the appropriate volume for the dilution. Add sufficient internal standard to maintain a concentration of 40ug/ml. Cap the vial and gently shake to disperse the sample through the solvent.

11.7.3.3 Volumetric Flask Dilutions – Large dilutions may require the use of a 10 ml Class A Volumetric flask.

11.8 Establishing Search Criteria. Search criteria for each compound listed in the method must be entered into the method quantitation/identification file in the Enviroquant software package. This activity must be performed before attempting qualitative and quantitative analysis on any acquired data file. The search criteria are based on compound retention time and the characteristic ions from the reference mass spectrum. Characteristic ions are defined as the three ions of greatest relative intensity, or any ions over 30% relative intensity, if less than three such ions occur in the reference spectrum. The number of secondary ions displayed for each compound search varies between compounds.

11.8.1 Select the primary ion for the target compound from the characteristic ions in Table 6. If multiple characteristic ions are listed, the first ion is the major (primary) ion. Enter this ion as the search ion. Enter the relative abundance of this ion (100% for base peak ions) and set the relative abundance window at ± 30%.

11.8.1.2 Alternate primary ions may be selected when interferences exist from ion abundance contribution from close eluting compounds.

11.8.2 Enter the remaining ions as secondary ions. Secondary ions are not be used to locate peaks within the search window, but are be used to support the qualitative identification of selected peaks. The number of secondary ions displayed for each compound search varies between compounds depending on the number of ions in the spectra >30% relative abundance.

11.8.3 Set the relative abundance windows for the secondary ions at ± 30%.

11.8.4 Establish the relative retention window for each compound. Because it is a relative retention window the same width window applies to all compounds on the quantitation list. The window must be established at a minimum of 0.06 relative retention time units.

11.9 Data Interpretation.

11.9.1 Executing Qualitative Searches. The target compounds shall be identified by analyst with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound.

11.9.1.1 The search procedure will identify peaks within the search window using the primary ion only. Secondary ions and the relative retention are used to determine “the best match”. If the best match contains secondary ions outside the relative abundance window, they will be flagged with a # sign.

11.9.2 Qualitative Identification. The qualitative identification of compounds determined by this method is based on retention time and on comparison of the sample mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. Compounds are identified when the following criteria are met.

11.9.2.1 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other.

11.9.2.2 The sample component must elute at the same relative retention time (RRT) as the daily standard. Criterion is the RRT of sample component must be within ± 0.06 RRT units of the standard.

11.9.2.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.)

11.9.2.3.1 If a chromatographic peak exhibits a spectrum containing an ion with relative abundance outside the relative abundance window is selected for reporting, the analyst must annotate the spectra that the compound qualified based on his/her best judgement. This circumstance will most often occur from coeluting compounds with similar ions or background matrix interferences.

11.9.3 Quantitative Analysis.

11.9.3.1 Once a target compound has been identified, its concentration (Section 13.4) will be based on the integrated area of the quantitation ion, normally the base peak (Table 6). The compound is quantitated by internal standard technique with an average response factor generated from the initial calibration curve.

11.9.3.2 If the sample produces interference for the primary ion, use a secondary ion to quantitate. This may be characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. Also interference could severely inhibit the response of the internal standard ion. The secondary ion must be used to generate a new response factor.

11.10 Library Search for Tentatively Identified Compounds.

11.10.1 If a library search is requested, the analyst should perform a forward library search of the NIST98 mass spectral library to tentatively identify 10 to 15 non-reported compounds (15 for base, 10 for acid, 25 for base/acid fraction).

11.10.2 Guidelines for making tentative identification are listed below.

11.10.2.1 These compounds should have a response greater than 10% of the nearest internal standard. The response is obtained from the integration for peak area of the Total Ion Chromatogram (TIC).

11.10.2.2 The search is to include a spectral printout of the 3 best library matches for a particular substance. The results are to be interpreted by analyst.

11.10.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

11.10.2.4 Relative intensities of major ions in the reference spectrum (ions > 10 % of the most abundant ion) should be present in the sample spectrum.

11.10.2.5 The relative intensities of the major ions should agree within ± 20 %. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must between 30 and 70%).

11.10.2.6 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

11.10.2.7 Ions present in the reference spectrum but not in the sample spectrum should be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.

11.10.3 Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 and is to be tabulated on the library search summary data sheet.

11.10.4 The resulting concentration should be reported indicating: (1) that the value is estimate, and (2) which internal standard was used to determine concentration. Quantitation is performed on the nearest internal standard.

11.11 Selected Ion Monitoring (SIM) Option

11.11.1 Instrument Set-Up: Modify the method for SIM analysis and define ion groups with retention times, ions and dwell times to include base peak ion for the target compounds of interest, surrogates, and internal standards (Table 2a, Table 8a) Select a mass dwell time of 50 milliseconds for all compounds.

11.11.2 Calibration: Calibrate the mass spectrometer in the selected ion monitoring mode using 6 calibration standards of 0.2, 1.0, 2.5, 5.0, 10.0 and 15.0 ug/ml. Spike each standard with the SIM specific internal standard solution at 4ug/ml. Calculate individual response factors and response factor RSDs using the procedures and criteria described in Section 10.1.6, 10.1.7.3 and 10.1.7.4.

11.11.3 Initial Calibration Verification. Verify the initial calibration after its completion using a 5.0 ug/ml calibration standard purchased or prepared from a second standards reference materials source. The initial calibration verification must meet the criteria of Section 10.2.2.

11.11.4 Continuing Calibration Verification. Verify the initial calibration every 12 hours using a 5.0 ug/ml calibration. The continuing calibration verification must meet the criteria of Section 10.3.

11.11.5 Sample Extract Analysis: Each extract has been previously spike with the SIM internal standard at 4 ug/ml. Analyze the sample extracts for the compounds of interest using the SIM scan parameters employed for the calibration standards.

11.11.6 Surrogate Standard Calculation.. Report surrogate spike accuracy for the surrogates spiked for the full scan GC/MS analysis at 40 ug/ml.

12.0 QUALITY CONTROL

12.1 QC Requirements Summary.

Daily GC/MS Performance Checks	Beginning of the analytical shift and every 12 hours
Initial Calibration	Whenever needed.
Second Source Calibration Check	Following initial calibration
Continuing Calibration Verification	Every 12 hours.
Method Blank	One per extraction batch*.
Blank Spike	One per extraction batch*.
Matrix Spike	One per extraction batch*.
Matrix Spike Duplicate	One per extraction batch*.
Surrogate	Every sample extract and standard.
Internal Standard	Every sample extract and standard.

*The maximum number of samples per batch is twenty or per project specification.

12.2 Daily GC/MS Performance Checks.

12.2.1 Refer to Section 11.2.

12.3 Initial Calibration.

12.3.1 Refer to Section 10.1.

12.4 Second Source Calibration Check.

12.4.1 Refer to Section 10.2.

12.5 Continuing Calibration Verification.

12.5.1 Refer to section 10.3.

12.6 Method blank.

12.6.1 The method blank is either reagent water or anhydrous sodium sulfate (depending on the sample matrix) which must be extracted with each set of 20 or less samples. For a running batch, a new method blank is required for each different extraction day. The method blank is then extracted and carried through all stages of the sample preparation and measurement.

12.6.2 If the method blank contains a target analyte above its MDL (Appendix I), the entire batch must be re-extracted and re-analyzed.

12.6.3 Surrogate compounds are added to the method blank prior to extraction. If the surrogate accuracy in the method blank does not meet in house criteria (Appendix I), it must be reanalyzed. If the reanalysis confirms the original data, the entire batch should be re-extracted.

12.7 Blank Spike

12.7.1 A blank spike must be extracted with each set of 20 or less samples. For a running batch, a new blank spike is required for each different extraction day. The blank spike consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same volume. It is spiked with the same analytes at the same concentrations as the matrix spike/matrix spike duplicate.

12.7.1.1 An additional blank spike is prepared for sample batches that contain samples which are analyzed for Polynuclear aromatic hydrocarbons. The concentration of tye bl;ank spike is prepared at

12.7.2 The blank spike recoveries should be assessed using in house limits specified in Appendix I.

12.7.3 If a blank spike is out of control, the following corrective actions must be taken and all the associated samples must be re-extracted and reanalyzed. The exception is if the blank spike recovery is high and no hits reported in associated samples and QC batch. In that case, the sample results can be reported with footnote (remark) and no further action is required.

12.7.3.1 Check to be sure that there are no errors in the calculations, or spike solutions. If errors are found, recalculate the data accordingly.

12.7.3.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample batch.

12.7.3.3 If no problem is found, re-extract and reanalyze the sample batch.

12.8 Matrix Spike(MS) / Matrix Spike Duplicate(MSD)

12.8.1 One sample is randomly selected from each extraction batch and spiked in duplicate to assess the performance of the method as applied to a particular matrix and to provide information on the homogeneity of the matrix. Both the MS and MSD are carried through the complete sample preparation, and determinative procedures.

12.8.2 Matrix spikes are prepared by spiking an actual sample at a concentration of 50 μg/l for both base/neutral and acids.

12.8.3 Assess the matrix spike recoveries (% R) (Section 13.5) and relative percent difference (RPD) (Section 13.6) against the control limits in Appendix I.

12.8.4 If the matrix spike accuracy of any individual compound is out of control, the accuracy for the compound in the blank spike must be within control. In such case, matrix interference is assumed and the data is reported with footnote (e.g., spike recovery indicates possible matrix interference). No further corrective action is required.

12.9 Surrogates

12.9.1 All standards, blanks, sample extracts, and matrix spikes contain surrogate compounds which are used to monitor the performance of the extraction and analytical system.

12.9.2 The recoveries (Section 13.5) of the surrogates must be evaluated to determine whether or not they fall within surrogate control limits (Appendix I) developed by the laboratory annually.

12.9.3 If the recovery of any surrogate compound does not meet the control limits, the calculation must be checked for possible error. The surrogate solution should be checked for degradation. Contamination and instrument performance should also be reviewed.

12.9.3.1 Reanalyze the extract if no calculation errors are detected. If the surrogate recoveries for the reanalyzed extract are in control, report the data from the reanalysis only.

12.9.3.2 If the data from the reanalysis is also out of control, re-extract and reanalyze the sample.

12.9.3.3 If, upon reanalysis, the surrogate recoveries are acceptable, report the reanalysis data. If the holding time has expired prior to the reanalysis, report both the original and reanalysis results and note the holding time problem.

12.9.3.4 If the recovery is again not within limits, the problem is considered to be matrix interference. Submit both data sets with the original analysis being reported.

12.9.4 If the sample exhibits matrix interference, defined as excessive signal where target or non-target responses are greater than the response of the internal standards. In this case, reanalysis may not be required following team leader/manager approval; the surrogates will be qualified as outside the limits due to matrix interference. Alternatively, sample may be reanalyzed on dilution, if the reanalysis is again not within the limit, the sample should be reported with a footnote indicating that there were possible matrix interference.

12.10 Internal Standards.

12.10.1 Retention time for all internal standards must be within ± 30 seconds of the corresponding internal standard in the latest continuing calibration or 50 μg/ml standard of initial calibration.

12.10.2 The area (Extracted Ion Current Profile) of the internal standard in all analyses must be within 50 to 200 % of the corresponding area of the latest calibration standard (12 hr. time period).

12.10.3 If the area of internal standard does not meet control limits, the calculations must be checked. If a problem is not discovered, the sample must be reanalyzed.

12.10.4 If the areas are acceptable upon reanalysis, the reanalysis data is reported.

12.10.5 If the areas are unacceptable upon reanalysis, then both sets of data are submitted with the original analysis reported.

13.0 CALCULATION

13.1 Response Factor (RF).

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:

A_s = Area of the characteristic ion for the compound being measured.
A_{is} = Area of the characteristic ion for the specific internal standard.
C_s = Concentration of the compound being measured (μg/ml).
C_{is} = Concentration of the specific internal standard (μg/ml).

13.2 Percent Relative Standard Deviation (%RSD).

$$\%RSD = \frac{SD}{RF_{av}} \times 100$$

where:

SD = Standard Deviation.
RF_{av} = Average response factor from initial calibration.

13.3 Percent Difference (%D).

$$\% D = \frac{|RF_{av} - RF_{cv}|}{RF_{av}} \times 100$$

where: RF_{cv} = Response factor from Calibration Verification Standard.

13.4 Concentration (Conc.).

13.4.1 for water:

$$\text{Conc. } (\mu g/l) = \frac{A_s \times C_{is} \times V_f \times D \times 1000}{A_{is} \times RF_{av} \times V_i}$$

13.4.2 for soil/sediment (on a dry weight basis):

$$\text{Conc. } (\mu g/kg) = \frac{A_s \times C_{is} \times V_f \times D \times 1000}{A_{is} \times RF_{av} \times W_s \times S}$$

where:

V_f = Final Volume of total extract (ml).
D = Secondary dilution factor.
V_i = Initial volume of water extracted (ml).
W_s = Weight of sample extracted (g).
S = (100 - % moisture in sample) / 100.

13.5 Percent Recovery (%R).

$$\% R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

13.6 Relative Percent Difference (RPD).

$$RPD = \frac{|MSC - MSDC|}{(1/2)(MSC+MSDC)} \times 100$$

where:

MSC = Matrix Spike Concentration.
MSDC = Matrix Spike Duplicate Concentration.

13.7 Percent Breakdown.

$$\% \text{ Breakdown for DDT} = \frac{\text{Total DDT degradation peak area}}{\text{Total DDT peak area}} \times 100$$

where:

Total DDT degradation peak area = DDE + DDD
Total DDT peak area = DDT + DDE + DDD.

13.8 Linear regression by the internal standard technique.

$$C_s = \left(\frac{\frac{A_s}{A_{is}} - b}{a} \right) \times C_{is}$$

Where:
Cs = concentration of target analyte
As = Area of target analyte
Cis = concentration of the internal standard
b = Intercept
a = slope of the line

$$a = \frac{N\,\Sigma xy - \Sigma x\,\Sigma y}{N\,\Sigma x^2 - (\Sigma x)^2}$$

$$b = \frac{\Sigma y - a\,\Sigma x}{N}$$

N = number of points
x = amount of analyte
y = response of instrument

13.9 Correlation Coefficient

$$r = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2\,\Sigma(y - \bar{y})^2}}$$

Where r = correlation coefficient
x = amount of analyte
y = response of instrument

$\bar{x}$ = average of x values

$\bar{y}$ = average of y values

14.0 DOCUMENTATION

14.1 The Analytical Logbook is a record of the analysis sequence; the logbook must be completed daily. Each instrument will have a separate logbook.

14.1.1 If samples require reanalysis, a brief explanation of the reason must be documented in this log.

14.2 The Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed, the page must be signed and dated by the respective person.

14.2.1 The Accutest Lot Number must be cross-referenced on the standard vial.

14.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

14.4 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

14.5 Unused blocks of any form must be X'ed and Z'ed by the analyst before submitting the data for review.

14.6 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information should also be verified during this review.

15.0 DATA REVIEW AND REPORTING

15.1 Initial and continuing calibration check. Verify that all calibration and continuing calibration criteria have been achieved. If the criteria had not been achieved, corrective action must be performed to bring the system in control before analyzing any samples.

15.1.1 If samples had been analyzed under non-compliant calibration criteria, all sample extracts must be re-analyzed once the system is brought into control.

15.2 Quality Control Data Review. Review all QC data. If QC criteria were not achieved, perform corrective action before proceeding with analysis.

15.2.1 In some situation, corrective action may demand that the entire sample batch be re-extracted and re-analyzed before processing data.

15.3 Chromatogram Review. The chromatogram of each sample is evaluated for target analytes.

15.3.1 Each sample may require the reporting of different target analytes. Review the login to assure that the correct target compounds are identified.

15.3.2 Manual integration of chromatographic peaks must be identified by the analysts by initialing and dating the changes made to the report.

15.4 Transfer to LIMS. Following the initial screen review, transfer the processed data to the LIMS.

15.4.1 Print the processed data and compare the printed values to the original values to verify transfer accuracy.

15.4.2 If transfer errors occurred, the errors must be corrected before the data is re-submitted.

15.5 Hardcopy Print & Data Package Assembly.

15.5.1 After successful transfer is verified, approve the data and print a hard copy.

15.5.2 Assemble the data package combining the LIMS output and instrumental data.

15.5.3 Pass the entire package forward to the supervisor for final review and release approval.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, ESM003. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

16.2.1 Non hazardous aqueous wastes.

16.2.2 Hazardous aqueous wastes

16.2.3 Chlorinated organic solvents

16.2.4 Non-chlorinated organic solvents

16.2.5 Hazardous solid wastes

16.2.6 Non-hazardous solid wastes

17.0 ADDITIONAL REFERENCES

17.1 No additional references are required for this SOP.

Table 1 – Target Compounds by SW846 8270C			
Benzenethiol (1)	4-Bromophenyl phenyl ether	Di-n-octyl phthalate	5-Nitro-o-toluidine
Benzoic Acid	Butyl benzyl phthalate	Diethyl phthalate	Naphthalene
2-Chlorophenol	Benzyl Alcohol	Dimethyl phthalate	Nitrobenzene
4-Chloro-3-methyl phenol	1,1'-Biphenyl (1)	2,3-Dichloroaniline (1)	n-Nitrosodimethylamine
2,4-Dichlorophenol	Butyl Stearate (1)	Decane	4-Nitroquinoline 1-Oxide
2,4-Dimethylphenol	2-Chloronaphthalene	Octadecane (1)	N-Nitroso-di-n-propylamine
2,4-Dinitrophenol	4-Chloroaniline	bis(2-Ethylhexyl)phthalate	N-Nitrosodi-n-butylamine
2,6-Dichlorophenol	Carbazole	Ethyl methanesulfonate	N-Nitrosodiethylamine
4,6-Dinitro-2-methylphenol	Caprolactam (1)	Famphur	N-Nitrosodiphenylamine
Dinoseb	Chlorobenzilate	Fluoranthene	N-Nitrosomethylethylamine
2-Methylphenol	Chrysene	Fluorene	N-Nitrosomorpholine
3&4-Methylphenol	Cumene (1)	Hexachlorobenzene	N-Nitrosopiperidine
2-Nitrophenol	bis(2-Chloroethoxy)methane	Hexachlorobutadiene	N-Nitrosopyrrolidine
4-Nitrophenol	bis(2-Chloroethyl)ether	Hexachlorocyclopentadiene	O,O,O-Triethyl phosphorothioat
Pentachlorophenol	bis(2-Chloroisopropyl)ether	Hexachloroethane	2-Picoline
Phenol	4-Chlorophenyl phenyl ether	Hexachlorophene	Parathion
2,3,4,6-Tetrachlorophenol	1,2-Dichlorobenzene	Hexachloropropene	Pentachloroethane (1)
2,4,5-Trichlorophenol	1,2-Diphenylhydrazine	Indene (1)	Pentachlorobenzene
2,4,6-Trichlorophenol	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene	Pentachloronitrobenzene
2-Acetylaminofluorene	1,4-Dichlorobenzene	Isodrin	Phenacetin
4-Aminobiphenyl	2,4-Dinitrotoluene	Isophorone	Phenanthrene
Acenaphthene	2,6-Dinitrotoluene	Isosafrole	Phorate
Acenaphthylene	3,3'-Dichlorobenzidine	Kepone	Pronamide
Acetophenone	3,3'-Dimethylbenzidine	1-Methylnaphthalene	Pyrene
Aniline	1,4-Dioxane (1)	2-Methylnaphthalene	Pyridine
Anthracene	7,12-Dimethylbenz(a)anthracene	3-Methylcholanthrene	p-Phenylenediamine
Aramite	Dimethylnaphthalenes (total) (1)	4,4'-Methylenebis(2-chloroaniline)	Quinoline (1)
Atrazine (1)	Diallate	Methapyrilene	Safrole
alpha-Terpineol	Dibenz(a,h)acridine	Methyl methanesulfonate	1,2,4,5-Tetrachlorobenzene
A,A-Dimethylphenethylamine	Dibenzo(a,h)anthracene	Methyl parathion	1,2,4-Trichlorobenzene
Benzidine	Dibenzofuran	6-Methyl Chrysene (1)	1,2,3-Trichlorobenzene (1)
Benzaldehyde (1)	Dimethoate	1,4-Naphthoquinone	1,3,5-Trichlorobenzene (1)
Benzo(a)anthracene	Diphenylamine	1-Naphthylamine	Thionazin
Benzo(a)pyrene	Disulfoton	2-Naphthylamine	o-Toluidine
Benzo(b)fluoranthene	m-Dinitrobenzene	2-Nitroaniline	sym-Trinitrobenzene
Benzo(g,h,i)perylene	p-(Dimethylamine)azobenzene	3-Nitroaniline	Tetraethyl dithiopyrophosphate
Benzo(k)fluoranthene	Di-n-butyl phthalate	4-Nitroaniline	

(1) NELAC Accreditation is not offered for this compound. Results may not be useable for regulatory purposes in States where this accreditation option is not offered.

Table 2 - RECOMMENDED OPERATING CONDITIONS: Gas Chromatograph/ Mass Spectrometer	
Injection Type	Splitless
Carrier Gas (linear velocity)	Helium at 30 cm/sec*
Mass range	35-500 AMU
Electron Energy	70 volts (nominal)
Scan time	not to exceed 1 sec. per scan
Injection port temperature	200-300 °C
Source temperature	220-270 °C
Transfer line temperature	250-300 °C
Analyzer temperature	220-250 °C
Gas Chromatograph Temperature Program*	
Initial temperature	40-50 °C*
Time 1	2-4 minutes*
Column temperature rate	8-25 degrees/min*
Final temperature	290-320 °C according to column type*
Total run time	*20-40 minutes*

***** Parameter modification allowed for performance optimization as long as QC criteria are achieved.

Table 2a – SIM Group Parameters

Group No.	Retention Time (minutes)	Ions
1	0 – 7.8	150, 64, 93, 82, 152, 99, 63, 128, 112, 42, 95
2	7.8 – 11	150, 128, 225, 142, 172, 152, 129, 223, 141, 171, 122, 127, 227, 115, 170
3	11 – 13.8	172, 152, 166, 182, 334, 266, 176, 153, 165, 330, 284, 264, 174, 154, 77, 332, 286, 268
4	13.8 – 18	266, 179, 202, 122, 268, 212, 203, 284, 178, 213, 244, 286
5	18 – 22	244, 229, 167, 122, 226, 202, 228, 149, 203
6	22 – 34.7	264, 149, 253, 278, 263, 150, 250, 139, 265, 252, 276, 138

Table 3 - DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

Mass	Ion Abundance Criteria
51	30-60 of mass 198
68	<2 % of mass 69
70	<2 % of mass 69
127	40-60 % of mass 198
197	<1 % of mass 198
198	Base peak, 100 % relative abundance
199	5-9 % of mass 198
275	10-30 % of mass 198
365	>1 % of mass 198
441	Present but less than mass 443
442	>40 % of mass 198
443	17-23 % of mass 442

Table 4 - INTERNAL STANDARDS	
Internal Standard (Full Scan)	**Prim/Sec. ions**
1,4-Dichlorobenzene-d4	152 / 150, 115
Naphthalene-d8	136 / 68
Acenaphthene-d10	164 / 162, 160
Phenanthrene-d10	188 / 94, 80
Chrysene-d12	240 / 120, 236
Perylene-d12	264 / 260, 265
Internal Standard (SIM)	**Prim/Sec. ions**
1,2-Dichlorobenzene-d4	152/ 150
1-Methylnaphthalene-d10	150/ 152, 122
Fluorene-d10	174/ 176
Fluoranthene-d10	212/ 213
Benzo(a)pyrene- d12	264/ 263, 265

Table 5 - Criteria for CCC and SPCC	
Initial Calibration: CCC % RSD is ≤ 30 %.	Continuing Calibration: CCC % D is ≤ 20 %
Calibration Check Compounds (CCC)	
Base Neutral	**Acid**
1,4-Dichlorobenzene	Phenol
Hexachlorobutadiene	2,4-Dichlorophenol
Acenaphthene	2-Nitrophenol
Fluoranthene	4-Chloro-3-methylphenol
N-Nitrosodiphenylamine	2,4,6-Trichlorophenol
Di-n-octyl phthalate	Pentachlorophenol
Benzo (a) pyrene	
System Performance Check Compounds (SPCC)	
Base Neutral	**Acid**
N-Nitroso-di-n-propylamine	2,4-Dinitrophenol
Hexachlorocyclopentadiene	4-Nitrophenol
Minimum acceptable average relative response factor (RRF) is 0.050 for SPCC.	

Table 6 – Full Scan Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation

1,4-Dichlorobenzene-d4	**Ions**	**Acenaphthene-d10**	**Ions**
Aniline	(93/66,65)	Acenaphthene	(154/153,152)
Benzaldehyde	(105)	Acenaphthylene	(152/151,153)
*Benzenethiol	(110)	*1-Chloronaphthalene	(162/127,164)
Benzyl alcohol	(108/79,77)	2-Chloronaphthalene	(162/127,164)
Bis(2-chloroethyl)ether	(93/63,95)	4-Chlorophenylphenyl ether	(204/206,141)
Bis (2-chloroisopropyl)ether	121	Dibenzofuran	(168/139)
2-Chlorophenol	(128/64,130)	Diethyl phthalate	(149/177,150)
Cumene	(105,120)	Dimethyl phthalate	(163/149,164)
Decane	(43)	*m-Dinitrobenzene	(168)
1,3-Dichlorobenzene	(146/148,111)	2,4-Dinitrophenol	(184/63,154)
1,4-Dichlorobenzene	(146/148,111)	2,4-Dinitrotoluene	(165/63,89)
1,2-Dichlorobenzene	(146/148,111)	2,6-Dinitrotoluene	(165/63,89)
1,4 Dioxane	(88)	Fluorene	(166/165,167)
*Ethyl methanesulfonate	(79/109,97)	Hexachlorocyclopentadiene	(295/237,142)
2-Fluorophenol (SURR.)	(112)	*1,4 – Naphthoquinone	(158)
Hexachloroethane	(117/201,199)	*1- Naphthylamine	(143/115,116)
Indene	(116)	*2- Naphthylamine	(143/115,116)
*Methyl methanesulfonate	(80/79,64)	2-Nitroaniline	(65/92,138)
2-Methylphenol	(108/107,79)	3-Nitroaniline	(138/108,92)
4-Methylphenol	(108/107,79)	4-Nitroaniline	(138/108,92)
*N-Nitrosodiethylamine	(102)	4-Nitrophenol	(139/109,65)
N-Nitrosodimethylamine	(74/42)	* 5 Nitro-o-toluidine	(152)
N-Nitroso-di-n-propylamine	(70/101,130)	Pentachlorobenzene	(250/252,248)
*N-Nitrosomethyethylamine	(42)	*Pentachloronitrobenzene	(237/235,272)
* N-Nitrosomorpholine	(56)	*Phenacetin	(108/109,179)
* N-Nitrosoptrrolidine	(41)	*Phorate	(75)
*O-Toluidine	(106)	*Pronamide	(173/175,145)
* Petachloroethane	(167)	*1,2,4,5-Tetrachlorobenzene	(216/214,218)
Phenol	(94)	*2,3,4,6-Tetrachlorphenol	(232/230,131)
Phenol-d5 (SURR.)	(99)	*Tetraethyldithiopyrophosphate	(322)
*2-Picoline	(93/66,92)	*Thioazin	(143)
Pyridine	(79)	2,4,6-Trichlorophenol	(196/198,200)
		2,4,5-Trichlorophenol	(196/198,200)

Table 6 (cont'd) – Full Scan Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation

Naphthalene-d8	**Ions**	**Phenanthrene-d10**	**Ions**
*A,A-Dimethylphenethylamine	(58)	*4-Aminobiphenyl	(169/168,170)
*Acetophenone	(105/77,51)	Anthracene	(178/176,179)
Benzoic acid	(184/92,185)	Atrazine	(58)
Bis(2-chloroethoxy)methane	(93/95,123)	4-Bromophenyl phenyl ether	(248/250,141)
Caprolactam	(55)	Carbazole	(167)
4-Chloroaniline	(127)	*Diallate	(86)
4-Chloro-methylphenol	(107/144)	*Dimethoate	(87)
2,3 Dichloroaniline	(161)	Di-n-Butyl phthalate	(149/150)
2,4-Dichlorophenol	(162/164,98)	4,6-Dinitro-2-methylphenol	(198/51,105)
*2,6-Dichlorophenol	(162/164,98)	*Dinoseb	(211)
Dimethylnaphthalene	(156)	*Diphenylamine	(169/168,167)
2,4-Dimethylphenol	(122/107)	1,2-Diphenylhydrazine	(77/105)
*a,a-Dimethyl-phenethylamine	(58/91,42)	*Disulfoton	(88)
Hexachlorobutadiene	(225/223,227)	Fluoranthene	(202/101,203)
*Hexachloroprene	(213)	2-Fluorobiphenyl (SURR)	(172)
Isophorone	(82/95,138)	Hexachlorobenzene	(284/142,249)
*Isosafrole	(127)	*Isodrin	(193)
1-Methylnaphthalene	(142)	*Methapyriline	(58)
2-Methylnaphthalene	(142/141)	*Methyl Parathion	(125)
Naphthalene	(128/129,127)	N-Nitrosodiphenylamine	(169/168,167)
Nitrobenzene	(77/123,65)	*4-Nitroquinoline 1-oxide	(190)
Nitrobenzene-d5 (SURR.)	(82)	Octadecane	(57)
N-Nitroso-di-n-butylamine	(84/57/41)	*Parathion	(109)
2-Nitrophenol	(139/109,65)	Pentachlorophenol	(266/264,268)
Quinoline	(129)	Phenanthrene	(178/179,176)
*N-Nitrosopiperidine	(42/114,55)	*Pronamide	(173)
*p-Phenylenediamine	(108)	sym- Trinitrobenzene	(213)
*O,O,O-Triethylphosphorthioat	(198)	2,4,6 Tribromophenol (SURR)	(330)
*Safrole	(162)		
alpha –Terpineol	(128)	**Perylene-d12**	**Ions**
1,2,3-Trichlorobenzene	(180/182,145)	Benzo(b)fluoranthene	(252/125)
1,2,4-Trichlorobenzene	(180/182,145)	Benzo(k)fluoranthene	(252/125)
1,3,5-Trichlorobenzene	(180/182,145)	Benzo(g.h.i)perylene	(276/138,277)
		Benzo(a)pyrene	(252/253,125)
Chrysene-d12	**Ions**	*Dibenz(a,j)acridine	(279/280)
2 –Acetylaminofluorene	(181)	Dibenz(a,h)anthracene	(278/139,279)
*Aramite	(194)	*7,12-Dimethylbenz(a)anthracene	(256/241,257)
Benzidine	(184)	Di-n-Octyl Phthalate	(149)
Benzo(a)anthracene	(228/229/226)	Hexachlorophene	(196)
Bis(2-ethylhexyl)phthalate	(149/167,279)	Indeno(1,2,3-d)pyrene	(276)
Butylbenzyl phthalate	(149/91)	*3-Methylchloanthrene	(268/253)
*Chlorobenzilate	(251)	* non-routine target compound	
Chrysene	(228/226,229)		
3,3'-Dichlorobenzidine	(252/254,126)		
*p-Dimethylaminoazobenzene	(120/225,77)		
*3,3 Dimethylbenzidine	(212)		
*Famphur	(218)		
*Kepone	(272)		
* Methyl Chrysene	(242)		
Pyrene	(202/200,203)		
Terphenyl-d14 (SURR.)	(244)		

Table 6a – SIM Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation

1,4-Dichlorobenzene-d4	**Ions**	**Fluoranthene-d10**	**Ions**
2-Fluorophenol (Surr)	(112)	Fluoranthene	202, 101, 203
Phenol-d5 (Surr)	(99)	Pyrene	202, 203
Bis-(2-chloro-ethyl)ether	93, 63, 95	Terphenyl-d14 (Surr)	(244)
Nitrobenzene-d5 (Surr)	(82)	Benzo(a)anthracene	228, 229, 226
		Chrysene	228, 226, 229
1-Methylnaphthalene-d10	**Ions**	Bis(2-ethylhexylphthalate	149, 167, 279
Naphthalene	128, 129, 127		
Hexachlorobutadiene	225, 223, 227	**Benzo(a) pyrene-d12**	**Ions**
2-Methyl Naphthalene	142, 141, 115	Di-n-octyl phthalate	149, 150, 43
2-Fluorobiphenyl (Surr)	(172)	Benzo(b)fluoranthene	252, 253
		Benzo(k)fluoranthene	252, 125
Fluorene-d10	**Ions**	Benzo(a)pyrene	252, 253, 125
Acenaphthylene	152, 151, 153	Indeno(1,2,3-cd)pyrene	276, 277, 138
Acenaphthene	153, 152, 154	Dibenzo(a,h)anthracene	278, 139, 279
Fluorene	166, 165, 167	Benzo(g,h,i)perylene	276, 138, 277
1,2-Diphenylhydrazine	77, 105, 182		
2,4,6-Tribromophenol (Surr)	(330)		
Hexachlorobenzene	284, 286		
Pentachlorophenol	266, 264		
Phenanthrene	178, 179, 176		
Anthracene	178, 176, 179		

Table 7. STANDARD PREPARATION

Table 7A – Intermediate Calibration Standard Solution

Stock Solution	**Stock Conc., μg/ml**	**Volume Added, μl**	**Final Vol. in $MeCl_2$, ml**	**Final Conc. μg/ml**
Semivolatile Standard Mix # 1	2,000	500	10	100
Semivolatile Standard Mix # 2	2,000	500	10	100
Semivolatile Standard Mix # 4	2,000	500	10	100
Semivolatile Standard Mix # 5	2,000	500	10	100
Semivolatile Standard Mix # 6	2,000	500	10	100
Semivolatile Standard Mix # 7	2,000	500	10	100
PAH Mixture #2	2,000	500	10	100
Semivolatile Standard Mix # 8	2,000	500	10	100
Additional Requested Compound(s) Mix	2,000	500	10	100
Pyridines Mixture	2,000	500	10	100
1,2,3-Trichlorobenzene	1,000	1,000	10	100
1,3,5-Trichlorobenzene	1,000	1,000	10	100
Butyl Stearate	10,000	200	10	200
Pentachlorophenol	1,000	1,000	10	100
B/N Surrogate Standard Mix	5,000	200	10	100
Acid Surrogate Standard Mix	7,500	134	10	100.5

Table 7A – Intermediate Calibration Standard Solution -SIM

Stock Solution	Stock Conc., μg/ml	Volume Added, μl	Final Vol. in $MeCl_2$, ml	Final Conc. μg/ml
Semivolatile Standard Mix # 1	2,000	500	10	100
Semivolatile Standard Mix # 2	2,000	500	10	100
PAH Mixture #2	2,000	500	10	100
Semivolatile Standard Mix # 8 (Acids)	2,000	2,500	10	500
Additional Requested Compound(s) Mix	2,000	500	10	100
B/N Surrogate Standard Mix	5,000	200	10	100
Acid Surrogate Standard Mix (Full Scan)	7500	66.7	10	500

Table 7B – Initial Calibration Standards Preparation Scheme

Standard Solution	Intermediate Conc., μg/ml	Intermediate added, μl Full Scan	Intermediate added, μl SIM	Final Volume in $MeCl_2$, ml	Final Conc., μg/ml – Full Scan	Final Conc., μg/ml – SIM Scan
STD 1	100	1,000	150	1	100	15/75 (Acids)
STD 2	100	800	100	1	80	10/50 (Acids)
STD 3	100	500	50	1	50	5/25 (Acids)
STD 4	100	250	25	1	25	2.5/12/5 (Acids)
STD 5	100	200	10	1	20	1/5 (Acids)
STD 6	100/10 (SIM)	100	20	1	10	0.2/1 (Acids)
STD 7	100	50	10	1	5	
STD 8	100	20	-	1	2	-

Table 7C – Second Source Calibration Check Standard

Intermediate	Intermediate Conc., μg/ml	Volume Used, μl (Full/SIM)	Final Volume in Acetone, ml	Final Conc., μg/ml (Full/SIM)
Base Neutrals Mixture	100	500/ 50	1	50/ 5
Acid Mixture	100	500/ 50	1	50/ 5

Table 8a –Selected Ion Monitoring: Masses and Dwell Times

Compound	**Mass Ion (m/z)**	**Dwell Time (ms)**
Acenaphthene	153, 152, 154	50
Acenaphthylene	152, 151, 153	50
Anthracene	178, 176, 179	50
Benzo(a)anthracene	228, 229, 226	50
Benzo(a)pyrene	252, 253, 125	50
Benzo(b)fluoranthene	252, 253	50
Benzo(g,h,i)perylene	276, 138, 277	50
Benzo(k)fluoranthene	252, 125	50
Chrysene	228, 226, 229	50
Dibenzo(a,h)anthracene	278, 139, 279	50
Fluoranthene	202, 101, 203	50
Fluorene	166, 165, 167	50
Indeno(1,2,3-cd)pyrene	276, 277, 138	50
Naphthalene	128, 129, 127	50
Phenanthrene	178, 179, 176	50
Pyrene	202, 203	50
2-Methyl Naphthalene	142, 141, 115	50
Bis-(2-chloro-ethyl)ether	93, 63, 95	50
Pentachlorophenol	266, 264	50
Hexachlorobutadiene	225, 223, 227	50
1,2-Diphenylhydrazine	77, 105, 182	50
Bis(2-ethylhexylphthalate	149, 167, 279	50
Di-n-octyl phthalate	149, 150, 43	50
Hexachlorobenzene	284, 286	50
2-Fluorophenol	112, 64, 63	50
Phenol-d5	99, 42	50
Nitrobenzene-d5	82, 128	50
2-Fluorobiphenyl	172, 171, 170	50
2,4,6-Tribromophenol	330, 332, 334	50
Terphenyl-d14	244, 122	50

Table 9. REPORTING LIMITS

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Benzoic Acid	20	667	Carbazole	5	167
2-Chlorophenol	5	167	Chlorobenzilate	5	167
4-Chloro-3-methylphenol	5	167	Chrysene	5	167
2,4-Dichlorophenol	5	167	bis(2-Chloroethoxy)methane	5	167
2,4-Dimethlyphenol	5	167	bis(2-Chloroethyl)ether	5	167
2,4-Dinitrophenol	20	667	Bis(2-Chloroisopropyl)ether	5	167
4,6-Dinitro-o-cresol	20	667	4-Chlorophenyl phenyl ether	5	167
Dinoseb	5	167	1,2-Dichlorobenzene	5	167
2-Methylphenol	5	167	1,3-Dichlorobenzene	5	167
4-Methylphenol	5	167	1,4-Dichlorobenzene	5	167
2-Nitrophenol	5	167	2,4-Dinitrotoluene	5	167
4-Nitrophenol	20	667	2,6-Dinitrotoluene	5	167
Pentachlorophenol	20	667	3,3'-Dichlorobenzidine	5	167
Phenol	5	167	3,3'-Dimethylbenzidine	5	167
2,3,4,6-Tetrachlorophenol	5	167	7,12-Dimethylbenz(a)anthracene	5	167
2,4,5-Trichlorophenol	5	167	Diallate	5	167
2,4,6-Trichlorophenol	5	167	Dibenzo(a,h)anthracene	5	167
2-Acetylaminofluorene	5	167	Dibenzofuran	5	167
4-Aminobiphenyl	5	167	Dimethoate	5	167
Acenaphthene	5	167	Diphenylamine	5	167
Acenaphthylene	5	167	Disulfuton	5	167
Acetophenone	5	167	m-Dinitrobenzene	5	167
Aniline	2	67	p-(Dimethylamine)azobenzene	5	167
Anthracene	5	167	Di-n-butyl phthalate	5	167
Aramite	5	167	Di-n-octyl phthalate	5	167
A,A-Dimethylphenethylamine	5	167	Diethyl phthalate	5	167
Benzo(a)anthracene	5	167	Dimethyl phthalate	5	167
Benzo(a)pyrene	5	167	bis(2-Ethylhexyl)phthalate	5	167
Benzo(b)fluoranthene	5	167	Ethyl methansulfonate	5	167
Benzo(g,h,i)perylene	5	167	Famphur	5	167
Benzo (k)fluoranthene	5	167	Fluoranthene	5	167
4-Bromophenyl phenyl ether	5	167	Fluorene	5	167
Butyl benzyl phthalate	5	167	Hexachlorobenzene	5	167
Benzyl Alcohol	5	167	Hexachlorobutadiene	5	167
2-Chloronaphthalene	5	167	Hexachlorocyclopentadiene	20	667
4-Chloroaniline	5	167	Hexahloroethane	5	167

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Hexachlorophene	5	167	N-Nitrosodiethylamine	5	167
Hexachloropropene	5	167	N-Nitrosodiphenylamine	5	167
Indeno(1,2,3-cd)pyrene	5	167	N-Nitrosomethylethylamine	5	167
Isodrin	5	167	N-Nitrosomorpholine	5	167
Isophorone	5	167	N-Nitrosopiperidine	5	167
Isosafrole	5	167	N-Nitrosopyrrolidine	5	167
Kepone	5	167	O,O,O Triethylphosphorothioat	5	167
2-Methylnaphthalene	5	167	2-Picoline	5	167
3-Methylcholanthene	5	167	Parathion	5	167
Methapyrilene	5	167	Pentachlorobenzene	5	167
Methyl Methanesulfonate	5	167	Pentachloronitrobenzene	5	167
Methyl Parathion	5	167	Phenacetin	5	167
1,4 Naphthoquinone	5	167	Phenanthrene	2	67
1-Naphthylamine	5	167	Phorate	5	167
2-Naphthylamine	5	167	Pronamide	5	167
2-Nitroaniline	5	167	Pyrene	2	67
3-Nitroaniline	5	167	Pyridine	2	67
4-Nitroaniline	5	167	p-Phenylenediamine	5	167
5-Nitro-o-toluidine	5	167	Safrole	5	167
Naphthalene	5	167	1,2,4,5 Tetrachlorobenzene	5	167
Nitrobenzene	5	167	1,2,4-Trichlorobenzene	2	67
n-Nitrosodimethylamine	2	67	Thionazin	5	167
4-Nitroquinoline-1-Oxide	10	333	o-Toluidine	5	167
N-Nitroso-di-n-propylamine	2	33	sym-Trinitrobenzene	5	167
N-Nitrosodi-n-butylamine	5	167	Tetraethyl dithiopyrophosphate	5	167

Table 10. Selected Ion Monitoring Reporting Limits

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Pentachlorophenol	1.0	33	Fluoranthene	0.2	3.3
Acenaphthene	0.2	6.6	Fluorene	0.2	6.6
Acenaphthylene	0.2	6.6	Hexachlorobenzene	0.2	6.6
Anthracene	0.2	6.6	Hexachlorobutadiene	0.2	6.6
Benzo(a)anthracene	0.2	6.6	Indeno(1,2,3-cd)pyrene	0.2	6.6
Benzo(a)pyrene	0.2	6.6	2-Methylnaphthalene	0.2	6.6
Benzo(b)fluoranthene	0.2	6.6	Naphthalene	0.2	6.6
Benzo(g,h,i)perylene	0.2	6.6	Phenanthrene	0.2	6.6
Benzo (k)fluoranthene	0.2	6.6	Pyrene	0.2	6.6
Chrysene	0.2	6.6	bis(2-Chloroethyl)ether	0.2	6.6
Dibenzo(a,h)anthracene	0.2	6.6	Bis (2-ethylhexyl) phthalate	0.2	6.6

1,2-Diphenylhydrazine	0.2	6.6	Di-n-octyl phthalate	0.2	6.6

August 15, 2007

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Former Mobil Tappan Terminal
Hastings-On-Hudson, New York

Prepared for

EXXONMOBIL REFINING AND SUPPLY COMPANY
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Inwood, New York 11096-1342

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Environmental Consulting & Management

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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has prepared this Site-specific Health and Safety Plan (HASP) in accordance with the Occupational Safety and Health Administration's (OSHA) Hazardous Waste Operation and Emergency Response Standard (29 CFR 1910.120 and 1926.65) and other OSHA requirements for job safety and health protection (Appendix A), and our Standard Operating Procedures (SOPs). In addition, various guidance documents were also consulted in preparing this HASP, including the National Institute for Occupational Safety and Health's (NIOSH) Occupation Safety and Health Guidance Manual for Hazardous Waste Site Activities, System 4b: Hazardous Communications of Major Projects Group Implementation Procedure; ExxonMobil Operations Integrity Management Systems (OIMS) July 15, 2005 revision; and ExxonMobil's Loss Prevention System (LPS). It addresses all the activities described below that are associated with the remediation of the Former Mobil Tappan Terminal located in Hastings-On-Hudson, New York (Site; Figure 1) and will be implemented by the designated Site Health and Safety Officer (SHSO) during Site work. The HASP attempts to identify all potential hazards at the Site; however, Site conditions are dynamic and new hazards may appear constantly. Personnel must remain alert to existing and potential hazards as Site conditions change and protect themselves accordingly.

Compliance with this HASP is required for all Roux Associates personnel who enter this Site. Assistance in implementing this HASP can be obtained from the Roux Associates Office Health and Safety Manager (OHSM). The content of this HASP may undergo revision based upon additional information made available. Any changes proposed must be reviewed and approved by the Roux Associates OHSM or his designee and documented on the Field Change Request form included as Appendix B. The following are key personnel involved with this project.

Responsibility	Name/Affiliation	Telephone / Cell Number
Project Principal	Noelle M. Clarke Roux Associates, Inc.	(631) 232-2600 / (631) 807-6523
Project Manager	Therese Pitterle Roux Associates, Inc.	(631) 232-2600 / (631) 831-1503
Site O&M Manager	John LoMeli, Jr. Roux Associates, Inc.	(631) 232-2600 / (631) 445-8643
Site Health & Safety Officer	Indira Rattiram Roux Associates, Inc.	(631) 232-2600 / (631) 484-2292
Office Health & Safety Manager	Joseph Gentile Roux Associates, Inc.	(856) 423-8800 / (610) 844-6911
ExxonMobil Contacts		
Project Manager	Steve Trifiletti	(718) 383-7374 / (908) 578-8704

All Site operations are under the direction of ExxonMobil and any operations or activities covered under this HASP, which are also addressed by ExxonMobil procedures and protocols, will be performed in compliance with ExxonMobil's requirements (Appendix F). Specifically, routine operations or activities performed at the Site that commonly require adherence to ExxonMobil procedures and protocols include confined space entry. Additionally, ExxonMobil has specific requirements regarding the use of personal protective equipment/clothing (PPE). These requirements are incorporated into Section 6.2 of this HASP and, at a minimum, include the use of a hard hat, safety glasses, high visibility clothing, and steel toe boots. Special PPE, i.e., work gloves, may be required during various tasks and should be utilized as necessary or as required by OSHA, the SOPs, or by ExxonMobil procedures and protocols. Prior to initiating a task, all activities associated with the task should be evaluated to determine the appropriate procedures that need to be followed and PPE that is necessary.

1.1 Scope of Work

The scope of work will vary depending on the tasks planned for the Site and the adjacent areas associated with the Site (Figure 2). In general, the tasks will include the following tasks associated with operation and maintenance and groundwater sampling:

- oversight of remedial activities;
- operation and maintenance of remedial equipment and systems; and
- monitoring well gauging and sampling.

Detailed scopes of work for other specific activities performed and planned for the Site will be prepared prior to implementation of each task.

1.2 Emergency Contacts

Multiple emergency services may be obtained from 911. More specific numbers for local services are listed below and in Table 1.

Type	Name	Telephone Numbers
Police	Hastings-On-Hudson Police Department	(914) 478-2344
Fire	Hastings-On-Hudson Fire Department	(914) 478-2344
Hospital (map attached)	Community Hospital at Dobbs Ferry	(914) 693-0700
Poison Control Center	State Poison Control Center	(800) 222-1222

Environmental Emergency

(e.g., release or spill)

Type	Name/Affiliate	Telephone
Project Manager	Therese Pitterle Roux Associates, Inc.	(631) 232-2600 (631) 831-1503 (Cellular) (814) 861-5427 (Home)
Project Principal	Noelle M. Clarke Roux Associates, Inc.	(631) 232-2600 (631) 807-6523 (Cellular)
Environmental Technician / Site O&M Manager	John LoMeli, Jr. Roux Associates, Inc.	(631) 232-2600 (631) 445-8643 (Cellular) (631) 698-4875 (Home)
Site Health and Safety Officer	Indira Rattiram Roux Associates, Inc.	(631) 232-2600 (631) 484-2292 (Cellular)
Office Health and Safety Manager	Joseph Gentile, CIH Roux Associates, Inc.	(856) 423-8800 (610) 844-6911 (Cellular) (484) 373-0953 (Home)
Project Manager (ExxonMobil)	Steve Trifiletti ExxonMobil	(718) 383-7374 (908) 578-8704 (Cell)

Refer to Table 1 for an extended list of emergency contacts and phone numbers.

Note: Roux personnel will be equipped with a mobile telephone.

(Additional emergency information is provided in Section 11.0)

2.0 PERSONNEL RESPONSIBILITIES

2.1 Project Principal

The Project Principal is responsible for defining the overall project objectives (field and office related activities), determining chain-of-command, evaluating program outcome, and serves as final technical review of deliverables. For Roux Associates, the Project Principal is ultimately responsible for overall Site activities, including health and safety issues. The day-to-day management of health and safety issues is the responsibility of the Project Manager. The SHSO, OHSM, PM, and Project Principal shall consult and make an agreeable determination should Site information or unforeseen circumstances indicate a change in field procedures may be warranted. Changes to this HASP must be made by formal addendum and be approved by the Project Principal, PM, OHSM, and SHSO. The Project Principal is responsible for ensuring that all required signatures are in place prior to implementing fieldwork. The Project Principal for the Former Mobil Tappan Terminal located in Hastings-On-Hudson, New York is Ms. Noelle Clarke.

2.2 Project Manager

The Project Manager (PM) is responsible for day-to-day activities associated with his/her project, including health and safety. The PM is also responsible for coordination of subcontractors and tasks related to accomplishment of the scope of work. The Project Manager for the Former Mobil Tappan Terminal located in Hastings-On-Hudson, New York is Ms. Therese Pitterle.

2.3 Site Manager

The Site Manager (SM) is responsible for making certain that personnel receive and are aware of the provisions of this HASP, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies. The SM assures that personnel are aware of the potential hazards associated with Site operations and correcting any work practices or conditions that may result in injury or exposure to hazardous substances. The SM assures that all field personnel are in compliance with the hazardous waste worker health and safety training and medical surveillance requirements of 29 CFR 1910.120 and all other applicable regulations. The Site Manager for the Former Mobil Tappan Terminal located in Hastings-On-Hudson, New York is Mr. John LoMeli, Jr.

2.4 Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) will be present onsite during the conduct of all field operations, will be responsible for all health and safety activities, and has the authority to make all health and safety related decisions. The SHSO ensures that all personnel working onsite are qualified according to applicable USEPA, OSHA, and state requirements. The determination of hazard levels will be made by the SHSO in consultation with the OSHM. The SHSO has stop-work authorization, which he or she will execute upon determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation, such as detrimental weather conditions. Authorization to proceed with work will be issued by the SHSO or OHSM in consultation with the Project Principal or his/her designee (e.g., PM or SM). The SHSO or Project Principal will contact emergency facilities and personnel, when appropriate. Alternate SHSOs may be designated by the SHSO, if required, but must be pre-qualified and approved by the OHSM. The SHSO is responsible for ensuring that a duplicate office copy of this HASP is placed in the central project files. The SHSO for the Former Mobil Tappan Terminal located in Hastings-On-Hudson, New York is Ms. Indira Rattiram; however, the SHSO may vary based upon the task to be completed and the personnel assigned to do the work.

2.5 Office Health and Safety Manager

The Office Health and Safety Manager (OHSM) serves in assuring that the policies and procedures of the HASP are implemented by the SHSO and provides consultation to the Site personnel on all questions related to health and safety. The OHSM is responsible for assuring that the appropriate monitoring and safety equipment and other resources necessary to perform Site activities safely are addressed in the HASP. The OHSM ensures that all Roux Associates personnel designated to work onsite are qualified according to applicable United States Environmental Protection Agency (USEPA), OSHA, and state requirements. The OHSM for the Former Mobil Tappan Terminal located in Hastings-On-Hudson, New York is Mr. Joseph Gentile.

2.6 Field Crew Personnel

All field crew personnel are responsible for understanding and complying with this HASP; taking all reasonable precautions to prevent injury to themselves and to their fellow employees;

performing only those tasks that they believe they can do safely, immediately reporting any accidents and/or unsafe conditions to the SHSO; notifying the SM and the SHSO of any special medical problems (e.g., allergies) and making certain that all onsite personnel are aware of any such problems; and reporting unsafe or hazardous conditions to the SHSO.

3.0 SITE HISTORY AND PHYSICAL DESCRIPTION

The Former Mobil Tappan Terminal is located at 1 Railroad Avenue, in the Village of Hastings-On-Hudson, Westchester County, New York (Figure 1). The Site is bordered to the north by the former Anaconda Wire Mill (currently undergoing extensive remedial activities), to the east by the former dye and pigment manufacturer Uhlich Color Company (Uhlich), and to the west by the Hudson River (Figure 2). The property is approximately 8.2 acres in size and is relatively flat, with an earthen berm located on the western edge of the property along the shore of the Hudson River. ExxonMobil currently owns the property.

In 1961, Tappan Tanker Terminal (TTT) purchased the property and the property to the east occupied by Uhlich. The majority of the TTT operations were located on the subject property and included the storage of fuel oils for distribution and toluene, benzene, pyridine, and picoline for eventual disposal at sea. The Site was leased and eventually purchased by Mobil beginning in 1970 and operated as an oil transfer and storage terminal for No. 2, 4, and 6 fuel oils. In addition, two large steam boilers were operated on the property. Groundwater at the Site has been impacted with petroleum hydrocarbons due to incidental leakage during Site operations.

Mobil ceased operations at the Site in 1985, and Uhlich ceased operations on their property in 2002. In 1987, the New York State Department of Environmental Conservation (NYSDEC) listed the Site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. In 1992, evidence of a petroleum release on both the Mobil and Uhlich properties was discovered, and in 1994, an oil remediation plan was approved by the NYSDEC and Mobil and Uhlich entered into a Stipulation Agreement to remediate the spill. In 1996, Mobil entered into a Voluntary Agreement with the NYSDEC to investigate petroleum contamination on the western portion of the Site. Most buildings at the Site were demolished in early 2003. The Site is presently a vacant lot and there are currently no on-site operations. A Record of Decision (ROD) was issued by the NYSDEC in September 2006 in order to facilitate the remediation of impacts present at the Site. The remedy selected in the ROD includes:

- Treatment of volatile organic compound (VOC)-contaminated soil and groundwater by air sparging, soil vapor extraction, and/or other technologies to be evaluated during the remedial design.

- Excavation and off-site disposal of soil that is visibly contaminated with dye or petroleum, is grossly impacted, or contains greater than 500 ppm total semivolatile organic compounds (SVOCs).

- Construction of a two-foot thick soil cover to prevent exposure.

Development of a Site Management Plan and an environmental easement are also required.

4.0 HAZARD ASSESSMENT

This section defines the hazards that may be present at the Site. A Safe Performance Self Assessment (SPSA) will be performed before each task. Additionally, a Job Safety Analysis (JSA) will be performed, if warranted, prior to the start of fieldwork in accordance with the ExxonMobil JSA Protocol (Appendix D).

Chemical Hazards

Investigation results and materials storage records indicate that benzene, toluene, ethylbenzene, xylenes (BTEX), lead, total petroleum hydrocarbons (TPH), and other petroleum-related constituents are present in the groundwater at the Site. The toxicological, physical, and chemical properties of these potential contaminants are presented in Table 2. This table includes action levels (permissible exposure levels), which will establish the level of protection. Material Safety Data Sheets (MSDSs) for products found at the Site are located onsite at the remediation shed and in Appendix S, and are available for review by project personnel.

The above-mentioned compounds may pose a potential exposure hazard through ingestion, inhalation, skin absorption, or a combination of these routes during intrusive activities such as excavation/earth moving activities. These exposures will be further controlled through the use of personal protective equipment (PPE), designated action levels based upon onsite air monitoring, and the assignment of experienced field personnel.

Physical Hazards

A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any former terminal. These physical hazards are due to motor vehicle and heavy equipment operation, and hazardous walking and working surfaces. A hard hat must be worn at all times while working at the Former Mobil Tappan Terminal Site. Workers must also be aware of electrical hazards, such as overhead power lines, while performing their assigned tasks. These hazards are not unique and are generally familiar to most field personnel. Additional task-specific requirements may be covered during safety briefings.

Flammability/Explosive Hazards

Highly flammable/explosive materials have not been identified as being currently stored at the Site. However, if these materials are identified prior to performing activities near potentially flammable/explosive materials (i.e., within storage areas), all applicable sections of this HASP and any ExxonMobil procedures specific to these areas need to be thoroughly understood and adhered to. Any questions or concerns should be directed to the SHSO or the ExxonMobil project engineer.

Heat/Cold Stress

The National Weather Service records average minimum/maximum temperatures of 25/85 degrees Fahrenheit during the year in New York. Heat and cold stress are potential hazards associated with heavy physical activity and/or the use of PPE in hot or cold weather environments. Heat and Cold stress are discussed in Sections 8.17 and 8.18 and symptoms, prevention, and treatment are described in Appendix C. Protection against heat and cold stress must be implemented when warranted.

Noise

Noise is associated with the operation of heavy equipment, power tools, pumps, and generators. Hearing protection is required within the Former Mobil Tappan Terminal biosparge remediation shed and when working near operating equipment such as drill rigs. High noise operations will be evaluated by the SHSO. Personnel with 8-hour time weighted average exposures exceeding 85dBA must be included in a hearing conservation program according to the regulations as specified in 29 CFR 1910.95. Noise exposure will be controlled through the use of hearing protection such as ear plugs or ear muffs, or by maintaining set-backs from high noise equipment, as warranted. Personnel handling heavy equipment and using power tools that produce noise levels exceeding 90 dBA are required to wear hearing protection. In order to assess hazardous sources for specific onsite tasks and procedures, ExxonMobil has included an “ExxonMobil Job Safety Analysis (JSA)” form included in Appendix D.

General Safety Hazards

- Heavy equipment and motor vehicle traffic. Workers shall wear high visibility clothing in high traffic areas and utilize traffic cones, barricades, and caution tape to protect work areas, as necessary.
- Slip, trip, fall hazards associated with uneven terrain, obstacles, and slippery or icy surfaces. General housekeeping will be performed to reduce slip, trip, and fall hazards.
- Sharp edges, broken glass, exposed nails, rusty metal.
- Pinch points.
- Overhead hazards (wear hard hats).
- Flying objects and airborne particulate hazards. Wear safety glasses, goggles, or face shields, when appropriate.

Electrical Hazards

Portable pumps, generators, and other power tools require proper grounding and/or a ground fault circuit interrupter (GFCI) before operation. Personnel should never attempt to move an operating pump or generator. Overhead and underground utilities will also be marked out and avoided when drilling.

Biological Hazards

Biological hazards include the possibility of animal bites by potentially rabid stray or wild animals, ticks or other insect bites, and bee and wasp stings. Ticks may carry Lyme disease and/or rocky mountain spotted fever. Personnel shall examine themselves for ticks. Insecticides containing DEET may be an effective tick repellent but should be used with caution to avoid contaminating samples. Ticks are a particular concern in high grass areas of the Site, and according to the NYSDOH website:

> "The chances of being bitten by a deer tick are greater during times of the year when ticks are most active. Young deer ticks, called nymphs, are active from mid-May to mid-August and are about the size of poppy seeds. Adult ticks, which are approximately the size of sesame seeds, are most active from March to mid-May and from mid-August to November. Both nymphs and adults can transmit Lyme disease. Ticks can be active any time the temperature is above freezing. Infected deer ticks can be found throughout New York State."

Personnel allergic to bee and/or wasp stings shall provide medicine and antidotes to treat allergic reactions, as prescribed by their personal physicians.

Some pests are more active at certain times – for example, some mosquitoes are most active between dusk and dawn. Ticks may be active at any time of day. Some places are more likely to have higher activity too – mosquitoes generally live in brush and trees; ticks prefer areas with tall grass, brush, and trees. Some areas have mosquitoes that carry viruses (for example, West Nile virus or Eastern Equine Encephalitis).

Other biological hazards include poison ivy, poison oak, and poison sumac. If exposed to these plants, personnel will wash skin thoroughly with soap and water.

5.0 TRAINING REQUIREMENTS

5.1 Basic Training

All Site personnel who will perform work in areas where there exists the potential for chemical exposure will be health and safety trained prior to performing work onsite per OSHA (29 CFR 1910.120(e)). Training records will be maintained by the SHSO onsite and as described in Section 5.5.

5.2 Loss Prevention System Training

ExxonMobil requires that all personnel who perform work onsite, including subcontractors, more than one day per fiscal quarter must complete ExxonMobil's 8-hour Loss Prevention System (LPS) training and have proof of training while working onsite. Personnel who perform any work onsite, regardless of the frequency, must at least complete ExxonMobil's 1-hr LPS course. The OHSM is responsible for administering the LPS course. Under no circumstances shall personnel who are not LPS trained be allowed to work on the Site.

5.3 Site-Specific Training

Training that specifically addresses the activities, procedures, monitoring, and equipment to be utilized by Site personnel and visitors will be provided by the SHSO and/or SM. The training will include Site and facility layout, hazards, emergency services at the Site, and will detail all provisions contained within this HASP. A summary of Site-specific hazard and emergency information will be provided to all Site personnel and visitors (Appendix E). This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Site-specific training will be documented and kept as part of the project records.

5.4 Safety Briefings

Project personnel will be given briefings by the SHSO, the PM, and/or the ExxonMobil project engineer on an as-needed basis to further assist them in conducting their activities safely. Contractors have to comply with ExxonMobil Contractor Safety Requirements (Appendix F). Safety briefings will be provided when new operations are to be conducted, changes in work practices must be implemented due to new information made available, and before work is begun at each work site. Safety briefings will be documented on the form included as Appendix G or by use of the Work Permit Form and will be kept by the SHSO as part of the project records. At the conclusion of the safety briefing, all personnel performing work at the Site will be required to review the HASP and sign the appropriate waiver.

5.5 Record Keeping Requirements

All record keeping requirements mandated by OSHA (29 CFR 1910.120) will be strictly followed. Specifically, all current personnel training records, incident reports (Appendix H), medical fit for duty papers, and respirator fit test forms will be required before work can begin and maintained onsite during the length of the project. These records along with injury/incident reports, medical examination records, and exposure monitoring records will become a permanent part of the project records. Each subcontractor will maintain the above-mentioned records for his/her employees.

6.0 ZONES, PROTECTION, AND COMMUNICATION

These safety requirements are for activities not typically associated with the normal facility operations at the Site, but which may be required for any work that has the potential to spread contamination.

6.1 Site Zones

A three-zone approach to Site operations to control the potential spread of contamination will be employed. The three zones are:

- The Exclusion Zone;
- The Contamination Reduction Zone; and
- The Support Zone.

The establishment of work zones will ensure that: personnel are properly protected against the potential hazards in the area where they are working; work activities and potential contamination are limited to the specific areas; and personnel can be easily located and evacuated in an emergency. The establishment of work zones and the levels of protection required within the zones will be determined on a case by case basis. The SHSO, PM, and the ExxonMobil Project Engineer will determine the need for work zones, and based upon Site-specific knowledge and data, determine the levels of protection within the established zones.

Level D operation will not generally require segregated zones. Upgrading to Level C protection is not anticipated on this project. However, should the level of protection worn by field personnel be upgraded to Level C, Roux Associates will employ the three-zone approach. Please note that Roux Associates does not perform work in Level A or B unless activities require upgrading from Level C or D in order to bring work to a safe stoppage. The following sections provide general specifications for the three work zones.

6.1.1 Exclusion Zone

The area(s) that contain, or are suspected to contain, hazardous materials or activities will be considered the Exclusion Zone. The SHSO may establish more than one restricted area within the Exclusion Zone when different levels of protection may be employed or different hazards exist. No personnel are allowed in the Exclusion Zone without:

- the proper personal protective equipment;
- medical authorization per Section 7.4; and
- training certification.

During excavation, drilling, and sampling activities, the Exclusion Zone is defined as the excavation and a 10-foot radius around the excavation boundary, drilling, or sampling locations. For the purposes of this project, the Exclusion Zone(s) will be delineated once the work sites have been determined.

6.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Exclusion Zone and the Support Zone. The CRZ will contain the contamination reduction corridor (CRC) and is designed to reduce the probability that the uncontaminated clean areas will become contaminated or affected by other Site hazards. It is the area where decontamination of personnel and equipment takes place and serves to limit the physical transfer of hazardous substances into clean areas. The CRZ is to be used for general Site entry and egress including access for heavy equipment for investigation activities. The CRZ will also contain safety and emergency equipment (see Section 6.2.3). No personnel are allowed in the CRZ without:

- the proper personal protective equipment;
- medical authorization per Section 7.4; and
- training certification.

For purposes of this project, if Level C protection is required, the CRZ will include an area outside of the Exclusion Zone to a 50-foot radius around each monitoring well.

6.1.3 Support Zone

The Support Zone is considered the uncontaminated area and will be separated from the CRZ by the "Contamination Control Line." The “Contamination Control Line” will be a different colored flag tape than the “Hotline.” The Support Zone will contain the support facility, which will provide for team communication and emergency response. At least one person will remain in the Support Zone at all times during operations downrange to facilitate communications and emergency response. Appropriate sanitary facilities and safety and support equipment will be located in this zone. The majority of Site operations, as well as Site access of authorized persons, will be controlled from this location. The support facility will be located up-wind of Site operations, if possible, and may be used as a potential evacuation point. No potentially contaminated personnel or materials are allowed in this zone except appropriately packaged/ decontaminated and labeled samples and drummed wastes.

For purposes of this project, the Support Zone will include all areas outside of the CRZ.

6.1.4 Buddy System

Select field activities conducted in contaminated, hazardous, and remote areas of the Site may require the use of the buddy system. Instances when the buddy system should be employed include, but are not limited to, activities performed in or near the Hudson River, excavation activities, drilling activities, and confined space entry (permit required and non-permit required). Prior to commencing with field tasks in a potentially hazardous area, the need for using the buddy system should be evaluated. If required, a buddy should be able to:

- provide his/her partner with assistance;
- observe his/her partner for signs of chemical or heat/cold exposure;
- periodically check the integrity of his/her partner's protective clothing; and
- notify the SHSO or others if emergency help is needed.

6.2 Personal Protection

This section describes the levels of protection, which will be required by onsite personnel during Site activities.

6.2.1 General

Appropriate personal protective equipment (PPE) shall be worn by Site personnel when there is a potential exposure to chemical hazards or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity, noise) and as otherwise directed by the SHSO. The level of personal protection, type, and kind of equipment selected depends on the hazardous conditions and, in some cases, cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors must be made before work can be safely carried out.

Roux Associates maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit, and inspection. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General Industry) standards for PPE:

- Head Protection - 29 CFR 1910.135;
- Eye and Face Protection - 29 CFR 1910.133;
- Respiratory Protection - 29 CFR 1910.134;
- Hand Protection - 29 CFR 1910.138;
- Foot Protection - 29 CFR 1910.136; and
- Protective Clothing – 29 CFR 1910.120.

The level of protection to be worn by field personnel will be defined and controlled by the SHSO in conjunction with the Project Principal or his/her designee. Where more than one hazard area is indicated, further definition will be provided by review of Site hazards, conditions, and operational requirements and by monitoring during the particular operation being conducted. Any upgrades or downgrades must be immediately communicated to the Project Principal or his/her designee. Protection may be upgraded or downgraded by the SHSO in conjunction with the Project Principal on the basis of action levels presented below:

Task	Level of Protection
Drilling and installation of monitoring wells and excavation activities	Level D with monitoring
Monitoring well gauging and sampling	Level D
Biosparge system monitoring	Level D
Operation and maintenance activities	Level D

Intrusive activities (e.g., drilling, excavation activities, etc.) include any Site activity which will, or potentially will, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen deficient/oxygen enriched atmospheres. Prior to commencing with any field activity, the potential for such conditions should be evaluated to determine air monitoring requirements. General procedures for air monitoring are described below.

During intrusive activities, continuous monitoring will be performed using a photoionization detector (PID) for relative VOC concentrations, and Dräger tubes for initial and periodic measurements of benzene. Personnel monitoring utilizing activated charcoal tubes may also be performed in areas where high benzene concentrations were present during previous investigations.

The use of Dräger tubes for benzene will allow the SHSO to make an immediate decision on the adequacy of protection against this compound. Should the PID or Dräger tubes indicate that the action level for benzene has been exceeded, work will cease in this area until:

- Workers have donned a pressure-demand, self-contained breathing apparatus (Level B), or, at a minimum, an atmosphere purifying respirator (Level C); or
- The concentration levels for benzene are below the Dräger tube detection levels.

Based upon the results of intrusive activities in these worst-case areas, and also based upon previous sampling results, the level of personnel protection will be established for the remainder of the Site. Protection may be upgraded or downgraded by the SHSO in conjunction with the PM based upon the PID instrument and Dräger tube results.

All non-intrusive activities, which preclude contact with contaminated media, will be performed in Level D protection without continuous monitoring, unless periodic PID monitoring indicates additional monitoring is warranted. However, initial monitoring may be necessary utilizing the PID and the Dräger tubes and/or personnel monitoring (charcoal tubes or passive dosimeters).

6.2.2 Respiratory Protection and Clothing

Three levels of protective equipment are discussed below including Level D, Level C, and Level B.

Level D Protection

1. Personal Protective Equipment:
    - boots/shoes, leather or chemical-resistant, steel toe and shank;
    - boots (outer), chemical-resistant (disposable)*;
    - chemical-resistant gloves (e.g., nitriles)*;
    - cut-resistant gloves (e.g., Kevlar)**;
    - leather/work gloves***;
    - chemical-resistant clothing (e.g., Tyvek)*;
    - safety glasses or chemical splash goggles;
    - hard hat;
    - hearing protection;
    - high visibility clothing; and
    - fire-retardant coveralls for hot work.

    * Must be worn when handling petroleum product (i.e., well bailing) and materials (i.e., soil, sorbent products, etc.) exhibiting high degrees of petroleum contamination, or when performing other activities that warrant this equipment; optional for other activities.

    ** Must be worn when handling laboratory glassware (i.e., VOA vials) and when using cutting tools; optional for other activities.

    *** Must be worn when handling equipment/tools; optional for other activities.

2. Criteria for Selection:
    - Non-intrusive activities and intrusive activities in areas where the potential airborne hazards are substantially characterized and do not pose a threat of exposure in excess of one-half the PEL.

- PID instrument (such as a MiniRAE 2000 or other comparable instrument) readings in the breathing zone are less than 5 parts per million (ppm) and benzene is not detectable utilizing colorimetric indicator tubes (e.g., Dräeger tubes). Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

Notes: 1. Benzene may also be monitored initially and periodically in the breathing zone utilizing activated charcoal sampling devices.

2. Modifications of Level D will be used to increase or decrease the level of skin protection during activities, which increase or preclude, respectively, the degree of contact with chemical hazards. Modifications for increased protection may include the use of chemical-resistant coveralls (e.g., Tyvek) and chemical-resistant gloves. Chemical-resistant coveralls, gloves, and boots will be used when handling petroleum products is required (i.e., well bailing). Any modifications of Level D will require approval of the SHSO and PM.

Level C Protection

1. Personal Protective Equipment:
   - full-face, air-purifying, cartridge-equipped respirator (Mine Safety and Health Administration/National Institute of Occupational Safety and Health [MSHA/ NIOSH] specifically approved for protection from organic vapors per OSHA 1910.1028);
   - chemical-resistant clothing (coverall; hooded, two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls);
   - cotton coveralls;
   - gloves (outer), chemical-resistant, nitriles;
   - gloves (inner), chemical-resistant, latex;
   - boots (inner), chemical-resistant, steel toe and shank;
   - boots (outer), chemical-resistant (disposable);
   - safety glasses or chemical splash goggles;
   - hard hat (face shield*);
   - hearing protection; and
   - escape mask*.

   * Optional

2. Criteria for Selection:

   Meeting any of the criteria below warrants use of Level C protection.

   - Airborne hazards are known to be present but are unlikely to exceed protection factors provided by air purifying respirators.
   - Continuous total organic vapor readings in the breathing zone register between 5 ppm and 25 ppm on a PID (such as a MiniRAE 2000 or other comparable instrument); benzene readings utilizing colorimetric indicator tubes (e.g., Dräger or Sensidyne) are undetectable.
   - Measured air concentrations of known organic vapors will be reduced by the respirator to at or below one half the permissible exposure limit, and the individual and combined compound concentrations are within the service limit of the respirator cartridge.
   - Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) concentrations.
   - Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
   - Job functions have been determined not to require self-contained breathing apparatus.

Notes: 1. Benzene may also be monitored initially and periodically in the breathing zone utilizing activated charcoal sampling devices.

2. Modifications of Level C will be used to increase or decrease the level of skin protection during activities, which increase or preclude, respectively, the degree of contact with chemical hazards. Modifications for increased protection may include the use of chemical-resistant coveralls (e.g., Tyvek) and chemical-resistant gloves. Any modifications to Level C will require approval of the SHSO and PM.

Level B Protection

1. Personal Protective Equipment:

   - pressure-demand, self-contained breathing apparatus (MSHA/NIOSH approved);
   - chemical-resistant clothing (overall and long-sleeved jacket; coveralls; hooded, one or two-piece chemical-splash suit; disposable chemical-resistant coveralls);
   - cotton coveralls;
   - gloves (outer), chemical-resistant, nitriles;
   - gloves (inner), chemical-resistant, latex;

- boots (inner), chemical-resistant, steel toe and shank;
- boots (outer), chemical-resistant (disposable);
- hard hat (face shield);
- hearing protection; and
- 2-way radio communication (intrinsically safe).

2. Criteria for Selection:

   Meeting any of the criteria below warrants use of Level B protection:

   - PID instrument (such as a MiniRAE 2000 or other comparable instrument) readings in the breathing zone are greater than 25 ppm, and less than 500 ppm of benzene is detectable utilizing colorimetric indicator tubes (e.g., Dräger or Sensidyne).
   - Airborne hazards are known to be present, but are not identified or quantified.
   - The type(s) and atmospheric concentration(s) of toxic substance(s) have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
     - with IDLH concentrations;
     - exceeding limits of protection afforded by a full-face, air-purifying respirator; or
     - containing substances requiring supplied-air PPE, but substances and/or concentrations do not represent a serious skin hazard.
   - The atmosphere contains less than 19.5% oxygen.
   - Site operations make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances.
   - If work is performed in an enclosed space.

Action Levels for Respiratory Protection

Organic Vapor Concentrations

PID[1]	Benzene[2]	Action[3]
< 5 ppm	Non-detect	No Action
5 ppm - < 25 ppm	Non-detect	Level C
5 ppm - < 25 ppm	Detected	Level B
25 ppm - < 100 ppm	Non-detect	Level B
25 ppm - < 100 ppm	Detected	Level B

[1] Based on relative response/sensitivity of PID to volatile organic compounds.
[2] Colorimetric indicator tube readings.
[3] Measured air concentrations of known organic vapors will be reduced by the respirator to at or below one half the permissible exposure limit, and the individual and combined compound concentrations are within the service limit of the respirator cartridge.

Action Levels for Oxygen Levels and Combustible Gases

Combustible Gases[1]	
2.0 - 10.0% LEL	Continue monitoring
10.0 - 19.0% LEL	Notify SHSO
20.0% LEL or greater	Potential explosion hazard Interrupt task/Evacuate Area
Oxygen[1]	
20.9% O_2	Oxygen level normal
< 20.9 O_2 - > 19.5% O_2	Oxygen deficient - Notify SHSO
< 19.5% O_2 OR > 20.9% O_2	Oxygen deficient OR Oxygen enriched Interrupt task/Evacuate area

[1] Action levels based on USEPA Standard Operating Safety Guides; Table 5-1, Atmospheric Hazard Action Guides

6.2.3 Safety Equipment

Basic emergency and first aid equipment will be available at the work site, work vehicle, Support Zone, and/or the CRZ as appropriate. This may include HASP-specified communications, first aid kit, emergency eyewash or emergency shower or drench system, fire extinguishers, and other safety-related equipment. Other safety equipment will be located at the site of specific operations, e.g., drilling, as appropriate. Traffic cones, barricades, and high visibility clothing will be used when work is required in high traffic areas.

Field personnel will be notified of the locations of emergency and first aid equipment prior to commencing with field activities.

6.3 Communication

Telephones, for communication with emergency support services/facilities, will be provided. Roux Associates personnel will be equipped with a mobile telephone.

7.0 MONITORING PROCEDURES FOR SITE OPERATIONS

7.1 Air Monitoring During Site Operations

The SHSO will monitor and record air monitoring measurements as required for onsite activities (Section 7.2 below) and during confined space entry (Section 8.15). All monitoring equipment will be calibrated to the manufacturer's specifications each day prior to use, and documented in Site field books.

7.2 Onsite Activities

Activities requiring air monitoring include any Site activity which will, or will possibly, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen deficient/oxygen enriched atmospheres. These activities include but are not limited to O&M of the Biosparge System. The following procedures will be followed for any intrusive activities and for O&M of the Biosparge system.

Air monitoring will be performed to establish the concentrations of volatile organic compounds during invasive activities using the following instrument(s):

- photoionization detector (PID);
- colorimetric indicator tubes (e.g., Dräger or Sensidyne); and
- activated charcoal sampling devices, if necessary.

The PID and colorimetric indicator tubes will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine whether or not personnel protection is adequate.

A combustible gas/O_2 meter will be used to monitor the potential for oxygen deficient/oxygen enriched atmospheres and for explosive concentrations of organic vapors during intrusive operations and confined space work. Monitoring will be performed according to the action levels for oxygen and combustible gases provided in Section 6.2.2.

Monitoring equipment will be calibrated in accordance with the owner's manual. Air monitoring during invasive site activities will be performed, as appropriate, as specified in the following sections. All air monitoring results will become part of the project records.

7.2.1 Level D Intrusive Activities

Level D intrusive activities will initially include all intrusive Site activities. These investigations/activities will begin utilizing Level D protection as described in Section 6.2.2, with upgrading as necessary to ensure adequate personnel protection.

The SHSO will monitor the breathing zone with a PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 ppm, which is below the PEL for all constituents of concern, except benzene. If the PID indicates the 5 ppm concentration has been exceeded, the SHSO will order cessation of the activity and the exclusion zone cleared of all personnel until the PID indicates a reading less than 5 ppm, or until the nature of the hazard has been more thoroughly evaluated.

Colorimetric indicator tubes will be used to establish the concentration of benzene. The colorimetric indicator tubes may not be chemical-specific for these compounds but will be conservatively biased high and the readings will be assumed to be benzene, which will enable the SHSO to make an immediate decision on the appropriate level of protection. Benzene may also be monitored initially in the breathing zone, using activated charcoal sampling devices. If any detections of benzene are noted based on the colorimetric indicator tube readings, the SHSO will order cessation of the activity until: 1) the benzene concentrations are non-detectable by the colorimetric indicator tubes; or 2) all potentially exposed personnel have donned Level B respiratory protection as described in Section 6.2.2 and PID readings are less than 5 ppm; or 3) until the nature of the hazard has been more thoroughly evaluated and it is determined that the measured compound(s) was not benzene.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and possibly other organic compounds (as necessary) at the beginning of new activities and periodically during intrusive activities. These samples would be sent to an American Industrial Hygiene Association (AIHA) accredited laboratory for analysis using the approved National Institute of Occupational Safety and Health (NIOSH) analytical methods.

7.2.2 Level C Intrusive Activities

Level C intrusive activities will initially include only those activities which require upgrading from Level D. Level C protection will be as described in Section 6.2.2, with upgrading, as necessary, to Level B to ensure adequate personnel protection. Downgrading to Level D protection will also be possible if monitoring demonstrates no inhalation hazard exists for the activity.

The SHSO will monitor the breathing zone with a PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 ppm, which is below the PEL for all constituents of concern except benzene. If the PID indicates the 5 ppm concentration has been exceeded, the SHSO will initiate measurements utilizing the colorimetric indicator tubes for benzene.

If the PID readings exceed 25 ppm total organic vapor, or the benzene colorimetric indicator tubes detect benzene, the SHSO will order cessation of the activity until: 1) the PID indicates a reading less than 25 ppm, and colorimetric indicator tube readings are non-detectable, 2) all potentially exposed personnel have donned Level B respiratory protection or, 3) the nature of the hazard has been more thoroughly evaluated and it is determined that the measured concentrations do not pose a potential exposure in excess of the PEL utilizing the Level C protection.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and possibly other organic compounds (as necessary) at the beginning of new activities and periodically during intrusive activities. These samples would be sent to an AIHA accredited laboratory for analysis using the approved NIOSH analytical methods.

7.2.3 Level B Intrusive Activities

Level B intrusive activities will initially include only those activities which require upgrading from Level C or D, and only those activities required to bring work to a safe stoppage. No work is currently planned utilizing Level B protection, and this HASP will require amendment at such time as Level B work becomes necessary (except for safe work stoppage activities).

When Level B protection is utilized, the SHSO will monitor the breathing zone with a PID in continuous operating mode and with the alarm activated. The alarm will be set at 100 ppm. If the PID indicates the 100 ppm concentration is exceeded, the SHSO will order cessation of the activity until: 1) the PID readings are below 100 ppm or; 2) until the nature of the hazard has been more thoroughly evaluated and it is determined that the measured concentrations do not pose a potential exposure in excess of the PEL utilizing the Level B protection.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and possibly other organic compounds (as necessary) whenever Level B protection is utilized.

7.3 Non-Intrusive Activities

Non-intrusive activities, including O&M of the Biosparge system, may result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen deficient/oxygen enriched atmospheres. Based upon the current understanding of Site conditions, personnel monitoring may be performed using colorimetric indicator tubes or activated charcoal sampling devices on the first day of non-intrusive activities, and periodically thereafter, if the PID readings indicate a more accurate assessment is warranted.

7.4 Medical Surveillance Requirements

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates' personnel, and subcontractors contracted directly by Roux Associates, are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120. At a minimum, the examination will include:

- Complete medical and work histories;
- Urinalysis;
- Physical exam;

- Vision and hearing exam;
- Blood chemistry;
- Pulmonary function test; and
- Audiometry.

The examination will be taken annually, at a minimum, and upon termination of employment with the company. Additional medical testing may be required by the Corporate Health and Safety Manager (CHSM) or OHSM in consultation with the company physician and the SHSO if an overt exposure or accident occurs, or if other Site conditions warrant further medical surveillance.

8.0 SAFETY CONSIDERATIONS FOR SITE OPERATIONS

8.1 General

The contents of this HASP have been implemented in accordance with the guidelines provided in ExxonMobil's OIMS Procedure 1.3: Health and Safety Plan (HASP) Procedure, July 15, 2005 revision, and the Loss Prevention System. As appropriate, this information will be reviewed and implemented prior to commencing work at the Site. This information may be cross-referenced as follows:

Topic	Reference Section
Hazard Safety Analysis (HSA) of work activities including: • Job Safety Analysis (JSA) • Loss Prevention Observation (LPO) • Subsurface clearance procedure	Section 8.0; Appendices D, I, and L
Identification of potentially hazardous chemicals	Table 2; Appendix E
Communication of hazards to employees and consultants/contractors	Sections 4.0 and 8.0; Appendices C, D, E, F, G, J, K, L, M, N, P, and S
Training and medical surveillance requirements	Sections 5.0 and 7.4; Appendix R
Personnel protective equipment (PPE) to be used	Section 6.2
Site control measures including: • Site zones • Traffic control plan, etc.	Sections 6.1, 8.7, 8.8, and 8.11; Appendix K
Emergency response and disaster contingency plan	Section 11.0; Appendices P and Q

8.2 Field Staff Tailgate Meeting

Each day's activities shall begin with a tailgate meeting including a discussion of potential Site-specific hazards. All items discussed shall be documented in the Health and Safety Briefing/Tailgate Meeting Form in Appendix G.

8.3 Hazard Safety Analysis

Under ExxonMobil's OIMS and LPS programs, Site personnel are required to perform three types of hazard safety analyses: Safe Performance Self-Assessment (SPSA), Job Safety Analysis (JSA), and Loss Prevention Observation (LPO).

The SPSA is a brief, general risk assessment made by employees prior to performing each task. The objective is to identify and eliminate potential workplace practices and hazard conditions that could lead to any type of loss. An SPSA is a mental exercise performed onsite where personnel consider a task they are about to undertake, confirm that they are following protocol, and identify any potential health and safety hazards before continuing with the task. An SPSA is designed to combat complacency associated with tasks performed on a routine basis by forcing one to consider changes in the job condition, weather, the task being performed, and the overall situation. Personnel must anticipate what could go wrong, the worst thing that could happen if something does go wrong, and decide if he or she has the necessary training, knowledge, tools, and PPE to successfully perform the task with minimal risk.

The JSA is a tool used to carefully study and record each step of a job or task, identifying existing or potential hazards to safety, health, and the environment, and determining the best procedures to follow in order to avoid the hazards. The JSA for a particular task must be completed before the task is undertaken. Personnel must determine the sequence of job steps and consider any potential health and safety hazards associated with each step. Proper procedure and PPE must be recommended to mitigate any potential hazards. The analysis should be documented on the JSA form (Appendix D). Completed JSAs are included in Appendix D for future reference within the HASP.

The LPO is an activity where (1) we observe how a task is performed compared to company standards, (2) we identify positive and questionable behaviors, and (3) the supervisor provides proactive feedback so "NOBODY GETS HURT." An LPO is used as an internal assessment of safe practice by Site personnel and should be performed every 400 man-hours onsite for non-intrusive activities and every 200 man-hours for intrusive activities. During an LPO, one field staff member is to observe another field staff member performing a common Site-related task.

The observer is to use the checklist and complete the summary/checklist on the LPO form (Appendix I). The two project members must then meet with the Project Manager to discuss the evaluation and enforce and/or redefine safe practices for the particular task being analyzed. The Project Manager is to collect and record all LPOs.

8.4 Contractor Orientation Meeting

All personnel must attend a contractor orientation meeting hosted by a Project or Site Manager (PM/SM) prior to the commencement of remediation or construction activities. The purpose of the meeting is to ensure that contractors are aware of the project scope, required safety practices, Site procedures, and other issues that will enhance the contractor's safety performance. The PM/SM will address key SH&E items in accordance with the checklist sited in ExxonMobil's OIMS Procedure 1.2: Project Orientation and Daily Site Safety Meetings Procedure, July 15, 2005 revision. This checklist is provided in Appendix J of this HASP and must be completed by a designated individual as needed.

8.5 Site Walk-Throughs

Safety considerations during Site walk-throughs are important since this activity will usually precede all other field operations. Air monitoring will be performed as indicated in Sections 6.2 and 7.1, and will be used to assist in prescribing levels of protection for future Site operations, designating Site layout, and identifying areas of particular hazard, if any.

8.6 Automobile Safety

Motor vehicle safety and awareness is a very important aspect of the health and safety plan, especially in prevention of injuries. Deaths, injuries, and property damage can occur from careless and unsafe driving acts. The main rule for vehicle safety is being smart (i.e., do not take chances) and driving defensively. Driving defensively means not only taking responsibility for yourself and your actions but also keeping an eye on the other guy to avoid dangerous situations.

The following are guidelines to help reduce your risks on the road:

- Secure each passenger before starting engine. Lock all doors.
- Check your mirrors.

- Driving too fast or slow can increase the likelihood of collisions.
- Avoid an impaired driver by turning right at the next corner or exiting. If an oncoming car appears to cross into your lane, pull over, sound horn, and flash lights.
- Don't contest the "right of way" or try to race another car during a merge.
- Be aware of sudden traffic slow downs due to security checkpoints and accidents.
- While driving, be cautious, aware, and responsible.

Before operating your vehicle, and on a regular basis, check the following:

- Does the driver have a valid drivers license?
- Does the vehicle have valid inspection stickers and insurance information?
- Are tires inflated to the right pressure?
- Is there an inflated spare?
- Are lights and indicators working?
- Are windshield wipers and washer fluid working?
- Are vehicle attachments (such as ladders) secured?
- Is the horn working?
- Is the license plate clean and visible?
- Does the vehicle have any dirt or residual material inside or outside that requires decontamination?

Remember, commercial vehicles are prohibited from left lanes, HOV lanes, and many expressways. Always be aware of your surroundings and be responsible for your possessions and company equipment.

8.7 Vehicular Traffic Control and Safety Procedures

A vehicular traffic area is any area where a vehicle may legally travel including, but not limited to, a roadway, roadway shoulder, driveway, or parking area.

Onsite Traffic Control Procedures

Traffic control procedures should be implemented if activities at the Site are conducted within proximity of a public roadway or an onsite access roadway. These measures should be implemented in accordance with ExxonMobil's OIMS Procedure 1.3: Health and Safety Plan (HASP) Procedure, July 15, 2005 revision (Appendix K), to protect personnel working in these areas as well as to alert roadway users of necessary precautions. When precautionary measures/controls cannot be implemented, the Traffic Control Process Flow Diagram (Appendix K) should be observed.

The principal exposures to vehicular traffic at the Site occur in the following work areas:

- Monitoring wells in and around roadways and parking areas.

Onsite Traffic Safety Procedures

When performing activities on or adjacent to roads, including activities near monitoring wells, the following traffic safety procedures must be followed.

- High visibility clothing and hard hats, as well as any other applicable PPE specified in the HASP, must be worn at all times.
- The worker's vehicle should be positioned, to the fullest extent possible, to form a barrier between the worker(s) and oncoming traffic. In addition, each work vehicle will be equipped with a minimum of four high visibility traffic cones. All traffic cones will be placed as necessary to alert traffic of ongoing activities.
- In high volume traffic areas or areas with unpredictable traffic patterns, a traffic watchman or police detail should be utilized. The traffic watchman must be equipped with a warning flag and remain alert and focused on traffic conditions at all times. The need for a traffic watchman or police detail should be discussed with the Project Manager and client prior to deployment.
- Notify the local police of the work location, dates of work, and the anticipated work times when work is to be conducted in a public roadway.
- Additional requirements of local transportation, highway, public safety, and police departments must also be followed when work is performed in a public roadway.
- Any time work is initiated or there is a change in the type of work or location of work, the SHSO should consider the potential traffic safety hazards. If appropriate, implement protective measures in addition to those described above.

- Daily safety briefings should include a discussion of traffic safety as it relates to the activities planned for that day.
- All Roux Associates' subcontractors performing work at the Site must also adhere to the above safety procedures.

Monitoring Well Areas

Work in vehicular traffic areas at or near monitoring wells primarily consists of the following tasks:

- gauging;
- sampling;
- well installation and maintenance; and
- general maintenance and cleanup.

Vehicular traffic in these work areas within the former terminal is typically fairly light and infrequent; however, traffic along Railroad Avenue leading to the Site is usually very heavy. Traffic along Railroad Avenue consists of car and large-commercial truck traffic typically moving at speeds of 25 to 30 miles per hour (mph). Note that the local speed limit is 25 mph. Vehicle speed in work areas within parking lots is typically low but may be hazardous due to vision limitations caused by miscellaneous obstructions. During activities within all of these work areas, project staff generally park their vehicles within the former terminal or at the southeastern end of the Zinsser Bridge. Within parking lots, vehicles utilize designated parking spaces.

The following procedures shall be followed to mitigate vehicular traffic hazards posed at the work areas of the Site during any activities within a roadway, roadway shoulder, or any active parking area unless the area is secured (fenced and gated without any vehicle movement potential).

- Double parking shall not be permitted.
- All workers shall wear hardhats and high visibility clothing.
- Workers shall use caution when crossing any road.

- Workers should take care to avoid sudden movements across the road.

- Workers shall position vehicles and equipment to minimize exposure to traffic and to facilitate safe access and egress from vehicles while loading and unloading equipment and/or materials.

- Traffic cones shall be deployed around work areas while workers are present.

- Traffic cones shall be placed at strategic locations to warn approaching traffic.

- All vehicles shall be parked as close to the work area as possible to use the vehicle as a barrier against oncoming traffic.

- When performing activities on a roadway or on the shoulder of any roadway, a minimum of two people must be present. One person will serve as a "traffic watchman" whose sole responsibility is to monitor vehicular traffic conditions and alert worker(s) of potential traffic hazards. The "traffic watchman" must be alert at all times and focused on traffic conditions. At no time should the "traffic watchman" engage in activities other than monitoring traffic conditions.

In addition to the above guidelines, project personnel are reminded of the following routine vehicular traffic safety procedures.

- As always, each day's activities shall begin with a tailgate meeting including a discussion of traffic hazards at the Site.

- Project staff shall require that all project subcontractors conform to the same guidelines.

- High visibility clothing and hard hats, as well as any other applicable PPE specified in the HASP, must be worn at all times.

- The worker's vehicle should be positioned, to the fullest extent possible, to form a barrier between the worker(s) and oncoming traffic. In addition, each work vehicle will be equipped with a minimum of four high visibility traffic cones. All traffic cones will be placed as necessary to alert traffic of ongoing activities.

- In high volume traffic areas or areas with unpredictable traffic patterns, a traffic watchman or police detail should be utilized. The need for a traffic watchman or police detail should be discussed with the Project Manager and client prior to deployment.

- Any time there is a change in the type of work or location of work, the SHSO should consider the potential traffic safety hazards. If appropriate, implement protective measures in addition to those described above.

- Daily safety briefings should include a discussion of traffic safety as it relates to the activities planned for that day.

A checklist used to determine the applicability of Traffic Control Procedures for various activities at the Site can be found in Appendix K. All Traffic Control Procedures will be performed in accordance with Exxon Mobil's Traffic Control Plan, included in Appendix K.

8.8 Construction Activities

Activities involved with construction of any remedial action treatment systems will initially be considered non-intrusive activities. However, initial and/or periodic monitoring, as described in Sections 6.2 and 7.0, may be performed by the SHSO.

A variety of physical hazards may be present during any construction-type project. Personnel should be aware of safety issues associated with: noise, cold, hot work such as welding, cutting, and burning, heavy lifting, rough terrain, heavy equipment operation, ladders, scaffolding, excavating and trenching, underground and overhead utilities, electrical hazards, and the hazards associated with hand and power tools. These hazards are not unique and are generally familiar to most construction personnel.

8.9 Operation and Maintenance Activities

Any personnel involved in sampling, testing, repairs, and operation and maintenance of the system must be health and safety trained before being allowed to work on the system. Verification of compliance with 29 CFR 1910.120 must be provided, and will be maintained by the SHSO onsite as described in Section 5.5 of the HASP. PPE shall be worn as follows: hard hat, safety glasses, high visibility clothing, and steel-toe boots.

All remedial action treatment system activities will be performed under the requirements of the HASP.

Air monitoring will be performed to establish the general or specific concentrations of benzene and other chlorinated and non-chlorinated solvents prior to maintenance activities, as deemed necessary, using the following instruments:

- photoionization detector (PID);
- colorimetric indicator tubes; and

- activated charcoal sampling devices, if necessary.

Action levels described in Section 6.2 of the HASP will apply to all operation and maintenance tasks.

Hearing protection is to be used when performing activities within the treatment shed. Additionally, be sure that appropriate PPE/clothing is used when handling chemicals (i.e., polymers, coagulants, disinfecting agents, etc.) used during operation and maintenance activities.

Extreme care must be taken when working on or around the Biosparge system. No loose clothing or long hair will be worn to avoid injury from moving mechanical parts. All necessary PPE must be worn at all times. Electrical systems shall be handled only with insulated gloves and tools.

8.10 Subsurface Clearance Procedure

The procedure for exercises to be conducted prior to and during ground disturbance activities has been established by ExxonMobil in OIMS Procedure 2.4: Subsurface Structures Identification Procedure, July 15, 2005 revision. The Subsurface Clearance Procedure and Checklist is included in Appendix L. The objective of the protocol is to prevent damage to subsurface structures during drilling, augering, sampling, or other advancement operations. The proximity of chemical, water, sewer, and electrical lines will be identified by a utility mark-out service before any subsurface activity or sampling is attempted.

Roux Associates personnel and subcontractors will practice sound investigation and drilling practices as well as employ all necessary measures to avoid damage to subsurface systems and structures. Adequate training and supervision for these activities will also be provided. The SHSO will be present onsite during invasive operations, such as excavation and drilling, and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are followed by Roux Associates personnel. The SHSO and Project Manager shall confirm that the utility mark-out service has been notified at least 72 hours prior to earth disturbing activities and that the mark-out was completed.

8.11 Heavy Equipment Safety

The SHSO will be present onsite during all invasive operations and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are followed by Roux Associates personnel. ExxonMobil's Subsurface Clearance Procedure (Appendix L) must be followed during all intrusive activity. The proximity of chemical, water, sewer, and electrical lines will be identified by a utility mark-out service before any subsurface activity or sampling is attempted. The SHSO and Project Manager shall confirm that the utility mark-out service has been notified at least 72 hours prior to earth disturbing activities and that the mark-out was completed.

Hazardous waste sites utilize all of the mechanical equipment used on any major construction site. Typical machinery to be found includes pumps, compressors, generators, portable lighting systems, pneumatic tools (drum openers), hydraulic drum crushers, pug mills, fork lifts, trucks, dozers, and backhoes. From a safety standpoint, it is always important to be continually aware of the equipment around you. The equipment poses a serious hazard if not operated properly, or if operators cannot see personnel near machinery. In particular, the following heavy equipment hazards are common at the Site and need to be considered from a safety standpoint.

Interaction/contact with heavy equipment contractors - Heavy equipment (i.e., backhoes, bulldozers, etc.) operators may not be aware of your presence. Be sure that the operator is aware of your presence before approaching any heavy equipment. When possible, inform operators of your planned activities in the area prior to them beginning their activities.

Each piece of potentially hazardous equipment (i.e., power tools,) will be inspected for proper and safe operation prior to its use.

- All mechanical and rigging equipment will be inspected by the operators prior to beginning this work effort, and at least daily thereafter to ensure proper operating capability. Defective equipment must be repaired or replaced prior to continued use/operation.
- Inspect all cables, sheaves, slings, chains, hooks, and eyes prior to use.
- Secure equipment firmly or be sure it is supported.

- Be sure all power lines are inactivated, removed, or at a safe distance.
- Always use proper loading for capacity at lifting radius.
- Keep all equipment lubricated and maintained.
- Employ signal persons whenever needed.
- Make certain that signals are understood and observed.

Drilling crews are confronted with all of these heavy equipment hazards. They must be responsible for good housekeeping around the rig because of the rods, auger sections, rope, and hand tools used for the operation. Maintenance is a constant requirement. Overhead and buried utilities require special precautions because of electrical and natural gas hazards. Electrical storms may seek out a standing derrick. The hoist or cathead rope poses specific hazards; always use clean, dry, sound rope. Keep hands away from the test hammer. Hearing loss can be caused by exposure to high noise levels from mechanical equipment. Use hearing protection to reduce your potential for overexposure to noise.

Proper containment and disposal practices will be followed in regard to the potential amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP. The use of hard hats, eye protection, ear protection, and steel-toe boots will be required during heavy equipment operation. Contaminated equipment will be placed on liner material when not in use, or when waiting and during decontamination. Communications with the Support Zone will be regularly maintained.

8.12 Heavy Equipment Decontamination

If a steam cleaner will be utilized to decontaminate equipment, personnel should exercise caution as the high pressure steam can cause severe burns. Protective gloves, face shields, hard hats, steel-toe boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

8.13 Overhead/Underground Power Lines

The positioning or operation of heavy equipment in the vicinity of utility services will not be initiated until the activities have been coordinated with the ExxonMobil Project Engineer and

Site Manager. Operation of equipment adjacent to or under overhead power lines, in such a manner that encroaches on authorized clearances, will not take place unless one of the following is satisfied:

- Power has been shut off and positive steps are taken to prevent the lines from being energized;
- The equipment does not have the ability to move laterally or horizontally within the minimum clearance specified in the table below for energized power lines;
- The equipment has been positioned and blocked to allow no part, including cables, to come within the minimum clearance specified in the table below; or
- Excavation operations are not initiated within 25 feet of the verified position of underground power lines.

Minimum Required Clearances for Energized Overhead Power Lines

Nominal System Voltage of Power Line (KV)	Minimum Required Clearance (feet)
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

1 kilovolt (KV) = 1,000 volts

8.14 Excavation and Backfill Operations

The SHSO will be present onsite during all of Roux Associates' contracted excavation and backfill operations and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are utilized. The inspections and procedures outlined in the ExxonMobil Subsurface Clearance Procedure Checklist (Appendix L) shall be performed prior to and during any excavation. The proximity of chemical, water, sewer, and electrical lines will be identified by the ExxonMobil Project Engineer before any subsurface activity or sampling is attempted.

The following safe work practices will be followed during this task.

- The proximity of chemical, water, sewer and electrical lines will be identified by a facility representative prior to any subsurface activity beginning.
- While excavating, stay out of the reach of the backhoe arm's swing by standing at the end of the excavation, not near the sides (sides have the potential to cave in).

Maximum Allowable Slopes

Soil or Rock Type	Maximum Allowable Slopes (H:V)[1] for Excavations less that 20 Feet Deep[3]	
Stable Rock	Vertical	(90°)
Type A[2]	3/4 : 1	(53°)
Type B	1 : 1	(45°)
Type C	1 1/2 : 1	(34°)

OSHA (29 CFR 1926.652, Subpart P, Appendices A and B)

Notes:

[1] Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

[2] A short-term maximum allowable slope of 1/2H : 1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 meters) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 meters) in depth shall be 3/4H : 1V (53°).

[3] Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

Proper stockpiling, containment, and disposal practices will be utilized in regard to the potential amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP. The use of hard hats, eye protection, ear protection, and steel-toe boots will be required during excavation or other heavy equipment operations.

8.15 Confined Space Entry

The scope of work may require personnel to enter a confined space during the conduct of this project. Confined space is defined as having limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These spaces include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos. All Confined Space Entry will be performed in accordance with ExxonMobil's Work Permit Procedure for Confined Spaces, included as Appendix N.

A permit required confined space is one that meets the definition of confined space, and has one or more of the following characteristics:

- contains or has the potential to contain a hazardous atmosphere;
- contains a material that has the potential for engulfing an entrant;
- has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- contains any other recognized serious safety or health hazards.

Routine confined space entry at the Site is not required but, if necessary, all personnel performing this activity are required to have OSHA confined space entry training (29 CFR 1910.146) and must adhere to ExxonMobil's confined space entry procedures (Appendix N). Every effort will be made to assure that the conditions in the confined space are free of hazards and the space re-classified as a non-permit confined space prior to entry.

Any remaining spaces at the Site that require entry are to be evaluated prior to entry and discussed with the SHSO to determine the entry requirements for that space (i.e., non-permit or permit required).

8.16 Hot/Cold Welding

Roux Associates shall not perform welding unless specific clearance has been obtained from the ExxonMobil project engineer, PM, and SM. Any contractors or Roux Associates personnel performing welding must adhere to ExxonMobil's hot work procedures (Appendix N) and the procedures outlined below.

Welding equipment shall be chosen for safe application to the work and shall be installed properly. Employees designated to operate welding equipment shall be properly instructed and qualified to operate it. Mechanical ventilation shall be provided when welding or cutting:

- where there is less than 10,000 cubic feet per welder;
- where the overhead height is less than 16 feet; and
- where required by ExxonMobil practices and procedures (e.g., Confined Space Permitting).

Proper shielding and eye protection shall be worn to prevent exposure of personnel to welding hazards. Proper precautions (isolating welding and cutting, removing fire hazards from vicinity, etc.) for fire prevention shall be taken in areas where welding or other "hot work" is being done. All welding operations and other "hot work" shall be scheduled and performed in accordance with the ExxonMobil permitting system. The SHSO will be responsible for securing these permits.

All welding and cutting operations carried out in confined spaces shall be adequately ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency and shall be performed in compliance with ExxonMobil's Confined Space Entry procedure. In general, oxygen shall never be used for ventilation. In such circumstances where it is impossible to provide ventilation, OSHA requires airline respirators or hose masks approved by the National Institute for Occupational Safety and Health (NIOSH) for this purpose to be utilized. In areas immediately dangerous to life, NIOSH approved powered air purifying respirators (PAPR) or self-contained breathing apparatus (SCBA) shall be used.

8.17 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of PPE in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat stress are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes shade, rest, and fluid replacement. Normally, the individual should recover within one-half hour. If the individual is not better within 30 minutes and the body temperature has not decreased, the individual should be transported to a hospital for medical attention (Figure 3 – "Hospital Location Map").

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids. If the individual is not better within 30 minutes and the body temperature has not decreased, the individual should be transported to the hospital for medical attention. A map of Hastings-On-Hudson with the location and directions to the Community Hospital at Dobbs Ferry is included as Figure 3.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY** requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot red skin;
- body temperature approaching or above 105 degrees F;
- large (dilated) pupils; and
- loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress is a significant hazard if any type of protective equipment (semi-permeable or impermeable), which prevents evaporative cooling, is worn in hot weather environments.

8.18 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. A work/rest regimen will be initiated when ambient temperatures and protective clothing cause a stressful situation. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. The signs and symptoms of cold stress include the following:

- severe shivering;
- abnormal behavior;
- slowing;
- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks and encourage activity such as walking, wrapped in a blanket.

8.19 Surface Water Sampling

Care shall be made while performing surface water sampling and working in the vicinity of the Hudson River bulkhead to prevent and minimize the risk associated with working near an open water body. The sampler shall wear a rope and harness, with the rope end fixed to an immovable object such as a tree or fence, if work entails leaning over the bulkhead. In addition, a Coast Guard approved safety vest shall be worn during all operations in the vicinity of the Hudson River bulkhead.

8.20 Communications

- Telephones -- A telephone will be available for communication with emergency support services/facilities.
- Hand Signals -- To be employed by personnel required to use Level C or B respiratory protection. They shall be known by the entire field team before operations commence and covered during Site-specific training.

Hand Signals

Signal	Meaning
Hand gripping throat	Out of air, can't breath
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm alright, okay
Thumbs down	No, negative

8.21 Additional Safe Work Practices

Refer to the SHSO for specific concerns regarding each individual Site task. The safety rules listed below, as well as the ExxonMobil Contractor Safety Requirements, must be strictly followed.

- Inform SM of planned activities and evaluate the degree of health and safety protection required for each task.
- Practice contamination avoidance, avoid any skin contact with potentially contaminated materials (i.e., surface or ground water, soil, etc.).
- Hard hat and eye protection will be worn when inside the exclusion zone.
- Do not carry gum, cigarettes, food, or drink of any kind into contaminated areas.
- Wash hands before handling food and drink and other activities that could cause hand-to-mouth transfer of contaminants.
- Appropriate foot, hearing, and hand protection will be worn by those directly involved in the work efforts when warranted.
- No facial hair that interferes with the face-to-face seal of respirators will be allowed.
- Personnel not involved in the operations, excavating, or monitoring activities will remain a safe distance from the equipment.
- Do not climb over/under obstacles.
- Be alert to your own physical condition.
- Watch your buddy for signs of fatigue, exposure, heat or cold stress, etc.
- No work will be conducted without adequate light.
- Report all accidents, no matter how minor, immediately to the SHSO and the ExxonMobil Project Engineer.
- **KNOW YOUR HEALTH AND SAFETY PLAN.**

Additional Site-specific Safety Plan amendments due to any alteration of the treatment facility must be included in the Health and Safety Plan. A Health and Safety Plan Amendment form is included as Appendix O.

Contractors who perform onsite activities should be informed of the "ExxonMobil Refining & Supply Statement of Policy on Contractor Safety Requirements" and the "ExxonMobil Subsurface Clearance Procedure" included as Appendix F and Appendix L, respectively.

9.0 DECONTAMINATION PROCEDURES

9.1 Contamination Prevention

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

Personnel

- do not walk through areas of obvious or known contamination;
- do not handle or touch contaminated materials directly;
- make sure all PPE has no cuts or tears prior to donning;
- fasten all closures on suits, covering with tape, if necessary;
- take particular care to protect any skin injuries;
- stay upwind of airborne contaminants; and
- do not carry cigarettes, gum, etc. into contaminated areas.

Heavy Equipment

- care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
- excavated soils should be contained and kept out of the way of workers; and
- decontamination of equipment should be performed prior to moving to another work area.

9.2 Decontamination

The SHSO shall be responsible for determining appropriate decontamination methods for all Site activities. Figures 4, 5, and 6 illustrate typical decontamination procedures for Levels D, C, and B and procedures for emergency decontamination. Decon water should be collected, handled, drummed and/or containerized prior to determination of classification and appropriate disposal method (see Section 10.0).

10.0 DISPOSAL PROCEDURES

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. All potentially contaminated materials should be bagged, drummed, or placed in waste wranglers, as necessary, labeled, and placed in the designated area of the Site. Potentially contaminated waste materials that are bagged or drummed outside of the remediation shed will be labeled prior to disposal.

All PPE and sorbent products contaminated with petroleum product will be stored in waste storage containers (i.e., drums) located outside of the remediation shed. Additionally, all petroleum products generated from product recovery activities (i.e., well bailing, etc.) will be drummed and stored outside of the remediation shed, or placed in drums/storage tanks positioned at the well head. All hazardous waste storage containers, tanks, and drums will be labeled with the appropriate hazardous waste labels and/or placards. All contaminated materials will be disposed by ExxonMobil in accordance with appropriate regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste.

11.0 EMERGENCY PLAN

As a result of the hazards at the Site and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by OSHA (29 CFR 1910.120) to be available for use and is included below. The Site O&M manager will have a copy of this HASP and a field copy shall be available in the Support Zone at each work site.

In the event of an emergency situation, such as fire, explosion, or significant Reportable Quantity (RQ) release, all persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified by the SHSO. The SHSO will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SHSO or SM must see that access for emergency equipment is provided and that all combustion apparatus has been shutdown once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. Then, other personnel listed in the Incident Response Plan (Appendix P) shall be notified.

An emergency response will be documented as described in this section and in accordance with ExxonMobil's Remediation Emergency Response Log (Appendix Q).

11.1 Site Emergency Coordinator(s)

The Site Emergency Coordinator(s) are:

Site O&M Manager:	John LoMeli, Jr., Roux Associates, Inc.
Site Health and Safety Officer:	Indira Rattiram, Roux Associates, Inc.
Project Manager:	Therese Pitterle, Roux Associates, Inc.

The Site Emergency Coordinator(s) shall implement this emergency plan whenever conditions at the Site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of Site personnel as necessary, and notification of emergency response units and the appropriate management staff.

11.2 Evacuation

Withdrawal Upwind

The work party will continually note general wind directions while onsite. Upon noting the conditions warranting movement away from the work site, the crew will move upwind a distance of approximately 100 feet or farther, as indicated by the Site monitoring instruments. Donning SCBA and a lifeline, SHSO will return to the work site to determine if the condition noted was transient or persistent. If persistent, onsite personnel will be notified of the situation and the need to leave the Site or don SCBA. When access to the Site is restricted and escape possibly hindered, the crew may be instructed to evacuate the Site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

Site Evacuation

Upon determination of conditions warranting Site evacuation, the work party will proceed upwind of the work site and notify the SHSO and the ExxonMobil Project Engineer of Site conditions. If the hazard is toxic gas, respirators will be retained. The crew will proceed to the field office to assess the situation. The advisability and type of further response action will be coordinated and carried out by the SHSO, the PM, and the ExxonMobil Project Engineer.

11.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedure will be implemented:

- immediately evacuate the Site as described above (Section 11.2);
- notify the ExxonMobil Project Engineer, SHSO, and PM; and
- call **911** to notify fire and security; non-emergency phone numbers are as follows:

Fire Department	(914) 478-2344
Police Department	(914) 478-2344

Fire Prevention

In the event of a fire at the Biosparge remediation shed, there are fire extinguishers located by the entrance.

11.4 Environmental Incident (Release or Spread of Contamination)

If possible, the spread of contamination should be controlled or stopped. The Site Manager must contact the Roux Associates Project Manager and the ExxonMobil Project Manager per the Incident Response Plan (Appendix P). The Project Mangers are responsible for contacting the appropriate personnel and/or authorities. If a significant release has occurred, the Project Managers or their designees should contact the National Response Center and other appropriate groups. Those groups will alert National or Regional Response Teams as necessary. Following these emergency calls, the remaining personnel listed in the table below shall be notified if necessary. The ExxonMobil Project Manager should complete an ExxonMobil Incident Report (Appendix H) once the incident has been contained and rectified.

In the case of an emergency (i.e., fire or immediate threat to personal or public health), immediately call **911**; for non-emergencies, contact the appropriate personnel in the table below.

Emergency Telephone Numbers

	Emergency Telephone Numbers	
Type	**Name**	**Telephone #**
Fire Department	Hastings-On-Hudson Fire Department	(914) 478-2344
HazMat Emergency Response		911
Law Enforcement	Hastings-On-Hudson Police Department	(914) 478-2344
Hospital	Community Hospital at Dobbs Ferry	(914) 693-0700
Ambulance		911
National Response Center (Release or Spill)		(800) 424-8802
ExxonMobil Project Engineer	Steve Trifiletti	(718) 383-7374 (work) (908) 578-8704 (cell)
Site Health and Safety Officer	Indira Rattiram	(631) 232-2600 (work) (631) 484-2292 (cell)
Project Manager	Therese Pitterle	(631) 232-2600 (work) (631) 831-1503 (cell)
OHSM	Joseph Gentile	(856) 423-8800 (work) (610) 844-6911 (cell)

11.5 Personal Injury

If onsite personnel require emergency medical treatment, the following steps will be taken:

1. Notify the Fire Department or Ambulance service and request an ambulance or transport the victim to the hospital, as appropriate, and make the necessary calls per the Incident Response Plan (Appendix P).
2. Decontaminate to the extent possible prior to administration of first aid or movement to emergency facilities.
3. First aid will be provided by emergency medical services (EMS) or by onsite personnel trained in first aid, CPR, and blood borne pathogens, if available.
4. The OHSM will supply medical data sheets (Appendix R) on the victim (if a Roux Associates employee) to appropriate medical personnel and complete the ExxonMobil Incident Report (Appendix H).

11.6 Overt Personnel Exposure

If an overt exposure to toxic materials should occur, the exposed person shall be treated at the Site as follows.

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention. An emergency shower or drench system shall be accessible at the Site at all times. Utilizing an eyewash, eyes should be rinsed for at least fifteen (15) minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or, if necessary, decontaminate and transport to the hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration:	Decontaminate and transport to emergency medical facility. The SHSO will provide medical data sheets to medical personnel as requested.

11.7 Adverse Weather Conditions

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

- heavy rainfall;
- high wind;
- potential for heat stress;
- potential for cold stress and cold-related injuries;
- limited visibility;
- potential for electrical storms;
- potential for malfunction of health and safety monitoring equipment or gear; and
- potential for accidents.

11.8 Near Loss and Loss Investigations

A "loss" is a specific event, sequence of events, or extended conditions that had unwanted or unintended impacts on the safety or health of people, property, environment, or on legal/regulatory compliance.

A "near loss" is a specific event, sequence of events, or extended conditions that COULD HAVE had unwanted or unintended impacts on the safety or health of people, property, environment, or on legal/regulatory compliance (or when something almost happened).

An "investigation" is a process to determine facts, root causes, and solutions. The process of investigating a loss or near loss is nearly the same because near loss factors are the same as loss factors. Near losses must be investigated like losses, using the same Incident Investigation Form (Appendix H) and process as follows:

- Ensure immediate medical attention is provided.
- Secure the scene.
- Notify supervisor and the ExxonMobil contact immediately.
- Assemble investigation team.

- Initiate the investigation.
- Gather facts.
- Draw conclusions.
- Determine root cause(s).
- Develop solution(s).
- Communicate incident investigation information to Global Remediation Organization.
- Perform verification and validation activities.

Ensure immediate medical attention is provided. Have someone accompany the injured person to the medical facility if additional treatment of diagnosis is required. Keep the ExxonMobil contact appraised of injured person status and any work limitations resulting from injury. Take action to secure the scene and initiate emergency response actions as necessary. Notify the supervisor and the Roux Associates OHSM of the incident and follow the guidelines outlined in OIMS Procedure 1.6.

The supervisor is to assemble an investigation team and take the lead role. The team may include supervisors, managers, subject matter experts, and involved employees. The investigation should be initiated as quickly as possible. For high risk incidents, begin the investigation immediately. For lower risk incidents, begin the investigation within 24 hours.

When gathering facts, speak only with persons directly involved in the incident. The interviews should be one on one. Deal only in facts, don't speculate. If needed, the investigation team may reenact the incident. Take photos of the scene. Use experts, if needed, to help gather and validate data. Review pertinent files, past incidents, etc. Collect drawings, sketches, and Site maps. Ask the questions "who, what, when, where, and how." Identify the causal factors. Organize the facts in the sequence of events, before and after the incident occurred. Develop a clear picture of what happened. Determine the root cause or causes. List and number each causal factor on the incident report form (Appendix H). For each causal factor, identify the corresponding root cause(s) and the matching solution. Implement the solution and communicate the incident investigation information to the Global Remediation Organization.

12.0 AUTHORIZATIONS

Roux Associates' personnel and Roux Associates' subcontractors authorized to enter the CRZ or Exclusion Zone while operations are being conducted must be approved by the SHSO and PM. Approval will require demonstrable evidence of the completion of appropriate training courses and medical examination requirements as specified by OSHA 29 CFR 1910.120, and review and sign-off of this HASP.

The following Roux Associates' personnel are authorized to perform work onsite:

1. Noelle M. Clarke
2. Therese Pitterle
3. John LoMeli Jr.
4. Tim Unalp
5. Laurie Ambrosio
6. Joseph W. Gentile
7. Indira Rattiram
8. Dana Bulcock
9. Tracy Bispham
10. Jessica Diminich
11. Jessica Collins
12. Alfredo Fernandez
13. Kathryn Sommo
14. Alissa Diminich
15.
16.
17.
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19. ______________________________
20. ______________________________
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33. ______________________________
34. ______________________________
35. ______________________________
36. ______________________________

13.0 FIELD TEAM REVIEW

Each person performing work or visiting at this Site shall sign this section after Site-specific training is completed and before being permitted to access the Site.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provisions contained herein.

Site/Project: Former Tappan Terminal

Name Printed	Signature	Date

14.0 APPROVALS

By their signature, the undersigned certify that this HASP is approved and will be utilized at the Former Tappan Terminal Site.

Site Health and Safety Officer	Date
Office Health and Safety Manager	Date
Project Manager	Date

TABLE 1. EMERGENCY PHONE NUMBER NOTIFICATION LIST

NAME / TITLE	AFFILIATION	NUMBER	
Personnel:			
Therese Pitterle, Project Manager	Roux Associates, Inc.	(631) 232 - 2600	(Work)
		(631) 831 - 1503	(Cell)
		(814) 861 - 5427	(Home)
Noelle M. Clarke, P.E., Principal Engineer	Roux Associates, Inc.	(631) 232 - 2600	(Work)
		(631) 807 - 6523	(Cell)
John LoMeli, Jr., Site O&M Manager	Roux Associates, Inc.	(631) 232 - 2600	(Work)
		(631) 445 - 8643	(Cell)
Indira Rattiram, Site H&S Officer	Roux Associates, Inc.	(631) 232 - 2600	(Work)
		(631) 484 - 2292	(Cell)
Tim Unalp, Environmental Technician	Roux Associates, Inc.	(631) 232 - 2600	(Work)
		(631) 445 - 0400	(Cell)
Steve Trifiletti, Project Manager	ExxonMobil Refining	(718) 383 - 7374	(Work)
	& Supply	(908) 578 - 8704	(Cell)
		(914) 381 - 3777	(Home)
Anne Proctor, Project Manager	Woodard & Curran	(203) 271 - 0379	(Work)
Joseph Gentile, CIH	Roux Associates, Inc.	(856) 423 - 8800	(Work)
Corporate Health & Safety Officer		(610) 844 - 6911	(Cell)
Government Agencies			
	USCG NRC	(800) 424 - 8802	or
		(202) 267 - 2675	
	USCG	(802) 864 - 6791	
	NYSDEC Spill Hotline	(800) 457 - 7362	
USEPA, Region II	Acting Emergency & Remedial Response Division	(212) 637 - 4391	
Peter DeCicco	NYSDEC Div. Of Environmental Remediation	(845) 256 - 3109	
Local Emergency (911):			
	Police Department	(914) 478 - 2344	
	Local Fire Department	(914) 478 - 2344	
	Community Hospital	(914) 693 - 0700	
	National Weather Service, NYC Region	(516) 924 - 0517	
	State Poison Control Center	(800) 222 - 1222	

Last Updated: August 2007

General Contrator Phone List

NAME / TITLE	AFFILIATION	NUMBER	
Stu Skopicki	Wire to Water, Inc.	(631) 777 - 7310	(Work)
Matt Cordova	Accutest Laboratories	(732) 329 - 0200	(Work)
Paul Fenley (#129), Carl Klepper, Jr.	Fenley & Nicol Env.	(631) 586 - 4900	(Work)
James E. Gasho, Jr.	J. E. Gasho & Assoc.	(610) 692 - 5650	(Work)
Donald J. Knice, Jr.	Dynamic Balancing Corp.	(973) 881 - 0360	(Work)
Paul Lane	Clean Earth	(302) 427 - 6633	(Work)
John Scripter	ORS	(603) 654 - 6840	(Work)
Don Jenkins	Casie Protank	(856) 696 - 4401	(Work)
Joanie	Fleet Pump	(914) 835 - 3801	(Work)
Jim Loundsberry / Joe Perrone	National Watermain Cleaning	(800) 242 - 7257	(Work)
William Poupis	Aquifer Drilling and Testing	(800) 238 - 3745 (516) 779 - 3477	(Work) (Cell)
Christopher Rinaldi	US Filter / Westates	(800) 659 - 1717 (201) 650 - 4260	(Work) (Cell)
Andy Talaga	Global Technologies	(414) 365 - 6430	(Work)
Glenn Cork	Ed Cork & Sons	(631) 207 - 9290	(Work)
Victor Gentile	Safeguard Fence	(718) 894 - 3368	(Work)

Spill/ Cleanup Contractor:

Fenley and Nicol Enivronmental		(631) 586 - 4900
Clean Harbors Environmental	Environmental Emergency Response Hotline	(800) 645 - 8265

Table 2. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Former Mobil Tappan Terminal, Hastings-On-Hudson, New York

Compound	*CAS #*	*TLV*	*IDLH*	*PEL*	*Routes of Exposure*	*Toxic Properties*	*Target Organs*	*Physical/Chemical Properties*
Asphalt (fume)	8052-42-4	0.5 (fumes)	Potential Carcinogen	None	Dermal; inhalation ingestion	Severe burns Dermatitis Photosensitization Pyloric obstruction	skin eyes stomach	Black or dark brown mass BP = <470° F1.Pt = 464°F LEL = 0.7% UEL = 6.0%
Benzene	71-43-2	0.5 ppm 2.5 ppm 15 minutes STEL skin	(ND) Carcinogen	1 ppm	Dermal; inhalation ingestion	CNS depression Hematopoietic depression Dermatitis	CNS blood skin eyes resp system bone marrow	Liquid (solid below 42°F) BP: 80.093°C flammable LEL: 1.4% UEL: 8.0%
Diesel Fuel	68334-30-5	NA	NA	NA	Dermal; inhalation	Resp irritation Dizziness, nausea Skin disorders Liver disorders	lungs CNS skin liver	Light amber liquid F1.Pt = >100°F LEL = 0.6% UEL = 7.0%
Ethylbenzene	100-41-4	434 mg/m^3 100 ppm 15 minutes STEL 125 ppm	800 ppm (10% LEL)	435 mg/m^3 100 ppm	Dermal; inhalation; ingestion	Sensory irritant CNS depressant Narcosis Hematological disorders	eyes skin CNS respiratory system blood	Liquid aromatic odor BP: 277°F Fl.P: 59°F LEL: 1.2% UEL: 7.0%
Fuel Oil	68476-33-5	NA	(ND)	NA	Dermal; inhalation ingestion	Skin cancer Liver damage Blood disorders	skin liver bone marrow	Dark liquid LEL = 1.0% UEL = 3.0% F1.Pt = >140°F

Table 2. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Former Mobil Tappan Terminal, Hastings-On-Hudson, New York

Compound	*CAS #*	*TLV*	*IDLH*	*PEL*	*Routes of Exposure*	*Toxic Properties*	*Target Organs*	*Physical/Chemical Properties*
Gasoline	8006-61-9	896 mg/m^3 300 ppm 15 minutes STEL 500 ppm	Confirmed Animal Carcinogen (ND)	None Exxon Mobil REL 100 ppm	Dermal; inhalation; ingestion	CNS depression Sensory irritant Dermatitis Pelmonary Edema	CNS eyes skin resp system	Liquid, aromatic F1.Pt = -50°F
Kerosene	8008-20-6	None NIOSH REL 10 HR TWA 100 mg/m^3	NA	NA	Dermal; inhalation	Eye/skin irritation Resp. irritation Dizziness, nausea	eyes skin resp. system CNS	yellow to white oily liquid F1.Pt = >115°F LEL = 0.7% UEL = 5.0%
Lead (as Pb)	7439-92-1	0.05 mg/m^3	100 mg/m^3	50 µg/M^3	Dermal; inhalation ingestion	Abdominal pain CNS depressant Anemia Nephropathy Reproductive effects	GI tract CNS blood kidneys	Metal - soft gray BP: 3164°F
Petroleum hydrocarbons (Petroleum distillates)	8002-05-9	350 mg/m^3	1,100 ppm	2,000 mg/m^3 500 ppm	Dermal; inhalation ingestion	CNS depressant Resiratory irritant Dried/cracked skin	CNS Respiratory tract skin	Colorless liquid Bt=86-460°F LEL: 1.1% UEL: 5.9%
Petroleum Naphtha	8030-30-6	400 ppm 1,590 mg/m^3	10,000 ppm	400 mg/m^3 100 ppm	Dermal; inhalation ingestion	Eye irritation Skin irritation CNS depressant	eyes skin	Black, dark brown amorphous residue Fl.Pt=-100-109°F LEL: 1% UEL: NA

Table 2. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Former Mobil Tappan Terminal, Hastings-On-Hudson, New York

Compound	*CAS #*	*TLV*	*IDLH*	*PEL*	*Routes of Exposure*	*Toxic Properties*	*Target Organs*	*Physical/Chemical Properties*
Slop Oil	68477-26-9	NA	NA	NA	Dermal	Eye irritation Skin irritation	Eyes skin	Dark liquid Fl.Pt=300°F LEL: 1.2% UEL: 7.1%
Toluene	108-88-3	188 mg/m^3 50 ppm	500 ppm	200 ppm Ceiling Conc. 300 ppm Max Peak 10 minutes 500 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP: 232°F flammable LEL: 1.2% UEL: 7.1%
Xylene(s)	1330-20-7	100 ppm STEL 150	500 ppm	435 mg/m^3 100 ppm	Dermal; inhalation; ingestion	Sensory irritant Blood dyscrasia Bronchitis CNS depression	CNS eyes skin GI tract blood liver kidneys	Liquid Aromatic odor BP: 138.5° flammable LEL: 1.1% UEL: 7.0%

Notes:
Ca - Carcinogen
TLV - Threshold Limit Value (ACGIH)
IDLH - Immediately Dangerous to Life and Health (OSHA)
PEL - Permissive Exposure Level (OSHA)
PPM - Parts per million

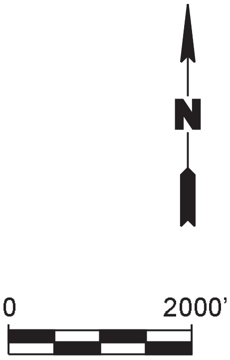
Notes continued:
mg/m^3 - milligrams per cubic meter
Fl. Pt. - Flash point
LEL - Lower Explosive Level
UEL - Upper Explosive Level
BP - Boiling Point
NA - Not Available
ND - Not Determined

References

Guide to Occupational Exposure Values, 2000. American Conference of Governmental Industrial Hygienists.
Hawley's Condensed Chemical Dictionary, Sax, N. Van Nostrand and Reinhold Company, 11th Edition, 1987.
Occupational Safety and Health Administration, 1993. General Industry Air Contaminant Standard (2a CFR 1910.1000).
Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.
Sax, N.I. and R.J. Lewis, 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
U.S. Department of Health and Human Services, 1997. NIOSH Pocket Guide to Chemical Hazards.

QUADRANGLE LOCATION

SOURCE:
USGS; Yonkers, NY-NJ (1998)
7.5 Minute Topographic Quadrangle



Title:

SITE LOCATION MAP

FORMER MOBIL TAPPAN TERMINAL
HASTINGS ON HUDSON, NEW YORK

Prepared for:

EXXONMOBIL REFINING AND SUPPLY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: C.R..	Date: 09AUG07	FIGURE
Prepared by: B.H.C.	Scale: AS SHOWN.	1
Project Mgr.: T.P.	Office: NY	
File No.: MC151100R01.CDR	Project No.: 172151Y03	

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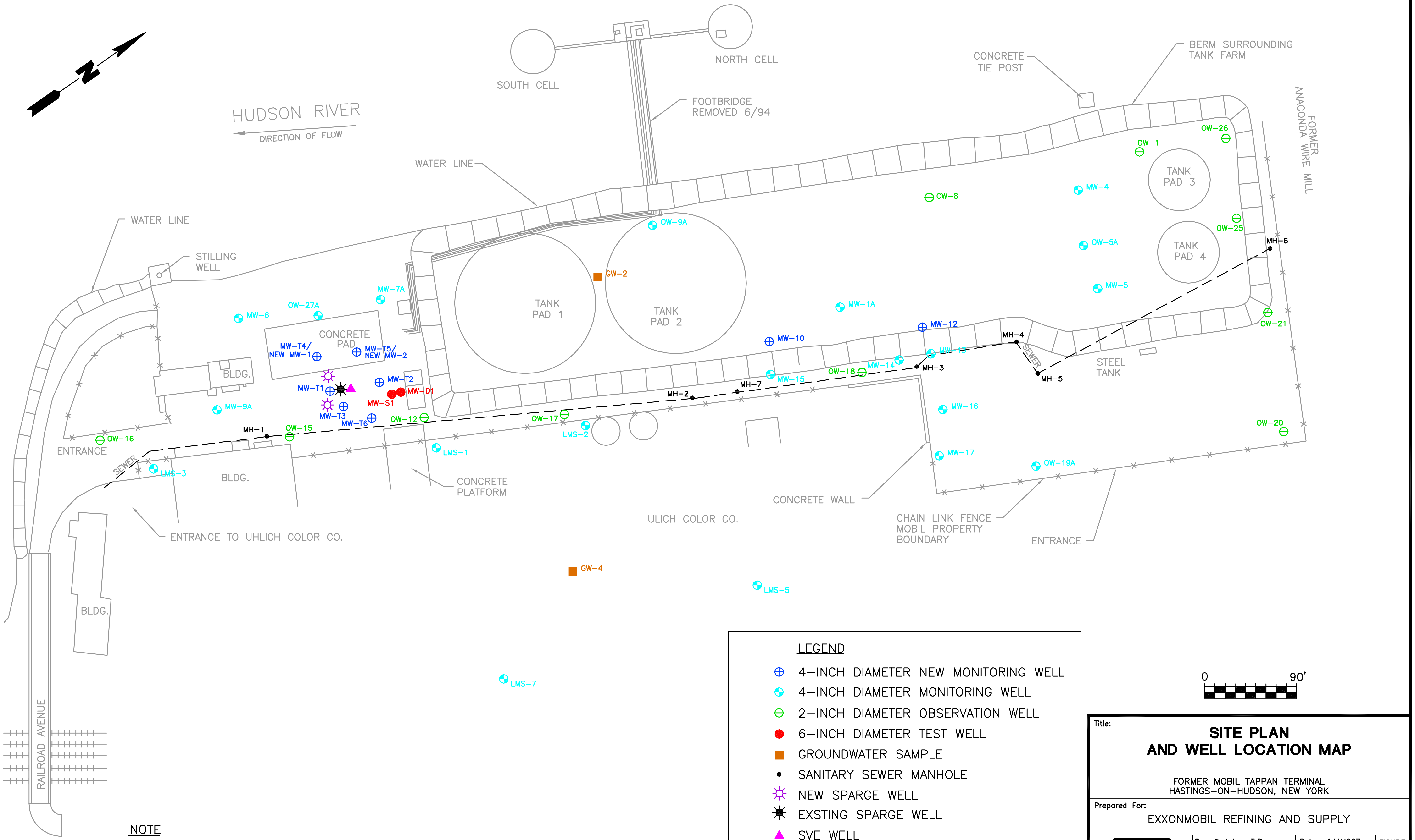

LEGEND

⊕	4–INCH DIAMETER NEW MONITORING WELL
◍	4–INCH DIAMETER MONITORING WELL
⊖	2–INCH DIAMETER OBSERVATION WELL
●	6–INCH DIAMETER TEST WELL
■	GROUNDWATER SAMPLE
•	SANITARY SEWER MANHOLE
☼	NEW SPARGE WELL
✹	EXSTING SPARGE WELL
▲	SVE WELL
— — —	SANITARY SEWER

NOTE

BASEMAP PROVIDED BY WOODARD & CURRAN, FIGURE 1, TITLED "SITE PLAN", DATED JULY 2001.

Title:

SITE PLAN
AND WELL LOCATION MAP

FORMER MOBIL TAPPAN TERMINAL
HASTINGS–ON–HUDSON, NEW YORK

Prepared For:

EXXONMOBIL REFINING AND SUPPLY

ROUX
REMEDIAL ENGINEERING, P.C.
ROUX ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS
Environmental Consulting
& Management

Compiled by: T.P.	Date: 14AUG07	FIGURE
Prepared by: B.H.C.	Scale: 1"=90'	2
Project Mgr: T.P.	Office: NY	
File No: MC151100R04	Project: 172151Y03	

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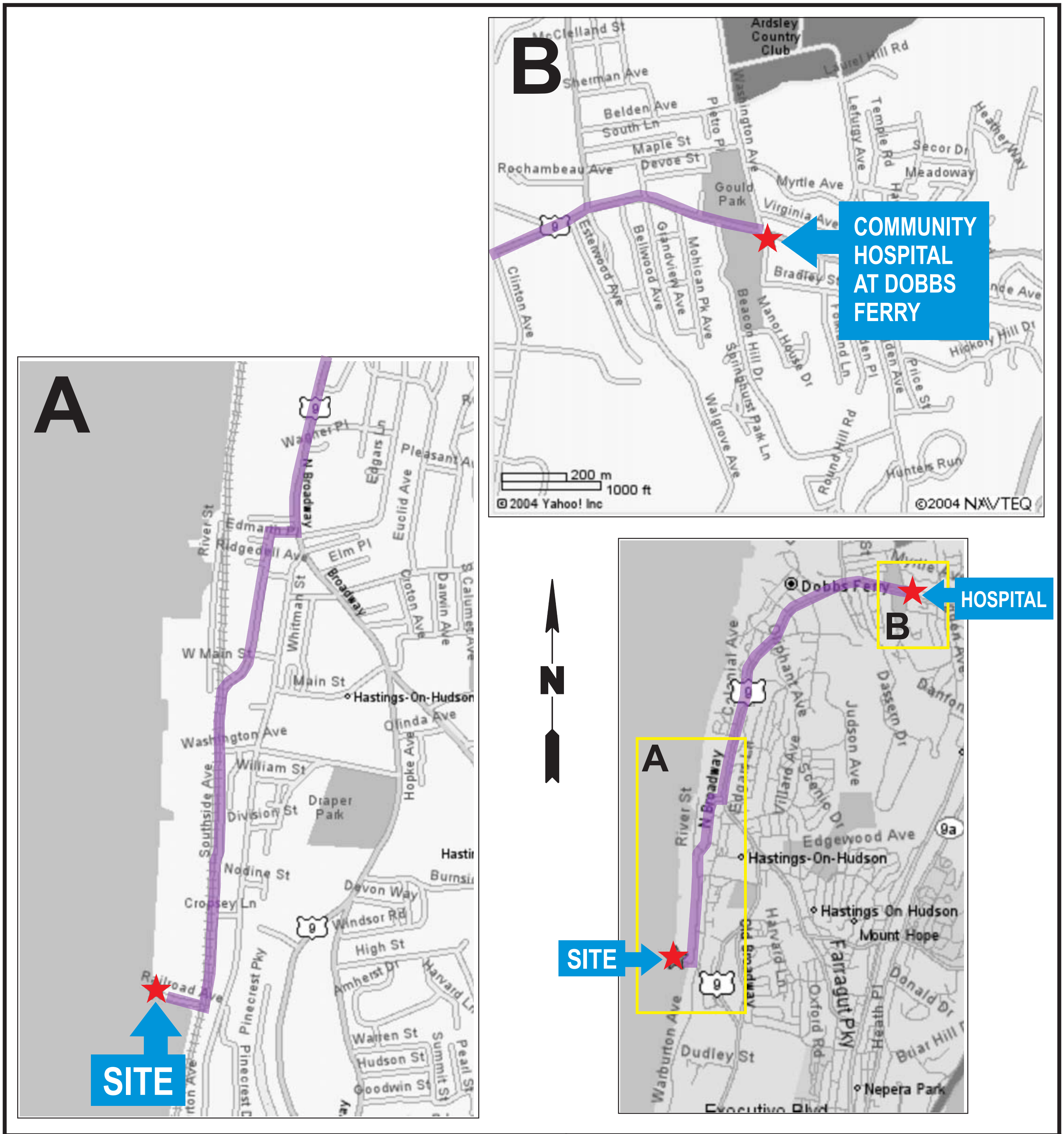

DIRECTIONS TO HOSPITAL

- **Start out going EAST on RAILROAD AVE toward SOUTHSIDE AVE.**
- **RAILROAD AVE becomes SOUTHSIDE AVE.**
- **SOUTHSIDE AVE becomes MAPLE AVE.**
- **MAPLE AVE becomes MAPLE LN.**
- **Turn LEFT onto US-9/N BROADWAY.**
- **Stay straight to go onto ASHFORD AVE.**
- **Hospital at 128 Ashford Ave, Dobbs Ferry, NY**

Title:

HOSPITAL LOCATION AND DIRECTIONS

FORMER MOBIL TAPPAN TERMINAL
HASTINGS ON HUDSON, NEW YORK

Prepared for:

EXXONMOBIL REFINING AND SUPPLY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: C.R.	Date: 09AUG07	FIGURE
Prepared by: B.H.C..	Scale: AS SHOWN	3
Project Mgr.: T.P..	Office: NY	
File No.: MC151100R02.CDR	Project No.: 172151Y	

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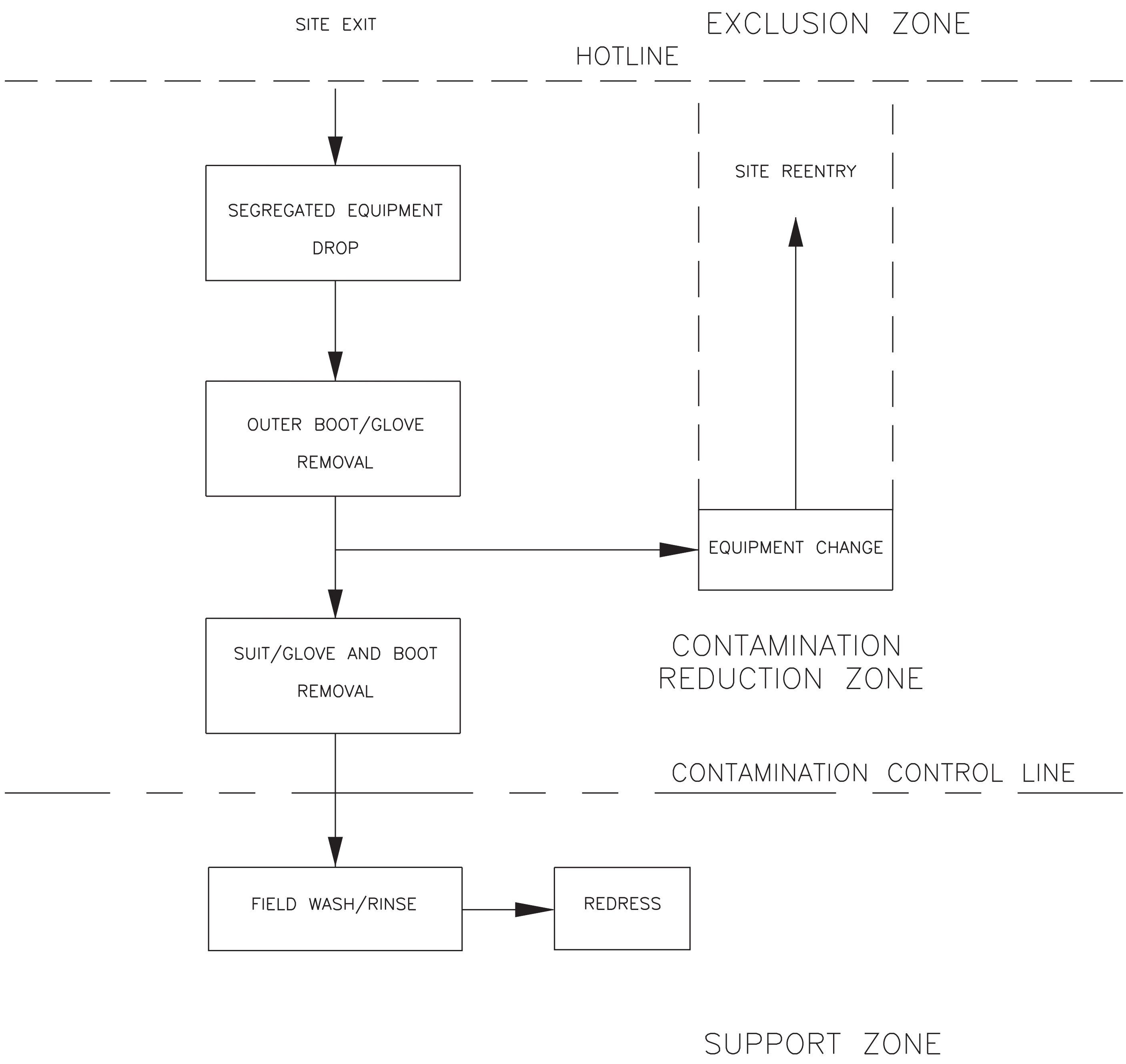

Title:

TYPICAL DECONTAMINATION LAYOUT
LEVEL D PROTECTION

FORMER MOBIL TAPPAN TERMINAL
HASTINGS ON HUDSON, NEW YORK

Prepared for:

EXXONMOBIL REFINING AND SUPPLY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: C.R.	Date: 09AUG07	FIGURE
Prepared by: B.H.C..	Scale: AS SHOWN	
Project Mgr.: T.P..	Office: NY	4
File No.: MC151100R03.CDR	Project No.:172151Y03	

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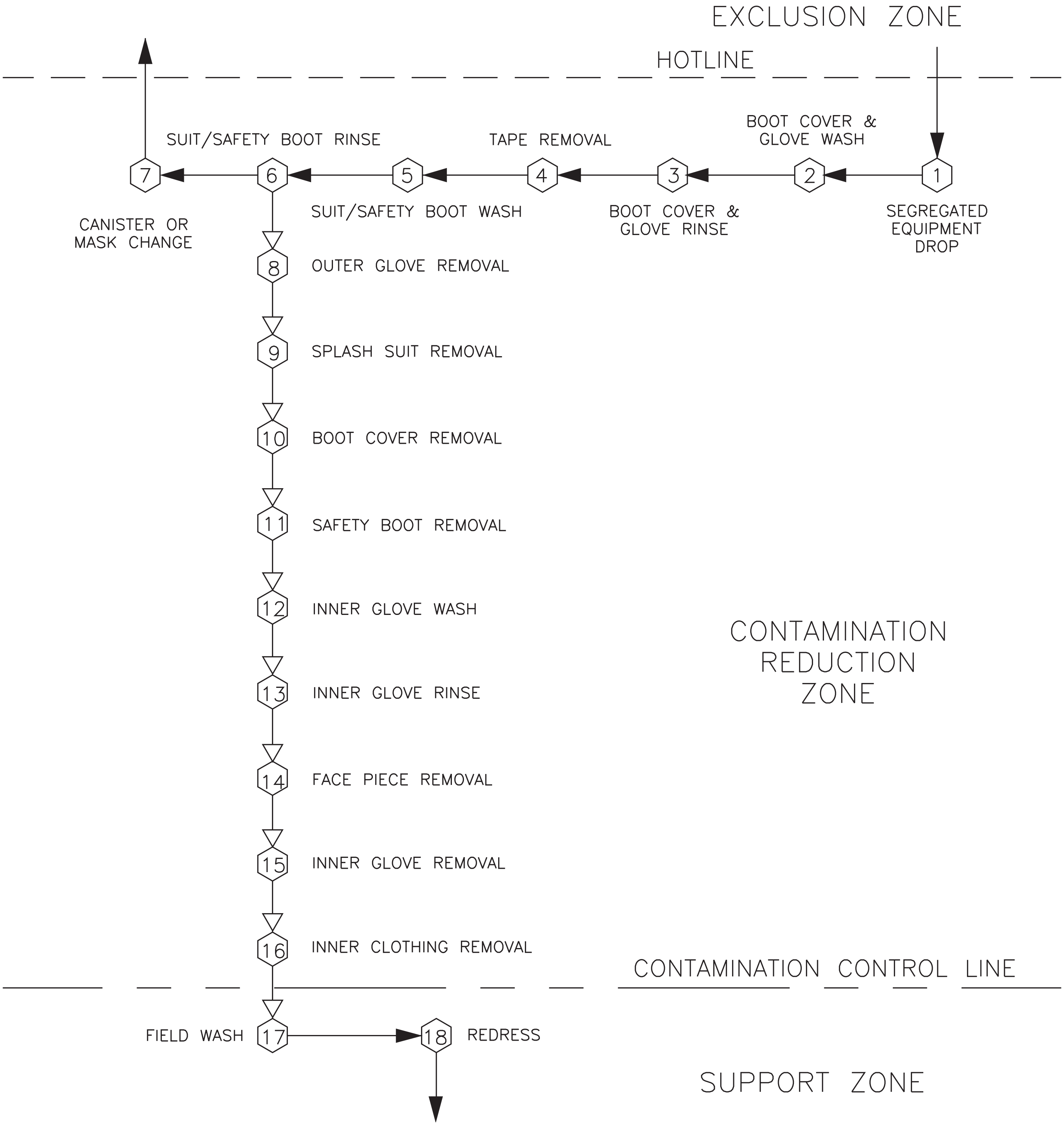

Title:

TYPICAL DECONTAMINATION LAYOUT

LEVEL C PROTECTION

FORMER MOBIL TAPPAN TERMINAL
HASTINGS ON HUDSON, NEW YORK

Prepared for:

EXXONMOBIL REFINING AND SUPPLY

ROUX ROUX ASSOCIATES, INC. *Environmental Consulting & Management*	Compiled by: C.R.	Date: 09AUG07	FIGURE 5
	Prepared by: B.H.C..	Scale: AS SHOWN	
	Project Mgr.: T.P..	Office: NY	
	File No.: MC151100R03.CDR	Project No.:172151Y03	

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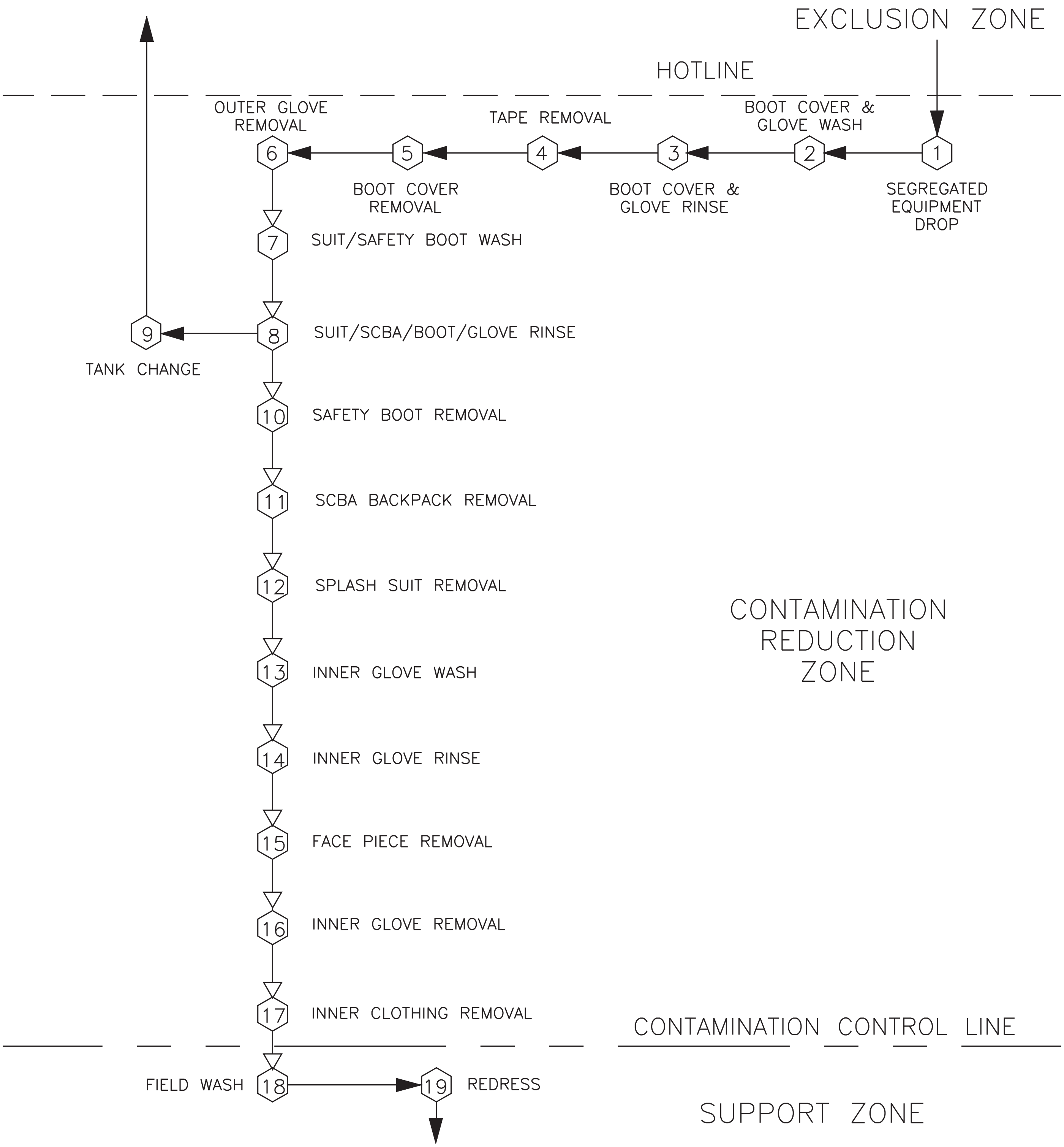

Title:

TYPICAL DECONTAMINATION LAYOUT

LEVEL B PROTECTION

FORMER MOBIL TAPPAN TERMINAL
HASTINGS ON HUDSON, NEW YORK

Prepared for:

EXXONMOBIL REFINING AND SUPPLY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: C.R.	Date: 09AUG07	FIGURE
Prepared by: B.H.C..	Scale: AS SHOWN	
Project Mgr.: T.P..	Office: NY	6
File No.: MC151100R03.CDR	Project No.:172151Y03	

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APPENDIX A

Job Safety and Health Protection (OSHA) Poster

You Have a Right to a Safe and Healthful Workplace.

IT'S THE LAW!

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in the inspection.
- You can file a complaint with OSHA within 30 days of discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have a right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violation.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records or records of your exposure to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.

The *Occupational Safety and Health Act of 1970 (OSH Act)*, P.L. 91-596, assures safe and healthful working conditions for working men and women throughout the Nation. The Occupational Safety and Health Administration, in the U.S. Department of Labor, has the primary responsibility for administering the *OSH Act*. The rights listed here may vary depending on the particular circumstances. To file a complaint, report an emergency, or seek OSHA advice, assistance, or products, call 1-800-321-OSHA or your nearest OSHA office: • Atlanta (404) 562-2300 • Boston (617) 565-9860 • Chicago (312) 353-2220 • Dallas (214) 767-4731 • Denver (303) 844-1600 • Kansas City (816) 426-5861 • New York (212) 337-2378 • Philadelphia (215) 861-4900 • San Francisco (415) 975-4310 • Seattle (206) 553-5930. Teletypewriter (TTY) number is 1-877-889-5627. To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website at **www.osha.gov**. If your workplace is in a state operating under an OSHA-approved plan, your employer must post the required state equivalent of this poster.

1-800-321-OSHA

www.osha.gov

U.S. Department of Labor • Occupational Safety and Health Administration • OSHA 3165

APPENDIX B

Field Change Request

HEALTH AND SAFETY FIELD CHANGE REQUEST FORM

SITE SAFETY REVIEW – CHANGES AND OVERALL EVALUATION
(To Be Completed For Each Field Change In Plan)

Was the Safety Plan followed as presented? _______ Yes _______ No

Describe, in detail, all changes to the Safety Plan:

____

____

____

Reasons for changes:

____

____

____

Follow-Up, Review and Evaluation Prepared by ____________________ Date ______________

Discipline ____

Approved by: Site Manager ______________________________ Date ______________

Site Safety Officer ______________________________ Date ______________

Approved by: Office Health & Safety Supervisor ____________________ Date ______________

Evaluation of Site Safety Plan:

Was the Safety Plan adequate? _______ Yes _______ No

What changes would you recommend?

____

____

____

____

APPENDIX C

Heat and Cold Stress Information

Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (PPE) in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- severe muscle cramps, usually in the legs and abdomen;
- exhaustion, often to the point of collapse; and
- dizziness or periods of faintness.

First aid treatment includes moving to a shaded area, rest, and fluid intake. Normally, the individual should recover within one-half hour. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- rapid and shallow breathing;
- weak pulse;
- cold and clammy skin with heavy perspiration;
- skin appears pale;
- fatigue and weakness;
- dizziness; and
- elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids and electrolytes. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY**, requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- dry, hot, red skin;
- body temperature approaching or above 105°F;
- large (dilated) pupils; and
- loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress (heat cramps, heat exhaustion, and heat stroke) is a significant hazard if any type of protective equipment (semi-permeable or impermeable) which prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the work load required to perform each task, type of protective equipment, temperature, and humidity. In general, when the temperature exceeds 88°F, a 15 minute rest cycle will be initiated once every two hours. In addition, potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- severe shivering;
- abnormal behavior;
- slowing of body movement;

- weakness;
- stumbling or repeated falling;
- inability to walk;
- collapse; and/or
- unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

APPENDIX D

ExxonMobil Job Safety Analysis (JSA)

Job Safety Analysis (JSA)
Former Tappan Terminal
Biosparge System O&M

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	2/22/2005	Rev. 1: 8/23/2005 Rev. 2: 8/13/2007	**Roux:** Therese Pitterle, Noelle Clarke, Dana Bulcock

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing - Hearing Protection	- Leather gloves when working with hand tools/equipment and when removing/replacing manhole covers - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools - Chemical-resistant disposable gloves when handling/working with liquids - 1 - 20 lb. fire extinguisher - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
1. Inform Riverside Autobody personnel of work scope and location.	1a. No communication with property owner could result in vehicular accident or H&S incident.	1a. Inform Riverside Autobody personnel of work scope and location.
		1a. Inquire about other activities taking place at the Site.
2. Drive/walk to remediation shed.	2a. Property damage and personal injury caused by obstructions/vehicles.	2a. Maintain speed limit of 5 mph on-site.
		2a. All equipment must be stowed and secured prior to moving.
		2a. Drive on established roadways.
		2a. Yield to all pedestrians.
		2a. Do not back up vehicle without spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.
	2b. Personal injury from tripping/falling due to uneven terrain and weather conditions.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
		2b. Use established pathways and walk on stable, secure ground.
	2c. Muscle strain while carrying equipment.	2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
	2d. Exposure to biological hazards - ticks, bees/wasps, poison ivy, insects, etc. (Ticks are most active any time the temperature is above freezing from March to November).	2d. Inspect area to avoid contact with biological hazards.
		2d. Wear long sleeved clothing to protect skin and apply insecticides containing DEET when working in overgrown areas of the Site.
		2d. Personnel shall examine themselves for ticks.
		2d. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water.
	2e. Exposure to sun, possibly causing sunburn.	2e. Wear sunscreen with an SPF of at least 15 whenever 30 minutes or more of exposure is expected.
3. Define and secure the work area.	3a. Personal injury or property damage from other vehicles on-site.	3a. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
		3a. Look both ways in high traffic areas.
		3a. Position vehicle to protect against oncoming traffic.
		3a. Place at least 3 traffic cones around work area when working in areas with traffic. Utilize a spotter in high traffic areas.
4. Ventilate the remediation shed to prevent potentially hazardous atmosphere.	4a. Exposure to process vapors.	4a. Ventilate shed for 10 minutes prior to entering.
		4a. Screen air with PID; if VOC levels are > 5 ppm, continue ventilating.
	4b. Engulfment, Fire, or Explosion.	4b. No open flames/heat sources in and around the shed.
		4b. Turn cell phone off.

Job Safety Analysis (JSA)
Former Tappan Terminal
Biosparge System O&M

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	2/22/2005	Rev. 1: 8/23/2005 Rev. 2: 8/13/2007	**Roux:** Therese Pitterle, Noelle Clarke, Dana Bulcock

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing - Hearing Protection	- Leather gloves when working with hand tools/equipment and when removing/replacing manhole covers - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools - Chemical-resistant disposable gloves when handling/working with liquids - 1 - 20 lb. fire extinguisher - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
	4c. Exposure to noise hazards due to compressor.	4c. Wear hearing protection.
5. De-energize the system.	5a. Electrocution, entanglement, pinching due to contact with electrical components and moving parts.	5a. Follow manufacturer's instructions for all maintenance activities.
6. Drain water accumulation in the compressor tank.	6a. Contact with contamination (e.g., contaminated water).	6a. Wear leather gloves and chemical-resistant disposable gloves.
		6a. Clean up any spills using absorbent pads.
	6b. Personal injury from tripping/falling due to system components.	6b. Do not climb over stored materials/equipment; walk around.
		6b. Keep tools and equipment in a designated area. When not in use, tools and equipment must be returned to their proper storage location. Keep work area clear of obstructions.
7. Mechanical maintenance: Inspect air compressor for proper operation.	7a. Exertion and muscle strain when handling compressor.	7a. Use proper lifting techniques and body positioning when handling equipment (see 2c).
	7b. Pinch points associated with compressor equipment.	7b. Wear leather gloves when handling/lifting equipment and tools.
	7c. Personal injury from tripping/falling due to system components.	7c. See 6b.
8. Re-energize the system.	8a. Bodily injury from improperly re-installed equipment.	8a. Inspect all equipment where work was performed for loose connections prior to re-energizing.
		8a. Position body out of "line of fire" of equipment.
	8b. Exposure to noise hazards due to compressor.	8b. Wear hearing protection.
9. Perform system monitoring activities: -Read various gauges and adjust to optimize performance; -Record flow rate and pressure.	9a. Pinch points associated with hand tools used to perform maintenance.	9a. See 7b.
		9a. Keep body parts away from fittings and connections.
	9b. Personal injury due to compressor cycling on and off automatically.	9b. Keep body parts clear of any moving parts.
	9c. Personal injury from tripping/falling due to system components.	9c. See 6b.

Job Safety Analysis (JSA)
Former Tappan Terminal
Iron Sampling

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	2/22/2005	Rev. 1: 8/13/2007	**Roux:** Therese Pitterle, Noelle Clarke, Dana Bulcock

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment and when removing/replacing manhole covers - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools - Chemical-resistant disposable gloves when handling/working with liquids - 1 - 20 lb. fire extinguisher - Hearing Protection when working in or near the remediation shed - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
1. Inform Riverside Autobody personnel of work scope and location.	1a. No communication with property owner could result in vehicular accident or H&S incident.	1a. Inform Riverside Autobody personnel of work scope and location.
		1a. Inquire about other activities taking place at the Site.
2. Drive/walk to monitoring well location.	2a. Property damage and personal injury caused by obstructions/vehicles.	2a. Maintain speed limit of 5 mph on-site.
		2a. All equipment must be stowed and secured prior to moving.
		2a. Drive on established roadways.
		2a. Yield to all pedestrians.
		2a. Do not back up vehicle without spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.
	2b. Personal injury from tripping/falling due to uneven terrain and weather conditions.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
		2b. Use established pathways and walk on stable, secure ground.
	2c. Muscle strain while carrying equipment.	2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
	2d. Exposure to biological hazards - ticks, bees/wasps, poison ivy, insects, etc. (Ticks are most active any time the temperature is above freezing from March to November).	2d. Inspect area to avoid contact with biological hazards.
		2d. Wear long sleeved clothing to protect skin and apply insecticides containing DEET when working in overgrown areas of the Site.
		2d. Personnel shall examine themselves for ticks.
		2d. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water.
	2e. Exposure to sun, possibly causing sunburn.	2e. Wear sunscreen with an SPF of at least 15 whenever 30 minutes or more of exposure is expected.
3. Define and secure the work area.	3a. Personal injury or property damage from other vehicles on-site.	3a. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
		3a. Look both ways in high traffic areas.
		3a. Position vehicle to protect against oncoming traffic.
		3a. Place at least 3 traffic cones around work area when working in areas with traffic. Utilize a spotter in high traffic areas.
4.Open/close monitoring well.	4a. Muscle strain (wells are covered by manholes/steel covers).	4a. Use proper lifting techniques (see 2c).

Job Safety Analysis (JSA)
Former Tappan Terminal
Iron Sampling

Location	**Date Prepared**	**Revisions**	**Prepared By**
1 Railroad Avenue Hastings-On-Hudson, New York	2/22/2005	Rev. 1: 8/13/2007	**Roux:** Therese Pitterle, Noelle Clarke, Dana Bulcock

Personal Protective Equipment

Minimum PPE Requirements	**Additional PPE Requirements**
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment and when removing/replacing manhole covers - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools - Chemical-resistant disposable gloves when handling/working with liquids - 1 - 20 lb. fire extinguisher - Hearing Protection when working in or near the remediation shed - Marine life vest when working within 10 feet of the Hudson River

Job Steps	**Potential Hazards**	**Recommended Actions**
4.Open/close monitoring well.	4b. Pinch points associated with removing/replacing manholes and working with hand tools.	4b. Wear leather gloves when working with well cover and hand tools. Use proper tools (ratchet and pry bar for well cover) and inspect before use. Do not put fingers under well cover.
	4c. Exposure to vapors.	4c. No open flames/heat sources.
		4c. Turn cell phone off.
		4c. Allow well to vent after opening it and before sampling activities begin to minimize exposure to vapors.
		4c. Work on the upwind side of well.
5. Bail well using a poly disposable bailer.	5a. Contact with contamination (e.g., SPH, contaminated groundwater, vapors).	5a. See 4c.
		5a. Wear chemical-resistant disposable gloves and safety glasses when bailing well.
		5a. Use an absorbent pad to remove contaminated water from the outside of the bailer or to clean up spills.
	5b. Muscle strain while handling equipment.	5b. Use proper lifting techniques when handling/moving equipment (see 2c).
6. Pour groundwater into plastic sampling bottle and add iron-testing reagent.	6a. Contact with contamination (e.g., SPH, contaminated groundwater).	6a. Wear chemical-resistant disposable gloves and safety glasses when pouring sample.
		6a. Pour liquids in such a manner that they do not splash.
		6a. Properly dispose of used materials/PPE in provided drums in designated drum storage area.
	6b. Iron reagent may cause eye, skin, and respiratory tract irritation.	6b. Review iron reagent MSDS prior to use.
		6b. Wear chemical-resistant disposable gloves and safety glasses when using iron reagent.
		6b. Ensure there is adequate ventilation in the work area.
		6b. Do not inhale iron reagent.
		6b. Do not eat, drink, or touch mouth while using iron reagent.
		6b. If iron reagent comes in contact with: *Eyes*: Immediately flush with water for 15 minutes, call physician; *Skin*: Wash skin with soap and plenty of water, call physician if irritation develops; *Ingestion*: Drink large quantities of water, do not induce vomiting, call physician immediately; *Inhalation*: Move to fresh air, give artificial respiration if necessary.
		6b. Once task is complete, thoroughly wash hands with soap and water before eating, drinking, or touching mouth.
	6c. Iron reagent reacts with oxidizers.	6c. Keep iron reagent away from oxidizers during use and storage.

Job Safety Analysis (JSA)
Former Tappan Terminal
Monitoring Well Gauging and Sampling

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	2/22/2005	Rev. 1: 8/9/2007	**Roux:** Therese Pitterle, Noelle Clarke, Dana Bulcock

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment and when removing/replacing manhole covers - Cut-resistant (i.e., Kevlar) gloves when handling VOA vials or cutting tools - Chemical-resistant disposable gloves when handling/working with liquids - 1 - 20 lb. fire extinguisher - Hearing Protection when working in or near the remediation shed - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
1. Inform Riverside Autobody personnel of work scope and location.	1a. No communication with property owner could result in vehicular accident or H&S incident.	1a. Inform Riverside Autobody personnel of work scope and location.
		1a. Inquire about other activities taking place at the Site.
2. Drive/walk to monitoring well location.	2a. Property damage and personal injury caused by obstructions/vehicles.	2a. Maintain speed limit of 5 mph on-site.
		2a. All equipment must be stowed and secured prior to moving.
		2a. Drive on established roadways.
		2a. Yield to all pedestrians.
		2a. Do not back up vehicle without spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.
	2b. Personal injury from tripping/falling due to uneven terrain and weather conditions.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
		2b. Use established pathways and walk on stable, secure ground.
	2c. Muscle strain while carrying equipment.	2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
	2d. Exposure to biological hazards - ticks, bees/wasps, poison ivy, insects, etc. (Ticks are most active any time the temperature is above freezing from March to November).	2d. Inspect area to avoid contact with biological hazards.
		2d. Wear long sleeved clothing to protect skin and apply insecticides containing DEET when working in overgrown areas of the Site.
		2d. Personnel shall examine themselves for ticks.
		2d. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water.
	2e. Exposure to sun, possibly causing sunburn.	2e. Wear sunscreen with an SPF of at least 15 whenever 30 minutes or more of exposure is expected.
3. Define and secure the work area.	3a. Personal injury or property damage from other vehicles on-site.	3a. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
		3a. Look both ways in high traffic areas.
		3a. Position vehicle to protect against oncoming traffic.
		3a. Place at least 3 traffic cones around work area when working in areas with traffic. Utilize a spotter in high traffic areas.
4.Open/close monitoring well.	4a. Muscle strain (wells are covered by manholes/steel covers).	4a. Use proper lifting techniques (see 2c).
	4b. Pinch points associated with removing/replacing manholes and working with hand tools.	4b. Wear leather gloves when working with well cover and hand tools. Use proper tools (ratchet and pry bar for well cover) and inspect before use. Do not put fingers under well cover.

Job Safety Analysis (JSA)
Former Tappan Terminal
Monitoring Well Gauging and Sampling

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	2/22/2005	Rev. 1: 8/9/2007	**Roux:** Therese Pitterle, Noelle Clarke, Dana Bulcock

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment and when removing/replacing manhole covers - Cut-resistant (i.e., Kevlar) gloves when handling VOA vials or cutting tools - Chemical-resistant disposable gloves when handling/working with liquids - 1 - 20 lb. fire extinguisher - Hearing Protection when working in or near the remediation shed - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
4.Open/close monitoring well.	4c. Exposure to vapors.	4c. No open flames/heat sources.
		4c. Turn cell phone off.
		4c. Allow well to vent after opening it and before sampling activities begin to minimize exposure to vapors.
		4c. Work on the upwind side of well.
5. Gauge monitoring well. Purge and sample well using bladder pump powered by compressed gas cylinder and battery operated controller.	5a. Contact with contamination (e.g., SPH, contaminated groundwater, vapors).	5a. See 4c.
		5a. Wear chemical-resistant disposable gloves when gauging/purging well.
		5a. Use an absorbent pad to clean probe.
	5b. Muscle strain while carrying equipment.	5b. Use proper lifting techniques when handling/moving equipment (see 2c).
	5c. Drowsiness, injury, or death by asphyxiation caused by exposure to high concentrations of CO2.	5c. Store and use CO2 cylinders in well ventilated areas only.
		5c. Keep CO2 cylinder valve closed when not in use.
	5d. Personal injury due to compressed gas cylinders discharging violently or being propelled by such discharge.	5d. Properly restrain cylinders.
		5d. Exercise caution when handling cylinders to prevent damage to outlet valve and cylinder body.
		5d. Inspect equipment including all fittings, hoses, and cylinder body prior to use.
	5e. Personal injury from direct contact with compressed CO2.	5e. Prior to opening valve, ensure that it has been properly installed to the correct system fitting.
	5f. Loss of pump and controller function due to excess usage of CO2.	5f. Use control pack in an upright position only to ensure that gaseous CO2 from the top of the cylinder, as opposed to liquid CO2 from the cylinder bottom, is used.
	5g. Personal injury due to pressurized pneumatic pump.	5g. Do not disassemble pump while it is connected to a compressed gas source.
	5h. Loss of bladder pump down the monitoring well.	5h. Tie a lanyard line to the cable eye as an added measure of pump protection.
	5i. Personal injury from contact with preservatives and contaminated liquids.	5i. Wear chemical-resistant disposable gloves when handling samples.
		5i. Open and fill sample jars slowly to avoid splashing and contact with preservatives.
	5j. Personal injury from cuts by glass or sharp objects.	5j. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant gloves when handling VOA vials or when using cutting tools.
6. Transfer purge water from 5-gallon buckets to 55-gallon drums.	6a. Contact with contamination (e.g., SPH, contaminated groundwater).	6a. Do not overfill buckets or drums, and pour liquids in such a manner that they do not splash.
		6a. Properly dispose of used materials/PPE in provided drums in designated drum storage area.
	6b. Muscle strain from lifting/carrying 5-gallon buckets.	6b. Use proper lifting techniques when carrying buckets (see 2c). Do not overfill buckets.
	6c. Pinch points associated with handling drum lid.	6c. Ensure that fingers are not placed under the lid of the drum. Wear leather gloves and use proper tools (ratchet) while sealing drum lid.
	6d. Slip/trip/fall on spilled purge water.	6d. Clean up any spills using absorbent pads.

Job Safety Analysis (JSA)
Former Tappan Terminal
Hand Clearing and Soil Sample Collection

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	8/14/2007		**Roux:** Therese Pitterle, Noelle Clarke

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools and filling sample jars - Chemical-resistant disposable gloves when handling/working with liquids/soils - 1 - 20 lb. fire extinguisher - Hearing Protection when sound levels exceed 85 db - Respirator if breathing zone vapors sustain levels > 5 ppm - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
1. Inform Riverside Autobody personnel of work scope and location.	1a. No communication with property owner could result in vehicular accident or H&S incident.	1a. Inform Riverside Autobody personnel of work scope and location.
		1a. Inquire about other activities taking place at the Site.
2. Drive/walk to hand clearing/hand augering location.	2a. Property damage and personal injury caused by obstructions/vehicles.	2a. Maintain speed limit of 5 mph on-site.
		2a. All equipment must be stowed and secured prior to moving.
		2a. Drive on established roadways.
		2a. Yield to all pedestrians.
		2a. Do not back up vehicle without spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.
	2b. Personal injury from tripping/falling due to uneven terrain and weather conditions.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
		2b. Use established pathways and walk on stable, secure ground.
	2c. Muscle strain/exhaustion while carrying equipment (i.e., hand auger, post-hole digger, shovel, pry bar).	2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
	2d. Exposure to biological hazards - ticks, bees/wasps, poison ivy, insects, etc. (Ticks are most active any time the temperature is above freezing from March to November).	2d. Inspect area to avoid contact with biological hazards.
		2d. Wear long sleeved clothing to protect skin and apply insecticides containing DEET when working in overgrown areas of the Site.
		2d. Personnel shall examine themselves for ticks.
		2d. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water.
	2e. Exposure to sun, possibly causing sunburn.	2e. Wear sunscreen with an SPF of at least 15 whenever 30 minutes or more of exposure is expected.
3. Define and secure the work area.	3a. Personal injury or property damage from other vehicles on-site.	3a. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
		3a. Look both ways in high traffic areas.
		3a. Position vehicle to protect against oncoming traffic.
		3a. Place at least 3 traffic cones around work area to re-direct traffic flow and to alert others as to the activity taking place when working in areas with traffic. Utilize a spotter in high traffic areas.
		3a. Only allow authorized personnel in work area.
	3b. Personal injury/pinch points and property damage due to faulty or improper equipment/hand tools.	3b. Always wear leather or cut resistant gloves when using hand tools.
		3b. Inspect all hand tools prior to use.
		3b. Keep body parts clear of moving objects.
	3c. Property damage and personal injury from utilities.	3c. Use hand auger, post-hole digger, and shovel only; use pry bar to loosen up visible layer of soil or rocks.
		3c. Confirm that mark-outs were completed by all parties for boring locations in street.

Job Safety Analysis (JSA)
Former Tappan Terminal
Hand Clearing and Soil Sample Collection

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	8/14/2007		**Roux:** Therese Pitterle, Noelle Clarke

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools and filling sample jars - Chemical-resistant disposable gloves when handling/working with liquids/soils - 1 - 20 lb. fire extinguisher - Hearing Protection when sound levels exceed 85 db - Respirator if breathing zone vapors sustain levels > 5 ppm - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
3. Define and secure the work area.	3c. Property damage and personal injury from utilities.	3c. Complete Subsurface Clearance Procedure and Checklist.
4. Augering/advancing the borehole.	4a. Personal injury/muscle strain from lifting, bending, pinch points, abrasions.	4a. When advancing the borehole, use proper techniques (see 2c).
		4a. See 3b.
		4a. Keep head and upper body clear when lifting pry bar/post-hole digger.
		4a. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.
	4b. Exposure to contamination (soil, water, and vapor).	4b. Monitor breathing zone with a PID. If vapors sustain > 5 ppm, upgrade PPE as per HASP.
		4b. Wear chemical-resistant disposable gloves and safety glasses when handling impacted materials.
		4b. Place excavated soil on plastic sheeting and store soil waste in designated area.
		4b. No open flames/heat sources.
		4b. Turn cell phone off.
		4b. Work on the upwind side of the boring.
	4c. Slip/Trip/Fall due to poor housekeeping.	4c. Keep tools and equipment in a designated area. When not in use, tools and equipment must be returned to their proper storage location. Keep work area clear of obstructions.
		4c. Do not climb over stored materials/equipment; walk around.
	4d. Damage to underground structures from drilling activities.	4d. Review and follow Subsurface Clearance Procedure.
5. Lithologic observation and soil sampling.	5a. Personal injury from pinch points, cuts, and abrasions from sampling equipment (including sample jars), tools, and material within soil sample.	5a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant disposable gloves when handling soil samples and sampling jars.
	5b. Contact with contamination (impacted soil and/or lab preservatives).	5b. Wear chemical-resistant disposable gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas.
		5b. When collecting soil sample from hand auger, put large zip lock bag over entire auger to prevent spillage of soil on to the ground.
		5b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
	5c. Muscle strain from heavy objects and repetitive motion.	5c. Use proper lifting techniques (see 2c).
	5d. Slip/Trip/Fall due to poor housekeeping.	5d. See 4c.
6. Transfer excess soil cuttings to 55-gallon drums.	6a. Contact with contaminated soil.	6a. Wear chemical-resistant disposable gloves and do not overfill drums to avoid spilling soil.
		6a. Properly dispose of used materials/PPE in provided drums in designated drum storage area.
	6b. Muscle strain from lifting/carrying 5-gallon buckets.	6b. Use proper lifting techniques when lifting/carrying buckets (see 2c). Do not overfill buckets.
	6c. Pinch points associated with handling drum lid.	6c. Ensure that fingers are not placed under the lid of the drum. Wear leather gloves and use proper tools (ratchet) while sealing drum lid.

Job Safety Analysis (JSA)
Former Tappan Terminal
Soil Excavation and Sampling

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	8/14/2007		**Roux:** Therese Pitterle, Noelle Clarke

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools and filling sample jars - Chemical-resistant disposable gloves when handling/working with liquids/soils - 2 - 20 lb. fire extinguishers - Hearing Protection when backhoe is operating - Respirator if breathing zone vapors sustain levels > 5 ppm - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
1. Inform Riverside Autobody personnel of work scope and location.	1a. No communication with property owner could result in vehicular accident or H&S incident.	1a. Inform Riverside Autobody personnel of work scope and location. 1a. Inquire about other activities taking place at the Site.
2. Drive/walk to excavation area.	2a. Property damage and personal injury caused by obstructions/vehicles.	2a. Maintain speed limit of 5 mph on-site. 2a. All equipment must be stowed and secured prior to moving. 2a. Drive on established roadways. 2a. Yield to all pedestrians. 2a. Do not back up vehicle without spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.
	2b. Personal injury from tripping/falling due to uneven terrain and weather conditions.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 2b. Use established pathways and walk on stable, secure ground.
	2c. Muscle strain/exhaustion while carrying equipment.	2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
	2d. Exposure to biological hazards - ticks, bees/wasps, poison ivy, insects, etc. (Ticks are most active any time the temperature is above freezing from March to November).	2d. Inspect area to avoid contact with biological hazards. 2d. Wear long sleeved clothing to protect skin and apply insecticides containing DEET when working in overgrown areas of the Site. 2d. Personnel shall examine themselves for ticks. 2d. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water.
	2e. Exposure to sun, possibly causing sunburn.	2e. Wear sunscreen with an SPF of at least 15 whenever 30 minutes or more of exposure is expected.
3. Define and secure the work area and set up for excavation.	3a. Personal injury or property damage from other vehicles on-site.	3a. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route. 3a. Look both ways in high traffic areas. 3a. Position vehicle to protect against oncoming traffic. 3a. Place at least 3 traffic cones around work area to re-direct traffic flow and to alert others as to the activity taking place when working in areas with traffic. Utilize a spotter in high traffic areas. 3a. Only allow authorized personnel in work area.
	3b. Personal injury/pinch points and property damage due to faulty or improper equipment/hand tools.	3b. Test all emergency shutdown devices prior to initiating excavation activities.

Job Safety Analysis (JSA)
Former Tappan Terminal
Soil Excavation and Sampling

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	8/14/2007		**Roux:** Therese Pitterle, Noelle Clarke

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools and filling sample jars - Chemical-resistant disposable gloves when handling/working with liquids/soils - 2 - 20 lb. fire extinguishers - Hearing Protection when backhoe is operating - Respirator if breathing zone vapors sustain levels > 5 ppm - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
3. Define and secure the work area and set up for excavation.	3b. Personal injury/pinch points and property damage due to faulty or improper equipment/hand tools.	3b. Always wear leather or cut resistant gloves when using hand tools.
		3b. Inspect all equipment/hand tools prior to use.
		3b. Keep body parts clear of moving objects.
	3c. Property damage and personal injury from utilities.	3c. Ensure > 30 ft from extended backhoe to overhead utility.
		3c. Confirm that mark-outs were completed by all parties for all excavation areas.
		3c. Identify subsurface obstructions that may interfere with excavation activities. Remove subsurface obstructions, or make visible and work around them.
		3c. Complete Subsurface Clearance Procedure and Checklist.
	3e. Pinch points from moving equipment.	3e. Always wear leather or cut resistant gloves when using hand tools.
		3e. Keep body parts clear of moving objects.
	3f. Exposure to contaminated vapors.	3f. Preferably set up backhoe upwind of excavation area.
4. Soil excavation/Backhoe operation.	4a. Personal injury from moving parts, pinch points, abrasions, crushing, and entanglement.	4a. See 3b and 3e.
		4a. Use 3 points of contact when entering and exiting backhoe.
		4a. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.
		4a. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment.
	4b. Personal injury from contact with heavy equipment.	4b. Remain in the line of sight of the operator at all times.
		4b. Wear high visibility clothing.
		4b. Communicate with operator using hand signals.
		4b. Personnel need to remain a minimum of 5 ft outside of the swing radius of the excavator.
		4b. Use spotter while performing excavation activities.
	4c. Personal injury from falling from equipment.	4c. Inspect area for placement of equipment for slope and stability.
		4c. Use 3 points of contact when entering and exiting backhoe.
		4c. All operators must wear seatbelts while in equipment.
		4c. Excavation equipment needs to be at least 4 ft from the edge of the excavation.
		4c. Distribute loads evenly before moving equipment.
		4c. Inspect equipment every morning for wear and tear, and perform required maintenance.
	4d. Hearing loss from noise exposure.	4d. Wear hearing protection when backhoe is in operation. Otherwise, if sound levels exceeds 85 db, put on hearing protection. See hearing protection requirement in PPE Section of the HASP.
	4e. Muscle strain due to heavy lifting, working with equipment, and repetitive motion.	4e. Use proper lifting techniques (see 2c).

Job Safety Analysis (JSA)
Former Tappan Terminal
Soil Excavation and Sampling

Location	Date Prepared	Revisions	Prepared By
1 Railroad Avenue Hastings-On-Hudson, New York	8/14/2007		**Roux:** Therese Pitterle, Noelle Clarke

Personal Protective Equipment

Minimum PPE Requirements	Additional PPE Requirements
- Hard Hat - Safety Glasses w/ Side Shields - Steel Toe Boots/Shoes - High Visibility Clothing	- Leather gloves when working with hand tools/equipment - Cut-resistant (i.e., Kevlar) gloves when handling cutting tools and filling sample jars - Chemical-resistant disposable gloves when handling/working with liquids/soils - 2 - 20 lb. fire extinguishers - Hearing Protection when backhoe is operating - Respirator if breathing zone vapors sustain levels > 5 ppm - Marine life vest when working within 10 feet of the Hudson River

Job Steps	Potential Hazards	Recommended Actions
4. Soil excavation/Backhoe operation.	4f. Inhalation of/Exposure to contamination (soil, water, and vapor).	4f. Monitor breathing zone with a PID. If vapors sustain levels > 5 ppm, upgrade PPE as per HASP.
		4f. Wear chemical-resistant disposable gloves and safety glasses when handling impacted materials.
		4f. Place excavated soil on plastic sheeting and store soil waste in designated area.
		4f. No open flames/heat sources.
		4f. Turn cell phone off.
		4f. Work on the upwind side of the excavation.
	4g. Slip/Trip/Fall due to poor housekeeping.	4g. Keep tools and equipment in a designated area. When not in use, tools and equipment must be returned to their proper storage location. Keep work area clear of obstructions.
	4h. Contact with elevated objects/falling objects.	4h. Never walk below an elevated or suspended object.
	4i. Damage to underground structures from excavation activities.	4i. Review and follow Subsurface Clearance Procedure (see HASP).
5. Lithologic observation and soil sampling.	5a. Personal injury from pinch points, cuts, and abrasions from sampling equipment (including sample jars), tools, and material within soil sample.	5a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant disposable gloves when handling soil samples and sampling jars.
	5b. Contact with contamination (impacted soil/groundwater, product, and/or lab preservatives).	5b. Wear chemical-resistant disposable gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas.
		5b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
	5c. Muscle strain from heavy objects and repetitive motion.	5c. Use proper lifting techniques (see 2c).
	5d. Slip/Trip/Fall due to poor housekeeping.	5d. See 4e.

ExxonMobil Refining & Supply - Global Remediation
JOB SAFETY ANALYSIS
Revised January 2005

COMPANY/ PROJECT NAME or ID/ LOCATION (City, State)	DATE	☐ NEW ☐ REVISED	PAGE 1 of

WORK ACTIVITY (Description):

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)

☐ REFLECTIVE VEST ☐ HARD HAT ☐ LIFELINE / HARNESS ☐ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☐ SAFETY SHOES ______	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☐ PPE CLOTHING ______	☐ GLOVES ______ ☐ OTHER ______

[1]JOB STEPS	[2]POTENTIAL HAZARDS	[3]CRITICAL ACTIONS TO MITIGATE HAZARDS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

[1] Each Job or Operation consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the associated hazards in Column 2

[2] A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

[3] Aligning with the first two columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

APPENDIX E

Health and Safety Orientation Handout and HASP Summary

Health and Safety Orientation Handout and HASP Summary
Former Tappan Terminal

Training

- All Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety trained prior to performing work onsite per OSHA requirements (29 CFR 1910.120(e)). All record keeping requirements mandated by OSHA (29 CFR 1910.120) will be strictly followed and maintained by the Site Health and Safety Officer (SHSO) onsite.
- All Site personnel who will perform work on any of the ExxonMobil Sites must be Loss Prevention System (LPS) trained prior to performing work onsite.
- Personnel who issue and/or receive Roux Associates, Inc.'s "EMGR Work Permits" must receive Permit System Training to recognize and identify the hazards associated with the various types of work and to perform the necessary inspections, including air monitoring, of the work area to ensure safe working conditions.

Required Personal Protective Equipment for All Work at All Times

- Hard hat;
- Steel-toe safety boots;
- High visibility clothing; and
- Safety Glasses/Eye protection.

Additional PPE that may be required depending upon specific tasks and conditions

- Nitrile gloves for any tasks involving contact with contamination hazards;
- Leather/Kevlar Gloves for any tasks involving pinch point or cut hazards;
- Hearing Protection when near operating machinery or equipment;
- Marine life vest for any work on or within 10 feet of the Hudson River;
- Tyvek coveralls;
- Respiratory Protection;
- Air-purifying respirator for hazardous atmospheres; and
- Insecticides containing DEET when working in wooded areas of the Site.

Safety Highlights for Site Operations

- Field staff shall begin each day's activities with a tailgate meeting and a discussion of site-specific hazards and safety requirements. The meeting will be led by a Roux Associates, Inc. field manager or lead site technician. No work will begin prior to this meeting.

- Safe Performance Self Assessments (SPSAs) must be performed by all personnel for all work tasks throughout the day. ASSESS the risks, ANALYZE how to eliminate the risks, ACT to ensure safe operations.

- Job Safety Analysis (JSA) forms must be reviewed prior to performing work tasks. If certain tasks don't have a JSA, the daily JSA form should be used to organize thoughts regarding job steps, hazards, and critical actions for safe operations.

- Roux Associates, Inc.'s "EMGR Work Permit" must be prepared by a trained Permit Issuer certifying safe working conditions and signed by a trained Permit Recipient prior to performing work tasks.

- Automobile Safety, Vehicular Traffic Safety Procedures, and Heavy Equipment Safety – it is important to continually be aware of the equipment and vehicular traffic around you. Any work in an area with potential for vehicular traffic must be secured and defined using traffic cones.

- Biological Hazards - Ticks, bees/wasps, and poison ivy may be encountered throughout the Site area. Ticks are a particular concern in wooded areas of the Site, and according to the NYSDOH website:

"The chances of being bitten by a deer tick are greater during times of the year when ticks are most active. Young deer ticks, called nymphs, are active from mid-May to mid-August and are about the size of poppy seeds. Adult ticks, which are approximately the size of sesame seeds, are most active from March to mid-May and from mid-August to November. Both nymphs and adults can transmit Lyme disease. Ticks can be active any time the temperature is above freezing. Infected deer ticks can be found throughout New York State."

- Slip/Trip Hazards - Uneven terrain and equipment/materials may present slip/trip hazards across much of the Site area.

- Every worker has the right and obligation to intervene if they witness unsafe conditions or work practices!

- Work that deserves special safety considerations and precautions:
    - Work along the Hudson River;
    - Work in areas with abundant overgrowth and poison ivy;
    - Any elevated work requiring ladders or scaffolding, or reaching above one's head to perform work;
    - Any work in potentially confined spaces; and
    - Any work on machinery or electrical equipment that requires lock out/tag out procedures to be followed.

Task-specific requirements are addressed in the HASP and JSAs, and will be covered during safety briefings. If it's not safe, don't do it.

Emergency Services

Multiple emergency services may be obtained from 911. More specific numbers for local services are listed below.

Type	Name	Telephone Numbers
Police	Hastings-On-Hudson Police Department	(914) 478-2344
Fire	Hastings-On-Hudson Fire Department	(914) 478-2344
Hospital (map attached)	Community Hospital at Dobbs Ferry	(914) 693-0700
State Poison Control Center	Poison Control Center	(800) 222-1222

Environmental Emergency (e.g., release or spill)

Type	Name	Telephone / *Cell* Numbers
Project Principal (Roux Associates, Inc.)	Noelle Clarke	(631) 232-2600 / *(631) 807-6523*
Project Manager/Site Health and Safety Officer (Roux Associates, Inc.)	Therese Pitterle	(631) 232-2600 / *(631) 831-1503*
Project Manager (Woodard & Curran)	Anne Proctor	(203) 271-0379
Environmental Technician	John LoMeli, Jr.	(631) 232-2600 / *(631) 445-8643*
Office Health and Safety Manager	Joseph Gentile	(856) 423-8800 / *(610) 844-6911*
Project Manager (ExxonMobil)	Steve Trifiletti	(718) 383-7374 / *(908) 578-8704*

Date Reviewed: August 15, 2007

APPENDIX F

ExxonMobil Contractor Safety Requirements

EXXONMOBIL Refining & Supply

Statement of Policy
on
Contractor Safety Requirements

As a Contractor with which ExxonMobil Refining & Supply does business, we feel it is important that we inform you of our policies concerning contractor safety.

The framework of our Contractor Safety Program is contained in the ExxonMobil hot/safe work permit, confined space entry permit, and the safe work conference required prior to the start of a contracted activity. The salient features of the aforementioned are as follows:

- No work can be undertaken without a daily issuance of a hot/ safe work permit. A safe work conference is required before a contracted activity can begin and, if appropriate, a debriefing should be held at the close of a contracted activity. Underground piping/ conduit identification and marking will be done as a part of the safe work conference.

- As of April 1, 1994, Mobil Oil, as a Corporation, does not allow smoking anywhere within the confines of its facilities. This applies to Contractors, as well as employees.

- ExxonMobil requires Contractors to supply their employees with appropriate safety and awareness training, i.e., OSHA-required training, right to know training, confined space training, HAZWOPER training, etc. Certification of said training may be required.

- All Contractor vehicles actively involved in work are required to have a fire extinguisher. All Contractors performing "hot work" are required to have, at a minimum, two 30-pound Ansul fire extinguishers at the site of the work. No substitutions will be allowed.

- MSDSs for any chemicals/substances brought on site must be supplied to Mobil EPT. ExxonMobil will supply MSDSs to Contractors as needed.

- Any warning signs and/or caution barriers required must be supplied by the Contractor. Work cannot begin until appropriate warning sights and caution barriers have been properly placed.

- Contractors must supply each and every employee working on ExxonMobil property with appropriate personal protective equipment (PPE). Minimum PPE required – hard hat, gloves, appropriate footwear, and eye and ear protection. Respiratory protection must be supplied as needed.

- Contractor vehicles should adhere to a 20 MPH speed limit while within the facility.

Please direct any questions to Mobil at (631) 232-2600.

APPENDIX G

Health and Safety Briefing/Tailgate Meeting Form

HEALTH & SAFETY BRIEFING / TAILGATE MEETING FORM

Site Name / Location ______________________________

Date: ____________________ Weather Forecast: ____________________

Names of Personnel Attending Briefing

Planned Work ______________________________

Items Discussed ______________________________

Work Permit Type and
Applicable Restrictions: ______________________________

Signatures of Attending Personnel

APPENDIX H

ExxonMobil Incident Report (NLI/LI)

EXXONMOBIL PRIVATE

ExxonMobil Environmental Services (EMES)
LOSS / NEAR LOSS REPORT
(Revised – July 2007)

Incident # **(must be included after # is assigned)**

PART 1: ADMINISTRATIVE INFORMATION

PROJECT TYPE:
☐ Retail
☐ Major Projects

SITE STATUS:
☐ Active / Operating
☐ Inactive / Idle

HIGH LEARNING VALUE INCIDENT:
☐ Yes ☐ No

REPORT TYPE:
☐ Loss
☐ Near Loss

REGION:
☐ United States
☐ Americas South
☐ Europe/Africa/Middle East
☐ Asia Pacific
☐ T&SS

SITE:
☐ MP Chemical Site
☐ MP Distribution Site
☐ MP Lube Site
☐ MP Mining Site
☐ Marketing Retail Site
☐ MP Pipeline Site
☐ MP Refinery Site
☐ MP Superfund Site
☐ MP Upstream Site

REPORT STATUS:
☐ Initial (24 hours) Date: ____________
☐ Final (5 /10 days) Date: ______
☐ All Solutions Completed
☐ All V&V Completed

INCIDENT TYPE (Select all that apply; Loss = ACTUAL, Near Loss = POTENTIAL Loss)

1. ☐ **FIRE/EXPLOSION**

2. ☐**INJURY** ☐**ILLNESS**

Injury/Illness Severity Level
☐Fatality
☐Lost Time
☐Restricted Work
☐Medical Treatment
☐First Aid
☐No Treatment

3. ☐ **SECURITY** (Theft, Unauthorized Entry, Vandalism, Etc.)

4. ☐ **ENVIRONMENTAL**
☐ Oil Spill
☐ Corporate Reportable Environmental Compliance (spill/release ≥RQ, permit discharge exceedance, fine/penalty ≥ $500)
☐Other Environmental Compliance (spill/release <RQ, NOV/Consent Order with no fine or fine <$500, misdirected waste)

5. ☐ **TRANSPORTATION OF PERSONNEL** (motor vehicle related)

6. ☐ **PROPERTY / EQUIPMENT DAMAGE**

CORPORATE REPORTABLE:
☐ Yes ☐ No

ESTIMATED INCIDENT COST TO EM (U.S. dollars):
$____________
☐ **≥ $50K (8021 Report required)**

FINE / PENALTY:
☐ **< $500**
☐ **≥ $500**

PERSONNEL INVOLVED IN INCIDENT:
☐ExxonMobil Employee
☐Contractor
☐Subcontractor
☐Third Party

DATE OCCURRED:	**TIME:**	**SITE ID NUMBER / NAME :**
DATE FIRST REPORTED TO EM:	**TIME:**	**INCIDENT LOCATION (CITY / STATE / COUNTRY):**

EM AREA MANAGER:	**EM PROJECT MANAGER (OR CONTRACTOR COMPANY ACTING AS EM PM):**	
CONTRACTOR COMPANY:	**PROJECT SUPERVISOR'S NAME:**	**PROJECT SUPV'S PHONE NUMBER:**
SUBCONTRACTOR COMPANY:	**SUB SUPERVISOR'S NAME:**	**SUB SUPV'S PHONE NUMBER**

INDIVIDUALS DIRECTLY INVOLVED IN INCIDENT

INJURED (Y/N)	JOB TITLE	COMPANY	YEARS WORKED FOR COMPANY	YEARS IN CURRENT JOB

IF THIRD PARTY INVOLVED - ADDRESS AND PHONE NUMBER:

	NAME(S)	ADDRESS	CITY/STATE	PHONE
INCIDENT WITNESSES				

WAS ALCOHOL/DRUG USE SUSPECTED? ☐ **Yes** ☐ **No**
IF ALCOHOL OR DRUGS WERE SUSPECTED SUMMARIZE ACTIONS TAKEN/TESTING (WHERE LEGALLY PERMISSIBLE):

REPORT PREPARED BY:	**JOB TITLE:**	**COMPANY:**

Our Safety Vision: "Nobody Gets Hurt!"

PART 2: INCIDENT DESCRIPTION

JOB TASK (primary job associated with work activities / incident)

☐ Carbon Change
☐ Construction
☐ Demolition
☐ Dewatering
☐ Drilling (includes well install)
☐ Excavation / Trenching
☐ Gauging
☐ Geoprobe / Direct Push
☐ Mobile Remediation (includes vacuum event and chemical injection)
☐ NAPL Recovery
☐ O&M (Remediation System)
☐ Pavement Cutting
☐ Pump Test
☐ Sampling
☐ Site Visit / Survey
☐ Subsurface Clearance
☐ System Install
☐ System Startup
☐ UST Removal (includes tank exposure and backfill)
☐ Waste Management
☐ Well Plugging / Abandonment
☐ Other:____________________
____

WHAT HAPPENED? EXPLAIN SEQUENCE OF EVENTS, PERTINENT FACTS, AND IMMEDIATE RESPONSE ACTIONS, BE BRIEF AND SPECIFIC. IF AN INJURY OR ILLNESS, DESCRIBE TREATMENT PROVIDED.

SUMMARY (1-2 sentences):

INCIDENT DETAILS (as brief as possible):

IMMEDIATE CORRECTIVE ACTIONS TAKEN:

EQUIPMENT INVOLVED (Select all that apply)

☐ Air Stripper
☐ API Separator
☐ Automobile
☐ Boom Material
☐ Bulldozer
☐ Carbon Drum / Vessel
☐ Chain Block
☐ Compressor, Air
☐ (Local) Control Panel
☐ Crane (Mobile)
☐ Drill Rig
☐ Drilling Equipment, Vacuum
☐ Drum, Vertical
☐ Dump Truck
☐ Excavator / Power Shovel
☐ Exclusion Zone Equipment
☐ Fan, Centrifugal / Blower
☐ Fencing
☐ Filter
☐ Fire Extinguisher
☐ Forklift
☐ Front End Loader
☐ Grader
☐ Hand Tool, Hammer
☐ Hand Tool, Knife
☐ Hand Tool, Non-Powered
☐ Hand Tool, Powered
☐ Hand Tool, Powered, Drill
☐ Hand Tool, Powered, Grinder
☐ Hand Tool, Powered, Hydraulic Torque
☐ Hand Tool, Powered, Saw
☐ Hand Tool,Powered,Wrench,Impact
☐ Hand Tool, Saw
☐ Hand Tool, Screwdriver
☐ Hand Tool, Shears
☐ Hand Tool, Shovel
☐ Hand Tool, Snip
☐ Hand Tool, Wrench
☐ Hoist
☐ Hook/Clamp/Buckle, etc.
☐ Jack
☐ Ladder, Extension
☐ Ladder, Platform
☐ Ladder, Step
☐ Lock / Tag
☐ Maintenance Tool, General
☐ Manifold
☐ Manlift / Basket / Cherry Picker
☐ Oxidizer
☐ Pallet
☐ Piping
☐ Piping, Hose
☐ Piping, Injection / Mixing Point
☐ Powered Tools, Hydrojet
☐ Pump, Centrifugal
☐ Pump, Diaphragm
☐ Pump, Reciprocating
☐ Pump, Regenerative
☐ Pump, Rotary
☐ Pump, Submerged
☐ PPE, Safety Glasses
☐ PPE, Safety Goggles
☐ PPE, Face Shield
☐ PPE, Fall Protection
☐ PPE, Safety Shoes / Boots
☐ PPE, Gloves
☐ PPE, Hard Hat / Helmet
☐ PPE, Hearing Protection
☐ PPE, Respiratory Chemical
☐ PPE, Respiratory Particulate
☐ PPE, Safety Vest / Clothing
☐ Pumps (transfer, electrical)
☐ Pump, Submerged
☐ Rope
☐ Sampling Equipment, Bailer
☐ Sampling Equipment, Geoprobe
☐ Sampling Equipment, Hand Auger
☐ Sampling Equipment, PID
☐ Sampling Equipment, Sample Container
☐ Sampling Equipment,Split Spoon Sampler
☐ Sling
☐ Snow Blower
☐ Snow Plow
☐ Space Heater, Electric
☐ System, Air Sparging
☐ System, Carbon Treatment
☐ System, Chemical Oxidation
☐ System, Dual Phase Product Recovery
☐ System, Groundwater Pump and Treat
☐ System, POET
☐ System, Shed or Trailer
☐ System, Vapor Extraction
☐ System, Vapor Phase Treatment
☐ System, Other
☐ Tank, Surge
☐ Tank, Underground
☐ Telemetry System
☐ Testing Devices
☐ Tractor Trailer
☐ Truck, Flatbed
☐ Truck, Pickup
☐ Truck, Tank Truck
☐ Truck, Vacuum
☐ Well, Extraction
☐ Well, Monitoring
☐ Well, Recovery
☐ Winch
☐ Wire Rope

Other: ______

IF THE LOSS IS AN INJURY OR ILLNESS, COMPLETE THE FOLLOWING:

TYPE OF INJURY/ILLNESS:

- ☐ Amputation/Avulsion
- ☐ Bruise/Contusion
- ☐ Burn - Chemical
- ☐ Burn - Thermal or Electrical
- ☐ Concussion/Unconscious
- ☐ Crush
- ☐ Cut/Scrape/Puncture
- ☐ Dislocation
- ☐ Foreign Object in Eye
- ☐ Fracture
- ☐ Hernia/Rupture
- ☐ Irritation
- ☐ Poisoning
- ☐ Sprain/Strain
- ☐ Sting/Bite
- ☐ Heat Stress/Exhaustion/Sunstroke
- ☐ Hypothermia
- ☐ Physical Agents - Radiation, etc.
- ☐ Repeat Trauma - CTS
- ☐ Repeat Trauma - Other Disorder
- ☐ Respiratory - Toxic Agents
- ☐ Skin Disease or Disorder
- ☐ Other:_____
- ☐ Unknown

BODY PART AFFECTED

- ☐ Abdomen/Groin
- ☐ Ankle
- ☐ Back/Spine
- ☐ Calf/Shin
- ☐ Central Nervous
- ☐ Chest
- ☐ Circulatory/Blood
- ☐ Ear
- ☐ Elbow
- ☐ Eye
- ☐ Face
- ☐ Fingers
- ☐ Foot
- ☐ Forearm
- ☐ Hand
- ☐ Hip
- ☐ Internal Organs
- ☐ Jaw
- ☐ Knee
- ☐ Neck
- ☐ Nose
- ☐ Respiratory
- ☐ Ribs
- ☐ Scalp
- ☐ Shoulder
- ☐ Skull
- ☐ Thigh
- ☐ Toes
- ☐ Tongue
- ☐ Tooth/Teeth
- ☐ Upper Arm
- ☐ Urinary
- ☐ Wrist

SOURCE OF INCIDENT:

Body Position/Force

- ☐ Line of Fire
- ☐ Overexertion/Strain
- ☐ Personal Energy
- ☐ Struck Against Object
- ☐ Struck By Object

☐ **Buried**

☐ **Caught In, Under, Between**

Chemical Exposure

- ☐ Inhalation
- ☐ Ingestion
- ☐ Physical Contact

Contact By

- ☐ Animal/Insect/Plant
- ☐ Blood/Potentially Infectious Materials
- ☐ Electricity
- ☐ Noise
- ☐ Other Physical Agents
- ☐ Radiation
- ☐ Temperature Extremes

☐ **Drowning**

Falls

- ☐ Fall, From Elevation
- ☐ Fall, Same Level
- ☐ Slip or Trip Without Fall

☐ **Other**

☐ **Suffocate/Asphyxiate (Lack of Oxygen)**

☐ **Transportation Incident**

LOST TIME or RESTRICTED WORK	**START DATE**	**# OF ESTIMATED DAYS**	**# OF ACTUAL DAYS**	☐No Reassignment ☐Permanently Reassigned ☐Temporarily Reassigned

IF THE LOSS IS A SECURITY INCIDENT, COMPLETE THE FOLLOWING:

INCIDENT INVOLVED:

- ☐Arson*
- ☐Assault (Attempted)
- ☐Assault (Actual)
- ☐Break-In (entering property by force)
- ☐Burglary (theft involving forceful, unauthorized entry into structure)
- ☐Public Disturbance or Activism (directed against EM)
- ☐Robbery (taking of property with the use of force, threat or violence)
- ☐Sabotage* (actions intended to adversely affect normal operations)
- ☐Theft* (taking of property without permission)
- ☐Threat (expression of intent to inflict injury or damage)
- ☐Trespassing (unauthorized intrusion or invasion of property)
- ☐Vandalism* (acts intended to damage or destroy property)

ESTIMATED COST (U.S. dollars):
$______________

EM % of Estimated Cost: _____%

☐ **≥ $5K (* = Corporate Report)**

☐ **Incident involved property owned or leased by ExxonMobil**

IF THE LOSS IS A SPILL OR RELEASE, COMPLETE THE FOLLOWING:

NAME OF MATERIAL / CHEMICAL RELEASED:

VOLUME OF MATERIAL / CHEMICAL RELEASED INCLUDING UNITS (e.g. gallons, liters, BBL, pH, PPM, pounds, etc.)

MEDIUM RELEASED TO:

- ☐Air
- ☐Other
- ☐Soil
- ☐Subsurface/Groundwater
- ☐Surface Water - Offshore
- ☐Surface Water - Onshore

COUNT (#) OF NUMERIC LIMITS/PARAMETERS DICTATED BY REGULATORY/LEGALLY BINDING REQUIREMENTS/AGREEMENTS (E.G. PERMIT) THAT WERE EXCEEDED:

COUNT OF RQs (U.S. only):

AUTHORITIES NOTIFIED	**DATE / TIME:**	**AGENCY:**	**NAME / JOB TITLE:**	**RESPONSE (ATTACH ADDITIONAL INFO / NOTIFICATION REPORTS)**

IF THE LOSS IS A PROPERTY DAMAGE, COMPLETE THE FOLLOWING:

PROPERTY DAMAGED:

- ☐Company
- ☐Contractor
- ☐Local Community (3rd party)
- ☐Personal

DESCRIPTION OF DAMAGE:

ESTIMATED COST (U.S. dollars):
$_______

EM % of Estimated Cost: _____%

PART 3: INCIDENT INVESTIGATION AND QUALITY REVIEW

CONCLUSION: WHY DID IT HAPPEN?

IDENTIFY THE FUNDAMENTAL REASON(S) WHY THE INCIDENT OCCURRED AND ASSOCIATED ROOT CAUSE(S).

ROOT CAUSE(S) AND SOLUTION(S): HOW TO PREVENT INCIDENT FROM RECURRING

REASON #	ROOT CAUSE # (1/line)	OIMS SYSTEM #	SOLUTION(S) (must match Root Cause)	PERSON RESPONSIBLE	TARGET COMPLETION DATE	ACTUAL COMPLETION DATE

INVESTIGATION TEAM

NAME	JOB TITLE	COMPANY	DATE

QUALITY REVIEW

Were the correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

NAME	JOB TITLE	COMPANY	DATE

PART 4: VERIFICATION (Solutions Implemented) & VALIDATION (Solutions Effective)

SOLUTION	VERIFIER'S NAME	JOB TITLE	COMPANY	DATE	DETAILS

SOLUTION	VALIDATOR'S NAME	JOB TITLE	COMPANY	DATE	DETAILS

PART 5: ATTACHMENTS (Photos, Sketches, Newspaper Articles, MVA / Agency Reports, etc.)

APPENDIX I

ExxonMobil Loss Prevention Observation (LPO)

ExxonMobil Refining & Supply - Global Remediation
LOSS PREVENTION OBSERVATION Revised January 2005

Location/Project Name: ____________________ **Date:** __________
Observer Name/Company: ____________________ **Time:** __________
Observer Title: ____________________ **Ctrl No:** __________

Task Observed

Drilling: ☐
GeoProbe/Direct push: ☐
Excavation/Trenching: ☐
Subsurface clearance: ☐
Pavement Cutting: ☐

Dewatering: ☐
Pump Test: ☐
Rigging/Lifting: ☐
Demolition: ☐
Carbon Change: ☐

Gauging: ☐
Sampling: ☐
O&M: ☐
System Install: ☐
System Start up: ☐

UST Removal: ☐
Mobile Rem/Vac event: ☐
Heavy Equipment Ops ☐
NAPL Recovery: ☐
Other (Specify): ☐ __________

Description of Task Observed and Background Information

Positive Comments

Conclusions /Why the Questionable Items occurred/Root Cause analysis

Session Conducted By: ____________________ **Date:** __________
Name of Observee's Supervisor: ____________________ **Time:** __________

Questionable Observations/Root Cause Analysis

Personal Factor:
(1) Lack of skill or knowledge
(2) Correct way takes more time/requires more effort
(3) Shortcutting standard procedures is rewarded or appreciated
(4) In past, did not follow procedures or acceptable practices and no incident occurred

Job Factor:
(5) Lack of or inadequate operational procedures or work standards
(6) Inadequate communication of expectations or work standards
(7) Inadequate tools or equipment

Questionable Observation #	Root Cause Analysis #	Solution(s) To Prevent Potential Loss from Occurring	Person Responsible	Agreed Due Date	Date Completed

Results of Verification (were solutions done?) and Validation (were solutions effective?)

Reviewed by: ____________________ **Date:** __________
Approved by: ____________________ **Time:** __________

ExxonMobil Refining & Supply - Global Remediation
LOSS PREVENTION OBSERVATION Revised January, 2005

PERSONAL PROTECTIVE EQUIPMENT	CORRECT	???	COMMENTS
1. Hearing Protection (e.g. Ear Plugs)			
2. Head Protection (e.g.Hard Hat)			
3. Eye Protection (e.g.Safety Glasses)			
4. Hand Protection (e.g.Gloves)			
5. Foot Protection (e.g.Safety Shoes)			
6. Respiratory Protection			
7. Fall Protection (e.g. harness)			
8. Reflective Vest/High Visibility Clothing			
9. Other (Specify)			
BODY USE AND POSITIONING	**CORRECT**	**???**	**COMMENTS**
10. Correct Body Use and Positioning When Lifting/Pushing/Pulling			
11. Pinching Points/Moving Equipment - Hands/Body Clear			
12. Mounts/Dismounts Using 3-Point Stance			
13. Other (Specify)			
WORK ENVIRONMENT	**CORRECT**	**???**	**COMMENTS**
14. Work/Walk Surface Free of Obstructions (e.g. tripping hazards)			
15. Housekeeping/Storage			
16. Defined and Secured (e.g. warning devices, barricades, cones, flags)			
17. Safety Shut Down Devices			
18. Proper Storage/Disposal of Sample & Waste materials			
19. Other (Specify)			
OPERATING PROCEDURES	**CORRECT**	**???**	**COMMENTS**
20. SPSA Performed/Job Planning			
21. Work Permit/Authorization to Work (Hot, Cold, LOTO, Confined Space)			
22. JSA Reviewed & Followed			
23. Checks Area for Hazards			
24. Interfaces with Other Functions (awareness with other personnel on site)			
25. Subsurface Structures Identified			
26. Other (Specify)			
TOOLS/EQUIPMENT	**CORRECT**	**???**	**COMMENTS**
27. Hand tool Selection, Condition & Use			
28. Power tool Selection, Condition & Use			
29. Equipment (inc heavy) Sel/Cond/Use			
30. Other (Specify)			
Total #	0	0	
% Correct **[(Total Correct/(Total Correct + Total Questionable))*100]**	#DIV/0!		

"Nobody Gets Hurt"

APPENDIX J

ExxonMobil Contractor Orientation Meeting

To Be Completed By Project Manager with Contractor

To Be Completed After Awarding Contract, Prior to Construction

Purpose:

The purpose of the Contractor Orientation Meeting is to ensure Contractor is fully aware of the project scope, required safety practices, plant procedures, and other issues which will enhance the Contractor's safety performance. The Project Manager will address key SH&E items, an example form / checklist is provided below.

Example Project Orientation Meeting

Revision - 0

Date of Revision - 01/08/05

Date: ______ Contractor: ______
Job Description/Title: ______
PO .: ______ Job Location: ______

CONTRACTOR INFORMATION

Address ______ Job Safety Director ______
Street ______ Site Work Location: ______
City ______ Project Description: ______
State ______

Office Phone Number: ______ Site Phone Number: ______
Job Supervisor: ______ Work Started: ______
Job Foreperson: ______ Work Completed ______

CHECKLIST OF SUBJECTS COVERED AT MEETING

1. Safety Booklet / HASP		11. Manpower Report / Time Sheets	
2. Safety Glasses & Side Shields		12. MSDS Review	
3. Safety Hard Hats		13. Housekeeping	
4. Work Permits		14. Waste Disposal	
5. General Specifications		15. Use of Sanitary Facilities	
6. Gate Access / Traffic Regulations		16. Drug and Alcohol Policy	
7. ID Badges / Site Security Issues		17. Contractor Safety Video Tape	
8. Smoking Areas		18. Emergency Procedures	
9. Emergency Call Procedure.		19. ExxonMobil Safety Credo	
10. Industrial Hygiene Review		20. LPS Training Verification	
21. Review of JSA / LPS Expectations		22. Other	

PRESENT OR PARTICIPATED IN MEETING -Contractor Staff (attach a sign-in form if large group):
ExxonMobil Personnel: ______

Meeting Conducted by: ______ Date: ______
Other Comments:

APPENDIX K

ExxonMobil Traffic Control Plan & Traffic Control Process Flow Diagram

Traffic Control Plan & Traffic Control Process Flow Diagram

Revision - 0

Date of Revision - 01/08/05

Identify which of the following Traffic Control Procedures applies to the work for this site.

A. Performing tasks in roadways:

- All employees are required to wear high-visibility clothing at all times while onsite.
- Review of site specific HASP should identify and require that the buddy system be implemented in areas considered high risk.
- Use of a minimum of 2 additional traffic control measures/devices.
- Lane closure procedures following appropriate regulatory standards (e.g. DOT/OSHA, National Highway Safety Uniform Traffic Control), local standards, or GR minimum standards.

B. Performing tasks in traffic areas (other than roadways) or any area where vehicular accidents could occur: (pump islands, parking lots/garages, up on curbed areas, in grass right of ways, etc.)

- All employees are required to wear high-visibility clothing at all times on site.
- Use of a minimum of 2 additional traffic control measures/devices.
- Review of site specific HASP should identify and require that the buddy system be implemented in areas considered high risk.

C. Long duration work (geoprobe operations, drilling, trenching, etc.):

In addition to standard practices for work in roadway and/or other traffic areas:

- Placement of cones and barricades as needed to protect the work area.
- Placement of flags as needed to protect the work area.
- Placement of "Men Working" sign for advance warning to motorists.

Which set(s) of procedures will be followed for this site?

A. Performing tasks in roadways
B. Performing tasks in traffic areas (but not in roadways).
C. Long duration work
D. Other (Describe)

______________________________ **Project Manager**

______________ **Date**

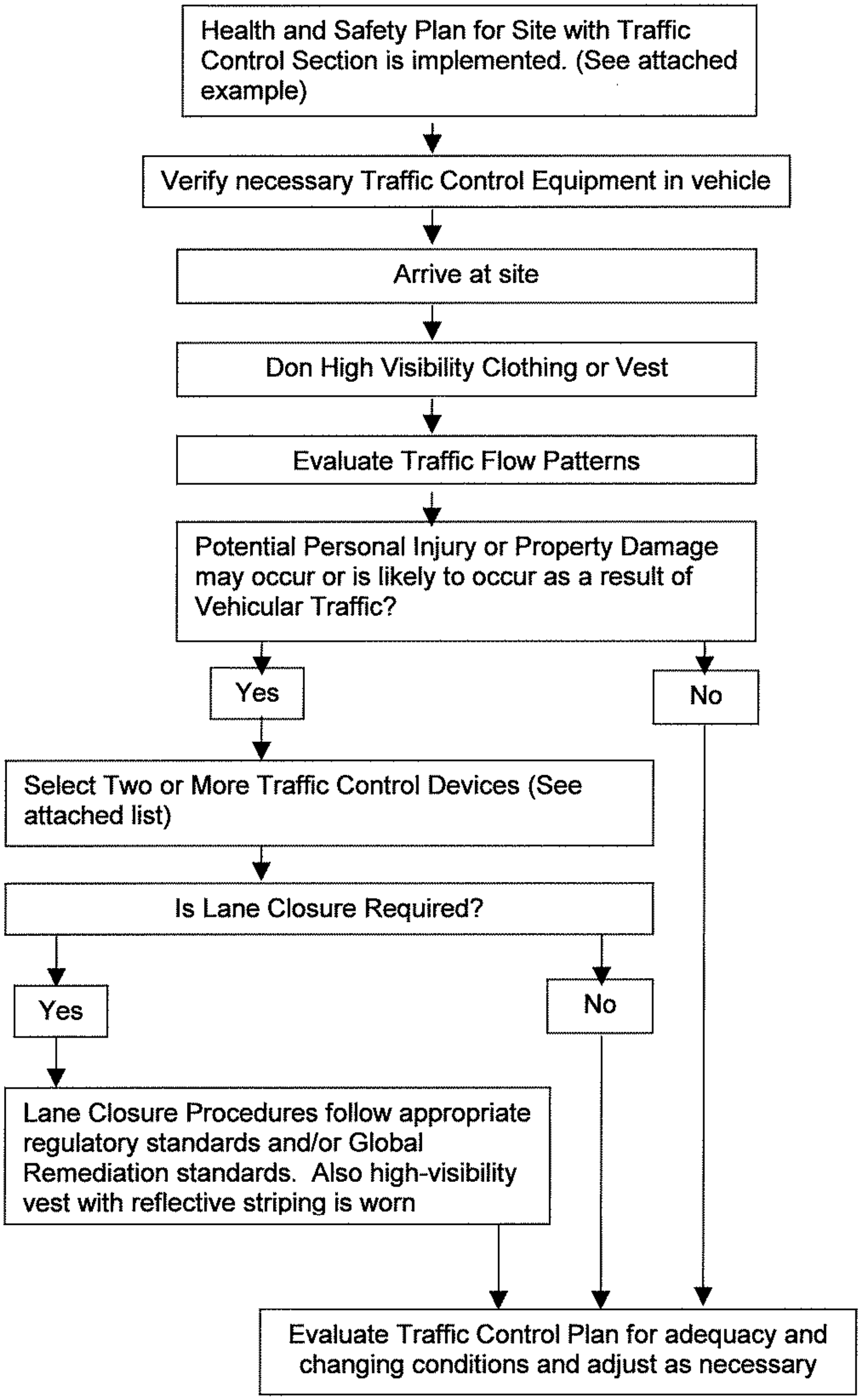
EXAMPLES OF PRECAUTIONARY MEASURES / CONTROLS

- Place wells in safe locations
- Be alert, pay attention, watch, and listen for cars
- Wear reflective vest and bright clothing
- Use cones at each point of service
- Place pole mounted warning flags inside of cones
- Park vehicle in order to block traffic
- Use flashing lights on barricades
- Use light bars or reflective lights on trucks
- Consult site manager about traffic – traffic evaluation
- Avoid prolonged time in traffic lanes
- Don't work around corners, make yourself visible
- Stay upright as much as possible
- Give notice to vehicle drivers nearby
- Trust no one, even if they see you
- Use buddy system
- Work during non-peak hours
- Always face traffic
- Use floodlights in darkness
- Obtain police assistance for roadwork and local permits as required
- Place letter on windshields to warn drivers – "CAUTION – Work area behind your vehicle"

EXAMPLES OF TRAFFIC CONTROL DEVICES

- Traffic Cones in combination with Standard Warning Flag. Total height at least 42in. (1m). 2 cones = Traffic Control Device
- 42in. (1m) Traffic Cone. 2 cones = Traffic Control Device
- Molded Plastic Barricades
- Type I and II Barricades
- Use of Vehicle to block traffic
- Use of light bars or reflective lights on trucks
- Buddy System
- Place letter on windshield to warn drivers-"Caution-Technician Working Behind Your Vehicle"
- Portable Gates
- Use of Floodlights in Darkness
- Placement of "Caution-Work Area" signs
- Plastic Channelizer (Orange Barrel)

TRAFFIC CONTROL PROCESS FLOW DIAGRAM



APPENDIX L

ExxonMobil Subsurface Clearance Procedure and Subsurface Clearance Procedure Checklist

LIMITATIONS

The Subsurface Clearance Procedures set forth in this document are the suggested procedures but may not be applicable to particular sites based on the site-specific considerations. The Consultant is responsible for making a site-specific evaluation of each site to determine whether the Subsurface Clearance Procedures should be utilized or require modification. If safety or other site-specific considerations require a modified or different procedure, the Consultant should review the modified / different procedure with the GR Field manager (Global Remediation) in advance.

PURPOSE

To prevent injury to workers and damage to subsurface structures (including tanks, pipe lines, water lines, gas lines, electrical service, etc.) during ground disturbance activities (including drilling, augering, sampling, use of direct-push technologies, excavation, trenching, concrete coring or removal, fence post installation, grading or other similar operations).

SCOPE

This procedure provides minimum guidance for subsurface clearance activities, which must be followed prior to and during ground disturbance activities at any and all ExxonMobil Global Remediation project sites. However, even after completing the subsurface clearance activities required in this procedure, all ground disturbance activities should proceed with due caution.

Deviations from this procedure may be provided on an exception basis for specific situations, such as underground storage tank system removals, verified above ground/overhead services / lines, undeveloped land / idle facilities, shallow ground water conditions, soil stability, or well construction QA/QC concerns, etc.

The consultant/contractor must review deviations with the ExxonMobil Global Remediation Field manager (PM) before proceeding. In these instances the review must be documented in the case file.

The consultant/contractor is responsible for, and shall ensure that all ground disturbance activities are completed safely, without incident and in accordance with applicable federal, state and local regulations.

This **procedure** shall not override any site specific or consultant/contractor procedures that are more stringent or provide a greater degree of safety or protection of health or the environment.

APPLICABLE DOCUMENTS

- Frequently Asked Questions: Subsurface Clearance Procedure, Subsurface Surveys, Technologies, and Markout Companies (Best Net)
- Key Points on Underground Location Industry and Technologies (Best Net)
- Technical Report: Techniques and Technologies for Subsurface Line Location (Best Net)

APPLICABLE APPENDICES

- Subsurface Clearance Checklist
- Subsurface Mark-Out Technology Application Chart

RESPONSIBLE RESOURCES

CONSULTANT/CONTRACTOR

- The consultant/contractor will be responsible for fulfilling the objectives of this procedure by ensuring that the identified procedures are carried out by all of the consultant's/contractor's employees, sub-contractors, and any other person involved in this activity.
- The consultant/contractor will ensure that all individuals working on ExxonMobil Global Remediation projects are adequately trained and supervised.
- The consultant/contractor will practice safe and environmentally compliant investigation and drilling practices and employ all necessary measures to avoid damage to subsurface structures.
- The consultant/contractor is responsible for reviewing with PM all selected ground disturbance locations/areas, as well as the equipment/methods to complete the work.
- The consultant/contractor will ensure this subsurface procedure has been reviewed and is understood by all involved site personnel.

GLOBAL REMEDIATION PROJECT MANAGER

- The PM, or other ExxonMobil person designated by the PM (designated person), will be the point of contact for the consultant/contractor in the event an exception to this procedure is requested.
- The PM, or designated person, will be responsible for reviewing all selected ground disturbance locations/areas, including any relocations, as well as all equipment necessary for those activities.

PROCEDURES

Consultant/contractor must complete the Subsurface Clearance Checklist in conjunction with the following procedures. The checklist must be completed before initiating any ground disturbance activities. The completed checklist must be submitted to the PM and included in the project files.

1. Safety

A Health and Safety Plan (HASP) must be available onsite and followed by all contractors and subcontractors. ExxonMobil Global Remediation's Contractual Safety Requirements must always be followed.

All work areas shall be defined and secured with safety cones, safety tape, construction fence, other barriers, or signs as appropriate.

Site work permits must be obtained as required by site procedures. Based on site conditions or classification, the use of intrinsically-safe equipment may be required.

If applicable, the emergency shutoff switch, or other emergency equipment, shall be located and the consultant/contractor, employees, sub-contractors, and any other person involved in this activity must be familiar with its use.

To ensure the safety of all on-site personnel and subsurface structure integrity, consideration should be given to de-energizing and locking out selected site utilities or temporarily shutting down a portion of or the entire facility.

Most of devices used for subsurface cable / equipment / tank detection are not intrinsically safe / designed for use in explosive / flammable atmospheres. **Therefore, ensure proper monitoring / gas free testing is performed before use. For additional help contact business line or regional safety or industrial hygiene staff.**

2. Preparation Tasks

Objective: To gather all relevant information about potential subsurface structures prior to the actual site visit.

a. Obtain Permits and Site Access

The consultant/contractor is responsible for following all applicable laws, guidance and approved codes of practice; obtaining all necessary permits and utility clearances; and securing site access permission.

b. Obtain Historic Site Information

Obtain most recent as-built drawings and/or site plans (including underground storage tank (UST), product and vent lines) as available. NOTE: As-built drawings may not accurately depict the locations and depths of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

The consultant/contractor should obtain any other site information such as easements, right-of-ways, historical plot plans, fire insurance plans, tank (dip) charts, previous site investigations, soil surveys, boring logs and aerial photographs, etc. as relevant to the planned ground disturbance activities.

Where applicable, the consultant/contractor should also contact personnel who may have historic site knowledge.

3. Mark-outs

Objective: To identify location of subsurface structures on surface.

The consultant/contractor must ensure that a thorough subsurface structure mark-out at the site is completed to locate electrical, gas, telephone, water, sewer, low voltage electric lines, product delivery pipelines and all other subsurface utilities/services.

- Where available public utility companies must be contacted to identify underground utilities.
- In addition, where available and warranted by site conditions, a private utility/pipeline mark-out company should be contracted to perform an electronic subsurface survey to identify the presence of suspected hazardous or critical underground utilities and subsurface structures. In some cases to also confirm public utility mark-outs in the vicinity of planned ground disturbance activities. (See Subsurface Mark-Out Technology Application Chart)

Consultant/contractor should review all available site plan subsurface information with private mark-out company to assist in locating utilities and other subsurface structures.

NOTE: Mark-outs may not accurately depict the exact locations of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

Where possible, the consultant/contractor is encouraged to be on site at time of subsurface mark-outs. This is to ensure accuracy and understanding of subsurface structures identified and provides an opportunity to exchange information with mark-out company personnel regarding planned work activities.

Subsurface structures should be marked throughout the entire work area(s) with adequate materials (e.g. site conditions may require paint and tape/flags). Ground disturbance activities must be started within 30 days of mark-out, unless local ordinances specify a shorter time period. If activities are not started within required time period or markings have faded, mark-outs must be redone.

Consultant/contractor should record time and date of mark-out request and list all companies contacted by the service and confirmation number. This should be available for review on site and checked off after visual confirmation of markings.

4. Initial Site Visit

Objective: To compare the site plan to actual conditions based on information gathered in Procedures 2 and 3 above, to obtain additional site information needed and to prepare a vicinity map.

The consultant/contractor shall document all findings and update the site plan with this information and provide updates to PM. On third party sites, close coordination with the site owner's representatives for mark-outs, review of as-builts, and other information reviews should be conducted prior to work. PMs are encouraged to provide updated as-built information to the respective Business Units.

In some regions it may be more effective and efficient to conduct the site visit at the same time the contractor and drill rig are mobilized to the site. The inspection should include the following activities and may include others as determined by the consultant/contractor and the PM:

a. Utilities

The consultant/contractor shall perform a detailed site walkthrough for the purpose of identifying all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within the planned work area. The inspection shall include, but not be limited to, the following:

- Utility mark-outs
- Aboveground utilities
- Area lights/signs
- Phones
- Drains
- Junction boxes
- Natural gas meters or connections
- Other utilities including: fire hydrants, on/below grade electrical transformers, splice cages, sewer lines, pipeline markers, cable markers, valve box covers, clean-outs/traps, sprinkler systems, steam lines (including insulated tanks that may indicate steam lines), cathodic protection on lines/tanks
- Observe paving scars (i.e. fresh asphalt/concrete patches, scored asphalt/concrete)

NOTE: In many cases, the on-site location of low-voltage electrical lines and individual property water and sewer line branches may be approximated by using the following technique.

- Locate the entry/connection location at the facility building
- Attempt to identify utility connections for the mains (water, sewer, etc.) by locating clean-outs, valve manways, etc. The location/path of the utility is likely within the area between the main connection and the facility building connection. Subsurface electrical line locations from the facility building to signs, lamps, etc. can be estimated with the same process.

b. Product Systems

The consultant/contractor shall perform a detailed site walkthrough for the purpose of identifying all aboveground indicators of product systems within the planned work area.

- Speak with someone (e.g. retailer, field supervisor, person responsible for issuing permit, etc.) with historical site knowledge to gain information about the site (location of former tanks, lines, etc.).
-
- For UST systems:
- Inspect for the presence of a dispenser pan and determine piping materials and whether piping is rigid or flexible, as flexible-piping runs may not be straight between connection points.

- Visually inspect the location of the tankfield, observation wells, dispensers, vent stack(s), and UST fill points. Note the location of the emergency shutoff switch and become familiar with its use.
- Note the orientation, arrangement, location, and the size/capacity of the tanks and submerged turbine pump (STP) covers (associated with product lines) and extractor covers (associated with stage I/II vapor recovery). Determine the burial depth of the tank field to also estimate burial depth of product lines, etc.
- Observe paving scars that may indicate location of product piping or other subsurface structures.

For other sites (e.g., Refineries/Chemical Plants, Terminals, Bulk Plants, Exploration & Production Facilities):

- Inspect for the presence of underground pipelines associated with pumps and pump galleries, manifolds, tank fields, compressors, production wells, loading racks, underground valves and other process equipment types.
- Inspect for underground instrumentation cable runs, as well as process/storm sewers. Note location of all instrumentation, analyzers, and lines leading from/to motor operated valves etc.

c. Existing Remediation Systems

Visually inspect the location of aboveground components.

Note the locations of well covers, sparge points, etc.

Observe new pavement/asphalt that may give indications of subsurface piping that is connected to recovery/injection wells and the aboveground components.

Other Pertinent Features

Note any other pertinent features that may be of relevance to the planned subsurface ground disturbance activities (e.g. underground private pipelines marked by aboveground designators, covers not associated with known lines that may be associated with historical underground tanks, hydraulic lifts etc.).

5. Selection of Ground Disturbance Locations

Objective: To document, communicate and review the selected ground disturbance area locations.

a. Define 'Critical Zones'

The following minimum criteria should be applied to determine critical zones:

- 10 feet (3 meters) distance from the furthest edge of any tank, pump(s) and pump galleries, manifolds on/below grade transformers, compressors, production wells, loading racks, and other process equipment types.
- 10 feet (3 meters) distance surrounding dispenser islands.
- The entire area between the tank field and dispenser island(s) at retail sites.

- 10 feet (3 meters) distance from suspected hazardous or critical underground utilities and other subsurface structures.
-
- The size of the critical zone may increase based on site conditions such as soil type, slope stability factors, and depth of subsurface ground disturbance activities to ensure that subsurface structure integrity is maintained. Final critical zone determination shall be reviewed with the PM.
-
- Note: Lines that can be verified as de-energized via a formal lock-out / tag-out program, and/or if impacted do not present a safety, environmental, community, or operational concern (either onsite of offsite), may at the discretion of the PM be excluded from the critical zone determination.
-
- Regional / country / site specific modifications to the critical zone applicability can
- be requested by the PM/Area Manager through the management of change process.
-
- More restrictive measures shall supercede if required by regulation / business units.
-

b. Select Ground Disturbance Locations

The consultant/contractor should utilize the information collected to this point in combination with regulatory requirements and project objectives to select ground disturbance locations. Ground disturbance locations should also consider the location of overhead obstructions (e.g. power lines, etc.).

If possible, the consultant/contractor should avoid selecting locations within the critical zone.

c. Review Selected Locations with the PM

The consultant/contractor must review the selected ground disturbance locations with the PM.

THE CONSULTANT/CONTRACTOR MUST NOT PROCEED WITH THE SUBSURFACE ACTIVITIES UNTIL THE PLAN HAS BEEN DISCUSSED WITH THE PM . IF RELOCATION OF PLANNED SUB-SURFACE ACTIVITIES IS NECESSARY OUTSIDE OF PREVIOUSLY REVIEWED AND APPROVED LIMITS/AREAS, THE CONSULTANT/CONTRACTOR MUST CONTACT THE PM PRIOR TO PROCEEDING.

-

6. Subsurface Structure Delineation Activities

Objective: To delineate subsurface structures prior to ground disturbance activities in order to prevent potential worker injuries, product release and/or damage to those structures.

a. Supervision:

The consultant/contractor's on-site representative will be responsible for all ground disturbance activities and must have a copy of this procedure on-site.

ALL GROUND DISTURBANCE ACTIVITIES INCLUDING SURFACE REMOVAL WILL BE PERFORMED, OBSERVED OR SUPERVISED BY THE CONSULTANT/CONTRACTOR'S REPRESENTATIVE AT ALL TIMES. This representative will ensure that the work is performed with due caution and will be alert for warning signs that could indicate the presence of underground tanks, utilities, product lines, or other subsurface structures. If any such indications arise, **THE WORK SHOULD IMMEDIATELY STOP IN THIS AREA AND THE PM SHALL BE CONTACTED IMMEDIATELY.** The consultant/contractor may proceed with other pre-assigned work at other locations on the site.

The consultant/contractor will ensure that all workers involved with subsurface ground disturbance activities have undergone appropriate training prior to working at an ExxonMobil Global Remediation site. At retail sites, ExxonMobil UST system training must also be completed.

b. Ground Disturbance Activities Sequence

If possible, ground disturbance activities should be planned such that the activities furthest from any suspected underground improvements are carried out first. This is done to determine the natural subsurface conditions and to allow the consultant/contractor to recognize fill conditions.

c. Warning Signs

The following warning signs may indicate the presence of a subsurface structure:

- Warning Tape (typically indicative of underground services)
- Pea Gravel/Sand/Non-indigenous Material (typically indicative of tanks or lines)
- Red Concrete (typically indicative of electrical duct banks)
- The abrupt absence of soil recovery in the hand auger. This could indicate pea gravel or sand that has spilled out of the auger. Except in areas where native soil conditions typically result in poor hand auger recoveries.
- Any unexpected departure from the native soil or backfill conditions as established in other onsite digging.

IF ANY OF THE ABOVE WARNING SIGNS OR A SUSPICIOUS CONDITION IS ENCOUNTERED, WORK IN THIS AREA SHOULD IMMEDIATELY STOP AND THE PM SHOULD BE CONTACTED.

d. Surface Removal for Paved Areas

Paving Removal

Sufficient paving or surface improvement should be removed to allow clear visibility of the subsurface conditions during clearance activities. Ground disturbance activities in an area of known subsurface structures may warrant a larger pavement opening.

- Monitoring Well Installations: 2 feet x 2 feet (60 cm x 60 cm) or 2-foot diameter minimum removal is suggested.
- Soil Borings/Push Type Samplers: 8 inches x 8 inches (20 cm x 20 cm) or 8-inch diameter minimum removal is suggested.
-
- NOTE: Coring and jack hammering should not take place directly over the location of known utility or subsurface structures / lines.

Surface Removal Technique
The technique used should not pose a threat to subsurface structures. Avoid use of heavy equipment if possible. In situations where heavy equipment must be used, additional precautions should be taken because subsurface structures could be located immediately below surface pavement.

e. Subsurface Delineation

The method used to delineate the subsurface should be compatible with the inherent associated risk given the type of facility/property, soil stratigraphy, and the location of the ground disturbance activity, such that the required delineation is obtained.

Subsurface Clearance Methods

The consultant/contractor should discuss clearance methods with the PM prior to start of field activities.

- Vacuum Digging - Soil should be broken up with an air lance and simultaneously vacuumed to remove loose soils. Alternatively a low volume/high pressure water lance may be used to break-up cohesive/dense soils while to vacuuming. Current test/experience indicates that water lances operating at pressures below 5,000 psi and at rates below 12 gpm are unlikely to damage typical fiberglass / metal lines/tanks and utilities. Using systems above these ranges should be tested prior to use.
- Probing - The probe should have a blunt or rounded tip and should be <u>advanced by hand without excessive force</u>. It is important to inspect the probe to ensure the tip is rounded and does not present a point/jagged cutting edge that could damage underground structures.
- Hand Digging - Should be performed with a small shovel.
- Hand Augering - The auger is to be turned slowly <u>and not forced through the soil.</u> It is recommended that an auger without sharp points (some augers have rounded edges) be used.
- Post-Hole Digging - A post-hole digger can be used for soil removal only in soil that has been probed by the 4 methods noted above, and cannot be used to advance the hole depth or width.
- An evaluation of sample collection requirements needs to be integrated into the selection of subsurface clearance methods to ensure sample integrity is maintained. For vacuum digging, with or without air lances the following guidance is provided:
- Loose sand soil - Vacuum lift only
- Tight dense sandy soils - Vacuum and air lance
- Dense cohesive soils - Vacuum and water lance
-
- Note: For retail sites, probing is required prior to hand augering or digging can be advanced only to the depth that has been probed.
-
- An evaluation of potential electrical or fire / explosion risks should be part of the overall sub-surface clearance job safety analysis to evaluate whether the use of non-conductive materials and/or non-sparking materials is warranted. (example: glass fiber handle on shovels or thick electrically insulating rubber grips on hand-auger or

probe). The use of non-conductive materials, electrical safety insulated gloves and footwear should also be evaluated. It is beyond the scope of this document to cover electrical / fire safety or protective equipment evaluation, selection, training and/or inspection methods. This should be part of the site safety program.

Subsurface Clearance Procedures Based on Planned Subsurface Ground Disturbance Activities:

Selected subsurface clearance methods that will achieve the highest level of precautionary investigation and/or safety based on site conditions should be reviewed with the PM prior to implementation.

(1) Drilling, Direct-Push Technologies, Augering, Fence Post Installation or Other Borehole Installation Activities:

- IN CRITICAL ZONES, A MINIMUM DELINEATION TO A DEPTH OF 8 FEET (2.5 METERS) IS REQUIRED.
-
- IN NON-CRITICAL ZONES, A MINIMUM DELINEATION TO A DEPTH OF 4 FEET (1.2 METERS) IS REQUIRED. IN AREAS WHERE EXPECTED FROST LEVELS ARE GREATER THAN 4 FEET, A GREATER DELINEATION DEPTH WILL BE REQUIRED.

The First 4 feet (1.2 meters)

The area to be delineated shall exceed the diameter of the largest tool (drill auger, push type sampler, ream, or similar mechanical equipment) to be advanced and sufficiently large to allow for visual inspection of any obstructions encountered.

The first 1 foot - 2 feet (0.3 meters - 0.6 meters) can be delineated by hand digging to remove the soil.

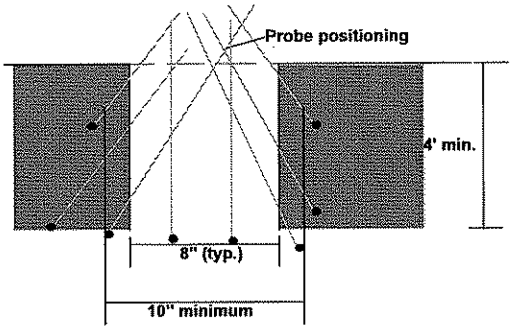
Next, delineate the area to ensure that no obstructions exist anywhere near the potential path of the mechanical equipment by probing / augering / vacuum digging or hand digging. Delineation shall extend as far laterally as possible and to a depth of 4-feet.

The Second 4 feet (1.2 meters)

<u>Critical Zones</u>
For boring locations inside the critical zone, delineation, utilizing one of the four methods described above, to an additional 4 feet (1.2 meters) is required.

<u>Non-critical Zones</u>
For sub-surface work outside the critical zone, delineation, of an additional 4 feet (1.2 meters) may be prudent due to site conditions / climate (deep frost-line) etc. but is not required.

Probing Example



NOTE: Not drawn to scale.

(2) Trenching/Excavation Activities:

-
- IN CRITICAL ZONES, A MINIMUM DELINEATION TO A DEPTH OF 4 FEET (1.2 METERS) IS REQUIRED. IN AREAS WHERE EXPECTED FROST LEVELS ARE GREATER THAN 4 FEET, A GREATER DELINEATION DEPTH WILL BE REQUIRED.
-
- The first 4 feet (1.2 meters) should be delineated by hand digging to remove the soil unless an alternative delineation method has been reviewed with the PM.
-
- Outside the critical zone, site-specific conditions will determine the appropriate course of action and delineation requirements must be reviewed with the PM prior to start of ground disturbance activities.

Appropriate subsurface clearance methods should be conducted along the length and width of the excavation at a frequency sufficient to ensure adequate precautions have been applied to the entire work area. The frequency and density of investigations shall be based on site knowledge, potential hazards and risks of the site / work area and surrounding locations (e.g. proximity to residential areas, public, etc.).

Whenever subsurface structures are exposed, work in area must cease until precautions (e.g. flags, cross bracing, stakes, etc.) are taken to ensure that the integrity of those structures is maintained during the trenching/excavation and subsequent backfilling activities.

A minimum 2-foot buffer zone must be maintained around exposed lines. No mechanical equipment may enter the buffer zone.

f. Alternative Subsurface Clearance Methods

In all cases the consultant/contractor must employ all means necessary to prevent damaging subsurface structures. Where natural subsurface conditions (e.g. cobbles/rocks, fill material, and/or bedrock) prevent adequate delineation utilizing methods identified above, the consultant/contractor must employ an effective and innovative alternative method of delineation following review with the PM.

Additionally, the depth of utility clearances may require modification based on regional / site construction details. Less restrictive methods should follow management of change procedure to ensure proper documentation and approvals are provided.

g. Incident Notification

IF ANY PORTION OF A TANK, LINE, UTILITY OR OTHER SUBSURFACE STRUCTURE IS ENCOUNTERED AND THERE IS REASON TO BELIEVE THAT IT HAS BEEN DAMAGED, THE WORK IS TO CEASE IN THAT AREA AND THE PM MUST BE NOTIFIED IMMEDIATELY. IF APPLICABLE, THE EMERGENCY SHUTOFF SWITCH SHOULD BE ACTIVATED. THE PM WILL DECIDE IF ADDITIONAL UNCOVERING BY HAND IS REQUIRED. IF IT IS CONFIRMED THAT AN ACTIVE UST SYSTEM HAS BEEN DAMAGED, A TIGHTNESS TEST(S) WILL BE PERFORMED. UNDER NO CIRCUMSTANCES IS THE AREA TO BE BACKFILLED WITHOUT NOTIFYING THE PM AND RECEIVING AN APPROVAL TO PROCEED.

h. Scheduling

As subsurface delineation may be time consuming, it may be appropriate to perform the surface removal and subsurface delineation in advance of planned subsurface ground disturbance activities. If these activities are conducted in advance, the clearance holes must be adequately covered with plates and/or backfilled. Care must be taken to prevent settlement of the material used to cover/backfill the holes.

For remote, idled, or access controlled sites, clearance holes can be left open; however, hazard cones, fencing or other methods shall be used to identify the hazard.

i. Waste Disposal

The consultant/contractor is responsible for coordinating the final disposition, including transportation of generated soil and water wastes per prevailing regulatory requirements and ExxonMobil Global Remediation guidelines.

Subsurface Mark-out Technology Application Chart

Technology ⇒ **Object ⇓**	Electro-Magnetic Detector	Ground Penetrating Radar (GPR)⊙	Acoustic Plastic Pipe Locator	Probe, Beacon, Sonde, or Trace Wire	Cesium Magnetometer⅄
Power/Instrument Line (Energized/Signaled☐)	✱ G	Y	R	R	Y
Power Line (Non-energized)	Y	✱ Y	R	R	Y
Sewer/Water Line (Metallic)	✱ G	>12" diameter G <12" diameter Y	Y	G	Y
Sewer/Water Line (Non-metallic)	R	>12" diameter G <12" diameter Y	G	✱ G	Y
Instrument/Telecomm Lines (Non-energized)	R	R	R	R	R
Natural Gas Line (Pipeline)◆	✱ G	>12" diameter G <12" diameter Y	R	R	G
Metallic/Non-Metallic Line (w/Tracer Wire)	✱ G	>12" diameter G <12" diameter Y	Y	Y	Y
Metallic/Non-Metallic Line (w/o Tracer Wire)	R	>12" ✱diameter G <12" ✱ diameter Y	Y	Y	R
Metal UST	✱ G	✱ G	R	R	G
Fiberglass UST	R	✱ G	R	R	Y

Additional Considerations

Technology ➡ **Variable** ⬇	Electro-Magnetic Detector	Ground Penetrating Radar (GPR)⊙	Acoustic Pipe Locator	Probe, Beacon, Sonde, or Trace Wire	Cesium Magnetometer⅄
Moist Soil	G	Y	G	G	Y
Dry Soil	Y	G	Y	G	G
Clay	Y	R	G	G	Y
Concrete w/Rebar	R	Y	G	G	R
Long Horizontal Profile	G	G	G	G	G
Short Horizontal but Deep Vertical Profile	Y	G	R	R	G
Access to Line✚	G	N/A	G	G	N/A
No Access to Line✚	Y	G	R	R	G
Ferrous Metal	G	G	G	G	G
Non-ferrous Metal	Y	G	G	G	Y

Each remediation site / project may have unique conditions, therefore do not use this chart as the sole decision criteria for technology selection. Use the chart as a starting point to assess <u>available</u> technology(s) applicable.

- ✱ **Indicates Best Technology for Given Object. <u>Site structures, rebar in concrete, etc. can significantly affect performance and reliability of any electro / magnetic method.</u>**
- ☐ **Metallic lines that have power running through them or can be connected to a tracer signal generator.**
- ◆ **Natural gas pipeline locating technicians must be trained/certified in the US requires DOT, Office of Pipeline Safety standards, other regions may have similar certification or requirements.**

⊙ Most sensitive to interpretation; the skill, training, and experience of operator are critical.
Ȧ Emerging technology with limited availability.
+ Access: induce unique electronic signature, apply acoustical impulse, or insert probe/beacon/sonde.

Green: - Generally, an applicable technology,
Yellow: - May or may not be applicable,
Red:- Not generally applicable.

ExxonMobil

Subsurface Clearance Procedure Checklist

Revision - 0

Date of Revision - 01/08/05

Site Identification: ____________________

Project Consultant/Contractor: ____________________

Sections: 1. Safety / 2. Preparation Tasks / 3. Mark-Outs (Page 1 of 3)

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
JSA's complete /compliant per LPS guidance. Worker's properly trained and briefed on potential site / work hazards and safety SPSA's conducted / planned for site/operation LPO's conducted / planned Morning Safety Meeting planned / completed				
HASP is available and all contractors and subcontractors are familiar with it.				
All applicable local, state and federal permits have been obtained.				
Site access / permission has been secured.				
Most recent as-built drawings and/or site plans (including UST, product and vent lines) obtained.				
Reviewed site information to identify subsurface structures relevant to planned site activities (easements, right-of-ways, historical plot plans, fire insurance plans, tank dip charts, previous site investigations, soil surveys, boring logs, aerial photographs etc.).				
Utility mark-outs have been performed by public utility company(s) Mark-outs clear / visible				
Subsurface structure mark-outs performed by private mark-out company. Mark-outs clear / visible				

Sections: 4. Initial Site Visit / 5. Selecting Ground Disturbance Locations

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Location of all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within the planned work area has been identified.				
Location of utility mark-outs by all utility companies previously contacted has been identified within required time period.				
Location of all subsurface structure mark-outs by private mark-out company has been identified within required time period.				
Location of area lights/signs and associated subsurface lines identified.				
Location of all phones and associated subsurface lines identified.				
Location of all drains and associated interconnecting lines identified.				
Location of all electrical junction boxes and associated interconnecting lines identified				
Location of all natural gas meters or connections and all interconnecting lines identified				

Sections: 4. Initial Site Visit / 5. Selection Ground Disturbance Locations (Page 2 of 3)

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Location of all other utilities/services (including fire hydrants, on/below grade electrical transformers, splice cages, sewer lines, pipeline markers, cable markers, valve box covers, clean-outs / traps, sprinkler systems, steam lines (including insulated tanks that may indicate steam lines), and cathodic protection on lines/tanks) identified				
Dispenser pan inspected to determine piping materials and whether piping is rigid or flexible				
Location of tank field, observation wells, dispensers, vent stacks, UST fill points, and emergency shutoff switch has been identified.				
Orientation, arrangement, location, sizes, of tanks, STP and extractor covers identified. Burial depth of tank determined if relevant.				
Location of paving scars indicative of product lines or other subsurface structures identified.				
Presence of underground pipelines associated with pumps and pump galleries, manifolds, tank fields, compressors, production wells, loading racks and equipment identified.				
Presence of underground instrumentation cable runs, PLCs, remote instrumentation (process analyzers, CEMs), lines leading from/to MOVs etc inspected / identified.				
Presence and tracing of process/storm sewers identified / understood.				
Location of other pertinent features that may be of relevance to work scope has been identified.				
Existing remediation systems (above-ground components, well covers, new pavement/asphalt that may indicate subsurface piping, etc.) have been identified.				
All other pertinent surface features identified.				
Clearance methods approved by FM.				
Critical zones - 10 feet (3 meters) distance from edge of tank, pumps and pump galleries, manifolds, on/below grade transformers, compressors, production wells, loading racks, other process equipment, operating dispenser islands and suspected underground lines (and entire area between tank field and dispensers) have been identified. Identify critical zones in Comments section.				
Ground disturbance locations reviewed by PM.				

6. Subsurface Structure Delineation Activities (page 3 of 3)

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
HASP is available and all contractors and contractors are familiar with requirements.				
Subsurface Clearance Protocols have been reviewed with all site personnel involved in subsurface disturbance activities.				
Work area is secured. Site work permits have been obtained. Emergency shut-off switch is located. Fire extinguishers / warning signs are present. Other safety equipment as needed				
Required paving or surface improvement has been removed to allow clear visibility of subsurface conditions.				
If conducting borehole advancement activities: First 4 feet (1.2 meters), or deeper in areas where expected frost levels are greater than 4 feet, has been delineated utilizing most effective method (e.g. vacuum digging, probing, hand digging, etc.) Note methods used in Comments.				
If conducting borehole advancement activities in critical zones (and non-critical zones if possible): Second 4 feet (total of 8 feet (2.4 meters)) has been delineated. Note methods used in Comments.				
If conducting trenching/excavation activities in critical zone: First 4 feet (1.2 meters), or deeper in areas where expected frost levels are greater than 4 feet, assessed for below grade issues. Note methods used in Comments.				
If subsurface structures exposed, extra precautions have been taken to ensure structural integrity.				

Other Comments / Findings:

Completed by: ______________________________
Name

Signature: ______________________________ ____________
Company Date

APPENDIX M

ExxonMobil Drill/Direct Push Type Rig Inspection Checklist

DRILL/DIRECT PUSH TYPE RIG INSPECTION CHECKLIST

SITE/PROJECT NAME: ______________________________

RIG INSPECTOR (NAME/CO.): ______________________________

RIG INFORMATION:

Rig Type: Rotary/Auger Drilling Rig ☐ Direct Push Type (DPT) ☐

Owner: ______________

Yr/Make: ______________

Model: ______________

VIN #: ______________

Mileage: ______________

Drill Hrs: ______________

Inspector to initial columns below as appropriate

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
Emergency Switches (#1)	Emergency shutdown switches are located and accessible to workers on both sides of the rotating stem. **NOTE:** Location and number of switches depend on the rig manufacturer, please refer to owner's manual (DPT typically has one switch on control panel).				
	Emergency shutdown switches installed by the manufacturer are verified to be in operable condition and all workers are familiar with the location and operation of these switches. **NEVER BYPASS, DISABLE, OR REMOVE EMERGENCY SHUTDOWN DEVICES.**				
Protective Guards (#2)	Drive shafts, belts, chain drives, and universal joints are guarded to prevent accidental insertion of hands, fingers, or tools.				
Cables (#3)	Cables on drill rig are free of kinks, frayed wires, birdcages, flat spots, grease, and worn or missing sections.				
	Cables are terminated at the working end with a proper eye splice; either swaged, coupled, or using cable clamps.				
	Cable clamps are installed with the saddle on the live or load side. Clamps are not alternated and are of the correct size and number for the cable size.				
	Wire ropes are not allowed to bend around sharp edges without cushion material.				
Pulleys (#4)	Pulleys are not to be bent, cracked, or broken.				
	Pulleys operate smoothly and freely, without resistance.				
Cable Winches (#5)	Motor is mounted in correct location and tightly secured to drill rig.				
	Winch is capable of being placed in the free spool (unwind smoothly) and locked position correctly, demonstrating that the cable is suitable for lifting during drilling operations.				
Safety Latches (#6)	Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation.				
	Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load.				
Flights/Augers (#7)	Flights/Augers should not be bent, cracked, or broken. **NOTE:** Flights/Augers failing inspection must be removed from jobsite.				
	Flights should be blunt to prevent the risks of cuts.				
	Auger keys should not be bent, have any cracks/fractures, be excessively worn, or otherwise damaged.				
	Auger bolt holes and threads should not be damaged.				

DRILL/DIRECT PUSH TYPE RIG INSPECTION CHECKLIST

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
Flights/Augers (#7) (cont.)	Inspect flights/augers for metal burrs. **NOTE:** Burrs must be filed to flat surface.				
	Avoid stacking augers; all should lay flat on ground.				
	Avoid manually lifting/moving augers. Should be lifted/moved with cable lines, or, at a minimum, by two persons.				
Drill String (#8)	Drill string should not be bent or have any cracks/fractures.				
	Drill string connecting pins should not be bent, have any cracks/fractures, or be excessively worn.				
Mast (#9)	Mast is free of bends, cracks, or broken sections.				
	All mounting hardware (pins, bolts, etc.) should be in place.				
Hammering Device (#10)	Hammer free of cracks, fatigue, or other signs of excessive wear.				
	Hammer connections are secure.				
Leveling Devices (#11)	Outriggers move in/out and up/down smoothly and freely while using controls on drill rig, with no hydraulic leaks.				
	Outriggers are extended prior to and whenever the mast is raised off its cradle. Outriggers must maintain pressure to continuously support and stabilize the drill rig (even while unattended).				
	Outriggers are properly supported on the ground surface to prevent settling into the soil (use of outrigger support pads).				
Controls (#12)	Controls are intact, properly labeled, have freedom of movement, and have no loose wiring or connections.				
	Controls are not blocked or locked into an operating position.				
	Installed lights, signals, gauges, and alarms operate properly.				
Lifting Devices (#13)	Slings, chokers, and lifting devices are inspected before using and are in proper working order. **NOTE:** Damaged units are to be labeled and removed from jobsite.				
	Shackles/Clevises are in proper working order with pins/ screws in place that is to be used while lifting.				
	Cables and lifting devices are not operated erratically or with a jerking action to overcome resistance.				
Hydraulic System (#14)	Hydraulic lines are secure, in good condition with no signs of excessive wear, and not leaking. **NOTE:** Check while pressurized.				
	Hydraulic lines are not in a bent or pinched position causing additional fluid restrictions/pressures.				
	Hydraulic oil reservoir has appropriate amount of oil and not leaking.				
	Documentation available to confirm that pressure relief valve was checked during shop maintenance activity and noted on maintenance log.				
Pump Lines (water, grout, etc.) (#15)	Suction/Discharge hoses, pipes, valves, and fittings are secured and not leaking.				
	High pressure hoses have a safety chain, cable, or strap at each end to prevent whipping in the event of a failure.				
Fire Prevention (#16)	A fire extinguisher of appropriate size is located on drill rig and readily available/accessible for drilling crew (recommended 20 lb.).				
	Documentation available to confirm that the drilling crew has received training on proper use of fire extinguishers.				
Ladders (#17)	Drill rig has a permanently attached or proper portable ladder to be used for access to drilling platform.				
Tracks (#18)	Tracks on rig are not excessively worn and free of any debris or foreign material.				

DRILL/DIRECT PUSH TYPE RIG INSPECTION CHECKLIST

CATEGORY	INSPECTION ITEMS	PASS	FAIL	N/A	ACTION NEEDED
General (#19)	Drill rig meets regulations for transport on state/federal highways (inspection sticker, license plate, etc.).				
	Documentation available to verify that rig was inspected prior to arriving at ExxonMobil job sites.				
	Does the rig size meet job requirements?				
	Maintenance log available for previous 3 months to confirm proper maintenance/inspection.				
Exhaust (#20)	Exhaust system should be free from defect and routes engine exhaust away from drill rig workers.				
Fuels (#21)	Fuel stored in an approved and properly labeled container.				
	Fuel transfer lines free from signs of excessive wear and not leaking.				
	Refueling and transferring of fuel is performed in an approved area with sufficient containment to prevent spillage.				
Exclusion/ Work Zones (#22)	The exclusion/work zone is centered over the borehole and the radius equal to or greater than the height of the mast (measured from ground level).				
	The exclusion/work zone should be clear of tripping hazards.				
Overhead Obstructions (#23)	Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to under, by, or near power lines in accordance with the following: * 50 KV or less - minimum clearance of 10 feet * 50 KV or greater - add 0.4 inches for every KV over 50 KV * If voltage is unknown, maintain at least 20 feet of clearance.				
	While the rig is in transit, clearance from energized power lines will be maintained as follows: * Less than 50 KV - 4 feet * 50 thru 365 KV - 10 feet * 366 thru 720 KV - 16 feet				
Mast (#24)	No moving of drill rig while mast is in vertical position.				
	Maintenance/repairs to be performed on mast only in horizontal position.				
Rig Repairs (#25)	Repairs, when possible, are conducted offsite to reduce the risk of any onsite incidents.				
Specialized PPE (#26)	When working at elevated heights, workers are to wear a fall restraining device attached in a manner to restrict fall to less than six feet.				
	When working in wet/slippery conditions, all workers have a lug-type sole or similar slip resistant sole, on their safety footwear to prevent slipping.				

RECOMMENDED SPARE PARTS/ITEMS TO BE SENT WITH DRILL CREW

DRILL RIG

* Emergency Switch
* Drive Coupling
* Shear pins/keys (for drive coupling)
* Pump Packing
* Pump Hoses
* Auger Bolts
* Rod to cap pins
* Cutter Head
* Safety Latches, Hooks, Clamps
* Split Spoon Cutter Head
* Spill Kit (5 gal. bucket with oil dry and absorbent pads)

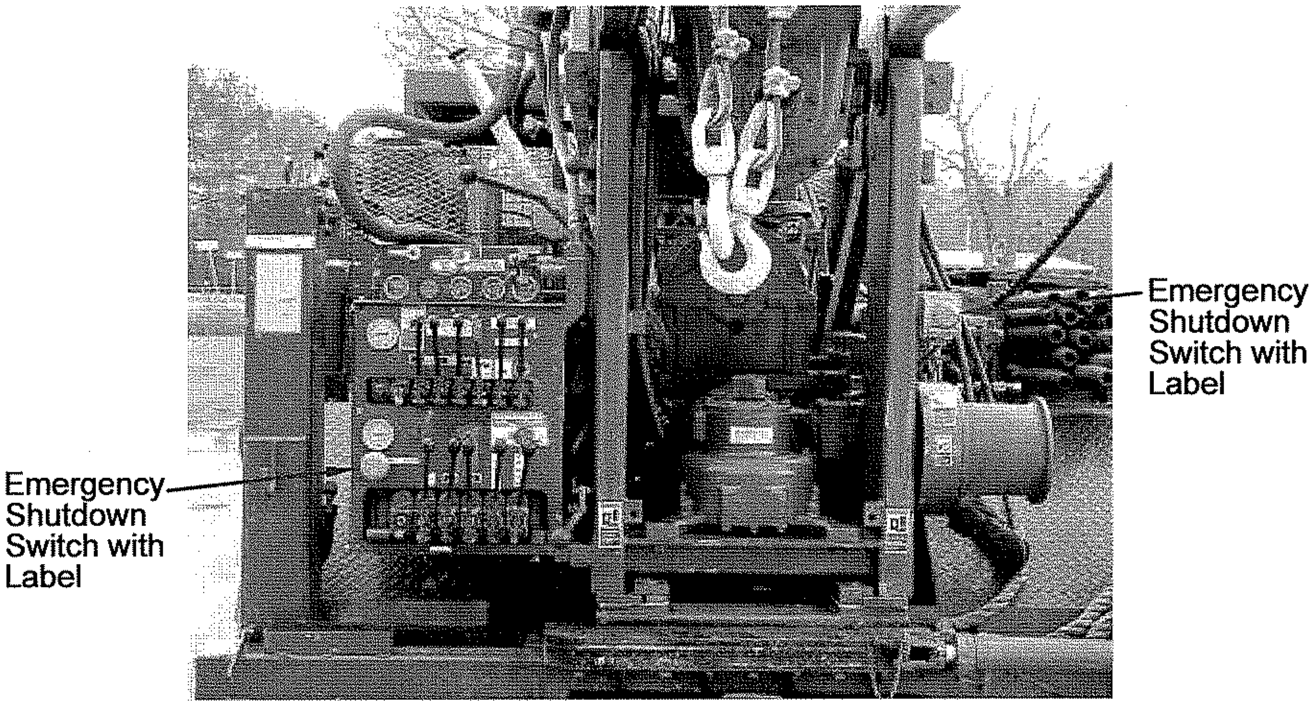
DPT RIG

* Emergency Switch
* Drive Caps
* Cutter Head
* Pull Cap
* Liner Cutter
* Rod to Cap Pins
* Liner Holder (used while cutting)
* Spill Kit (5 gal. Bucket with oil dry and absorbent pads)

Photographs

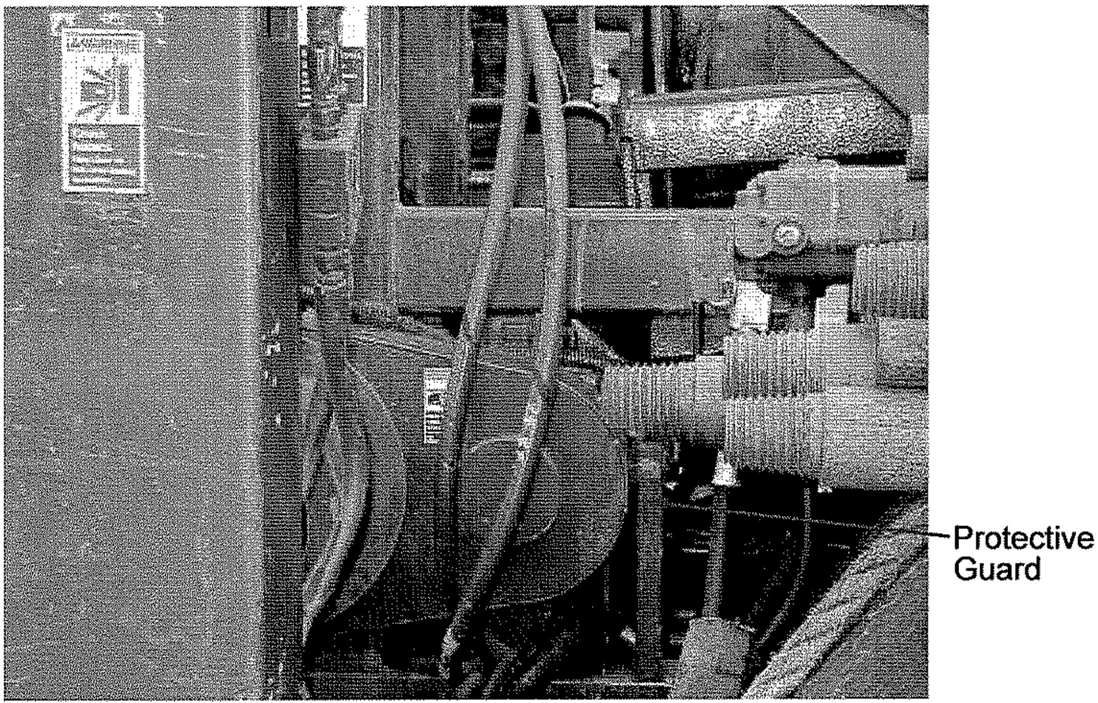
Drill Rig Inspection Checklist

EMERGENCY SWITCHES



Emergency Shutdown Switches present on both sides of rotating stem.

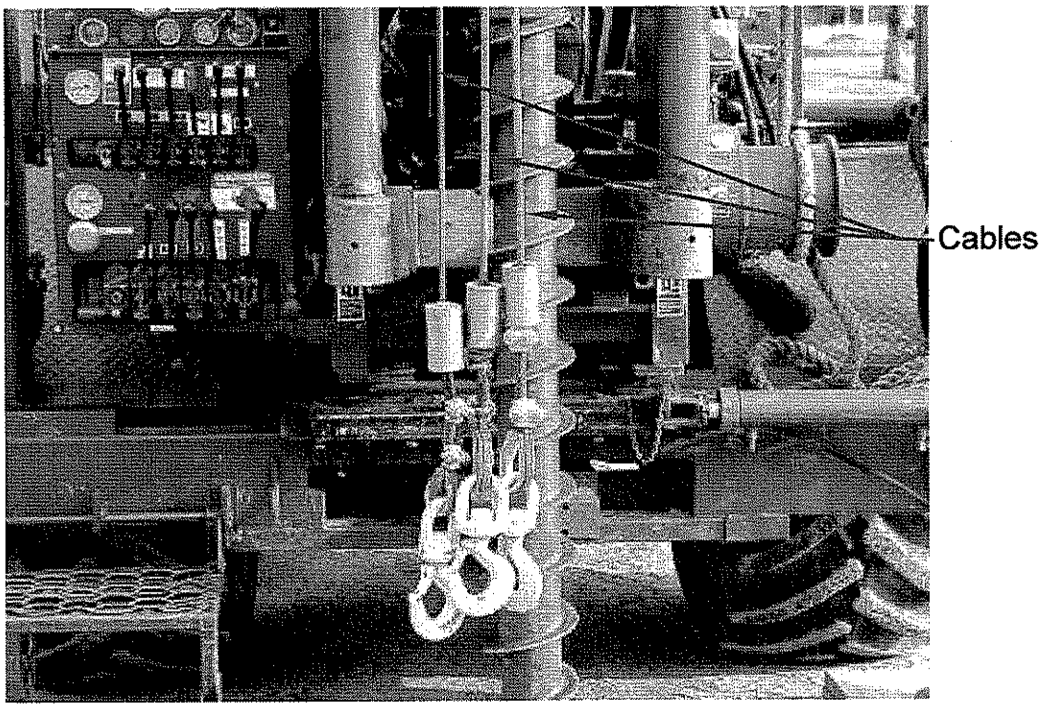
PROTECTIVE GUARDS



Protective guard present on chain drive.

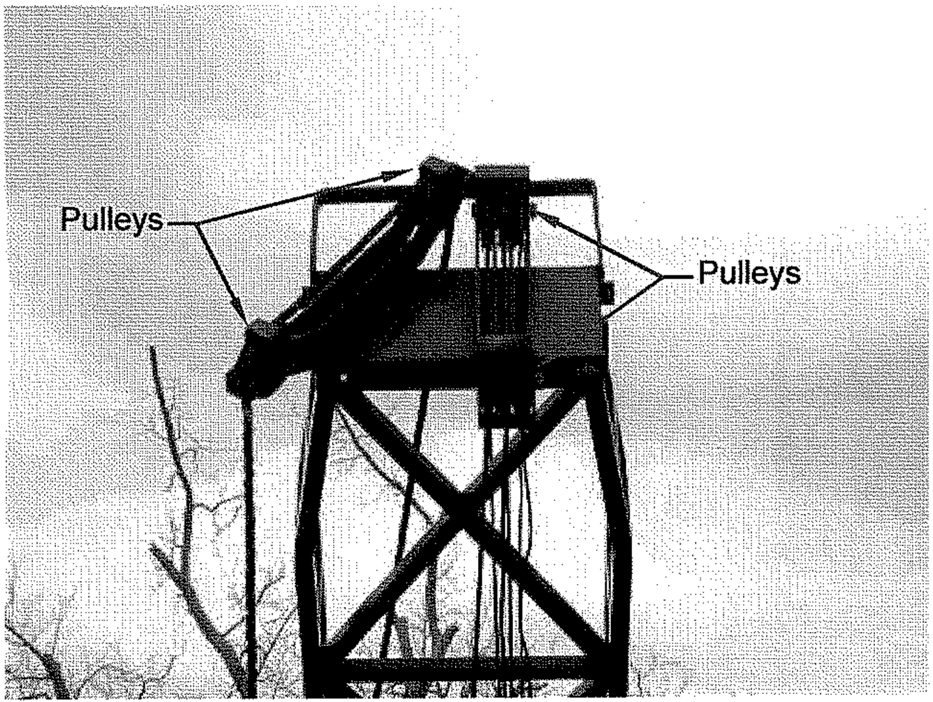
Drill Rig Inspection Checklist

CABLES



Close-up view of working end of cables.

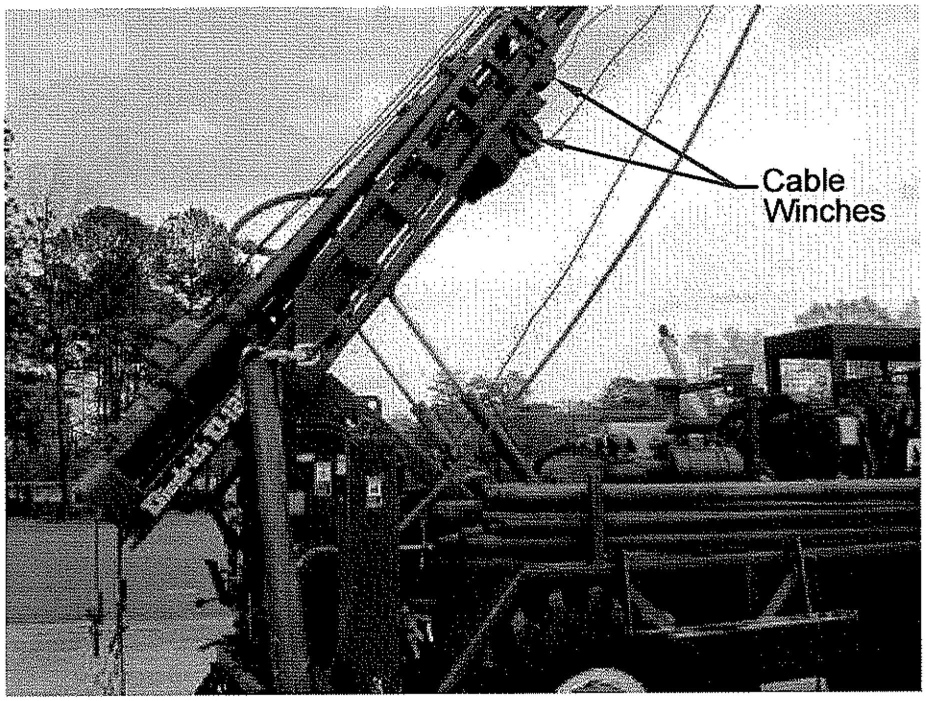
PULLEYS



Close-up view of Pulley system at top of mast.

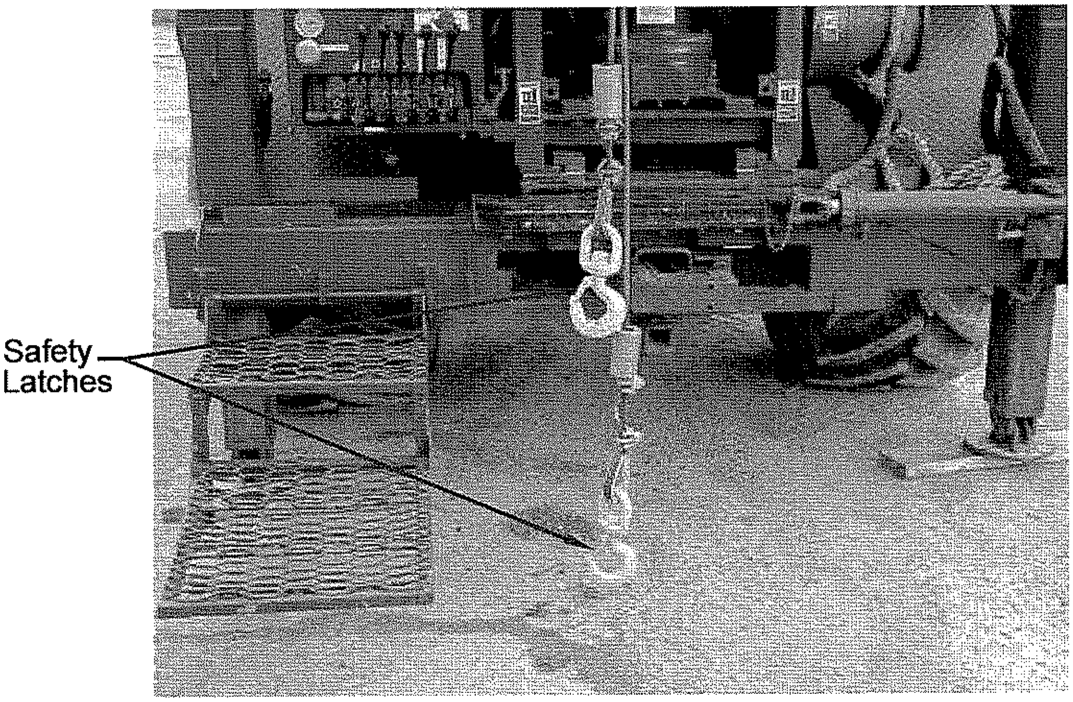
Drill Rig Inspection Checklist

CABLE WINCHES



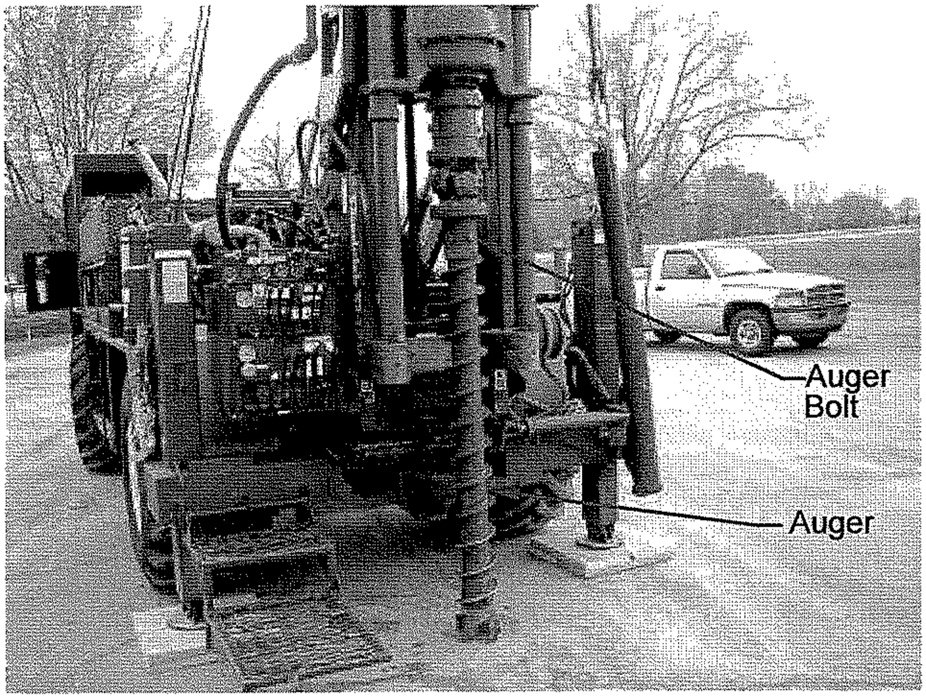
View of cable winch position on mast.

SAFETY LATCHES



Functional latches on the hooks of hoisting cables.

FLIGHTS/AUGERS

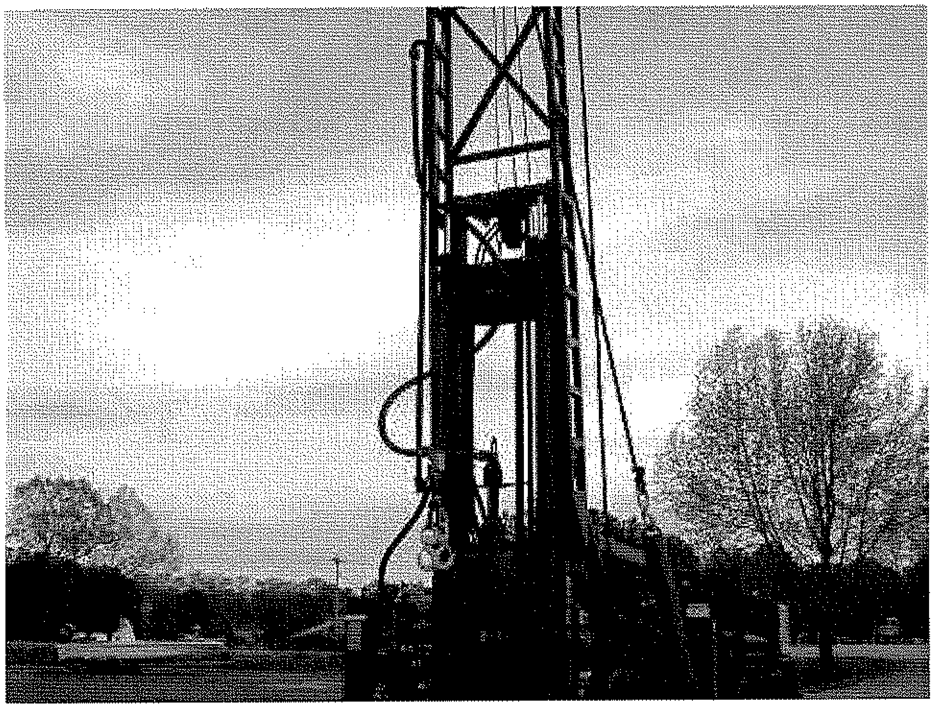


View of lead auger flight.

DRILL STRING

View of drill string in storage position on drill rig.

MAST

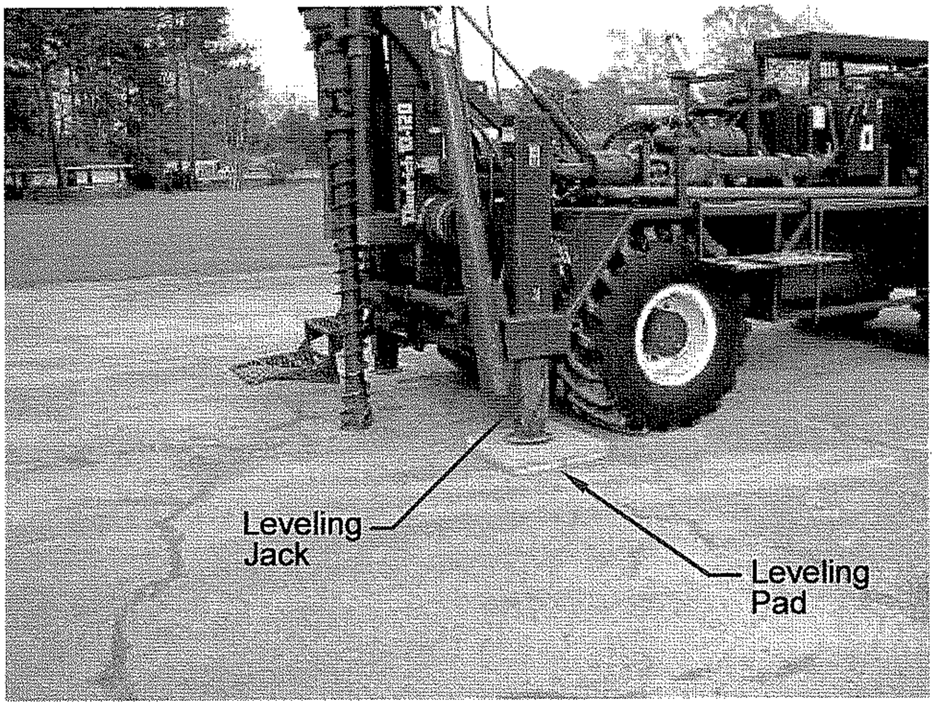


Mast in drilling position.

HAMMERING DEVICE

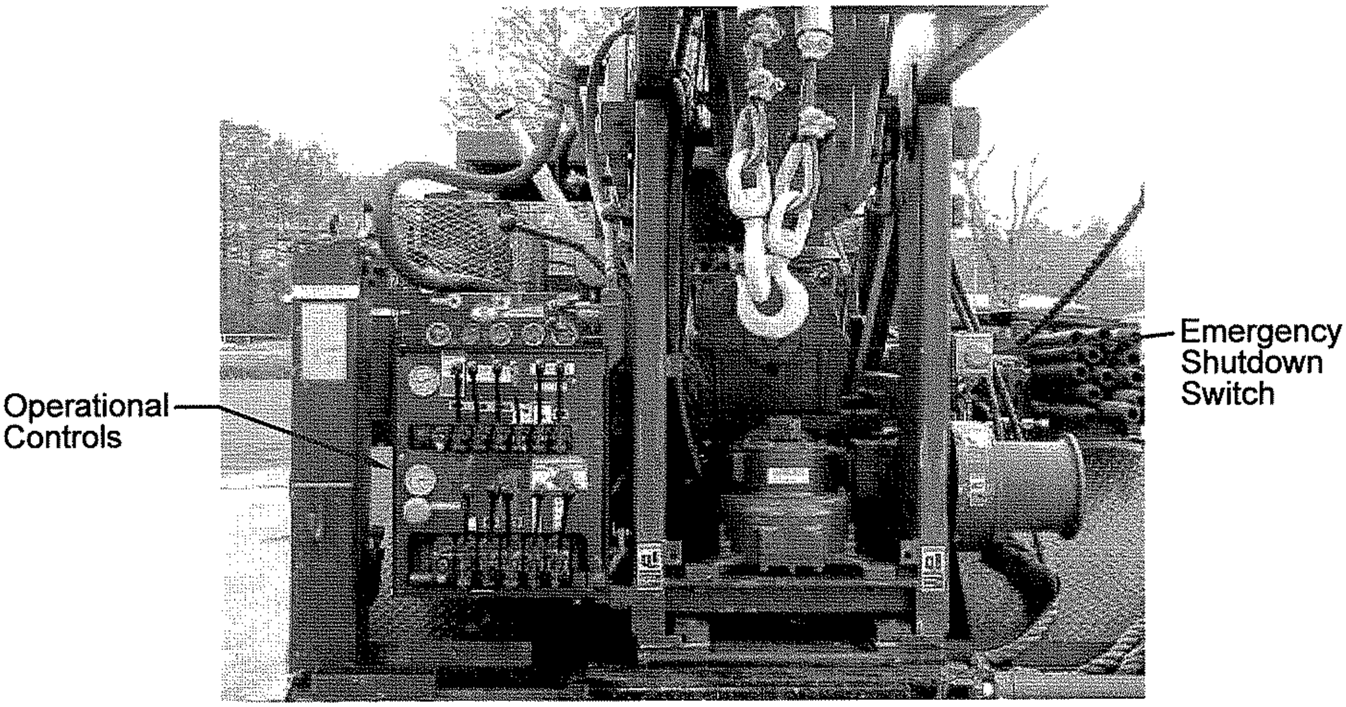
Hammering device in stand-by position.

LEVELING DEVICES



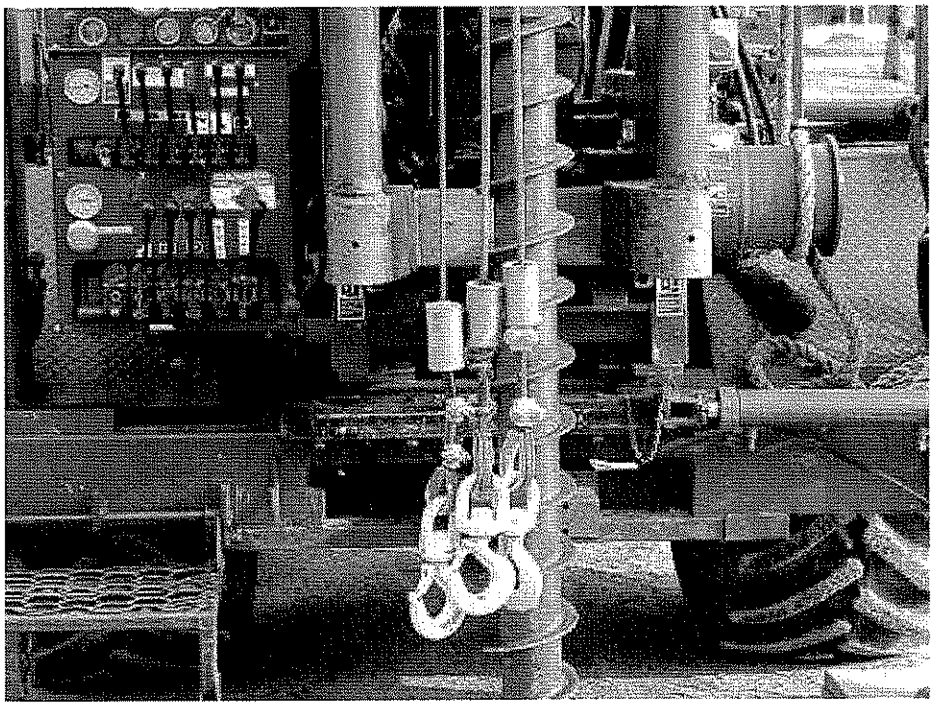
View of leveling devices in rear of drill rig.

CONTROLS



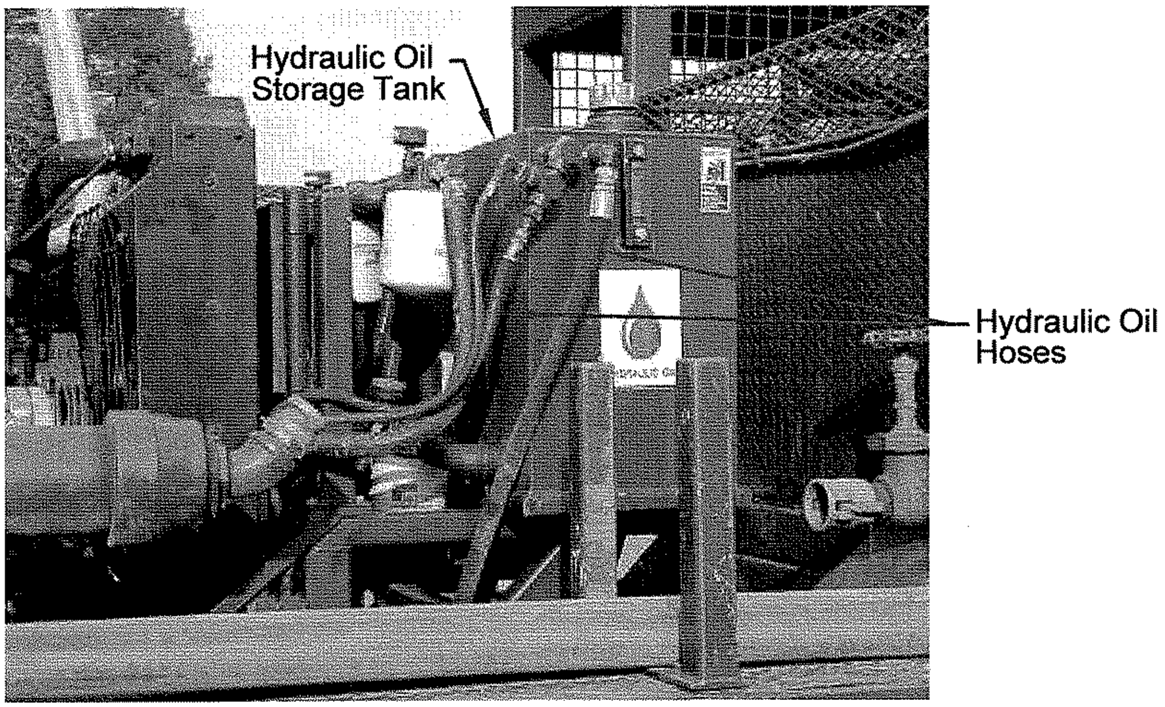
Operational controls for drill rig.

LIFTING DEVICES



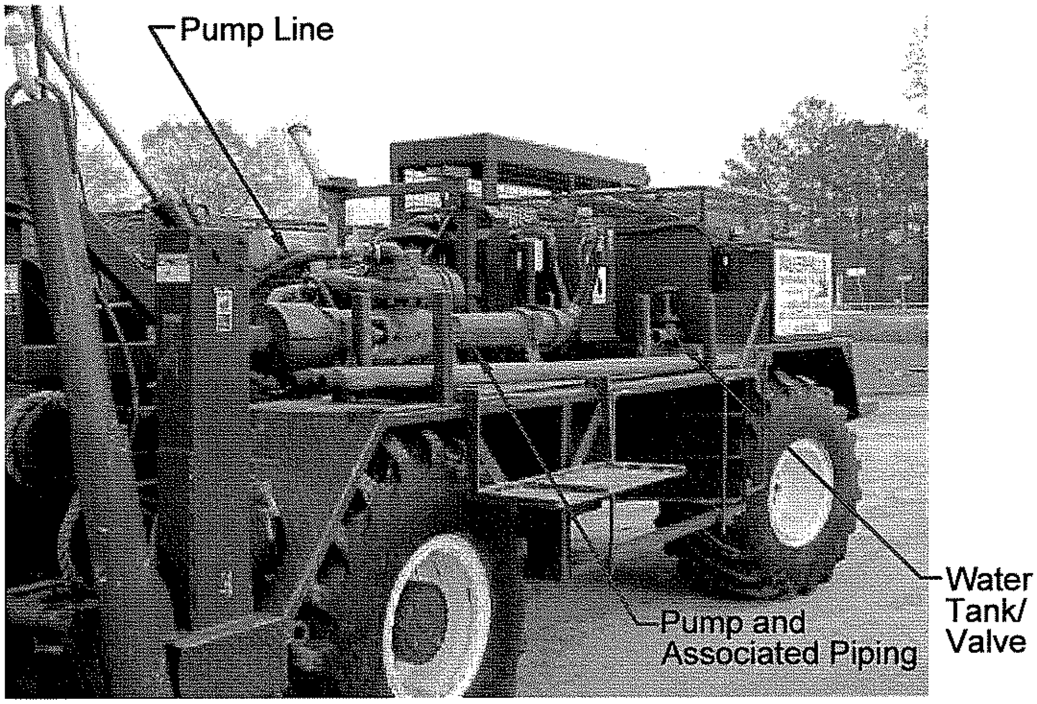
Close-up view of lifting devices.

HYDRAULIC SYSTEM



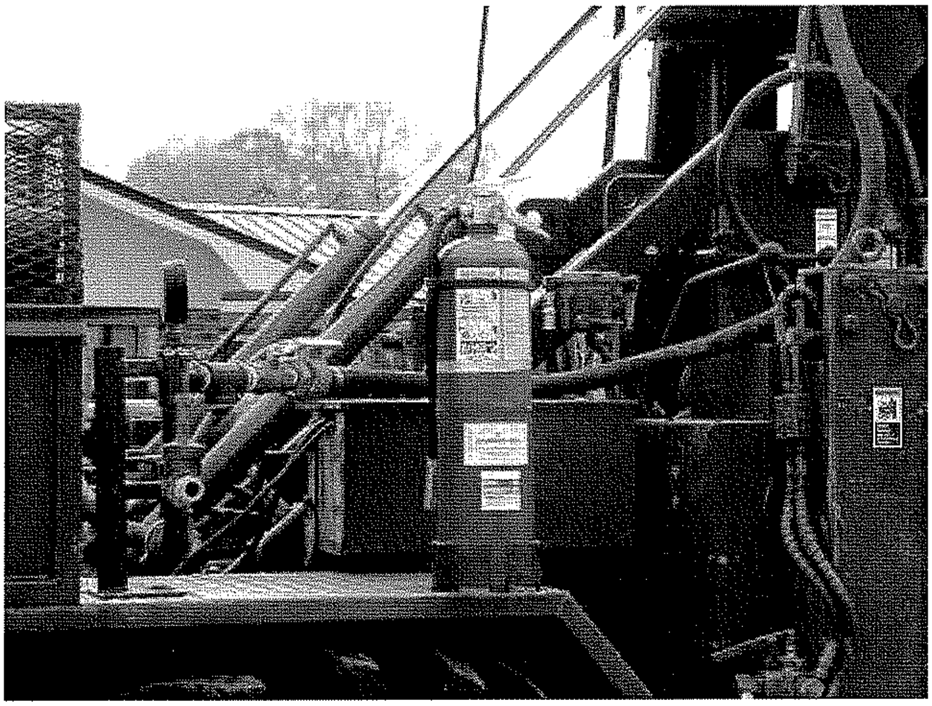
Hydraulic oil storage tank and associated hoses.

PUMP LINES



View of pump system and associated water tank.

FIRE PREVENTION

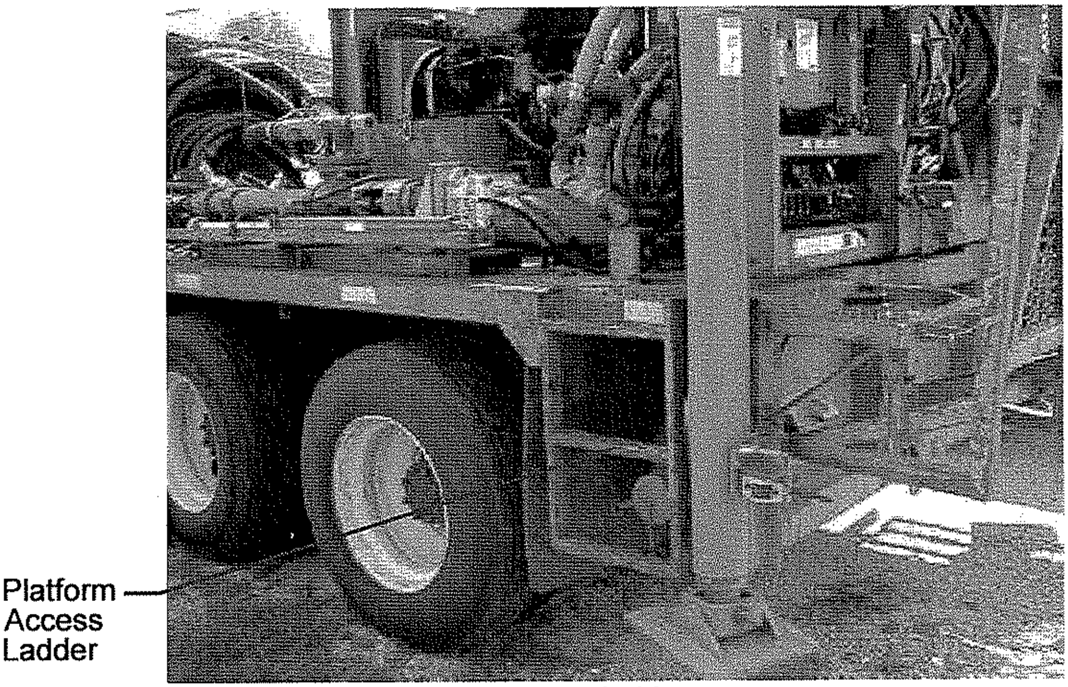


Mounted fire extinguisher.

Drill Rig Inspection Checklist

LADDERS

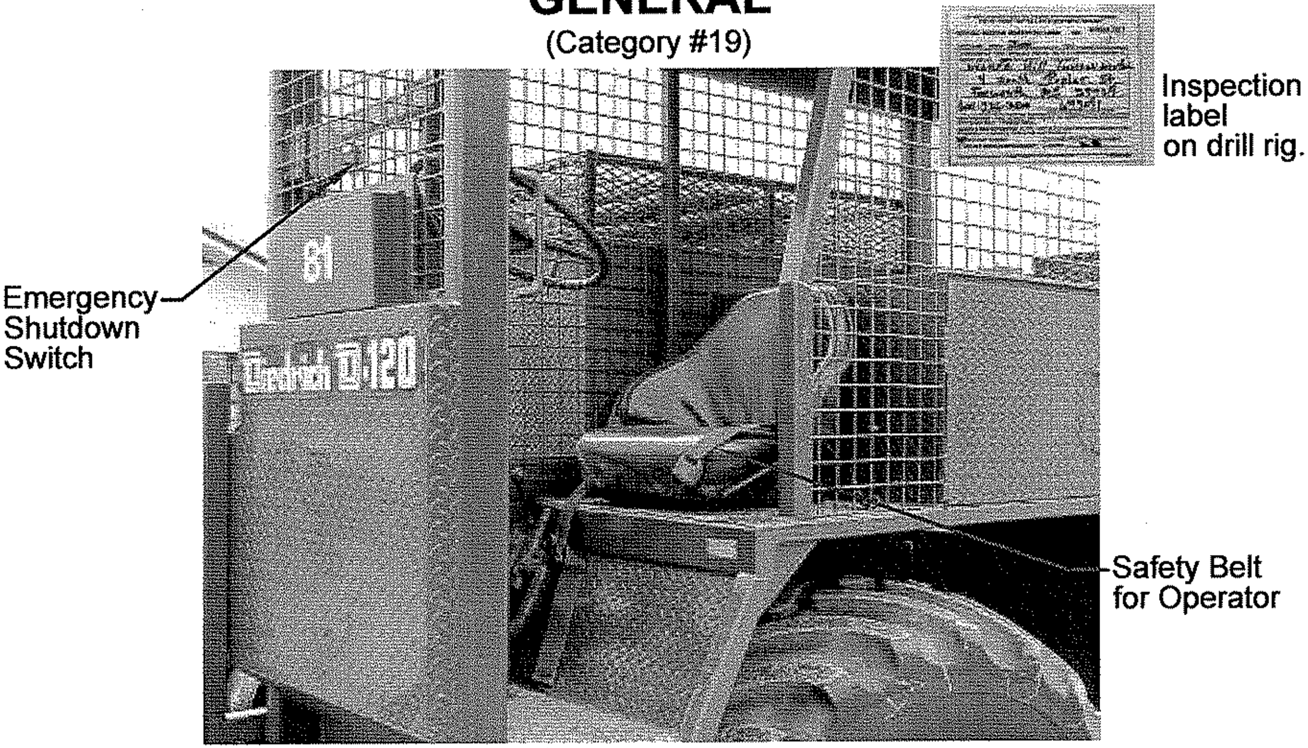
(Category #17)



View of drill rig platform access ladder.

GENERAL

(Category #19)



View of driver area of drill rig.

Job Safety Analysis for General Drilling

APPENDIX N

ExxonMobil Work Permit Procedures

1.5 Work Permit Procedure

Safety/Environmental

This Procedure meets Global Remediation OIMS System 6b requirements to conduct activities utilizing work permits that incorporate checks and authorizations consistent with mechanical and operational risks.

This Procedure applies to Global Remediation managed projects at U.S. Retail sites and Major Projects single-party sites.

The ExxonMobil Project Manager (PM) is responsible for meeting all requirements in this Procedure. The ExxonMobil PM may delegate some requirements to a Consultant/Contractor (CC), but remains responsible for ensuring project compliance with entire Procedure.

Activities that require a Work Permit

Entry into a confined space or permit-required confined space

Defined as when any part of a person's body breaks the plane of an opening into the space.

Confined space is defined as a space that:

- Is large enough and configured in a way that allows a person to bodily enter and perform work; and
- Has limited or restricted means for entry and exit (for example: tanks, vessels, vaults, silos, storage bins, hoppers, vaults, sewers and pits) and excavations that are greater than four feet in depth); and
- Is not designed for continuous human occupancy.

Permit-required confined space is defined as a confined space with one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard.

Hot work

Hot work is work that is capable of providing an *ignition source* where flammable materials, combustible gas-air mixtures, or combustible vapors are present or may be released to create a potential fire or explosion hazard. An *ignition source* is defined as any fire or spark producing activity, component or piece of equipment. Ignition sources include, but are not limited to, welding; grinding; saw-cutting concrete; non-explosion proof power tools and other electronic or electrical equipment; internal combustion engines; and heavy equipment operation (such as backhoes).

Hot work activities may include:

- Work that is within 10 feet (3 meters) of the following areas:
  - Underground storage tanks (USTs)
  - Product and vent piping

  - Dispenser islands
  - Vent stacks
  - Natural gas/propane lines

- Area between the UST field and the dispenser islands
- Drilling/boring and excavation in areas of known or potential hydrocarbon saturated soils and recovery/handling of liquefied petroleum hydrocarbons (LPH).

Cold Work

Cold work is any work that does not provide a source of ignition. Cold Work permit requirements are covered through Job Safety Analyses (JSAs), Health and Safety Plans (HASPs), tailgate safety meetings, etc. at all Retail sites and Major Projects non-operating facility sites unless risk assessment for field work (see 2.3 - Risk Assessment Procedure) identifies as a risk control method.

Control of Hazardous Energy ("Lockout / Tagout")

Any work (hot or cold) that requires the control of hazardous energy must follow Lockout/Tagout (LOTO) procedures per 29 CFR 1910.147. Control of hazardous energy refers to the procedure of de-energizing; de-pressuring; isolating; racking out; hanging lock adapters, locks, and/or lockout identification tags; and otherwise ensuring that applicable hazardous equipment will be rendered safe during work and not be unexpectedly operated.

Procedure

1. (CC) Conduct required work activities under a work permit system as described above.
2. (CC) Follow facility work permit system when performing remediation activities at Major Projects operating facility sites.
3. (CC) Develop work permit system for use at Retail sites, Major Projects non-operating facility sites and any other sites that do not have a permit system (see example Work Permit System). Permits must contain the following minimum requirements:

   Work Requested:

   - Defined work scope that permit covers including location and date of work
   - Permit duration (maximum one day)

   Work Permit Safety:

   - Hazards associated with work area and equipment and mitigation methods to be employed
   - Precautions to be observed
   - Vapor monitoring requirements
   - Stand-by equipment and personnel
   - Required PPE
   - Conditions under which work can proceed and that negate the permit
   - Procedures to identify work scope/condition changes requiring permit amendment and/or additional approval. Permits become invalid whenever changes occur which cause job conditions that conflict with permit stipulations

- Supplementary permits required

Work Authorization:

- Issuing signature (authorization by qualified personnel who approves the work requested)
- Acceptance signature (acknowledgement by worker responsible to make sure activities identified in the Work Permit are completed)
- Date and time of work completion

4. (CC) Provide personnel with appropriate work permit training and ensure qualifications prior to conducting field activities.
5. (CC) Issue (at Retail and other sites that do not have own work permit system) Work Permit daily, prior to implementing work.
6 (CC) Post the active Work Permit on site until completion of the work.
7 (CC) File original permit at issuing office with copies retained within the site Operation and Maintenance (O&M) Manual, if available, for one year and project file indefinitely.
8 (PM) **No PM will enter a confined space** unless request and obtain RM approval and appropriate training and qualifications prior to entry.
9 (RM) Review PM requests for entry into confined space and approve if appropriate.

Attachments and Direct Links

- Example Work Permit - U.S. Distribution (NOTE: example permit system is written to be specifically applicable to U.S. Distribution facilities and may require editing to apply to other types of facilities)
- Global Remediation Risk Management Guide

References

- GR OIMS System 6b - Work Permit Procedures

APPENDIX O

Safety Plan Amendments

SAFETY PLAN AMENDMENTS

Site Name: ______________________________

Start Date: ____________________ **End Date:** ____________________

Scope of Work/Change/Amendment/Update/Modification Made to the Plan:

Reason for Amendment:

Hazard Evaluation: ______________________________

Level of Protection: ______________________________

Air Monitoring: ______________________________

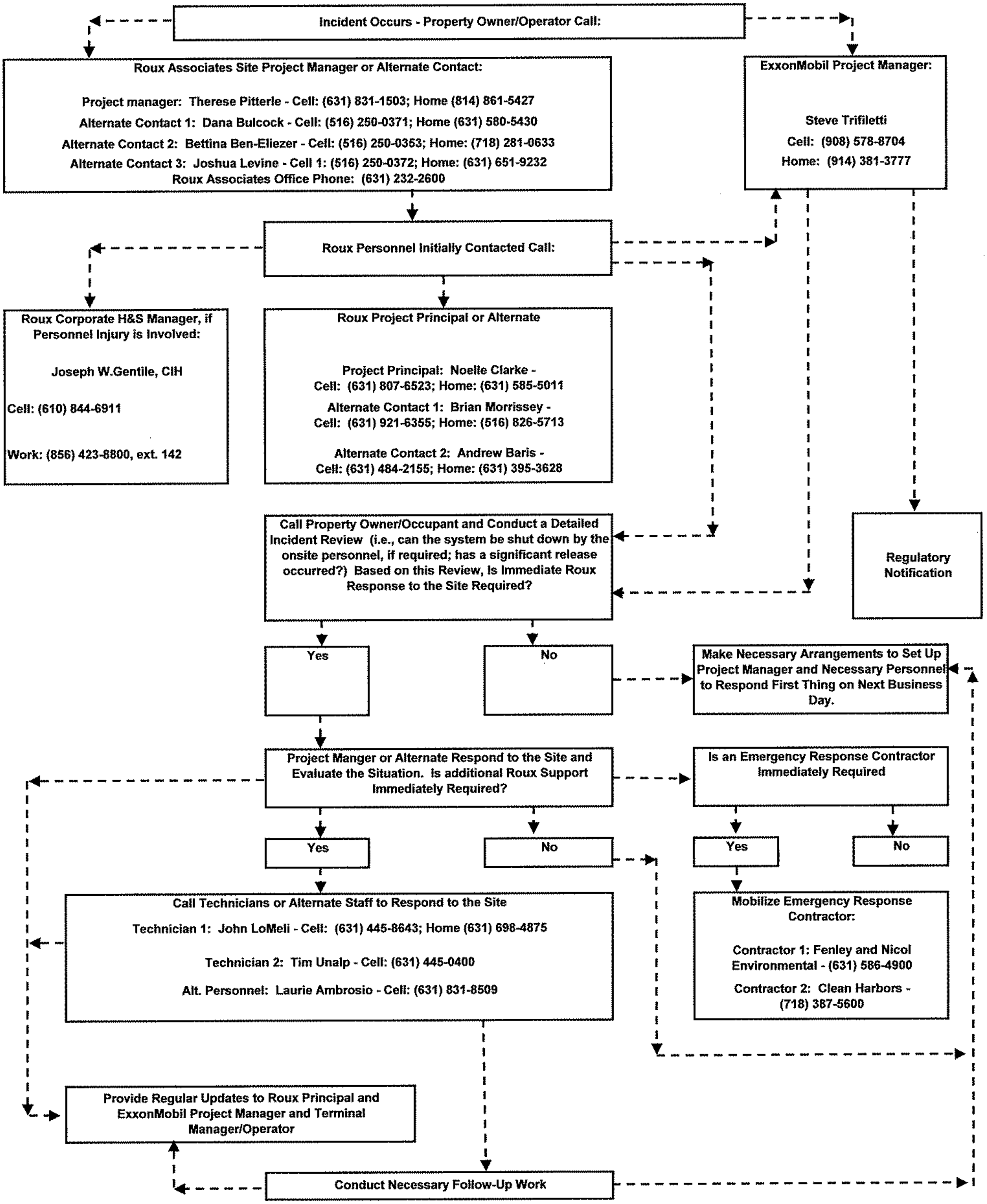
Person Requesting Amendment:	**Approval:**
Name	Name
Health and Safety Coordinator Title	Title
Date	Date
Signature	Signature

APPENDIX P

Incident Response Plan

INCIDENT RESPONSE PLAN

Former Mobil Tappan Terminal
1 Railroad Avenue
Hastings-On-Hudson, New York



Incident Occurs - Property Owner/Operator Call:

Roux Associates Site Project Manager or Alternate Contact:

Project manager: Therese Pitterle - Cell: (631) 831-1503; Home (814) 861-5427
Alternate Contact 1: Dana Bulcock - Cell: (516) 250-0371; Home (631) 580-5430
Alternate Contact 2: Bettina Ben-Eliezer - Cell: (516) 250-0353; Home: (718) 281-0633
Alternate Contact 3: Joshua Levine - Cell 1: (516) 250-0372; Home: (631) 651-9232
Roux Associates Office Phone: (631) 232-2600

ExxonMobil Project Manager:

Steve Trifiletti
Cell: (908) 578-8704
Home: (914) 381-3777

Roux Personnel Initially Contacted Call:

Roux Corporate H&S Manager, if Personnel Injury is Involved:

Joseph W.Gentile, CIH

Cell: (610) 844-6911

Work: (856) 423-8800, ext. 142

Roux Project Principal or Alternate

Project Principal: Noelle Clarke -
Cell: (631) 807-6523; Home: (631) 585-5011
Alternate Contact 1: Brian Morrissey -
Cell: (631) 921-6355; Home: (516) 826-5713

Alternate Contact 2: Andrew Baris -
Cell: (631) 484-2155; Home: (631) 395-3628

Regulatory Notification

Call Property Owner/Occupant and Conduct a Detailed Incident Review (i.e., can the system be shut down by the onsite personnel, if required; has a significant release occurred?) Based on this Review, Is Immediate Roux Response to the Site Required?

Yes

No

Make Necessary Arrangements to Set Up Project Manager and Necessary Personnel to Respond First Thing on Next Business Day.

Project Manger or Alternate Respond to the Site and Evaluate the Situation. Is additional Roux Support Immediately Required?

Is an Emergency Response Contractor Immediately Required

Yes

No

Yes

No

Call Technicians or Alternate Staff to Respond to the Site

Technician 1: John LoMeli - Cell: (631) 445-8643; Home (631) 698-4875

Technician 2: Tim Unalp - Cell: (631) 445-0400

Alt. Personnel: Laurie Ambrosio - Cell: (631) 831-8509

Mobilize Emergency Response Contractor:

Contractor 1: Fenley and Nicol Environmental - (631) 586-4900

Contractor 2: Clean Harbors - (718) 387-5600

Provide Regular Updates to Roux Principal and ExxonMobil Project Manager and Terminal Manager/Operator

Conduct Necessary Follow-Up Work

APPENDIX Q

ExxonMobil Emergency Response Log

SYSTEM 10b - ATTACHMENT 10b.1
GLOBAL REMEDIATION EMERGENCY RESPONSE LOG

Facility # ______ Address: ______
City ______ State: ______ Country: ______
Incident Type ______ Investigation Type ______
Incident Date ______ Incident Time ______ Incident Location ______

NATURE OF INCIDENT:

RESPONSE ACTIONS:

REQUIRED FOLLOW UP ACTIONS:

ROOT CAUSE / LESSONS LEARNED:

CONTACTS MADE:

GLOBAL REMEDIATION Response Team	GLOBAL REMEDIATION Investigation Team	Route To:
______	______	Involved Employee ☐
______	______	Employee's Supervisor ☐
______	______	Law ☐
______	______	GLOBAL REMEDIATION Safety Advisor ☐
______	______	System Steward ☐
______	______	

PREPARED BY ______ DATE ______

APPENDIX R

Medical Data Sheet

MEDICAL DATA SHEET

This form must be completed by all on-site personnel prior to the commencement of activities, and shall be kept by the Site Health and Safety Officer during site activities. This form must be delivered to any attending physician when medical assistance is needed.

(This form should be typed or printed legibly.)

Site: ______________________________

Name: ______________________ Home Telephone: ______________________
(Area Code/Telephone Number)

Address: ______________________________

Date of Birth: ______________ Height: ______________ Weight: ______________

Emergency Contact: ______________________ Telephone: ______________________
(Area Code/Telephone Number)

Drug Allergies or Other Allergies: ______________________________

____

Previous Illnesses or Exposures to Hazardous Substances: ______________________________

____

____

Current Medication (Prescription and Non-Prescription): ______________________________

____

____

Medical Restrictions: ______________________________

____

Name, Address and Telephone Number of Person Physician: ______________________________

____

APPENDIX S

Material Safety Data Sheets

Safety Data Sheet

Benzene

Division of Safety
National Institutes
of Health

WARNING!

THIS COMPOUND IS ACUTELY TOXIC, CARCINOGENIC, EMBRYOTOXIC, AND MUTAGENIC. IT IS READILY ABSORBED BY VARIOUS BODY TISSUES THROUGH THE SKIN AND RESPIRATORY AND INTESTINAL TRACTS AND TRANSPLACENTALLY. IT MAY IRRITATE THE EYES, MUCOUS MEMBRANES, AND LUNGS. AVOID FORMATION AND BREATHING OF AEROSOLS OR VAPORS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER. AVOID WASHING WITH SOLVENTS. AVOID RUBBING OF SKIN OR INCREASING ITS TEMPERATURE.

BENZENE IS FLAMMABLE AND EXPLOSIVE. KEEP AWAY FROM SPARKS AND OPEN FLAMES. IN CASE OF FIRE, USE CARBON DIOXIDE OR DRY CHEMICAL EXTINGUISHER.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DO NOT INDUCE VOMITING. DRINK MILK OR WATER. REFER FOR GASTRIC LAVAGE. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN.

IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS OR VAPORS. USE ABSORBENT PAPER TO MOP UP SPILL. AFTER THE RESIDUE HAS EVAPORATED, WASH DOWN AREA WITH WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY. MONITOR LABORATORY AIR AND CHECK FOR BENZENE RESIDUES AFTER CLEANUP.

Issued: 10/88

Prepared by the Environmental
Control and Research Program

A. Background

Benzene is a clear, colorless, volatile, highly flammable liquid. It is moderately toxic in animals and man and is carcinogenic, embryotoxic, and mutagenic. Benzene is used in the manufacture of many organic compounds, artificial leather, varnishes, lacquer, and other products. However, because of stringent governmental restrictions on occupational exposure to benzene, its industrial use is being curtailed; where possible, substitute solvents are sought.

The permissible exposure limit is 1 ppm as an 8-hour time-weighted average; the short-term exposure limit is 5 ppm averaged over any 15 minute period (Federal Register, 1987). The current threshold limit value for benzene is 10 ppm (ACGIH, 1988). IARC (1982), p. 97 lists official exposure limits imposed by various countries.

Recent reviews of the chemical and biological properties of benzene include IARC (1982), Mehlman (1983), and Aksoy (1988a).

B. Chemical and Physical Data

1. Chemical Abstract No.: 71-43-2

2. Synonyms:[A]

    Phene
    Benzol
    Benzole
    Pyrobenzol
    Pyrobenzole
    Phenylhydride
    Cyclohexatriene
    Bicarburet of hydrogen

3. Molecular

    formula:
    C_6H_6

    weight:
    78.11

    structure:

4. Density: Liquid, 0.8787 g/cm^3 at 15°C relative to water at 4°C; vapor, 2.7 (air = 1.0).

5. Absorption spectroscopy: UV (C_2H_5OH): λ (log ε) = 243 (2.2), 249 (2.3), 256 (2.4), and 261 (2.2). Infrared (Robinson, 1974) and mass (Monahan and Stanton, 1962) spectra have been reported.

"Benzin," "benzine," and "petroleum benzin" are terms used for a mixture of low-boiling aliphatic hydrocarbons and should not be confused with benzene.

6. Volatility: Vapor pressure, 74.6 mm Hg at 20°C. (For vapor pressures below and above 1 atmosphere, see pages D-201 and D-212, respectively, in Weast, 1988.)

7. Solubility: Water, 0.8 parts per 1,000 by weight at 20°C; miscible with ethanol, ether, acetone, chloroform, carbon disulfide, glacial acetic acid, and oils.

8. Description: Clear, colorless, volatile liquid.

9. Boiling point: 80.1°C.

   Melting point: 5.5°C.

10. Stability: Stable at normal temperatures; highly flammable.

11. Chemical reactivity: Benzene has relatively low reactivity; it is reduced (to cyclohexane) and oxidized (ring cleavage) only under very stringent conditions. It is, however, subject to substitution reactions such as nitration, sulfonation, halogenation, alkylation, and acylation in the presence of suitable catalysts. For a general review, see standard textbooks (e.g., p. 337 ff, Morrison and Boyd, 1973).

12. Flash point: -11.1°C (closed cup).

13. Autoignition temperature: 538°C.

14. Explosive limits in air: 1.4 - 7.1%.

Fire, Explosion, and Reactivity Hazard Data

1. Use dry chemical fire extinguisher. Fire-fighting personnel should wear air-supplied respirators will full-face masks.

2. Benzene is flammable and its vapors in air can form explosive mixtures (see above).

3. No other conditions contributing to instability are known.

4. No hazardous decomposition products have been identified.

5. Do not expose to sparks or open flames. Use nonspark tools and equipment.

Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The NIH Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving benzene.

It should be emphasized that this data sheet and the NIH Guidelines are intended as starting points for the implementation of good laboratory practices when using this compound. The practices and procedures described in the following sections pertain to the National Institutes of Health and may not be universally applicable to other institutions. Administrators and/or researchers at other institutions should modify the following items as needed to reflect their individual management system and current occupational and environmental regulations.

Benzene penetrates various glove materials (Sansone and Tewari, 1978). This factor should be taken into account when handling materials or equipment containing benzene.

1. Chemical inactivation: No validated method reported.

2. Decontamination: Turn off equipment that could be affected by benzene or the materials used for cleanup. If there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Use absorbent paper to mop up spill. After the residue has evaporated, wash with copious quantities of water. Glassware should be rinsed (in a hood) with ethanol, followed by soap and water. Animal cages should be washed with water.

3. Disposal: No waste streams containing benzene shall be disposed of in sinks or general refuse. Surplus benzene or chemical waste streams contaminated with benzene shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Nonchemical waste (e.g., animal carcasses and bedding) containing benzene shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing benzene shall be packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with benzene shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g., associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing benzene shall be handled in accordance with the NIH radioactive waste disposal system.

4. Storage: Store in sealed ampoules or in bottles with caps with polyethylene cone liners inside a sealed secondary container. This should be kept in a solvent storage cabinet or explosion-safe refrigerator. Store working quantities of benzene and its solutions in an explosion-safe refrigerator in the work area.

E. Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. Sampling: The procedure for air sampling recommended by the Intersociety Committee on Methods for Air Sampling and Analysis (Sawicki et al., 1975) and NIOSH (1977) is adsorption on

charcoal and desorption with carbon disulfide. Because of the toxicity and flammability of CS_2, as well as its unsuitability when electron capture or photoionization detectors are used in conjunction with gas chromatography, silica gel or commercial polymers with elution by methanol or ethanol have been proposed as substitutes (van Tassel et al., 1981). Methods for the extraction of blood (Snyder et al., 1975) and tissue (Snyder et al., 1977) for subsequent gas chromatographic analysis have been published.

2. Analysis: Methods of analysis have been reviewed (Snyder, 1977; Ikeda and Okuno, 1988); IARC (1982, p. 107) provides an overview of methods through 1980. The method of choice is gas chromatography with a variety of detectors. Special high-pressure liquid chromatographic methods have been developed for the separation and quantitation of benzene metabolites for pharmacokinetic studies (Greenlee et al., 1981; Sabourin et al., 1988a).

Biological Effects (Animal and Human)

1. Absorption: Benzene is absorbed readily by inhalation, ingestion, and parenteral injection. Percutaneous absorption used to be considered as slight but has recently been shown (in hairless mice) to contribute a significant portion of the total absorbed dose (Susten et al., 1985).

2. Distribution and pharmacokinetics: On inhalation of benzene by animals, the 40-50% amount retained (the rest being exhaled unchanged) is transported by the blood (preferentially, the red cells) to the liver, bone marrow, and tissues with high lipid content where it is subsequently metabolized (Schrenk et al., 1941). Excretion in the lungs follows a biphasic pattern, suggesting a two-compartment model for distribution, in the rat (Rickert et al., 1979). Similar results were found in humans where, however, a three-compartment model is indicated (Srbova et al., 1950; Berlin et al., 1979).

3. Metabolism and excretion: Schemes of the metabolic pathways of benzene have been depicted (Pellack-Walker et al., 1985; Kalf et al., 1987; and Cooper and Snyder, 1988 among others). Essentially they consist of oxidation to phenol (probably via benzene epoxide) and further by two pathways either to hydroquinone and benzoquinone, or to catechol and 1,2,4benzene triol. These are excreted in the urine as glucuronides and sulfates. In addition, benzene is also excreted in the urine unchanged, the relative amounts of benzene and metabolites depending on the amount administered since the capacity of mammalian liver to oxidize benzene is limited (Sabourin et al., 1987, 1988b). A further excretion product, transmuconic acid, is the result of oxidative opening of the catechol ring. This oxidation has been demonstrated in liver and bone marrow and is mediated by cytochrome P-450 or reactive oxygen species.

Further details are discussed in IARC (1982) and the above-named references.

4. Toxic effects: The acute oral LD50 of benzene in the mouse and rat has been reported as 3-5 g/kg. The inhalation LC50 in these species is 10,000 ppm for a 7-hour exposure. The target organ for acute poisoning is mainly the central and peripheral nervous system, and this poisoning results in muscle tremors, convulsions, salivation, nystagmus, and asphyxiation due to paralysis of the respiratory center. Chronic poisoning effects in man have been summarized as follows: "The net effect in the human is a disease characterized by gradual decreases in white cell levels, among which the granulocytes are most severely affected, but decreases in lymphocytes, the form more sensitive in rodents, are also affected. Red cell and platelet levels may also fall ... Reason for pancytopenia is severe bone marrow damage and the disease is called aplastic anemia" (Snyder, 1984).

   These toxic effects have been reviewed in detail by van Raalte and Grasso (1982) and Aksoy (1988b). The biochemical basis for these toxic actions appears to be covalent binding of benzene metabolites to nucleic acids and protein in liver, and inhibition of thymidine uptake in bone marrow DNA (Cooper and Snyder, 1988).

5. Carcinogenic effects: IARC (1982) summarizes its extensive review of the literature as follows: "There is limited evidence that benzene is carcinogenic in experimental animals... There is sufficient evidence that benzene is carcinogenic to man." The evidence has been further reviewed and updated by Aksoy (1988c). Oral administration or inhalation of benzene in BD Wistar rats and Swiss mice results in carcinomas of the Zymbal glands, oral and nasal cavity, skin, forestomach and mammary glands, hepatomas and pulmonary tumors (Maltoni et al., 1985).

6. Mutagenic and teratogenic effects: Benzene is not mutagenic in the Ames test or in the *E. coli* DNA repair test (DeFlora et al., 1984; Rexroat and Probst, 1985). Evidence to date indicates that benzene is not teratogenic in doses which are fetotoxic and embryolethal. *In vitro* studies on human lymphocytes have demonstrated sister chromatid exchanges on exposure to benzene, but potency in this respect is far lower than that of benzene metabolites (Erexson et al., 1985).

Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash skin with soap and water. Skin should not be rinsed with organic solvents. Since benzene is readily absorbed through the skin, avoid rubbing of skin or increasing its temperature. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes. Obtain ophthalmological evaluation.

2. Ingestion: Drink plenty of water or milk. Do not induce vomiting. (Vomiting might re-expose the mouth and esophagus.) Refer for gastric lavage.

3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.

4. Refer to physician at once. Consider treatment for pulmonary irritation.

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Material Safety Data Sheets Collection:
Sheet No. 317
Toluene
Issued: 8/79 Revision: E, 9/92 Errata: 2/94

Section 1. Material Identification

Toluene ($C_6H_5CH_3$) Description: Derived from petroleum i.e., dehydrogenation of cycloparaffin fractions followed by the aromatization of saturated aromatic hydrocarbons or by fractional distillation of coal-tar light oil and purified by rectification. Used widely as a solvent (replacing benzene in many cases) for oils, resins, adhesives, natural rubber, coal tar, asphalt, pitch, acetyl celluloses, cellulose paints and varnishes; a diluent for photogravure inks, raw material for organic synthesis (benzoyl & benzilidene chlorides, saccharine, TNT, toluene diisocyanate, and many dyestuffs), in aviation and high octane automobile gasoline, as a nonclinical thermometer liquid and suspension solution for navigational instruments.

Other Designations: CAS No. 108-88-3, Methacide, methylbenzene, methylbenzol, phenylmethane, toluol, Tolu-sol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Toluene is an eye, skin, and respiratory tract irritant becoming narcotic at high centrations. Liver and kidney damage has occurred. Pregnant women chronically exposed to toluene have shown teratogenic effects. Toluene is highly flammable.

R 1
I 3
S 2*
K 3
* Skin absorption

NFPA
3
2 0
-

HMIS
H 2- Chronic effects
F 3
R 0
PPE-Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Toluene, < 100%: may contain a small amount of benzene (~ 1%), xylene, and nonaromatic hydrocarbons.

1991 OSHA PELs
8-hr TWA: 100 ppm (375 mg/m³)
15-min STEL: 150 ppm (560 mg/m³)

1990 IDLH Level
2000 ppm

1990 NIOSH RELs
TWA: 100 ppm (375 mg/m³)
STEL: 150 ppm (560 mg/m³)

1992-93 ACGIH TLV (Skin)
TWA: 50 ppm (188 mg/m³)

1990 DFG (Germany) MAK*
TWA: 100 ppm (380 mg/m³)
Half-life: 2 hr to end of shift
Category II: Substances with systemic effects
Peak Exposure Limit: 500 ppm, 30 min average value, 2/shift

1985-86 Toxicity Data†
Man, inhalation, TC_{Lo}: 100 ppm caused hallucinations, and changes in motor activity and changes in psychophysiological tests.
Human, oral, LD_{Lo}: 50 mg/kg: toxic effects not yet reviewed
Human, eye: 300 ppm caused irritation.
Rat, oral, LD_{50}: 5000 mg/kg
Rat, liver: 30 µmol/L caused DNA damage.

* Available information suggests damage to the developing fetus is probable.
†See NIOSH, *RTECS* (XS5250000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 232 F (110.6 C)
Melting Point: -139 F (-95°C)
Molecular Weight: 92.15
Density: 0.866 at 68 F (20/4 C)
Surface Tension: 29 dyne/cm at 68 F (20 C)
Viscosity: 0.59 cP at 68 F (20 C)
Refraction Index: 1.4967 at 20 C/D
Water Solubility: Very slightly soluble, 0.6 mg/L at 68 F (20 C)
Other Solubilities: Soluble in acetone, alcohol, ether, benzene, chloroform, glacial acetic acid, petroleum ether, and carbon disulfide.
Vapor Pressure: 22 mm Hg at 68 F (20 C); 36.7 mm Hg at 86 F (30 C)
Saturated Vapor Density (Air = 0.075 lb/ft³ or 1.2 kg/m³): 0.0797 lb/ft³ or 1.2755 kg/m³
Odor Threshold (range of all referenced values): 0.021 to 69 ppm

Appearance and Odor: Colorless liquid with a sickly sweet odor.

Section 4. Fire and Explosion Data

Flash Point: 40 F (4.4 C) CC	**Autoignition Temperature:** 896 F (480 C)	**LEL:** 1.27% v/v	**UEL:** 7.0% v/v

Extinguishing Media: Toluene is a Class 1B flammable liquid. To fight fire, use dry chemical carbon dioxide, or 'alcohol-resistant' foam. Water spray may be ineffective as toluene floats on water and may actually spread fire. **Unusual Fire or Explosion Hazards:** Concentrated vapors are heavier than air and may travel to an ignition source and flash back. Container may explode in heat of fire. Toluenes' burning rate = 5.7 mm/min and its flame speed = 37 cm/sec. Vapor poses an explosion hazard indoors, outdoors, and in sewers. May accumulate static electricity. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing provides only limited protection. Apply cooling water to sides of tanks until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from fire and let burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire because a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Toluene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization can't occur. **Chemical Incompatibilities:** Strong oxidizers, concentrated nitric acid, nitric acid + sulfuric acid, dinitrogen tetroxide, silver perchlorate, bromine trifluoride, tetranitromethane, and 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione. **Conditions to Avoid:** Contact with heat, ignition sources, or incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of toluene can produce carbon dioxide, and acrid, irritating smoke.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list toluene as a carcinogen. **Summary of Risks:** Toluene is irritating to the eyes, nose, and respiratory tract. Inhalation of high concentrations produces a narcotic effect sometimes leading to coma as well as liver and kidney damage. 93% of inhaled toluene is retained in the body of which 80% is metabolized to benzoic acid, then to hippuric acid and excreted in urine. The remainder is metabolized to *o*-cresol and excreted or exhaled unchanged. Toluene metabolism is inhibited by alcohol ingestion and is synergistic with benzene, asphalt fumes, or chlorinated hydrocarbons (i.e. perchloroethylene). Toluene is readily absorbed through the skin at 14 to 23 mg/cm²/hr. Toluene is absorbed quicker during exercise than at rest and appears to be retained longer in obese versus thin victims; presumably due to its lipid solubility. There is inconsistent data on toluene's ability to damage bone marrow; chronic poisoning has resulted in anemia and leucopenia with biopsy showing bone marrow hypo-plasia. These reports are few and some authorities argue that the effects may have been due to benzene contaminants. Chronic inhalation during pregnancy has been associated with teratogenic effects on the fetus including microcephaly, CNS dysfunction, attentional deficits, developmental delay + language impairment, growth retardation, and physical defects including a small midface, short palpebral fissures, with deep-set eyes, low-set ears, flat nasal bridge with a small nose, micrognathia, and blunt fingertips. There is some evidence that toluene illness in which the body produces antibodies that cause inflammation of its own kidney.

Continue on next page

ection 6. Health Hazard Data

edical Conditions Aggravated by Long-Term Exposure: Alcoholism and CNS, kidney, skin, or liver disease. **Target Organs:** CNS, liver, ney, skin. **Primary Entry Routes:** Inhalation, skin contact/absorption. **Acute Effects:** Vapor inhalation causes respiratory tract irritation, fatigue. akness, confusion. dizziness. headache. dilated pupils, watering eyes, nervousness, insomnia, parasthesis, and vertigo progressing to narcotic coma. eath may result from cardiac arrest due to ventricular fibrillation with catecholamines loss. Liquid splashed in the eye causes conjunctival irritation, ansient corneal damage and possible burns. Prolonged skin contact leads to drying and fissured dermatitis. Ingestion causes GI tract irritation and nptoms associated with inhalation. **Chronic Effects:** Symptoms include mucous membrane irritation, headache, vertigo, nausea, appetite loss and ohol intolerance. Repeated heavy exposure may result in encephalopathies (cerebellar ataxia and cognitive dysfunction), liver enlargement, and dney dystrophy (wasting away). Symptoms usually appear at workdays end. worsen at weeks end and decrease or disappear over the weekend.

IRST AID **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding ounts of water until transported to an emergency medical facility. Consult an ophthalmologist immediately. **Skin:** *Quickly* remove contaminated thing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. **Inhalation:** Remove exposed person to esh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control enter and unless otherwise advised. have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting because of nger of aspiration into the lungs. Gastric lavage may be indicated if large amounts are swallowed: potential toxicity needs to be weighed against piration risk when deciding for or against gastric lavage. **Note to Physicians:** Monitor cardiac function. If indicated, use epinephrine and other techolamines carefully, because of the possibility of a lowered myocardial threshold to the arrhythmogenic effects of such substances. Obtain CBC, lectrolytes, and urinalysis. Monitor arterial blood gases. If toluene has > 0.02% (200 ppm) benzene, evaluate for potential benzene toxicity. BEI: ppuric acid in urine. sample at shift end (2.5 g/g creatinine): Toluene in venous blood, sample at shift end (1.0 mg/L).

ection 7. Spill, Leak, and Disposal Procedures

pill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel protect against inhalation and skin/eye contact. Use water spray to cool and disperse vapors but it may not prevent ignition in closed spaces. Cellosolve, hycar absorbent materials, and uorocarbon water can also be used for vapor suppression/containment. Take up small spill with earth, sand, vermiculite, or other absorbent, ncombustible material. Dike far ahead of large spills for later reclamation or disposal. For water spills, (10 ppm or greater) apply activated carbon at 0X the spilled amount and remove trapped material with suction hoses or use mechanical dredges/lifts to remove immobilized masses of pollutants and precipitates. Toluene can undergo fluidized bed incineration at 842 to 1796 F (450 to 980 C), rotary kiln incineration at 1508 to 2912 F (820 to 600 C), or liquid injection incineration at 1202 to 2912 F (650 to 1600 C). Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity alues:** Blue gill, LC_{50} = 17 mg/L/24 hr; shrimp (*Crangonfracis coron*), LC_{50} = 4.3 ppm/96 hr; fathead minnow (*Pimephales promelas*), LC_{50} = 36.2 g/L/96 hr. **Environmental Degradation:** If released to land, toluene evaporates and undergoes microbial degradation. In water, toluene volatilizes and biodegrades with a half-life of days to several weeks. In air, toluene degrades by reaction with photochemically produced hydroxyl radicals.

isposal: Treat contaminated water by gravity separation of solids, followed by skimming of surface. Pass through dual media filtration and carbon bsorption units (carbon ratio 1 kg to 10 kg soluble material). Return waste water from backwash to gravity separator. Contact your supplier or a censed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

isted as a RCRA Hazardous Waste (40 CFR 261.33): No. U220
ARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
isted as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg)
[* per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307 (a)]
isted as a SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

ection 8. Special Protection Data

oggles: Wear protective eyeglasses with shatter-resistant glass and side-shields or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional dvice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-pproved respirator. For < 1000 ppm, use any chemical cartridge respirator with appropriate organic vapor cartridges, any supplied-air respirator (SAR), or SCBA. For < 2000 ppm, use any SAR operated in continuous-flow mode, any SAR or SCBA with a full facepiece, or any air-purifying respirator with a full facepiece having a chin-style, front or back mounted organic vapor canister. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* f respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polyvinyl alcohol with a breakthrough time of > 8 hr, Teflon and Viton are recommended as suitable materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103) **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove toluene from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from ignition sources and incompatibles. Outside or detached storage is preferred. If stored inside, use a standard flammable liquids warehouse, room, or cabinet. To prevent static sparks, electrically ground and bond all equipment used with toluene. Do not use open lights in toluene areas. Install Class I, Group D electrical equipment. Check that toluene is free of or contains < 1% benzene before use. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Adopt controls for confined spaces (29 CFR 1910.146) if entering areas of unknown toluene levels (holes, wells, storage tanks). Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, liver, kidney, and skin. Include hemocytometric and thrombocyte count in cases where benzene is a contaminant of toluene. Monitor air at regular intervals to ensure effective ventilation.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Toluene
DOT Hazard Class: 3
ID No.: UN1294
DOT Packing Group: II
DOT Label: Flammable Liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 150
b) Non-bulk Packaging: 202
c) Bulk Packaging: 242

Quantity Limitations
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements
Vessel Stowage: B
Other: --

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 140, 148, 153, 159, 163, 164, 167, 169, 171, 174, 175, 176, 180.

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, CIH, MPH; **Medical Review:** AC Darlington, MD, MPH

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Material Safety Data Sheets Collection:

Sheet No. 385
Ethylbenzene

Issued: 8/78 Revision: B, 9/92

Section 1. Material Identification

Ethylbenzene ($C_6H_5C_2H_5$) Description: Derived by heating benzene and ethylene in presence of aluminum chloride with subsequent distillation, by fractionation directly from the mixed xylene stream in petroleum refining, or dehydrogenation of naphthenes. Used as a solvent, an antiknock agent in gasoline; and as an intermediate in production of synthetic rubber, styrene, cellulose acetate, diethylbenzene, acetophenone, ethyl anthraquinone, propyl oxide, and α-methylbenzol alcohol.

Other Designations: CAS No. 100-41-4, ethylbenzol, EB, phenylethane, NCI-C56393.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 3
S 2*
K 4
* Skin absorption

NFPA

HMIS
H 2†
F 3
R 0
PPE - Sec. 8
† Chronic effects

Cautions: Ethylbenzene is a skin and mucous membrane irritant considered the most irritating of the benzene series. Inhalation causes acute and chronic central nervous system (CNS) effects. It is highly flammable and forms explosive mixtures with air.

Section 2. Ingredients and Occupational Exposure Limits

Ethylbenzene, ca >99.0%. Impurities include ~ 0.1% *meta & para* xylene, ~ 0.1% cumene, and ~ 0.1% toluene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m^3)
15-min STEL: 125 ppm (545 mg/m^3)
Action Level: 50 ppm (217 mg/m^3)

1990 IDLH Level
2000 ppm

1990 NIOSH REL
TWA: 100 ppm (435 mg/m^3)
STEL: 125 ppm (545 mg/m^3)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m^3)
STEL: 125 ppm (545 mg/m^3)

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m^3)
Category 1: local irritants
Peak Exposure Limit: 200 ppm, 5 min momentary value, max of 8/shift
Danger of cutaneous absorption

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 100 ppm/8 hr caused eye effects, sleep, and respiratory changes.
Human, lymphocyte: 1 mmol/L induced sister chromatid exchange.
Rat, oral, LD_{50}: 3500 mg/kg; toxic effects not yet reviewed
Rat (female), inhalation, TC_{Lo}: 1000 ppm/7 hr/day, 5 days/wk, for 3 wk prior to mating and daily for 19 days of gestation produced pups with high incidence of extra ribs.(179)

* See NIOSH, *RTECS* (DA0700000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 277 F (136 C)
Melting Point: -139 F (-95 C)
Surface Tension: 31.5 dyne/cm
Ionization Potential: 8.76 eV
Viscosity: 0.64 cP at 77 F (25 C)
Refraction Index: 1.4959 at 68 F (20 C)
Relative Evaporation Rate (ether = 1): 0.0106
Bulk Density: 7.21 lb/Gal at 77 F (25 C)
Critical Temperature: 651 F (343.9 C)
Critical Pressure: 35.6 atm
Molecular Weight: 106.16
Density: 0.863 at 77 F (25 C)
Water Solubility: Slightly, 14 mg/100 mL at 59 F (15 C)
Other Solubilities: Miscible in alcohol, ether; soluble in carbon tetrachloride, benzene, sulfur dioxide, and many organic solvents; insoluble in ammonia
Odor Threshold: 2.3 ppm
Vapor Pressure: 7.1 mm Hg at 68 F (20 C); 10 mmHg at 78.62 F (25.9 C); 100 mm Hg 165.38 F (74.1 C)
Saturated Vapor Density (Air = 0.075 lb/ft^3 or 1.2 kg/m^3): 0.0768 lb/ft^3 or 1.2298 kg/m^3

Appearance and Odor: Colorless, flammable liquid with a pungent odor.

Section 4. Fire and Explosion Data

Flash Point: 64 F (18 C) CC	**Autoignition Temperature:** 810 F (432 C)	**LEL:** 1.0% v/v	**UEL:** 6.7% v/v

Extinguishing Media: Class 1B Flammable liquid. For small fires, use dry chemical, carbon dioxide, or 'alcohol-resistant' foam. For large fires, use fog or 'alcohol-resistant' foam. Use water only if other agents are unavailable; EB floats on water and may travel to an ignition source and spread fire. **Unusual Fire or Explosion Hazards:** Burning rate = 5.8 mm/min. Vapors may travel to an ignition source and flash back. Container may explode in heat of fire. EB poses a vapor explosion hazard indoors, outdoors, and in sewers. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Cool container sides with water until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Withdraw immediately if you hear rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Ethylbenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Reacts vigorously with oxidizers.

Conditions to Avoid: Exposure to heat and oxidizers.

Hazardous Products of Decomposition: Thermal oxidative decomposition of EB can produce acrid smoke and irritating fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list EB as a carcinogen. **Summary of Risks:** Occupational exposure to EB alone is rare since it is usually present together with other solvents. EB is irritating to the eyes, skin, and respiratory tract. Vapor inhalation produces varying degrees of CNS effects depending on concentration. The liquid is absorbed through the skin but vapors are not. 56 to 64% of inhaled ethylbenzene is retained and metabolized. Urinary metabolites following exposure to 23 to 85 ppm for 8 hr are mandelic acid (64%), phenylglyoxylic acid (25%), and methylphenylcarbinol/1-phenyl ethanol (5%). Concurrent exposure to xylene and ethylbenzene causes slower excretion of EB metabolites. Based on the rat LD_{50}, one manufacturer gives 3 to 4 oz. as the lethal dose for a 100 lb person.

Continue on next page

Section 6. Health Hazard Data

edical Conditions Aggravated by Long-Term Exposure: Skin and CNS diseases and impaired pulmonary function (especially obstructive way disease). **Target Organs:** Eyes, respiratory system, skin, CNS, blood. **Primary Entry Routes:** Inhalation, skin and eye contact. **Acute** ffects: Vapor inhalation of 200 ppm caused transient eye irritation; 1000 ppm caused eye irritation with profuse watering (tolerance developed apidly); 2000 ppm caused severe and immediate eye irritation and watering, nasal irritation, chest constriction, and vertigo; 5000 ppm was olerable and caused eye and nose irritation. Inhalation of high concentrations may cause narcosis, cramps, and death due to respiratory paralysis. kin exposed to pure ethylbenzene for 10 to 15 min absorbed 22 to 33 mg/cm^2/hr. Immersion of hand in solutions of 112 & 156 mg/L for 1 hr sorbed 118 & 215.7 µg/cm^2/hr, respectively. **Chronic Effects:** Repeated skin contact may cause dryness, scaling, and fissuring. Workers chronically exposed to > 100 ppm complained of fatigue, sleepiness, headache, and mild irritation of the eyes and respiratory tract. Repeated vapor inhalation may result in blood disorders, particularly leukopenia (abnormally low level of white blood cells) and lymphocytosis.

IRST AID

yes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **nhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or onvulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting! Aspiration of even a small amount of EB in vomitus can cause severe damage since its low viscosity and surface tension will cause it to spread over a large area of the lung tissue.

fter first aid, get appropriate in-plant, paramedic, or community medical support.

ote to Physicians: BEI = mandelic acid in urine (1.5 g/g of creatinine), sample at end of shift at workweeks end. Since this test is not specific, st for EB in expired air for confirmation.

Section 7. Spill, Leak, and Disposal Procedures

pill/Leak: Notify safety personnel. Isolate and ventilate area, deny entry and stay upwind. Shut off all ignition sources. Cleanup personnel should rotect against vapor inhalation and skin/eye contact. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container. Dike far ahead of large spill for later reclamation or disposal. Report any release >1000 lb. Follow applicable SHA regulations (29 CFR 1910.120). **Environmental Transport:** If released to soil, EB partially evaporates into the atmosphere, with a half-life f hrs to wks, and some leaches into groundwater, especially in soil with low organic carbon content. Biodegradation occurs with a half-life of 2 ays. Some EB may absorb to sediment or bioconcentrate in fish. Evidence points to slow biodegradation in groundwater. In air, it reacts with photochemically produced hydroxyl radicals with a half-life of hrs to 2 days. Additional amounts may be removed by rain. **Ecotoxicity Values:** Shrimp (*Mysidopsis bahia*), LC_{50} = 87.6 mg/L/96 hr; sheepshead minnow (*Cyprinodon variegatus*) LC_{50} = 275 mg/L/96 hr; fathead minnow (*Pimephales promelas*) LC_{50} = 42.3 mg/L/96 hr in hard water & 48.5 mg/L/96 hr in softwater. **Disposal:** A candidate for rotary kiln incineration at 508 to 2912 F (820 to 1600 C), liquid injection incineration at 1202 to 2912 F (650 to 1600 C), and fluidized bed incineration at 842 to 1796 F (450 to 980 C). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

PA Designations
isted as a RCRA Hazardous Waste (40 CFR 261.21): No. D001
isted as a SARA Toxic Chemical (40 CFR 372.65)
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311 (b)(4) & CWA, Sec. 307 (a)]

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because ontact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use a powered air-purifying respirator with an appropriate organic vapor cartridge, a supplied-air respirator (SAR), SCBA, or chemical cartridge respirator with appropriate organic vapor cartridge. For < 2000 ppm, use a SAR or SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made of Viton or polyvinylchloride to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103) **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in a cool, dry, well-ventilated area away from ignition sources and oxidizers. Outside or detatched storage is preferred. If inside, store in a standard flammable liquids cabinet. Containers should have flame-arrester or pressure-vacuum venting. To prevent static sparks, electrically ground and bond all equipment used with ethylbenzene. Install Class 1, Group D electrical equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain levels as low as possible. Purge and ventilate reaction vessels before workers are allowed to enter for maintenance or cleanup. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, skin, blood, and respiratory system.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Ethylbenzene
DOT Hazard Class: 3
ID No.: UN1175
DOT Packing Group: II
DOT Label: Flammable liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60 L
Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: —

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 153, 159, 162, 163, 164, 167, 168, 171, 176, 179

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 318
Xylene *(Mixed Isomers)*

Issued: 11/80 Revision: E, 9/92 Errata: 12/94

Section 1. Material Identification

Xylene (Mixed Isomers) (C_8H_{10}) Description: The commercial product is a blend of the three isomers [*ortho*-(*o*-), *meta*-(*m*-), *para*-(*p*-)] with the largest proportion being *m*-xylene. Xylene is obtained from coal tar, toluene by transalkylation, and pseudocumene. Used in the manufacture of dyes, resins, paints, varnishes, and other organics; as a general solvent for adhesives, a cleaning agent in microscope technique; as a solvent for Canada balsam microscopy; as a fuel component; in aviation gasoline, protective coatings, sterilizing catgut, hydrogen peroxide, perfumes, insect repellants, pharmaceuticals, and the leather industry; in the production of phthalic anhydride, isophthalic, and terephthalic acids and their dimethyl esters which are used in the manufacture of polyester fibers; and as an indirect food additive as a component of adhesives. Around the home, xylene is found as vehicles in paints, paint removers, degreasing cleaners, lacquers, glues and cements and as solvent/vehicles for pesticides.

Other Designations: CAS No. 1330-20-7 [95-47-6; 108-38-3; 106-42-3 (*o*-, *m*-, *p*-isomers)], dimethylbenzene, methyltoluene, NCI-C55232, Violet 3, xylol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 2
S 2
K 3

NFPA

HMIS
H 2
F 3
R 0
PPE ‡
† Chronic Effects
‡ Sec. 8

Cautions: Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

Section 2. Ingredients and Occupational Exposure Limits

Xylene (mixed isomers): the commercial product generally contains ~ 40% *m*-xylene; 20% each of *o*-xylene, *p*-xylene, and ethylbenzene; and small quantities of toluene. Unpurified xylene may contain pseudocumene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m^3)
15-min STEL: 150 ppm (655 mg/m^3)

1990 IDLH Level
1000 ppm

1990 NIOSH RELs
TWA: 100 ppm (435 mg/m^3)
STEL: 150 ppm (655 mg/m^3)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m^3)
STEL: 150 ppm (651 mg/m^3)
BEI (Biological Exposure Index): Methylhippuric acids in urine at end of shift: 1.5 g/g creatinine

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m^3)
Category II: Substances with systemic effects
Half-life: < 2 hr
Peak Exposure: 200 ppm, 30 min, average value, 4 peaks per shift

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 200 ppm produced olfaction effects, conjunctiva irritation, and other changes involving the lungs, thorax, or respiration.
Man, inhalation, LC_{Lo}: 10000 ppm/6 hr; toxic effects not yet reviewed.
Human, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted.
Rat, oral, LD_{50}: 4300 mg/kg; toxic effect not yet reviewed.
Rat, inhalation, LC_{50}: 5000 ppm/4 hr; toxic effects not yet reviewed.

* See NIOSH, *RTECS* (XE2100000), for additional toxicity data.

Section 3. Physical Data

Boiling Point Range: 279 to 284 F (137 to 140 C)*
Boiling Point: *ortho:* 291 F (144 C); *meta:* 281.8 F (138.8 C); *para:* 281.3 F (138.5 C)
Freezing Point/Melting Point: *ortho:* -13 F (-25 C); *meta:* -53.3 F (-47.4 C); *para:* 55 to 57 F (13 to 14 C)
Vapor Pressure: 6.72 mm Hg at 70 F (21 C)
Saturated Vapor Density (Air = 1.2 kg/m^3): 1.23 kg/m^3, 0.077 lbs/ft^3
Molecular Weight: 106.16
Specific Gravity: 0.864 at 20 C/4 C
Water Solubility: Practically insoluble
Other Solubilities: Miscible with absolute alcohol, ether, and many other organic liquids.
Octanol/Water Partition Coefficient: logKow = 3.12-3.20
Odor Threshold: 1 ppm
Viscosity: <32.6 SUS

Appearance and Odor: Clear, sweet-smelling liquid.

* Materials with wider and narrower boiling ranges are commercially available.

Section 4. Fire and Explosion Data

Flash Point: 63 to 77 F (17 to 25 C) CC
Autoignition Temperature: 982 F (527 C) (*m*-)
LEL: 1.1 (*m*-, *p*-); 0.9 (*o*-)
UEL: 7.0 (*m*-, *p*-); 6.7 (*o*-)

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), water spray or regular foam. For large fires, use water spray, fog or regular foam. Water may be ineffective. Use water spray to cool fire-exposed containers. **Unusual Fire or Explosion Hazards:** Xylene vapors or liquid (which floats on water) may travel to an ignition source and flash back. The heat of fire may cause containers to explode and/or produce irritating or poisonous decomposition products. Xylene may present a vapor explosion hazard indoors, outdoors, or in sewers. Accumulated static electricity may occur from vapor or liquid flow sufficient to cause ignition. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing will provide limited protection. If feasible and without risk, move containers from fire area. Otherwise, cool fire-exposed containers until well after fire is extinguished. Stay clear of tank ends. Use unmanned hose holder or monitor nozzles for massive cargo fires. If impossible, withdraw from area and let fire burn. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Xylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Xylene is easily chlorinated, sulfonated, or nitrated. **Chemical Incompatibilities:** Incompatibilities include strong acids and oxidizers and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin). Xylene attacks some forms of plastics, rubber, and coatings. **Conditions to Avoid:** Avoid heat and ignition sources and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of xylene can produce carbon dioxide, carbon monoxide, and various hydrocarbon products.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list xylene as a carcinogen. **Summary of Risks:** Xylene is an eye, mucous membrane, and respiratory tract irritant. Irritation starts at 200 ppm; severe breathing difficulties which may be delayed in onset can occur at high concentrations. It is a central nervous system (CNS) depressant and at high concentrations can cause coma. Kidney and liver damage can occur with xylene exposure. With prolonged or repeated cutaneous exposure, xylene produces a defatting dermatitis. Chronic toxicity is not well defined, but it is less toxic than benzene. Prior to the 1950s, benzene was often found as a contaminant of xylene and the effects attributed to xylene such as blood dyscrasias are questionable. Since the late 1950s, xylenes have been virtually benzene-free and blood dyscrasias have not been associated with xylenes. Chronic exposure to high concentrations of xylene in animal studies have demonstrated mild reversible decrease in red and white cell

Continue on next pag

ction 6. Health Hazard Data, *continued*

strual irregularity was reported in association with workplace exposure to xylene perhaps due to effects on liver metabolism. Xylene crosses the an placenta. but does not appear to be teratogenic under conditions tested to date. **Medical Conditions Aggravated by Long-Term Expo-** **Target Organs:** CNS. eyes. GI tract. liver. kidneys. and skin. : CNS. respiratory. eye. skin. gastrointestinal (GI) . liver and kidney disorders. mary **Entry Routes:** Inhalation, skin absorption (slight). eye contact. ingestion. **Acute Effects:** Inhalation of high xylene concentrations may e dizziness; nausea, vomiting, and abdominal pain; eye, nose, and throat irritation; respiratory tract irritation leading to pulmonary edema (fluid ng); drowsiness; and unconsciousness. Direct eye contact can result in conjunctivitis and corneal burns. Ingestion may cause a burning sensa- in the oropharynx and stomach and transient CNS depression. **Chronic Effects:** Repeated or prolonged skin contact may cause drying and atting of the skin leading to dermatitis. Repeated eye exposure to high vapor concentrations may cause reversible eye damage, peripheral and ral neuropathy, and liver damage. Other symptoms of chronic exposure include headache, fatigue. irritability, chronic bronchitis, and GI urbances such as nausea. loss of appetite, and gas.

ST AID *Emergency personnel should protect against exposure.* **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician nediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap water. For reddened or blistered skin. consult a physician. Carefully dispose of contaminated clothing as it may pose a fire hazard. **Inhalation:** hove exposed person to fresh air and support breathing as needed. Monitor exposed person for respiratory distress. **Ingestion:** Never give thing by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, *do not induce vomiting!* If ntaneous vomiting should occur. keep exposed person's head below the hips to prevent aspiration (breathing liquid xylene into the lungs). *iration of a few millimeters of xylene can cause chemical pneumonitis, pulmonary edema, and hemorrhage.* **Note to Physicians:** Hippuric acid he ether glucuronide of *ortho*-toluic acid may be useful in diagnosis of *meta-*, *para-* and *ortho*-xylene exposure. respectively. Consider gastric ge if a large quantity of xylene was ingested. Proceed gastric lavage with protection of the airway from aspiration; consider endotracheal ubation with inflated cuff.

ction 7. Spill, Leak, and Disposal Procedures

ll/Leak: Notify safety personnel, evacuate all unnecessary personnel. remove all heat and ignition sources. and ventilate spill area. Cleanup rsonnel should protect against vapor inhalation and skin or eye contact. If feasible and without undue risk, stop leak. Use appropriate foam to anket release and suppress vapors. Water spray may reduce vapor, but does not prevent ignition in closed spaces. For small spills, absorb on paper l evaporate in appropriate exhaust hood or absorb with sand or some non-combustible absorbent and place in containers for later disposal. For e spills dike far ahead of liquid to contain. Do not allow xylene to enter a confined space such as sewers or drains. On land, dike to contain or ert to impermeable holding area. Apply water spray to control flammable vapor and remove material with pumps or vacuum equipment. On ater, contain material with natural barriers. booms, or weirs; apply universal gelling agent; and use suction hoses to remove spilled material. port any release in excess of 1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** Little bioconcen- ion is expected. Biological oxygen demand 5 (after 5 days at 20 C): 0.64 (no stated isomer). **Ecotoxicity values:** LD_{50}, Goldfish, 13 mg/L/24 hr, ditions of bioassay not specified. no specific isomer. **Environmental Degradation:** In the atmosphere, xylenes degrade by reacting with otochemically produced hydroxyl radicals with a half-life ranging from 1-1.7 hr. in the summer to 10-18 hr in winter or a typical loss of 67-86% r day. Xylenes are resistant to hydrolysis. **Soil Absorption/Mobility:** Xylenes have low to moderate adsorption to soil and when spilled on land, l volatilize and leach into groundwater. **Disposal:** As a hydrocarbon. xylene is a good candidate for controlled incineration. Contact your supplier a licensed contractor for detailed recommendations. Follow applicable Federal. state. and local regulations.

A Designations
ARA Extremely Hazardous Substance (40 CFR 355): Not listed
isted as a SARA Toxic Chemical (40 CFR 372.65)
sted as a RCRA Hazardous Waste (40 CFR 261.33): No. U239, F003 (spent solvent)
sted as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4); per RCRA. Sec. 3001]

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

ection 8. Special Protection Data

oggles: Wear protective eyeglasses or chemical safety goggles. per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because ntact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. ollow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations >1000 om. use any chemical cartridge respirator with organic vapor cartridges; any powered. air-purifying respirator with organic vapor cartridges; any pplied-air respirator; or any self-contained breathing apparatus. For emergency or nonroutine operations (cleaning spills, reactor vessels, or orage tanks). wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* **Other:** Wear chemi- ally protective gloves, boots, aprons, and gauntlets to prevent all skin contact. With breakthrough times > 8 hr, consider polyvinyl alcohol and luorocarbon rubber (Viton) as materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concen- ations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by ontrolling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and ashing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing efore wearing. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good per- onal hygiene after using this material, especially before eating, drinking. smoking. using the toilet, or applying cosmetics.

ection 9. Special Precautions and Comments

Storage Requirements: Store in clearly labelled, tightly closed, containers in a cool, well-ventilated place, away from strong oxidizing materials and heat and ignition sources. During transferring operations, electrically ground and bond metal containers. **Engineering Controls:** To reduce otential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the west practical level. Use hermetically sealed equipment, transfer xylene in enclosed systems, avoid processes associated with open evaporating rfaces, and provide sources of gas release with enclosures and local exhaust ventilation. Use Class I, Group D electrical equipment. **Administra- tive Controls:** Establish air and biological monitoring programs and evaluate regularly. Consider preplacement and periodic medical examinations including a complete blood count, a routine urinalysis, and liver function tests. Consider hematologic studies if there is any significant contamination f the solvent with benzene. If feasible, consider the replacement of xylene by less toxic solvents such as petrol (motor fuel) or white spirit. Before arrying out maintenance and repair work, steam and flush all equipment to remove any xylene residues.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Xylenes
OT Hazard Class: 3
D No.: UN1307
DOT Packing Group: II
DOT Label: Flammable Liquid
pecial Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 173.150
b) Nonbulk Packaging : 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 5L
b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: –

ISDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 176, 180.
repared by: MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 735
Methyl Tertiary Butyl Ether

Issued: 11/90

Section 1. Material Identification

R	1
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S	2
K	4

Genium

HMIS
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PPG*
* Sec. 8

Methyl Tertiary Butyl Ether [(CH$_3$)$_4$CO] Description: Prepared by reacting isobutylene with a small amount of methanol. Used as an octane booster in gasoline (in concentrations of up to 11% by volume); as a chromatographic eluent, especially in HPLC; and medically to dissolve cholesterol gallstones. MTBE improves combustion efficacy by oxygenation and is primarily used in unleaded premium brands. MTBE is one of the top 50 chemicals produced in the US, and is currently used in about 10% of the nation's gasoline. As leaded gasoline is phased out, this percentage is expected to increase.

Other Designations: CAS No. 1634-04-4, MBE, methyl 1,1-dimethylethyl ether, (2,-methyl-2-propyl) methyl ether, 2-methoxy-2-methyl propane, 2-methyl-2-methoxy propane, MTBE, tert-butyl methyl ether.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

Cautions: *Extremely flammable*. MTBE is a mild skin and eye irritant that may cause dizziness and/or suffocation if inhaled.

Section 2. Ingredients and Occupational Exposure Limits

Methyl tertiary butyl ether, ca 100%

1989 OSHA PEL	1990-91 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data*
None established	None established	None established	Rat, oral, LD$_{50}$: 4 g/kg Rat, inhalation, LC$_{50}$: 23,576 ppm/4 hr

* See NIOSH, *RTECS* (KN5250000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: 131 F (55 C)
Melting Point: -166 F (-110 C)
Vapor Pressure: 245 mm Hg at 77 F (25 C)
Molecular Weight: 88.15
Specific Gravity (20 C/4 C): 0.7405
Water Solubility: 4.8 g/100 g
Appearance and Odor: A clear, colorless liquid with a slight hydrocarbon odor with a mild mint or terpene-like odor.

Section 4. Fire and Explosion Data

Flash Point: -18.4 F (-28 C)	Autoignition Temperature: 815 F (435 C)	LEL: 1.6% v/v	UEL: 8.4% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, halon, water spray, or alcohol foam as extinguishing media.

Unusual Fire or Explosion Hazards: MTBE is extremely flammable. Its vapors may explode if ignited in an enclosed area or travel to a source of ignition and flash back. At temperatures at or above flashpoint, MTBE can release vapors that form flammable mixtures.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and appropriate, required chemical protective clothing (including goggles, rubber over-clothing, gloves, and boots). If feasible, remove containers from fire-risk area. Otherwise, use water spray to cool fire-exposed containers. Be aware of runoff from fire control methods. Do not release to enclosed areas, sewers, or waterways due to the potential explosion and health hazard MTBE presents.

Section 5. Reactivity Data

Stability/Polymerization: MTBE is stable at room temperature in closed containers under normal storage and handling conditions. MTBE is unstable in acid solutions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: MTBE does not react with water or common materials. It is incompatible and unstable with strong oxidizing agents, strong acids, caustics, amines, aldehydes, ammonia, and chlorinated compounds.

Conditions to Avoid: Avoid all heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of MTBE can produce carbon dioxide (CO$_2$) and water vapor. Incomplete combustion can produce carbon monoxide, t-butyl formate, acetone, formic acid, and methyl radicals. If present in sufficient concentrations, these products of partial oxidation can pose serious health hazards.

Section 6. Health Hazard Data

Carcinogenicity: The NTP and IARC do not list MTBE as a carcinogen.
Summary of Risks: Data on MTBE ingestion and inhalation toxicity are based on animal studies. Human exposures are reported primarily with exposure to gasoline-MTBE mixtures and with use of MTBE in dissolving gall bladder stones by direct infusion. These reports reveal MTBE's primary anesthetic effect on the central nervous system (CNS). A progression of nausea, vomiting, and sedation followed by general anesthesia is noted with increasing exposure. A warm or burning sensation is reported with gall bladder instillation. Elevated liver function studies, duodenal inflammation, kidney failure, blood cell hemolysis, and foul breath odor are also noted with this procedure. Animal studies note primary irritation to the mucous membranes of the nose, throat, skin, and cornea. Aspiration of gasoline-MTBE mixtures may cause lung pneumonitis.
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Upper respiratory tract, central nervous system.
Primary Entry Routes: Inhalation, ingestion (gasoline-MTBE mixtures).
Acute Effects: Contact with the eyes or skin may cause irritaton or burning at high concentrations. Inhalation may result in nausea, vomiting, sedation and general anesthia (central nervous system and respiratory depression). Ingestion of MTBE may result in aspiration pneumonitis.
Chronic Effects: Chronic inhalation causes nasal and tracheal inflammation.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, consult a physician immediately. *Do not induce vomiting* due to the risk of aspiration pneumonitis. If individual is coughing or choking, aspiration may have already occurred; transport to an emergency medical facility.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Activated charcoal is not recommended for MTBE ingestion because of MTBE's poor absorbing qualities. Carefully observe patients for any development of systemic signs. If large quantities of MTBE were ingested, Syrup of Ipecac is preferable to lavage in an alert patient requiring emesis. If aspiration has occurred, obtain baseline chest x-ray and vital signs. Liver function studies may be indicated following substantial MTBE exposure. PFTs, chest x-rays, and supportive care may be necessary after aspiration exposures.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and skin or eye contact. Take up spilled material with noncombustible absorbent material and place in appropriate containers for disposal. For large spills, dike far ahead of spill to contain. Do not allow MTBE to enter enclosed areas (explosion) or waterways. MTBE is more water soluble than other gasoline components, so there may be a higher MBTE concentration in groundwater when there is a spill of gasoline-MTBE mixtures. It also has a moderate to high mobility in soil. MTBE is poorly biodegraded by microorganisms in activated sludge. Cleanup of groundwater contamination is difficult. When high air-to-water ratios are used, air stripping systems can remove MTBE. Products of atmospheric degradation include t-butyl formate, acetone, and methyl radicals. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations at levels that promote worker safety and productivity. A TWA of up to 3 ppm in air produced no adverse effects in workers at ARCO's MTBE manufacturing and transport facilities. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool well-ventilated area away from all heat and ignition sources. Outside or detached storage may be preferred. Protect containers against physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas.
Engineering Controls: Avoid inhalation of vapors and contact with skin or eyes. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid heat and ignition sources. Practice good personal hygiene and housekeeping procedures.

Transportation Data (49 CFR 172.102)
IMO Shipping Name: Methyl-tert-butyl ether
IMO Hazard Class: 3.2
ID No.: UN2398
IMO Label: Flammable liquid
IMDG Packaging Group: II

MSDS Collection **References:** 73, 103, 124, 136, 150, 151
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS

Material Safety Data Sheet

From Genium's Reference Collection

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GENIUM PUBLISHING CORP.

No. 624

NAPHTHALENE

Issued: November 1987

24

SECTION 1. MATERIAL IDENTIFICATION

Material Name: NAPHTHALENE

Description (Origin/Uses): Used as a moth repellant and in many industrial processes.

Other Designations: Naphthalin; Naphthene; Tar Camphor; $C_{10}H_8$; NIOSH *RTECS* No. QJ0525000; CAS No. 0091-20-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyer's Guide* (Genium ref. 73) for a list of suppliers.

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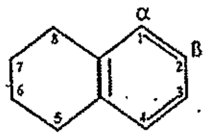
F 2
R 0
PPG*
*See sect. 8

R 1
I 4
S 1
K 2

SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	EXPOSURE LIMITS
Naphthalene, CAS No. 0091-20-3	ca 100	IDLH* Level: 500 ppm **ACGIH TLVs, 1987-88** TLV-TWA: 10 ppm, 50 mg/m^3 **OSHA PEL** 8-Hr TWA: 10 ppm, 50 mg/m^3 **Toxicity Data**** Child, Oral, LD_{Lo}: 100 mg/kg Man, Unknown, LD_{Lo}: 74 mg/kg Rat, Oral, LD_{50}: 1250 mg/kg



*Immediately dangerous to life and health
**See NIOSH *RTECS* for additional data with references to irritative, mutagenic, reproductive, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 424 F (218 C)
Vapor Density (Air = 1): 4.4
Vapor Pressure: 0.087 Torr at 77 F (25 C)
Water Solubility: Insoluble

Specific Gravity (H_20 = 1): 1.162 at 68 F (20 C)
Melting Point: 176 F (80 C)
Molecular Weight: 128 Grams/Mole
% Volatile by Volume: ca 100

Appearance and Odor: White crystalline flakes; strong coal tar odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
174 F (79 C) OC; 190 F (88 C) CC	979 F (526 C)	% by Volume	0.9	5.9

Extinguishing Media: Use water spray, dry chemical, or carbon dioxide to fight fires involving naphthalene. **Caution:** Foam or direct water spray applied to molten naphthalene may cause extensive foaming.

Unusual Fire or Explosion Hazards: Naphthalene is a volatile solid that gives off flammable vapor when heated (as in fire situations). This vapor is much denser than air and will collect in enclosed or low-lying areas like sumps. In these areas an explosive air-vapor mixture may form, and extra caution is required to prevent any ignition sources from starting an explosion or fire.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Naphthalene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Naphthalene is incompatible with strong oxidizing agents, chromic anhydride, and mixtures of aluminum trichloride and benzoyl chloride.

Conditions to Avoid: Ignition sources like open flame, unprotected heaters, excessive heat, lighted tobacco products, and electric sparks must not occur in work areas where naphthalene vapor may become concentrated.

Hazardous Products of Decomposition: Toxic gases like carbon monoxide are produced during fire conditions. Irritating, flammable vapor forms below the melting point because even solid naphthalene has a significant vapor pressure.

SECTION 6. HEALTH HAZARD INFORMATION

Naphthalene is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: Renal shutdown (kidney failure), hemolytic effects (breakdown of red blood cells), hematuria (blood in the urine), oliguria (low volume of urine), jaundice, eye damage, and depression of the central nervous system (CNS) are the primary health concerns associated with exposure to naphthalene. The ACGIH TLVs in section 2 are set to prevent eye damage. These recommended exposure limits may not be low enough to prevent blood changes in genetically hypersensitive individuals.
Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver, and kidneys. Administer medical exams emphasizing these organs. **Target Organs:** Eyes, skin, kidneys, liver, blood (red blood cell effects), and CNS.
Primary Entry: Inhalation, skin contact. **Acute Effects:** Inhalation of naphthalene vapor causes excitement, confusion, headache, nausea, and loss of appetite. **Chronic Effects:** Increased incidence of cataracts.

FIRST AID

Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes to remove particles.
Skin Contact: Immediately wash the affected area with soap and water.
Inhalation: Remove victim to fresh air; restore and/or support his breathing as needed.
Ingestion: Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Administer a gastric lavage followed by saline catharsis. Monitor blood and electrolytic balance. Other sources recommend giving the victim several glasses of water to drink.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all ignition sources immediately. Cleanup personnel need protection against contact and inhalation of vapor (see sect. 8). Contain large spills and collect waste. Use nonsparking tools to place naphthalene into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.
Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z)
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. U165
CERCLA Hazardous Substance, Reportable Quantity: 100 lbs (45.4 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Respirator usage must be in accordance with the OSHA regulations of 29 CFR 1910.134. IDLH or unknown concentrations require an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. Warning: Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.
Other Equipment: Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment to prevent skin contact. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems of sufficient power to maintain airborne levels of naphthalene below the OSHA PEL standard cited in section 2. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard: soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove and launder contaminated clothing before wearing it again; clean this material from shoes and equipment.
Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep this material off of your clothing and equipment. Avoid transferring this material from hands to mouth while eating, drinking, or smoking. Do *not* smoke, eat, or drink in any immediate work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store naphthalene in a cool, dry, well-ventilated area away from chemical incompatibles (see sect. 5).
Special Handling/Storage: Protect containers from physical damage. All bulk storage facilities must be built with an explosion-proof design. All containers used in shipping/transferring operations must be electrically grounded to prevent static sparks. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.
Comments: All operations with naphthalene must be done carefully to prevent accidental ignition of its flammable/explosive vapor. If the weather is warm, more naphthalene vapor forms and the potential for explosion increases. Do *not* smoke in any use or storage area!

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Naphthalene	**DOT ID No.** UN1334
DOT Hazard Class: ORM-A	**IMO Label:** Flammable Solid
IMO Class: 4.1	**DOT Label:** None

References: 1, 2, 12, 73, 84-94, 103. PJI

Approvals
Indust. Hygiene/Safety
Medical Review

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.

ETHYL ETHER

MSDS Number: E2340 --- *Effective Date: 10/15/97*

1. Product Identification

Synonyms: Ether; ether,anhydrous; Diethyl ether; 1,1'Oxybisethane;ethyl oxide; diethyl oxide
CAS No.: 60-29-7
Molecular Weight: 74.12
Chemical Formula: C2H5OC2H5
Product Codes:
J.T. Baker: 5487, 9244, 9248, 9250, 9251
Mallinckrodt: 0847, 0848, 0852

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Diethyl Ether	60-29-7	100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS

CENTRAL NERVOUS SYSTEM.

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

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

Potential Health Effects

Inhalation:
Irritant. General anesthesia by inhalation can occur. Continued exposure may lead to respiratory failure or death. Early symptoms include irritation of nose and throat, vomiting, and irregular respiration, followed by dizziness, drowsiness, and unconsciousness.

Ingestion:
Irritating to the mucous membranes. Ingestion of 1 or 2 ounces may be fatal. Because of volatility the stomach becomes distended, which may cause belching. Other symptoms can include vomiting, unconsciousness, and coma.

Skin Contact:
Irritating to the skin and mucous membranes by drying effect. Can cause dermatitis on prolonged exposure. May be absorbed through skin.

Eye Contact:
May cause irritation, redness and pain. Prolonged exposures to high concentrations of vapor can cause eye damage.

Chronic Exposure:
Repeated exposures may be habit forming. Prolonged exposures may result in headache, drowsiness, excitation, and psychic disturbances. Teratogenic effects are possible.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver, kidney or respiratory function may be more susceptible to the effects of this substance. Alcoholic beverage consumption can enhance the toxic effects of this substance.

4. First Aid Measures

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

Ingestion:

DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact:

Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Call a physician.

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: -45C (-49F) CC
Autoignition temperature: 160C (320F)
Flammable limits in air % by volume:
lel: 1.9; uel: 36.0
Dangerous highly flammable liquid.

Explosion:

Containers may explode when involved in a fire. Above flash point, vapor-air mixtures are explosive within flammable limits noted above. May form explosive peroxides on long standing or after exposure to air or light. May explode when brought in contact with nitric acid. Sensitivity to mechanical impact: Yes, if peroxides are formed. Sensitive to static discharge..

Fire Extinguishing Media:

Dry chemical, foam or carbon dioxide. Treat as a flammable gas in a fire situation. Water spray may be used to keep fire exposed containers cool. Water is ineffective as an extinguishing agent.

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. This highly flammable liquid must be kept from sparks, open flame, hot surfaces, and all sources of heat and ignition. 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! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response

Center is (800) 424-8802.

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

7. Handling and Storage

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Bond and ground containers when transferring liquid. Isolate from other combustible material. Protect from direct sunlight. Protect against static electricity and lightning for large quantity storage rooms, protect with automatic sprinkler systems and total flooding carbon dioxide systems. The reactivity hazard may be increased on longstanding due to peroxide formation. Ether is subject to peroxide formation in opened containers and should be protected from exposure to air. When low peroxide ether is required, use only material from an unopened can. Do not allow to evaporate to near dryness. Addition of water or appropriate reducing agents will lessen peroxide formation. Any ether remaining in opened containers that has not been consumed/used after 2-3 days, should be discarded. Store At A Temperature Not Exceeding 30C (86F). DO NOT OPEN Unless Contents Are At Room Temperature (72F) or Below For At Least 24 Hours. 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:
-OSHA Permissible Exposure Limit (PEL):
400 ppm (TWA)

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

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

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING:

Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. An organic vapor respirator is predicted to have a short service life (less than 30 minutes at concentrations of ten times the TLV/PEL) when used with this material.

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.

Other Control Measures:

Shoes should be conductive and nonsparking.

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9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Sweet, ethereal odor.

Solubility:

8.43% by wt in H2O @ 15C; 6.05% by wt in H2O @ 25C.

Specific Gravity:

0.71 at 20C/4C

pH:

No information found.

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

No information found.

Boiling Point:

35C (95F)

Melting Point:

-123C (-189F)

Vapor Density (Air=1):

2.6

Vapor Pressure (mm Hg):

440 @ 20C (68F) (ether)

Evaporation Rate (BuAc=1):

37.5

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10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Heat, light, and long standing contribute to instability. Reacts with air to form explosive peroxides.

Hazardous Decomposition Products:

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

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Can react dangerously with acetyl peroxide, liquid oxygen, bromoazide, chlorine, and strong oxidizers such as nitrates. Avoid heat, flame, other sources of ignition, and exposure to light, air.

Conditions to Avoid:

Heat, flame, ignition sources, incompatibles, light, and air.

11. Toxicological Information

Toxicological Data:

Oral rat LD50: 1215 mg/kg; investigated as a tumorigen and mutagen; irritation eye rabbit: 100 mg moderate; skin rabbit 360 mg open mild

Reproductive Toxicity:

See Chronic Health Hazards.

--------\Cancer Lists\--------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Diethyl Ether (60-29-7)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is not expected to biodegrade. When released into water, this material is not expected to biodegrade. When released into the water, this material is expected to have a half-life of less than 1 day. When released to water, this material is expected to quickly evaporate. This material is not expected to significantly bioaccumulate. This material has a log octanol-water partition coefficient of less than 3.0. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is not expected to be degraded by photolysis. When released into the air, this material is expected to have a half-life between 1 and 10 days.

Environmental Toxicity:

The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be 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: RQ, DIETHYL ETHER
Hazard Class: 3
UN/NA: UN1155
Packing Group: I
Information reported for product/size: 320LB

International (Water, I.M.O.)

Proper Shipping Name: DIETHYL ETHER
Hazard Class: 3.1
UN/NA: UN1155
Packing Group: I
Information reported for product/size: 320LB

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Diethyl Ether (60-29-7)	Yes	Yes	Yes	Yes

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

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Diethyl Ether (60-29-7)	Yes	Yes	No	Yes

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

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Diethyl Ether (60-29-7)	No	No	No	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Diethyl Ether (60-29-7)	100	U117	Yes

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

Australian Hazchem Code: 3YE
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 4 Reactivity: 1
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.
Label Precautions:
May form explosive peroxides.
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Avoid breathing vapor.
Do not get in eyes, on skin, or on clothing.
Wash thoroughly after handling.
Store At A Temperature Not Exceeding 30C (86F).DO NOT OPEN Unless Contents Are At Room Temperature (72F) or Below For At Least 24 Hours.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 1, 3, 6.
Disclaimer:
****

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

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

National Response in Canada
CANUTEC: 613-996-6666

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

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

MSDS *Material Safety Data Sheet*

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

MALLINCKRODT J.T.Baker

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

HLOROBENZENE

DS Number: C2475 --- *Effective Date: 04/04/00*

Product Identification

Synonyms: Monochlorobenzene; Chlorobenzol; Phenyl chloride; Benzene chloride
CAS No.: 108-90-7
Molecular Weight: 112.56
Chemical Formula: C_6H_5Cl
Product Codes:
J.T. Baker: 9179
Mallinckrodt: 4419, 4426

Composition/Information on Ingredients

ngredient	CAS No	Percent	Hazardous
Chlorobenzene	108-90-7	99 - 100%	Yes

. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

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

Health Rating: 2 - Moderate
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER.
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Affects central nervous system causing dizziness, incoordination and unconsciousness.

Ingestion:
Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. Toxic! May cause systemic poisoning with symptoms paralleling those of inhalation.

Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. May be slowly absorbed through the skin with possible systemic effects.

Eye Contact:
Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

Chronic Exposure:
Prolonged or repeated skin exposure may cause dermatitis or skin burns. Prolonged or repeated exposure may cause liver, kidney, or lung damage.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin, eye or central nervous system disorders, or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this substance.

First Aid Measures

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

Ingestion:
Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

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

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

Fire Fighting Measures

Fire:
Flash point: 28C (82F) CC
Autoignition temperature: 593C (1099F)
Flammable limits in air % by volume:
lel: 1.3; uel: 9.6
Flammable Liquid

Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Reactions with incompatibles may pose an explosion hazard. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated. Sensitive to static discharge.

Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

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. This highly flammable liquid must be kept from sparks, open flame, hot surfaces, and all sources of heat and ignition. Combustion by-products include phosgene and hydrogen chloride gases.

Accidental Release Measures

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

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

Handling and Storage

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Containers should be bonded and grounded for transfers to avoid static sparks. 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.

Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
75 ppm (TWA)

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

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

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

Skin Protection:
Wear 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.

Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Faint, almond like odor.

Solubility:
Insoluble in water.

Specific Gravity:
1.11 @ 20C/4C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
132C (270F)

Melting Point:
-45C (-49F)

Vapor Density (Air=1):
3.9
Vapor Pressure (mm Hg):
11.8 @ 25C (77F)
Evaporation Rate (BuAc=1):
1.1

Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Oxidizing agents, dimethyl sulfoxide, silver perchlorate, silver chromate.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

Toxicological Information

For Chlorobenzene: Oral rat LD50: 1110 mg/kg; Inhalation rat LC50: 2965 ppm. Investigated as a tumorigen, mutagen, reproductive effector.

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--------\Cancer Lists\------------------------------------------------------
                                      ---NTP Carcinogen---
gredient                              Known    Anticipated    IARC Category
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lorobenzene (108-90-7)                 No          No             None
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Ecological Information

Environmental Fate:
When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life of less than 1 day. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:

The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

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.

Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, CHLOROBENZENE
Hazard Class: 3
UN/NA: UN1134
Packing Group: III
Information reported for product/size: 52L

International (Water, I.M.O.)

Proper Shipping Name: CHLOROBENZENE
Hazard Class: 3.3
UN/NA: UN1134
Packing Group: III
Information reported for product/size: 52L

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

Proper Shipping Name: CHLOROBENZENE
Hazard Class: 3
UN/NA: UN1134
Packing Group: III
Information reported for product/size: 52L

Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                       TSCA  EC   Japan  Australia
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Chlorobenzene (108-90-7)                          Yes  Yes   Yes      Yes
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------\Chemical Inventory Status - Part 2\----------------------------------

ngredient	Korea	--Canada-- DSL	NDSL	Phil.
lorobenzene (108-90-7)	Yes	Yes	No	Yes

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

gredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
lorobenzene (108-90-7)	No	No	Yes	No

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

gredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
hlorobenzene (108-90-7)	100	U037	Yes

mical Weapons Convention: No TSCA 12(b): No CDTA: Yes
RA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
ctivity: No (Pure / Liquid)

Australian Hazchem Code: 2Y
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

. Other Information

NFPA Ratings: Health: **2** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.
Label Precautions:
Keep away from heat, sparks and flame.
Avoid breathing vapor.
Keep container closed.
Wash thoroughly after handling.
Avoid contact with eyes, skin and clothing.
Use only with adequate ventilation.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, give large amounts of water to drink. 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. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.

Revision Information:
MSDS Section(s) changed since last revision of document include: 4, 11, 14, 16.
Disclaimer:

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