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PHASE IV
Implementation Of The Selected Remedial Action Alternative (310 CMR 40.0870)

263 Howard Street
Lowell, Massachusetts 01852

RTN 3-0601
Lightship Engineering Project No. 542.1.1

June 19, 2002

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Prepared for:

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LIGHTSHIP ENGINEERING
ENVIRONMENTAL & LAND-USE CONSULTANTS

LSP SERVICES • CIVIL ENGINEERING • ASSESSMENT • PERMITTING • REMEDIATION • CONSTRUCTION MANAGEMENT

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1

2.0 PROJECT CONTACTS 2-1

3.0 REMEDY IMPLEMENTATION PLAN 3-1
- 3.1 GOALS OF THE REMEDIAL ACTION 3-1
- 3.2 NEW INFORMATION RELATED TO THE DISPOSAL SITE CONDITIONS 3-1
- 3.3 DISPOSAL SITE MAP 3-1
- 3.4 CHARACTERISTICS OF ENVIRONMENTAL MEDIA 3-2
  - 3.4.1 Description of Soil Characteristics 3-2
  - 3.4.2 Description of Groundwater Characteristics 3-2
  - 3.4.3 OHM Impacted Media 3-2
  - 3.4.4 Nature and Extent of OHM Impacted Soil 3-3
  - 3.4.5 Nature and Extent of Groundwater Impact 3-3
- 3.5 REMEDIATION SYSTEM DESIGN 3-4
  - 3.5.1 SVE/AS Remediation System 3-4
- 3.6 MANAGEMENT OF REMEDIAL WASTES 3-7
  - 3.6.1 Soil 3-7
  - 3.6.2 Water 3-7
  - 3.6.3 Air 3-7
- 3.7 MEASURES INCORPORATED TO AVOID DELETERIOUS IMPACT ON ENVIRONMENTAL RECEPTORS 3-7
  - 3.7.1 Existing Disposal Site Activities 3-8
  - 3.7.2 Drainage Features, Natural Resource Areas, Local Planning, and Development Issues 3-8
  - 3.7.3 Soil and Groundwater Characteristics 3-8
- 3.8 CONSTRUCTION PLANS AND SPECIFICATIONS 3-8
  - 3.8.1 Material Specifications, Procedures and Schedule for Construction 3-8
  - 3.8.2 Schedule 3-10
- 3.9 OPERATION, MAINTENANCE, AND MONITORING 3-10
  - 3.9.1 Operation, Maintenance, and Monitoring Contacts 3-11
  - 3.9.2 General Operating Procedures 3-11
- 3.10 HEALTH AND SAFETY PLAN 3-12
- 3.11 PERMITS, APPROVALS AND LICENSES 3-12
- 3.12 DISPOSAL SITE ACCESS ISSUES 3-12

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TABLE OF CONTENTS (Continued)

4.0 AS BUILT CONSTRUCTION REPORT 4-1

5.0 PHASE IV FINAL INSPECTION REPORT 5-1

6.0 LIMITATIONS 6-1

Main Office: 36 Cordage Park Circle • Suite 312 • Plymouth, Massachusetts 02360 • (508) 830-3344 • Fax: (508) 830-3360
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LIST OF APPENDICES

APPENDIX A FIGURES

Figure 1-1 Site Locus Map
Figure 1-2 Disposal Site Map
Figure 3-1 SVE/AS System Layout
Figure 3-2 Process and Instrumentation Diagram
Figure 3-3 Air Sparging Well Detail
Figure 3-4 Soil Vapor Extraction Well Detail

APPENDIX B REMEDIAL EQUIPMENT SPECIFICATIONS

APPENDIX C HEALTH AND SAFETY PLAN

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1.0 INTRODUCTION

On behalf of Jones Environmental Services (Northeast), Inc., Lightship Engineering, LLC ("Lightship Engineering") has prepared this *Phase IV Implementation of the Selected Remedial Action Alternative Report* (the "Phase IV Report") pursuant to the Massachusetts Contingency Plan ("MCP") 310 CMR 40.0870. The Phase IV Report contains requirements for the design, construction, and implementation of the Comprehensive Remedial Action alternative selected as a result of the Phase III evaluation under 310 CMR 40.0850. The Phase III evaluation was conducted in connection with the release of oil and/or hazardous material ("OHM") in the vicinity of a former containment sump ("AOC3 Former Sump") in Building No. 2 of the Temporary Storage and Disposal Facility ("TSDF") located at 263 Howard Street, Lowell, Massachusetts (the "Site"). A Site Locus Map and a Disposal Site Map are attached as Figures 1-1 and 1-2, respectively, at Appendix A. The property is currently operated as a TSDF by Jones Environmental Services (Northeast), Inc.

Pursuant to 310 CMR 40.0872 (1) a Phase IV Report shall:

- ensure that the information, plans and reports related to the design, construction, and implementation of the selected remedial action alternative are sufficiently developed and documented to support the implementation of the Comprehensive Remedial Action;
- ensure that following initial implementation, the Comprehensive Remedial Action meets design and performance specifications;
- meet the Response Action Performance Standard for design, construction, and implementation of the Comprehensive Remedial Action, as described in 310 CMR 40.0191; and
- conform with all applicable requirements and deadlines set forth in 310 CMR 40.0000.

Pursuant to 310 CMR 40.0870, this Phase IV Report contains a Remedial Implementation Plan ("RIP") as set forth in Section 3.0.

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2.0 PROJECT CONTACTS

Pursuant to 310 CMR 40.0874(3)(a), the project contact for the entity responsible for the submission of the Phase IV Report is:

Jones Environmental Services (Northeast), Inc.
461 Cooke Street
Farmington, Connecticut 06032

Mr. Jim Green
(800) 585-7916

The Licensed Site Professional ("LSP") of record is set forth below.

Michael J. Pierdinock
Lightship Engineering, LLC
36 Cordage Park Circle – Suite 312
Plymouth, Massachusetts 02360
(508) 830-3344 x 110
LSP License No. 4078

Pursuant to 310 CMR 40.0874 3(a)(3), the person, on behalf of Jones Environmental Services (Northeast), Inc., who will operate and maintain the selected remedial action alternative is set forth below.

Joseph B. O'Brien, P.E.
Senior Project Manager
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3.0 REMEDY IMPLEMENTATION PLAN

Pursuant to 310 CMR 40.0874, a RIP shall be developed for the Comprehensive Remedial Action selected, the terms of which are set forth below.

3.1 GOALS OF THE REMEDIAL ACTION

Pursuant to 310 CMR 40.0874 (3) (b) (1), the goal of the remedial action, including performance requirements of the remedial systems and/or the requirements for achieving a Response Action Outcome ("RAO") is set forth in the bullets below:

- to reduce the concentrations of dissolved phase volatile organic compounds ("VOCs") in groundwater to below Upper Concentration Limits ("UCLs") in the area surrounding monitoring well MW-4.
- remediation of the source of OHM in this area should result in the decreased of concentrations of OHM in groundwater hydraulically downgradient of this area as a result of natural attenuation.

To achieve this goal, and based on the Phase III *Identification, Evaluation And Selection Of Comprehensive Remedial Action Alternatives Report* (the "Phase III Report"), air sparging ("AS") with soil vapor extraction ("SVE") was selected as the remedial action alternative to remediate the source of OHM at the disposal site.

3.2 NEW INFORMATION RELATED TO THE DISPOSAL SITE CONDITIONS

The disposal site conditions were included in the Phase II *Comprehensive Site Investigation* ("Phase II Report") completed by ORS and submitted to DEP August 14, 2001. Pursuant to 310 CMR 40.0874 (3) (b) (2), there are no significant changes or new information related to disposal site conditions which were not included in previous submittals.

3.3 DISPOSAL SITE MAP

Pursuant to 310 CMR 40.0874 (3) (b) (3), the disposal site map and location of the proposed AS/SVE system is attached as Figure 1-2 and Figure 3-1, Appendix A.

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3.4 CHARACTERISTICS OF ENVIRONMENTAL MEDIA

Pursuant to 310 CMR 40.0874 (3) (b) (4) a description of the characteristics, quantity, and location of environmental media or materials to be treated or otherwise managed is set forth below.

3.4.1 Description of Soil Characteristics

As set forth in the Phase II Report, the soils in the vicinity of monitoring well MW-4 consists of Brown fine sand, light silt and trace gravel ("silty sand and gravel") from grade to approximately 15 to 18 feet below grade. A dense till underlies the silty sand and gravel extends to approximately 25 feet below grade. Groundwater was observed approximately 8 to 9 feet below grade.

3.4.2 Description of Groundwater Characteristics

As set forth in the Phase II Report, groundwater in the vicinity of monitoring well MW-4 was observed approximately 8 to 9 feet below grade and the groundwater gradient in the vicinity of MW-4 was reported to be 0.007 feet/foot. Consistent with the Phase II Report, based on an assumed hydraulic permeability of 672 feet/year (6.5×10^{-4} cm/s) and an effective porosity of 0.35, the estimated groundwater flow velocity is 13.4 feet per year. Groundwater in the vicinity of MW-4 flows to the northwest towards the River Meadow Brook, located approximately 130 feet from the location of MW-4.

3.4.3 OHM Impacted Media

According to the Phase II Report, the source of OHM-impacted soil and groundwater appeared to be the former catch basin/spill containment sump (AOC3 Former sump) located in the southeast corner of Building No. 2 Hazardous Material Storage Area, as indicated on Figure 1-2, Appendix A. Historical releases to the sump were reported to have taken place from the mid-1970s to mid-1980s. The release was reported to the Department of Environmental Protection ("DEP") in 1990. During the cleanup of the sump in 1992, 26 drums of liquid and 3 drums of soil/sediment were removed from the sump. Additional liquid was observed in the sump after the cleanup activities and DEP required the closure of the sump. As part of the closure of the sump, monitoring well MW-4 was installed within the excavation. As set forth in the Phase II Report, residual OHM-impacted soil is likely serving as a continuing source of OHM impact to groundwater at the Site.

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3.4.4 Nature and Extent of OHM Impacted Soil

As set forth in the Phase II Report, OHM-impacted soil in connection with the former containment sump at the Site appears to be limited to saturated soils within the immediate vicinity of monitoring well MW-4. Residual impacts to saturated soils located hydraulically downgradient of the "source area" are likely associated with the migration of impacted groundwater from the source area.

Based on the Phase II Report, a dense till layer was identified from approximately 15 to 25 feet below grade. The till layer is most likely serving as an aquitard to limit the downward vertical migration of the chlorinated solvents in soil.

3.4.5 Nature and Extent of Groundwater Impact

Based on the Phase II Report, OHM-impacted groundwater exceeding UCLs appears to be limited to monitoring well MW-4 (former location of sump). Impacts to groundwater exceeding Method 1 GW-2 Groundwater Cleanup Standards were detected in monitoring well URS-2, located approximately 20 feet hydraulically upgradient of MW-4. Although URS-2 is located hydraulically upgradient of MW-4 (source), based on the relatively short distance between the two wells, dispersion of OHM may be the mechanism of migration to the location of URS-2 based on the shallow groundwater gradient measured at the Site. Chlorinated compounds were detected hydraulically downgradient of MW-4 at monitoring well GZA-4 (located approximately 110 feet from MW-4) which exceeded Method 1 GW-2 Groundwater Cleanup Standards. Chlorinated solvent concentrations were detected in groundwater at monitoring well WE-3 above the laboratory reporting limits, but below Method 1 GW-2 Groundwater Cleanup Standards. Based on the spatial distribution of the monitoring wells sampled at the Site and the concentrations of chlorinated solvents detected in groundwater, the extent of impacted-groundwater above UCLs is most likely limited to the area immediately surrounding MW-4.

As set forth in the Phase II, a Method 3 Risk Characterization was conducted for the Site that concluded that a level of No Significant Risk ("NSR") to human health and public safety exists at the Site with the continued use of the property for commercial or industrial purposes. The Site may pose a significant risk to public welfare and the environment as a result of the compounds that exceeded UCLs in groundwater at MW-4.

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3.5 REMEDIATION SYSTEM DESIGN

Pursuant to 310 CMR 40.0874(3) (b) 5, 6 and 7, descriptions of the relevant design and operation parameters, operational controls to avoid system malfunctions and accidental releases of OHM, and a conceptual plan of activities are set forth below.

3.5.1 SVE/AS Remediation System

A SVE/AS remediation system has been designed to aggressively treat halogenated VOC-impacted groundwater that is migrating hydraulically downgradient from the "source" area towards River Meadow Brook. Three AS injection wells will be installed surrounding monitoring MW-4 at radial distances of approximately 10 feet, as indicated on Figure 3-1, Appendix A. Five SVE extraction wells will be installed surrounding MW-4 and the three proposed AS wells to capture AS off-gas.

The proposed SVE/AS remediation system is designed to remediate the "source" of OHM and limit the migration of VOC-impacted groundwater by "stripping" the constituents from the groundwater and delivering them in the vapor state to the unsaturated zone to be collected by the SVE system. The SVE system will discharge recovered vapors to a catalytic oxidizer for off-gas treatment prior to discharge to the atmosphere.

Depth of AS Injection

Based on the characteristics of the OHM and the migratory pathway of OHM-impacted groundwater, the SVE/AS has been designed to treat the upper 10 feet of the saturated zone (8 to 18 feet below grade) above the identified till layer. The bottom of the AS screen will be installed 10 feet below the water table, at the top of the till layer. The actual installation depth of each well screen may vary slightly based upon geologic and field-screening data generated during installation.

AS Zone of Influence

Based on the injection depth of 10 feet, the expected radius of influence could be up to 30 feet radially from the AS point. A conservative 10 foot AS radius of influence was used for design assuming a one to one (1:1) vertical to horizontal air channel migration ratio.

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AS Injection Rate

Based on the assumptions that the AS zone of influence is a cone shaped area and the effective soil porosity is 35%, the AS zone of influence for a 10-foot injection depth with a 10-foot radius of influence would contain a groundwater volume of 366 cubic feet. The AS injection rate selected per screen is 3 to 5 standard cubic feet per minute ("SCFM") which will provide 11 to 19 air exchanges per day for each screen interval, based on a continuous sparge flow.

AS Injection Pressure

Based on an AS injection depth of 10 feet, a silty sand and gravel unit, and the utilization 2-foot stainless steel, 0.010-slot AS screens set in filter pack, the injection pressure is calculated as set forth below:

$$P_i = H_i + P_a + P_d$$

P_i = Pressure of injection
H_i = Saturated thickness above AS screen interval (feet of water)
P_a = Air entry pressure of soil formation (feet of water)
P_d = Air entry pressure for well screen (feet of water)

where:

H_i = 10 feet of water
P_a = estimated at 5 feet of water[1]
P_d = estimated at 3 feet of water[1]

therefore:

P_i = 18 feet of water or approximately 8 pounds per square inch ("psi").

Each AS well will be completed with a flow control valve to balance the injection pressure and injection flow rates.

[1] Nyer, Evan K. In Situ Treatment Technology. pp. 209, Lewis Publishers, New York, 1996.

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SVE Extraction Rate and Vacuum

Based on the AS injection rate (3 injection wells total) of 3 to 5 SCFM (15 SCFM total), a conservative rule of thumb for the SVE extraction rate per SVE well (5 extraction wells total) would be 10 SCFM (50 SCFM total) to provide approximately three to one (3:1) extraction rate versus injection ratio for the SVE/AS system. The estimated extraction vacuum based on the reported geology is 30 inches of water vacuum for a 2-inch diameter SVE extraction point. In addition, the off-gas treatment equipment will require 28 inches of pressure; therefore, a SVE blower capable of 100 SCFM at 60-inches of water column vacuum/pressure will be utilized at the Site.

Each SVE wellhead will be located in a secured, below-ground manhole. The piping from each well is connected via subsurface piping to the remedial equipment located in a shed described below.

SVE/AS Remedial Equipment

A positive displacement compressor capable of 15 SCFM at 10 psi will be installed for the AS injection. The compressor is equipped with filtered dilution air, a discharge blow-off line with silencer, a high temperature discharge switch, and an integral relay to shut down if the SVE unit shuts down. A regenerative type vacuum extraction blower capable of 100 SCFM at 60 inches of water vacuum/pressure will be installed for the SVE system. The SVE blower is equipped with a moisture separator with a high-level float switch, filtered inlet and dilution air, high temperature discharge switch, and a re-circulation/flow control valve. The SVE discharge is treated utilizing an electric fired catalytic oxidizer capable complete with a dry limestone scrubber capable of greater than 95% destruction of VOCs at 100 SCFM with an integral relay to shut down the SVE blower if the catalytic unit shuts down.

The SVE/AS remedial system will be housed within an equipment shed and the electric fired catalytic oxidizer and dry limestone scrubber will be enclosed in a fenced compound adjacent to the SVE/AS structure. Both structures are locked for security purposes. A master control panel will operate the remedial equipment and alert Lightship Engineering personnel via facsimile if key components of the system shutdown. If key components of the system shutdown, the whole SVE/AS remedial system is automatically shutdown. Lightship Engineering responds to shutdowns immediately upon receiving notification. The proposed location of the SVE/AS remedial equipment and catalytic oxidizer is indicated on Figure 3-1, Appendix A. The process and instrumentation diagram for the SVE/AS remedial system is set forth in Figure 3-2, Appendix A, and specifications on the electric fired catalytic oxidizer are attached at Appendix B.

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3.6 MANAGEMENT OF REMEDIAL WASTES

Pursuant to 310 CMR 40.0874 (3)(b)(8), the remediation waste which will be generated during the operation of the SVE/AS remedial system is set forth below.

3.6.1 Soil

Impacted soil generated during the well installation will be returned to the same depth and geologic unit within the borehole ot trench for treatment by the remedial systems. Soil excavated as part of the SVE/AS piping installation will be utilized as back fill during construction activities.

3.6.2 Water

Groundwater accumulation in the SVE moisture separator tank will be removed from the separator and disposed of pursuant to 310 CMR 40.0030.

3.6.3 Air

Prior to the discharge of SVE air emissions to the atmosphere, the air emissions proceed through a catalytic oxidizer and dry limestone scrubber to ensure a 95% Destruction Removal Efficiency ("DRE") pursuant to 310 CMR 40.0049 (5) and DEP's *Off-Gas Treatment of Point Source Remedial Air Emissions (WSC-94-150,* "DEP Off-Gas policy". Air emissions monitoring will be conducted consistent with DEP's Off-Gas Policy.

3.7 MEASURES INCORPORATED TO AVOID DELETERIOUS IMPACT ON ENVIRONMENTAL RECEPTORS

Pursuant to 310 CMR 40.0874 (3) (b) 9 and 10, descriptions of the Site-specific characteristics which may affect or be affected by the design construction or operation of the selected remedial action alternative and the measures incorporated to avoid deleterious impact on environmental receptors and natural resource areas are set forth below.

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3.7.1 Existing Disposal Site Activities

The Site is an active TSDF facility and the proposed remedial system location is located within a hazardous material storage warehouse. Therefore, with the exception of temporary disturbances during construction, there are no activities or operations being conducted at the disposal site that may affect or be affected by the SVE/AS system.

3.7.2 Drainage Features, Natural Resource Areas, Local Planning, and Development Issues

The proposed SVE/AS remedial system will be installed and operated within the limits of Building No. 2 and the parking area immediately to the south and, therefore, the operation and installation of the SVE/AS system will not destroy or otherwise impair any portion of the vegetated wetland.

3.7.3 Soil and Groundwater Characteristics

The soil and groundwater characteristics for the disposal site are set forth in Section 3.2. These characteristics will not affect or be affected by the proposed SVE/AS remedial systems. — ? GW MOUNDING

3.8 CONSTRUCTION PLANS AND SPECIFICATIONS

Pursuant to 310 CMR 40.0874 (3) (c), the construction plans and specifications for the selected remedial action alternative are set forth below.

3.8.1 Material Specifications, Procedures and Schedule for Construction

AS Injection Wells

AS injection wells will be installed utilizing the hollow-stem auger drilling methodology (4-1/2 inch inner diameter augers) as set forth in DEP's *Standard References for Monitoring Wells* (WSC-310-91). The AS wells will be constructed of 1-inch diameter black iron pipe with 2 foot long 1-1/4-inch diameter stainless steel 0.010 slot screens set approximately 10 feet beneath the groundwater table (above the till layer). The actual placement of the AS well screens will be dependent of the geology and field screening results encountered during installation. A

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grout/bentonite seal will be placed a minimum of 12-inches above the top of screen to grade. AS wells will be finished to grade with flush-mount steel roadboxes set into the concrete floor. A construction diagram of the typical AS injection well is attached as Figure 3-3, Appendix A.

SVE Extraction Wells

SVE extraction wells will to be installed utilizing the hollow-stem auger drilling methodology (4-1/2 inch inner diameter augers) as set forth in DEP's *Standard References for Monitoring Wells* (WSC-310-91). The SVE wells will be constructed of 2-inch diameter PVC riser with 6 foot long 2-inch diameter PVC 0.010-slot well screens set approximately 1 foot into and 5 feet above the groundwater table (3 to 9 feet below grade). The actual placement of the SVE well screens will be dependent on the geology and field screening results encountered during installation. A 12-inch concrete seal will be placed from a minimum of 12-inches above the top of screen to the bottom of the steel road box. SVE wells will be finished to grade with flush-mount steel roadboxes set into the concrete floor. A construction diagram of the typical SVE extraction well is attached as Figure 3-4, Appendix A.

SVE/AS Transport Piping

SVE and AS piping will be installed approximately 1 to 2 feet beneath the concrete floor and sloped towards the SVE/AS wells within Building No. 2. Subsurface piping will be located above grade along the southern wall of Building No. 2 and piped through the wall to the equipment compound located in the parking area south of Building No. 2.

SVE piping will be constructed of 2-inch diameter schedule 40 PVC pipe with solvent welded joints. All five SVE wellheads will be manifolded together below grade and piped in one common trunk line to the SVE equipment. SVE wellheads will be completed with 2-inch diameter ball valves for individual flow control and sample/vacuum ports.

AS transport piping was installed utilizing 1-inch diameter high-density polyethylene ("HDPE") pipe. The AS wellheads will be manifolded together below grade and piped in one common trunk line to the AS equipment. AS well heads will be completed with 1-inch diameter bronze ball valves, rotometer connections and sample/pressure ports.

SVE Blower

As set forth above, the proposed SVE blower must be capable of 100 SCFM at 30-inches of water column vacuum. In addition, the off-gas treatment equipment will require 28 inches of pressure; therefore, a SVE blower capable of 100 SCFM at 60 inches of water column vacuum/pressure is required. Lightship Engineering has specified a 3 horsepower Rotron

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explosion-proof ("XP") regenerative blower (Model EN 606M5L). Specifications for the proposed SVE blower are set forth in Appendix B. The SVE blower will be equipped with a moisture separator with a high level float switch, filtered inlet and dilution air, high temperature discharge switch, and a re-circulation/flow control valve.

AS Compressor

As set forth above, the proposed AS equipment must be capable of 15 SCFM at 10 psi. Lightship Engineering has specified a 3.5 horsepower Speedaire oil-less compressor complete with 20-gallon tank. Specifications of the proposed AS compressor are set forth in Appendix B. It should be noted that 15 SCFM at 10 psi (approximately 1 atmosphere) is equal to approximately 1.875 SCFM at 120 psi (approximately 8 atmospheres). The AS compressor will be equipped with a pressure regulator, filtered inlet air, check valve on discharge, a discharge blow off line with silencer, a high temperature discharge switch and integral relay to shut down if the SVE unit shuts down.

Catalytic Oxidizer

As set forth above, a catalytic oxidizer is proposed to treat SVE/AS off-gas emissions. Lightship Engineering has specified a FALCO-100 electric-powered catalytic oxidizer. Specifications for the catalytic oxidizer are set forth in Appendix B. The FALCO-100 utilizes a precious metal catalyst (platinum/palladium) to assist in the destruction of halogenated VOCs at temperatures of 310 to 430 degrees Celsius with a removal efficiency up to 99%. Although the FALCO-100 is capable of treating off-gas streams of up to 100 SCFM, Lightship Engineering will run a maximum of 50 SCFM through the unit. The FALCO-100 will be complete with an external control panel, automatic dilution valve, flame arrestor and integral relay to shut down the SVE/AS system when the unit is not operating.

3.8.2 Schedule

The SVE/AS remediation system is proposed to be installed in the Fall of 2002.

3.9 OPERATION, MAINTENANCE, AND MONITORING

Pursuant to 310 CMR 40.0874 (3) (d), the operation, maintenance, and monitoring activities for the selected remedial action alternative are set forth below.

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North Shore Office: P.O. Box 517 • North Andover Massachusetts 01845 • Phone (978) 557-5888
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3.9.1 Operation, Maintenance, and Monitoring Contacts

The project contacts for the disposal site are set forth in Section 2.0. Lightship Engineering, on behalf of Jones Environmental Services (Northeast), Inc. is conducting the operation, maintenance and monitoring of the SVE/AS remedial system.

3.9.2 General Operating, Maintenance and Monitoring Procedures

The proposed monthly operation and maintenance of the SVE/AS remedial equipment which includes the following tasks:

- Grease bearings on SVE blower as required;
- Replace air filters as required, but not more than monthly;
- Clean and check operation of float switches;
- Record runtime for remedial equipment;
- Measure and record operational data (vacuum, pressure, flow) at SVE/AS wellheads and at the SVE/AS equipment; and
- Groundwater elevation survey.

A master control panel operates the remedial equipment and alerts Lightship Engineering via facsimile if key components of the system shutdown. If key components of the system shutdown, the whole SVE/AS remedial wall system is automatically shutdown. Lightship Engineering responds to shutdowns immediately upon receiving notification.

In addition, quarterly groundwater sampling is proposed to assess remedial performance and groundwater quality at the disposal site. Quarterly groundwater sampling events will include:

- Low flow purging and sampling the 7 monitoring wells at the disposal site with disposable bailers;
- Providing all necessary personal protective equipment ("PPE") to perform sampling (assume Level D protection); and
- Submiting the samples to a Commonwealth of Massachusetts certified analytical laboratory for VOC (EPA Method 8260B) analysis.

Prior to the discharge of SVE air emissions to the atmosphere, the air emissions proceed through a catalytic oxidizer to ensure a minimum 95% DRE pursuant to 310 CMR 40.0049 (5) and DEP's *Off-Gas Policy).*

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3.10 HEALTH AND SAFETY PLAN

Pursuant to 310 CMR 40.0874 (3) (e) the health and safety plan to be utilized during the installation and operation of the SVE/AS remedial system installation is attached as Appendix C.

3.11 PERMITS, APPROVALS AND LICENSES

Pursuant to 310 CMR 40.0874 (3) (f), a list of the necessary federal, state, and/or local permits required for the design of the selected remedial action alternative are set forth below.

No federal, state or local permits have been identified that are required for the installation and operation of the proposed SVE/AS remedial system, with the exception of a local electric permit for the installation of the SVE/AS equipment.

3.12 DISPOSAL SITE ACCESS ISSUES

Pursuant to 310 CMR 40.0874 (3) (g), the property access issues that are relevant to the implementation of the Comprehensive Remedial Action and a schedule for resolving the property access issues are set forth below.

The disposal site has limited access due to partial security fencing associated with the Site. Access to the Site does not affect the Comprehensive Remedial Action being conducted.

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4.0 AS BUILT CONSTRUCTION REPORT

Pursuant to 310 CMR 40.0875 an As-Built Construction report is not required as set forth below:

- the disposal site is not a Tier IA disposal site;
- an engineered cap or other on-site system for the containment and/or physical immobilization of OHM is not being constructed as part of the remedial action alternative; and
- the remedial action alternative a proposed to be constructed does not vary significantly from the description of the remedial action alternative proposed in the Phase III Report and Phase IV RIP.

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5.0 PHASE IV FINAL INSPECTION REPORT

Pursuant to 310 CMR 40.0878, a final inspection shall be conducted by the LSP-of-record to ensure that:

- the Comprehensive Remedial Action has been constructed in accordance with construction plans under 310 CMR 40.0874 (3) (c) or appropriate modifications to such plans; and
- following initial implementation and operation and any modifications or adjustments necessary to optimize the performance of remedial systems, the Comprehensive Remedial Action is meeting projected design standards.

A Phase IV Final Inspection Report will be submitted upon completion of the start-up of the proposed remedial system.

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6.0 LIMITATIONS

1. Lightship Engineering is not responsible for the accuracy of information provided to Lightship Engineering by third parties. Except as otherwise stated in this report, Lightship Engineering has not attempted to verify the accuracy or completeness of any such information.

2. The data presented in this report and Lightship Engineering's opinions based on such data is provided in accordance with Lightship Engineering's proposal for professional services and the terms and conditions of the agreement between Lightship Engineering and Jones Environmental Services (Northeast), Inc., pursuant to which the services were provided. The data reported and findings, observations and conclusions expressed in this report are limited by Lightship Engineering's scope of work and the terms and conditions of that agreement, including the extent of subsurface exploration and other tests.

3. This report is for the sole use of Jones Environmental Services (Northeast), Inc. Any reuse or reliance on this report by any other third party shall be done only with the written consent of Lightship Engineering.

4. The findings, observations, opinions conclusions and recommendations are not intended to and do not imply a warranty or a guarantee and are based solely upon site conditions at the time of Lightship Engineering's investigation. The findings, observations, opinions conclusions and recommendations should not be considered an opinion concerning the compliance of any past or present owner or operator of the Site with any federal, state or local law or regulation. Nothing in this report constitutes a legal opinion or legal service and should not be relied upon as such.

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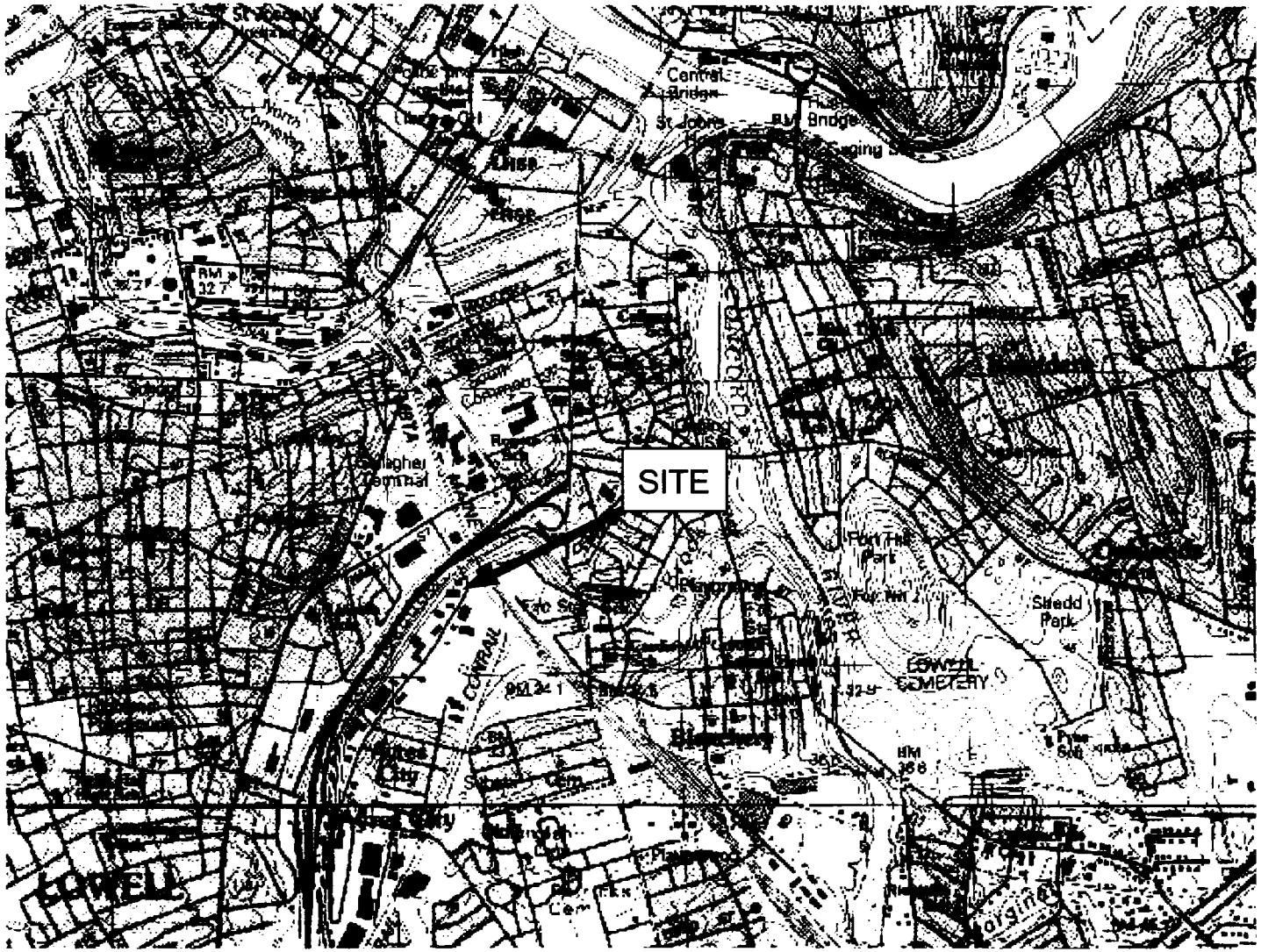
APPENDIX A

FIGURES

Figure 1-1	Site Locus Map
Figure 1-2	Disposal Site Map
Figure 3-1	SVE/AS System Layout
Figure 3-2	Process and Instrumentation Diagram
Figure 3-3	Air Sparging Well Detail
Figure 3-4	Soil Vapor Extraction Well Detail



N
W E
S

FIGURE 1-1

SITE LOCUS MAP

263 Howard Street, Lowell, Massachusetts

PREPARED FOR

Jones Environmental Services (Northeast), Inc.

SOURCE:
MASSACHUSETTS U.S. G.S. QUADRANGLE No. 221930.

SCALE:
1" = 1,850 FEET

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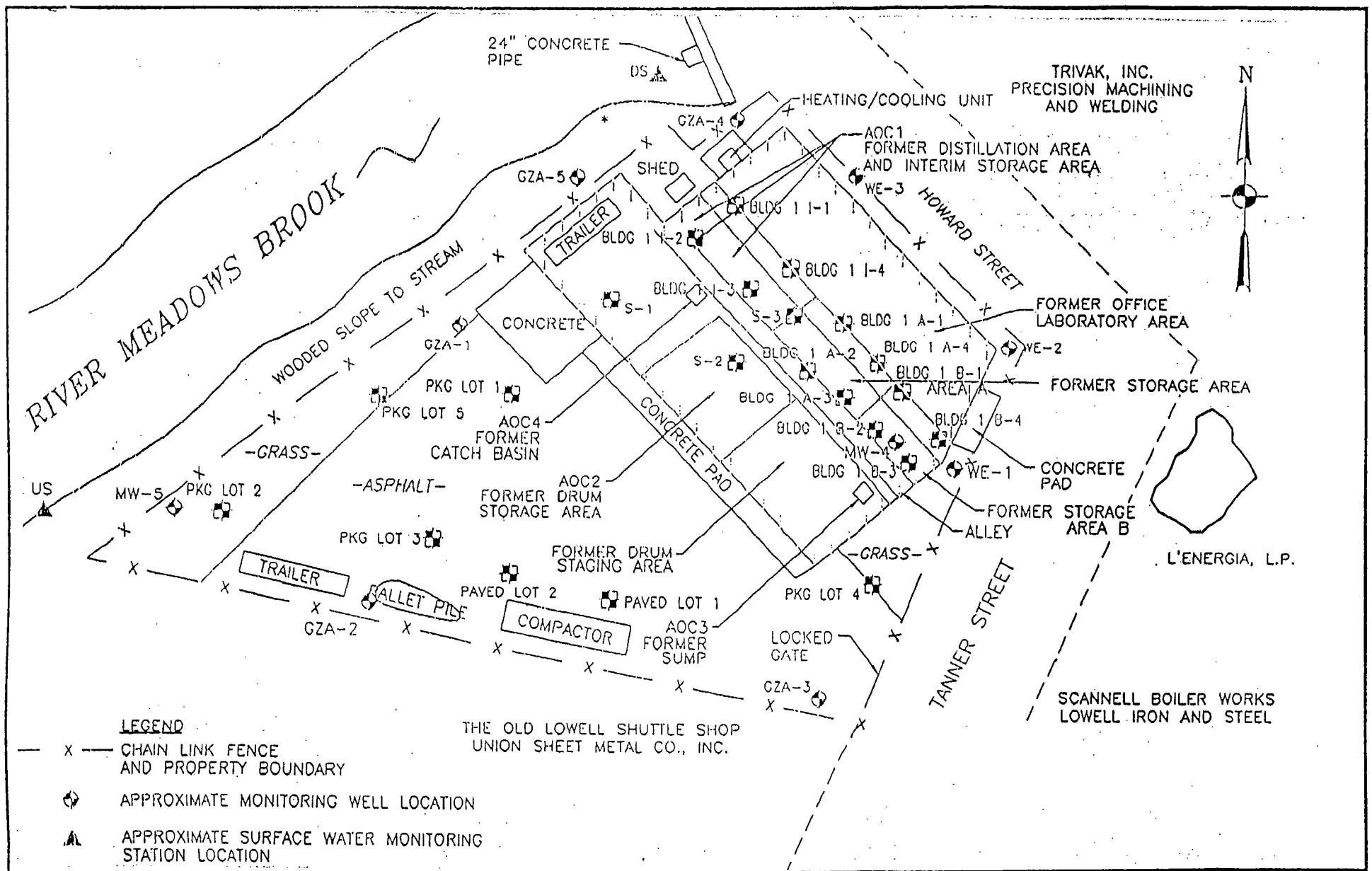
ENVIRONMENTAL & LAND-USE CONSULTANTS

36 CORDAGE PARK CIRCLE, SUITE 312, PLYMOUTH, MA 02360



N
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FIGURE 1-2

DISPOSAL SITE MAP

263 Howard Street, Lowell, Massachusetts

PREPARED FOR

Jones Environmental Services (Northeast), Inc.

SOURCE:
PHASE II MCP SITE INVESTIGATION, URS CORPORATION 6/22/01

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36 CORDAGE PARK CIRCLE, SUITE 312, PLYMOUTH, MA 02360

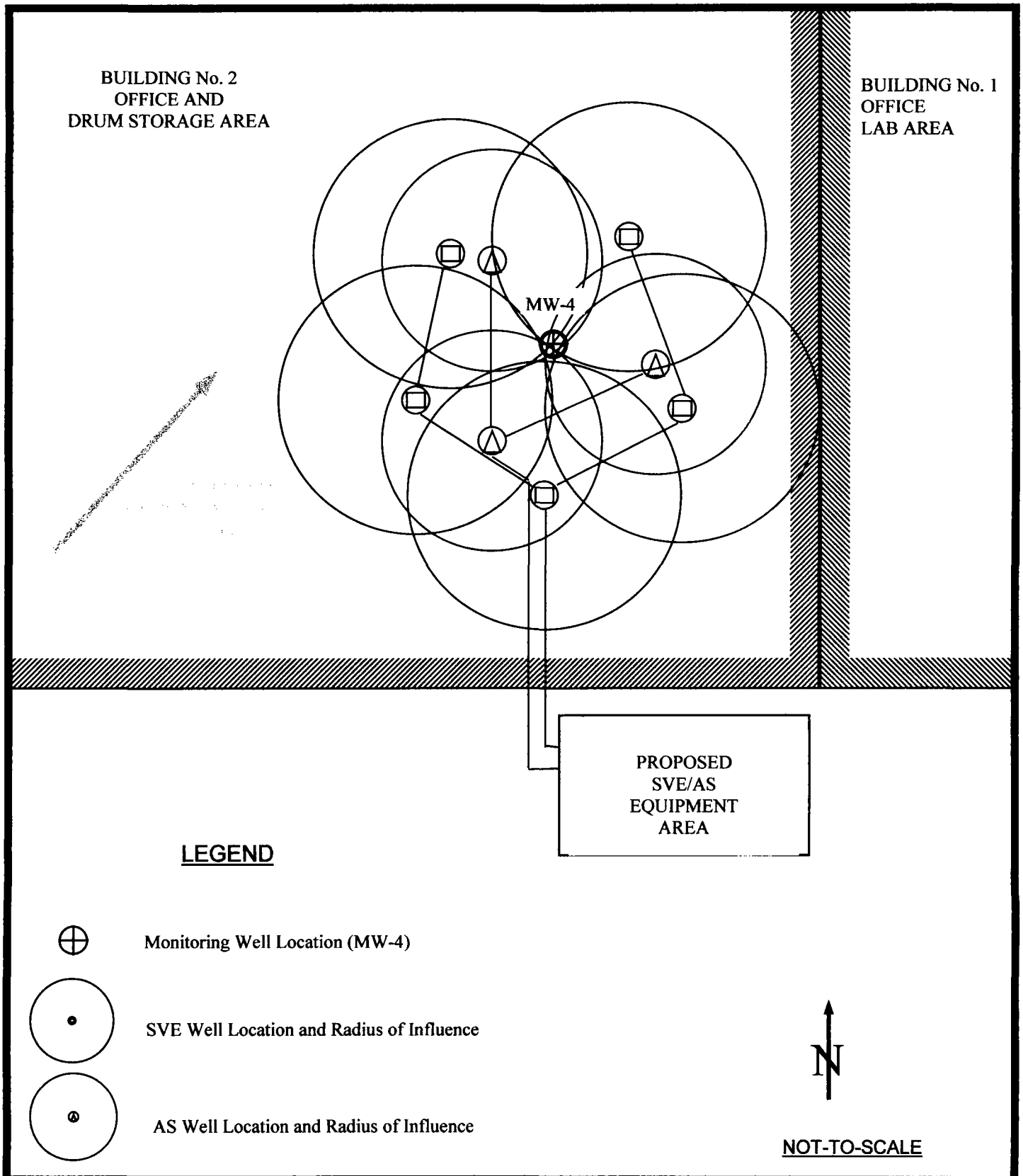

FIGURE 3-1

SVE/AS SYSTEM LAYOUT

263 Howard Street Lowell, Massachusetts

Prepared for:

Jones Environmental Services (northeast), Inc.

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ENVIRONMENTAL & LAND-USE CONSULTANTS

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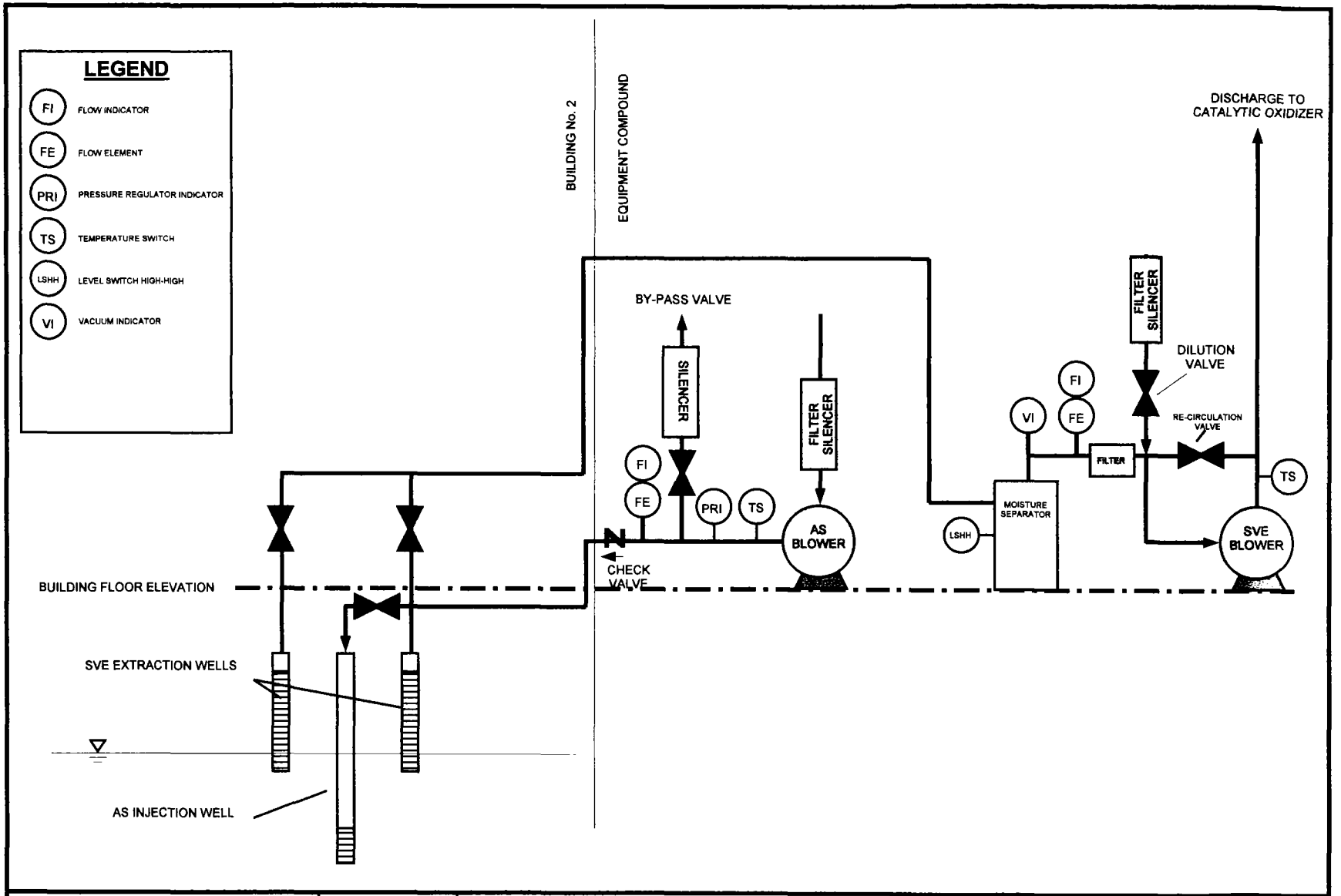

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W E
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FIGURE 3-2

PROCESS AND INSTRUMENTATION DIAGRAM
SVE/AS SYSTEM

263 Howard Street—Lowell, Massachusetts

PREPARED FOR

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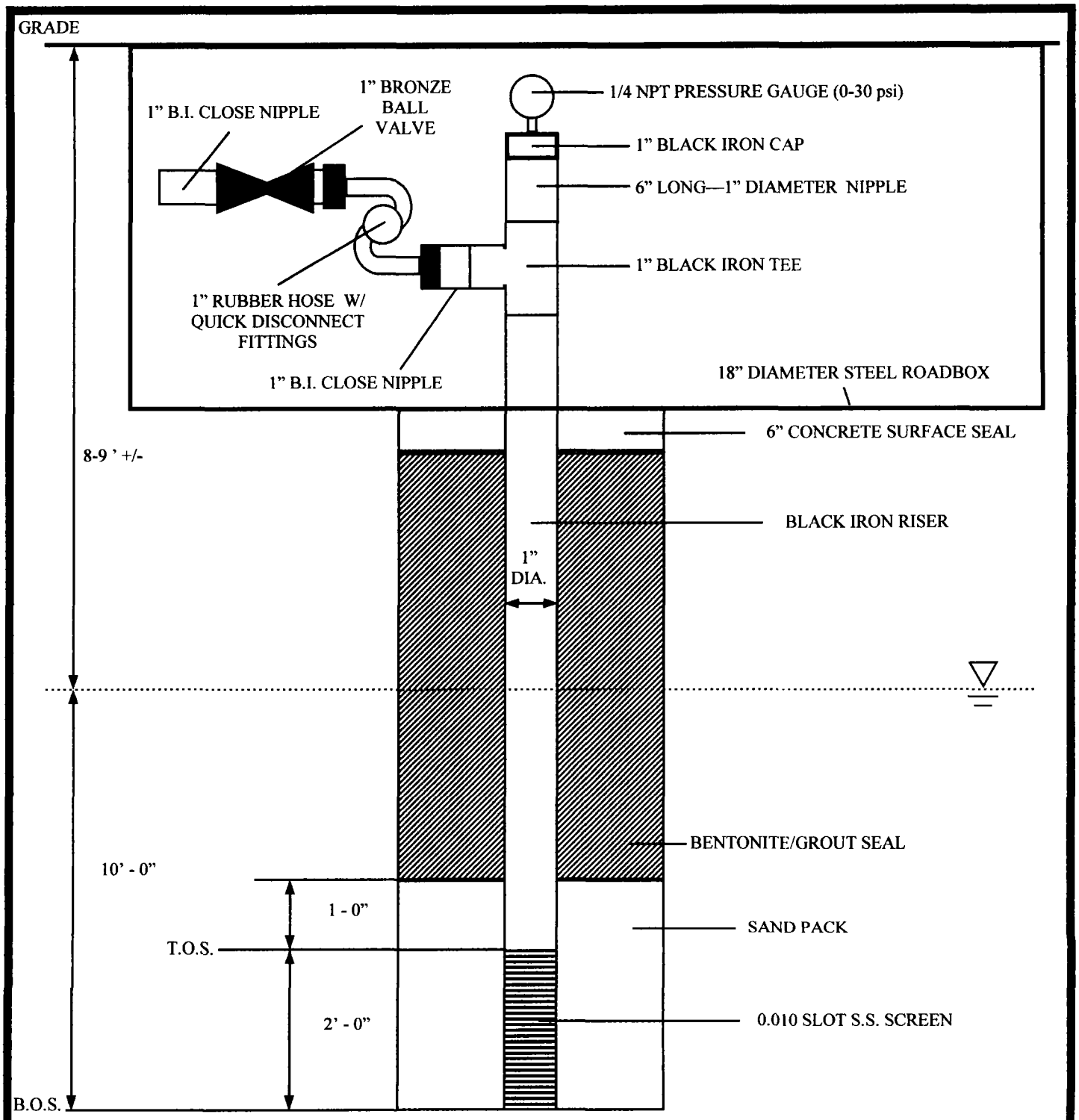

NOT-TO-SCALE

FIGURE 3-3

AIR SPARGING WELL DETAIL

263 Howard Street, Lowell, Massachusetts

Prepared for:

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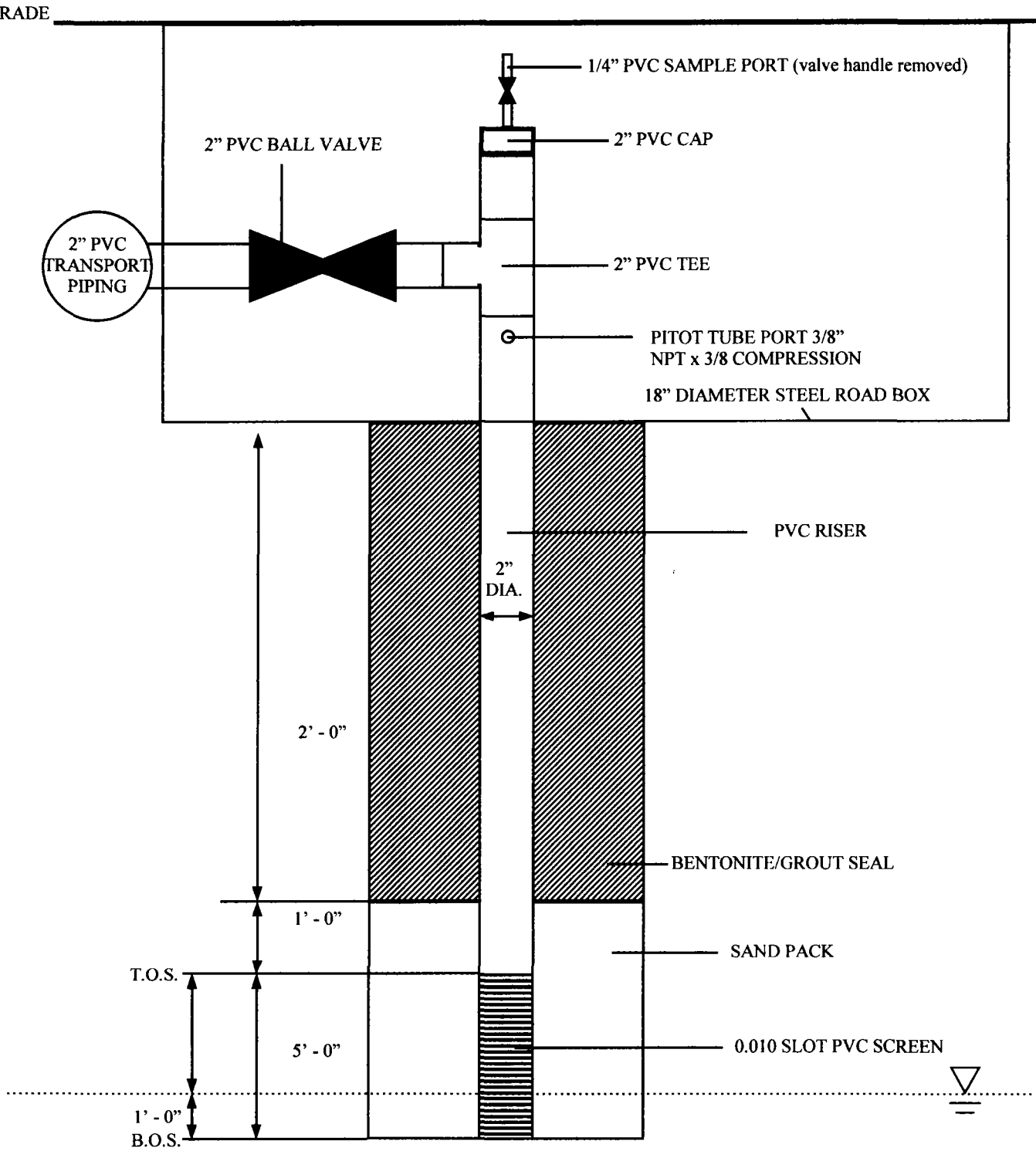

NOT-TO-SCALE

FIGURE 3-4

SOIL VAPOR EXTRACTION WELL DETAIL

263 Howard Street, Lowell, Massachusetts

Prepared for:

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APPENDIX B

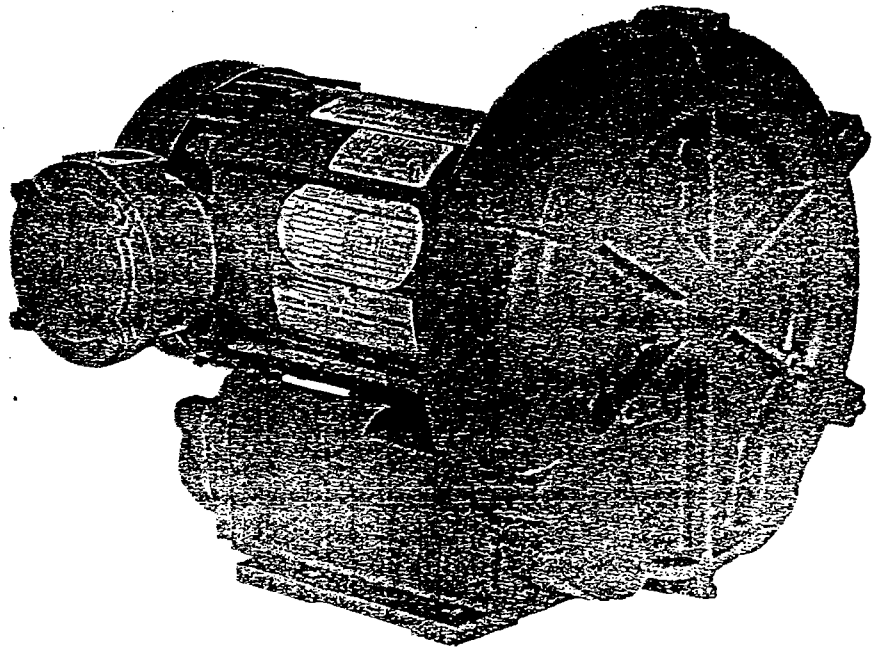
REMEDIAL EQUIPMENT SPECIFICATIONS

EN 606
Explosion-Proof Regenerative Blower

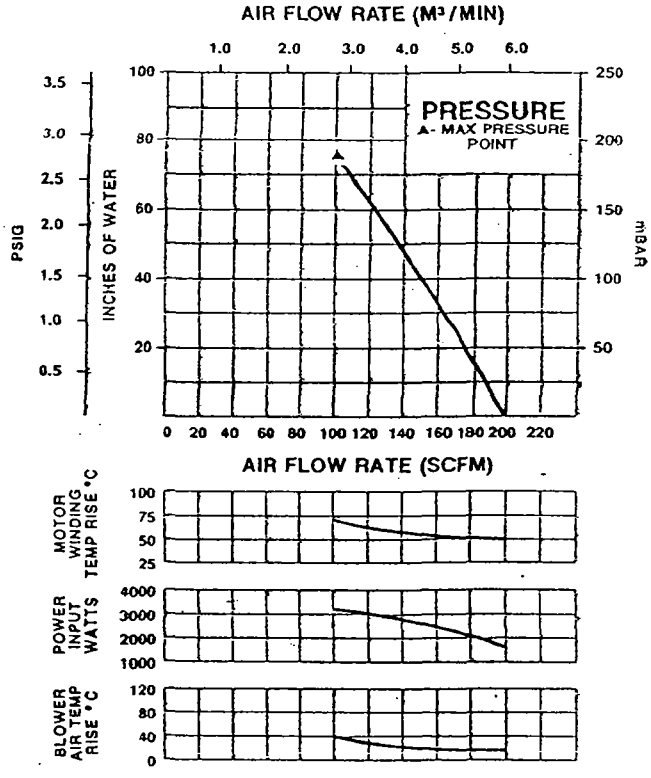
FEATURES
- Manufactured in the USA
- Maximum flow: 200 SCFM
- Maximum pressure: 75" WG
- Maximum vacuum: 75" WG
- Standard motor: 3.0 HP
- Blower construction — cast aluminum housing, cover, impeller & manifold; cast iron flanges
- UL & CSA approved motors for Class I, Group D atmospheres
- Sealed blower assembly
- Quiet operation within OSHA standards

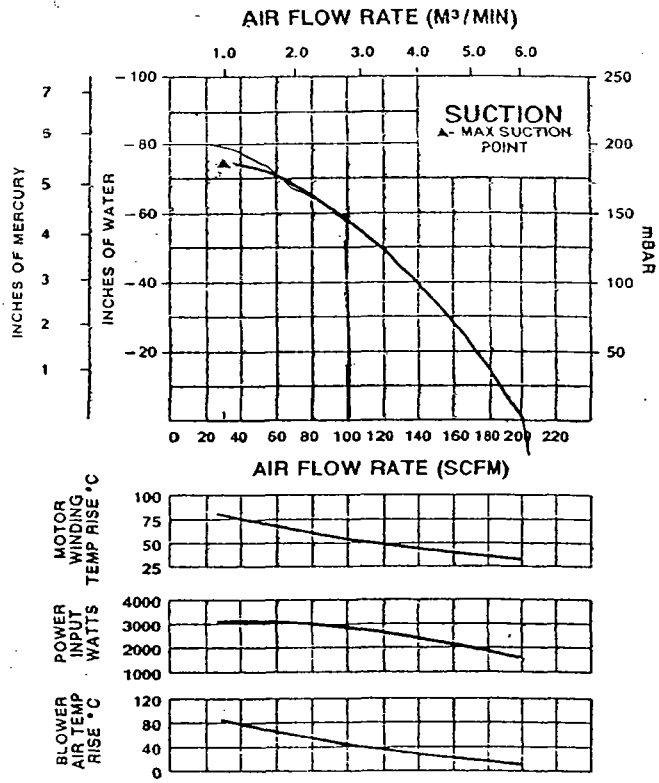
OPTIONS
- TEFC motors
- 50 Hz motors
- International voltages
- Other HP motors
- Corrosion resistant surface treatments
- Remote drive (motorless) models

ACCESSORIES
- Moisture separators
- Explosion-proof motor starters
- Inline & inlet filters
- Vacuum & pressure gauges
- Relief valves
- External mufflers



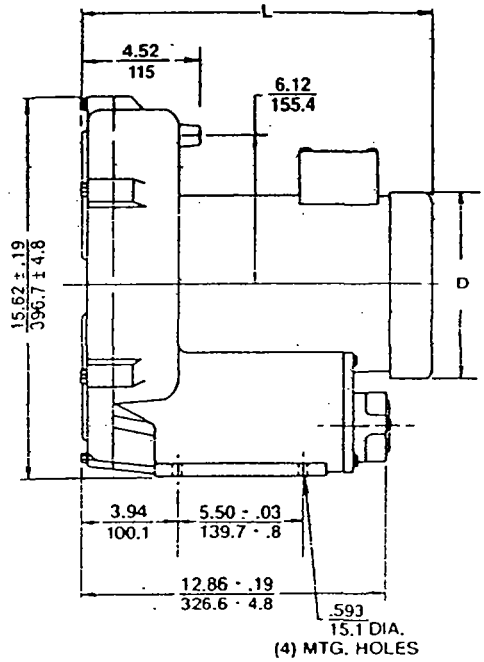
BLOWER PERFORMANCE AT STANDARD CONDITIONS

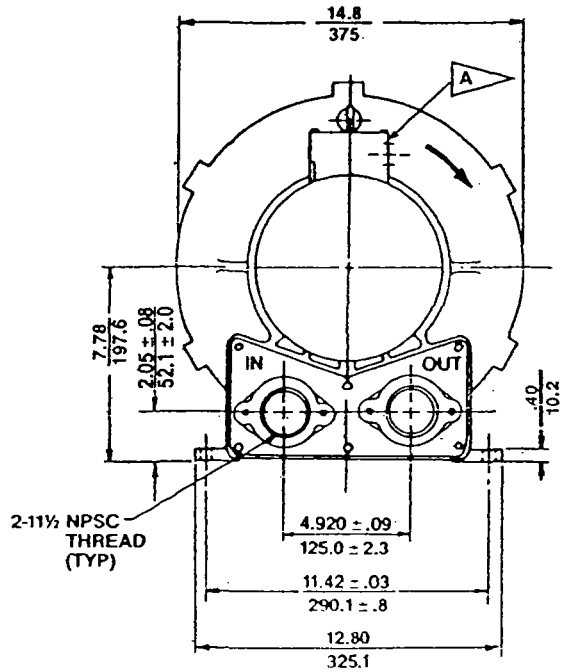




EG&G ROTRON, SAUGERTIES, N.Y. 12477 • 914/246-3401 • FAX 914/246-3802

EN 606
Explosion-Proof Regenerative Blower





DIMENSIONS: IN / MM TOLERANCES: .XX ± .1 / 2.5 (UNLESS OTHERWISE NOTED)

MODEL	L (IN) ± .3	L (MM) ± 8	D (IN) ± .1	D (MM) ± 3
EN606M72L	17.7	456	7.2	182
EN606M5L	19.9	505	8.5	216

A 0.75" NPT CONDUIT CONNECTION

SPECIFICATIONS

1,905.50

MODEL	EN606M5L	EN606M72L		EN606M86L
Part No.	038222	038179		038437
Motor Enclosure Type	Explosion-proof	Explosion-proof		Explosion-proof
Horsepower	3.0	3.0		3.0
Phase — Frequency	Single — 60 Hz	Three - 60 Hz		Three - 60 Hz
Voltage [1]	208/230	230	460	575
Motor Nameplate Amps	15.5-14.5	7.4	3.7	3.0
Maximum Blower Amps [3]	18.1-16.7	7.6	3.8	3.1
Inrush Amps	94-88	65	32.5	26
Starter Size	1	0	0	0
Service Factor	1.0	1.0		1.0
Thermal Protection [2]	Pilot Duty	Pilot Duty		Pilot Duty
Bearing Type	Sealed, Ball	Sealed, Ball		Sealed, Ball
Shipping Weight	130 lb (59 kg)	106 lb (48 kg)		106 lb (48 kg)

BLOWER LIMITATIONS

$3,918 - $2,600 $2,612 - $1,741

Min. Flow @ Max. Suction	30 SCFM @ –75" WG	30 SCFM @ –75" WG	30 SCFM @ –75" WG
Min. Flow @ Max. Pressure	105 SCFM @ 75" WG	105 SCFM @ 75" WG	105 SCFM @ 75" WG

[1]All dual voltage 3 phase motors are factory tested and certified to operate on 200-230/400-460 VAC-3 ph-60 Hz. All dual voltage 1 phase motors are factory tested and certified to operate on 110-120/200-230 VAC-1 ph-60 Hz.
[2]Maximum operating temperatures: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F insulation or 120°C for Class B insulation. Blower outlet air temperature should not exceed 140°C (air temperature rise plus ambient).
[3]Corresponds to the performance point at which the blower and/or motor temperature rise reaches the limit of the thermal protection in the motor.

Specifications subject to change without notice. Please contact factory for specification updates.

LIGHT-DUTY OIL-LESS AIR COMPRESSORS

Oil-free Air Compressors are simple and reliable. Ideal for home shop use. Oil-less air compressors are light weight, start easily in cold temperatures, can operate at any angle, and are virtually maintenance free. All models on this page are UL/CUL Listed.

No. 3JR69

- Tankless design with built in regulator.
- Maximum pressure: 125 PSI
- Unit weighs only 12 lbs.
- 115 volt universal motor starts easily under low voltage conditions
- Includes 25' air hose and tire chuck

No. 3JR70

- 2.5 gallon hotdog style tank
- Unit weighs only 25 lbs.
- 115 volt universal motor for improved start under low voltage conditions

No. 3JR71

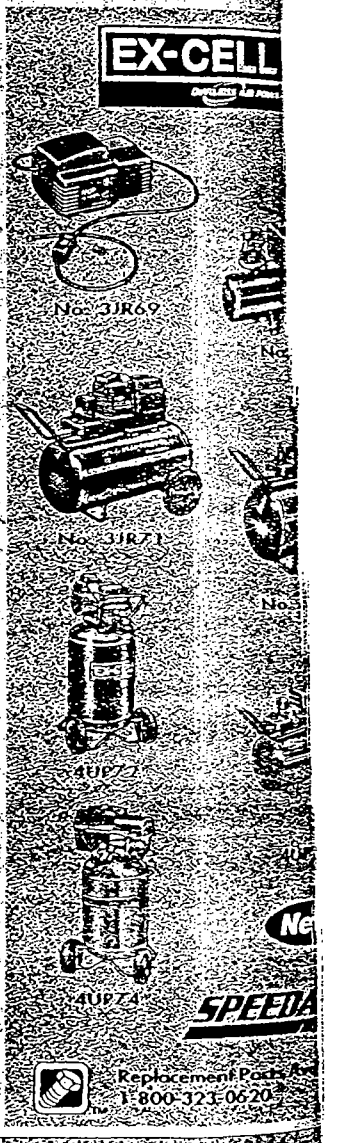
- 20 gallon horizontal portable tank for optimum mobility
- 5 HP NEMA rated motor operates on 120/230V standard household electric current
- Includes regulator, gauges, 1/4" (M)NPT outlets, and ASME safety valve

No. 4UP72

- Vertical/Portable tank design saves floor space and maintains portability
- 5 HP NEMA rated motor operates on 120V standard household electric current
- Includes regulator, gauges, 1/4" (M)NPT outlets, and ASME safety valve

No. 3JR72

- 30 gallon ASME code tank
- Twin cylinder, V-block, oil free design for high air flow and smooth operation
- 6HP NEMA motor operates on 240V current
- Includes regulator, gauges, 1/4" (M)NPT outlet, and ASME safety valve



HEAVY-DUTY OIL-LESS SPEEDAIRE AIR COMPRESSORS

Speedaire heavy-duty oil-less air compressors offer long life, quiet operation, high air flow, and low maintenance.

- 1725 pump RPM for cooler temperatures and longer life
- 2-cylinder, V-block, oil-free design for higher output and smooth operation
- 135 psi maximum/110 psi restart provides greater air supply for extended operation of air tools
- Rated for 65/35 higher-than-standard duty cycle
- 20-gallon ASME code tank
- 3.5 HP NEMA rated motor is equipped with automatic thermal overload protection which prevents motor damage
- Stainless steel valves, anodized cylinder coatings, Teflon piston ring, and large ball bearings ensure reliability
- Includes regulator, gauges, 1/4" (M)NPT outlets and ASME safety valve

No. 4UP73

- 10 X 3" pneumatic wheels for improved manueverability on uneven surfaces

No. 4UP74

- Vertical/Portable tank design saves floor space and maintains portability

Peak/ Developed HP**	Running Motor HP**	Free Air CFM @ PSI 90	Free Air CFM @ PSI 125	Tank Gal.	Tank Type	Volts 60 Hz	Amp Draw	Max. PSI	Dimensions (In.) L	W	H	Stock No.	List	Each
LIGHT-DUTY OIL-LESS AIR COMPRESSORS														
1	.65	2.1	1.8	—	—	120	9.1	125	15.4	11	16.75	3JR69	$130.00	$109.00
1	.70	2.1	1.8	2.5	Hotdog	120	9.5	125	23.5	11	18	3JR70	215.00	179.00
5	1.75	5.0	3.7	20	Horiz./Port.	120/230	15.0	125	34.25	16.5	31.5	3JR71	335.00	279.00
5	1.75	5.0	3.7	20	Vert./Port.	120	15.0	125	22.5	22.5	45.5	New4UP72	485.00	325.00
6	3.0	9.8	8.7	30	Horiz./Port.	240	14.3	125	38.5	17.5	35.5	3JR72	450.00	379.00
HEAVY-DUTY OIL-LESS AIR COMPRESSORS														
3.5	1.8	6.1	4.6	20	Horiz./Port.	120	15.0	135	35.75	18.7	32.36	New4UP73	485.00	375.00
3.5	1.8	6.1	4.6	20	Vert./Port.	120	15.0	135	22.5	22.5	45.5	New4UP74	500.00	375.00

(▲) Net prices, not subject to discounts. (**) For specific HP rating explanation, see page 2849.

SPEEDAIRE

...drive oil-less air com...
...to provide power,
...for job site nee...
...lubricated/oil-less de...
...operate at virtually
...pull or starve pick-
...compact for easy
...or maneuvering
...design eliminates bel
...well as messy oil
...housed 4-port reg
...gauge with auto pressure
...duty cycle
...power cord
...outlet
...48222 belt-driven, oil
...compressor is ideal for co
...general construction; op
...pneumatic tools.
...two-cylinder air compr
...offers greater durability a
...design provides smoot
...operation
...of gravity wheelbarr
...for easy job site maneuve
...beltguard for safe op
...duty cycle
...power cord
...NPT outlet

...GAUGE FOR WIRIN
...EXTENSION CORDS

	Length of Wire in Feet for 120V / 240V 25 / 50	50 / 1
14 ga.		10 ga
12		10
12		N/A
12		N/A

...WHEREVER POSSIBLE.
...extension cords can cause excessiv
...to non-starts and premature
...longer air hose instead.

Running Motor HP**	Free Air CFM @ PSI 90	125	Gal.
.71	2.0	1.7	3
.68	3.0	2.5	3
.90	3.1	2.4	4
1.60	4.3	3.4	4
1.80	6.1	4.6	8
1.80	5.7	4.9	8

...HP rating explanations, see page 284
...bearing life of the pump, see page 2

Ordering is easy —

FALCO 100 SPECIFICATIONS

FALCO 100 catalytic oxidizer treats air streams contaminated with volatile organic compounds. The catalyst provides VOC destruction efficiencies of up to 99%. Temperature controllers accurately regulate process temperatures in response to input loading. This lightweight, portable unit has an integrated heat exchanger which provides efficient heat recovery for processing low concentration vapor. When processing high concentration vapor, the control system automatically adjusts dilution air flow to maintain safe maximum input vapor concentration. Automatic shutdown results if temperature limits are exceeded. The FALCO 100 is Factory Mutual approved and Canadian Standards Association certified for use in hazardous locations.

• **CAPACITY**	40-120 CFM
• **DESTRUCTION EFFICIENCY**	Up to 99%
• **CATALYST INLET TEMP**	310-430°C
• **OUTLET TEMP**	330-620°C
• **CATALYST**	Platinum/palladium
• **WEIGHT**	325 lb.
• **CONSTRUCTION**	304 stainless steel and aluminum
• **DIMENSIONS (apx)**	6'8" high X 50" long X 24" wide
• **POWER REQUIREMENTS**	7.4 kW, 240 Volt single phase

FALMOUTH PRODUCTS P.O. BOX 541 FALMOUTH, MA 02541 PHONE 508 548 6686 FAX 508 548 8144

APPENDIX C

HEALTH AND SAFETY PLAN

LIGHTSHIP
ENGINEERING
ENVIRONMENTAL & LAND-USE CONSULTANTS

LSP SERVICES • CIVIL ENGINEERING • ASSESSMENT • PERMITTING • REMEDIATION • CONSTRUCTION MANAGEMENT

SITE HEALTH AND SAFETY PLAN

FOR:

263 Howard Street
Lowell, Massachusetts

Lightship Engineering Project 542.1.1

VOLUME 1

Prepared for:

Jones Environmental Services (northeast),Inc.
461 Cooke Street
Farmington, Connecticut 06032

Prepared by:

Lightship Engineering, LLC
36 Cordage Park Circle, Suite 312
Plymouth, Massachusetts 02360

LIGHTSHIP ENGINEERING, LLC, AND LIGHTSHIP ENGINEERING'S SUBCONTRACTORS, DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE HAZARDOUS NATURE OF THIS SITE, AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE, AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

TABLE OF CONTENTS

1.0 GENERAL INFORMATION ..... Page 1-1

2.0 SITE INFORMATION ..... Page 2-1
- 2.1 SITE CLASSIFICATION ..... Page 2-1
- 2.2 SITE RELEASE HISTORY ..... Page 2-1

3.0 SITE ACTIVITIES ..... Page 3-1

4.0 HAZARD ASSESSMENT ..... Page 4-1
- 4.1 PHYSICAL HAZARDS ..... Page 4-1
- 4.2 CHEMICAL HAZARDS ..... Page 4-2

5.0 MONITORING AND PERSONAL PROTECTION ..... Page 5-1
- 5.1 AIR MONITORING AND ACTION LEVELS FOR CHEMICAL HAZARDS ..... Page 5-1
  - 5.1.1 Particulate Dust Monitoring Action Level ..... Page 5-2
- 5.2 PHYSICAL HAZARD MANAGEMENT ..... Page 5-2
- 5.3 PERSONAL PROTECTIVE EQUIPMENT (PPE) ..... Page 5-4

6.0 EMERGENCY INFORMATION ..... Page 6-1
- Hospital ..... Page 6-1
- 6.1 EMERGENCY PLAN ..... Page 6-1
  - 6.1.1 Site Emergency Coordinator ..... Page 6-1
  - 6.1.2 Evacuation Point ..... Page 6-1
  - 6.1.3 Lightship Engineering Emergency Phone Numbers ..... Page 6-2

7.0 LIGHTSHIP ENGINEERING FIELD PERSONNEL REVIEW ..... Page 7-1

8.0 HASP APPROVAL ..... Page 8-1

LIST OF FIGURES

1-1 SITE LOCUS MAP ..... Page 2-2

6-1 DIRECTIONS TO HOSPITAL ..... Page 6-3

LIST OF TABLES

4-1 CHEMICALS OF CONCERN ..... Page 4-2

LIST OF APPENDICES
LOCATED IN VOLUME 2

APPENDIX A

DEFINITIONS AND ACRONYMS

APPENDIX B

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS

B.1 Primary Gasoline Constituents
B.2 Secondary Gasoline Constituents
B.3 Fuel Oil Constituents
B.4 Metals
B.5 Polynuclear Aromatic Hydrocarbons
B.6 Constituents in Pesticides
B.7 Entire Registry of Compounds

APPENDIX C

ASSIGNMENT OF RESPONSIBILITIES

C.1 Lightship Engineering Health and Safety Director
C.2 Site Health and Safety Officer
C.3 Field Sampling Personnel Responsibilities
C.4 Subcontractor Responsibilities
C.5 Trenching and Excavation Leader

APPENDIX D

TRAINING, MEDICAL SURVEILLANCE, AND SITE CLEARANCE REQUIREMENTS

D.1 Basic Training Required
D.2 Site-Specific Training
D.3 Safety Briefings
D.4 First Aid
D.5 Medical Surveillance Procedures
D.5.1 Groundwater Sampling

D.5.2 Soil Borings and Subsurface Soil Sampling
D.5.3 General Site Safety Requirements

APPENDIX E

OPERATING ZONES
E.1 Site Zones
E.1.1 Exclusion Zone (EZ)
E.1.2 Contamination Reduction Zone (CRZ)
E.1.3 Support Zone (SZ)

APPENDIX F

SAFETY CONSIDERATIONS FOR SITE OPERATIONS:
F.1 General
F.2 Initial Reconnaissance
F.3 Excavation Safety
F.4 Heavy Equipment Operation
F.5 Fire Safety
F.6 Confined Space Entry

APPENDIX G

MONITORING PROCEDURES FOR SITE OPERATIONS
G.1 General
G.2 Air Monitoring

APPENDIX H

PERSONNEL PROTECTION
H.1 General
H.2 Respiratory Protection
H.3 Clothing
H.4 Initial Levels of Protection
H.5 Safety Equipment
H.6 Communications

H.7 Site Control

APPENDIX I

ACTION LEVELS AND LEVELS OF PROTECTION FOR VARIOUS INSTRUMENT READINGS

APPENDIX J

DECONTAMINATION PROCEDURES
J.1 Personnel Decontamination Procedure
J.2 Equipment Decontamination
J.3 Sample Containers
J.4 Monitoring Equipment
J.5 Respirators
J.6 Laboratory Equipment
J.7 Heavy Equipment

APPENDIX K

EMERGENCY PROCEDURES
K.1 Evacuation
K.2 Potential or Actual Fire or Explosion
K.3 Environmental Incident (Release or Spread of Contamination)
K.4 Personnel Injury
K.5 Overt Personnel Exposure
K.6 Adverse Weather Conditions

APPENDIX L

REFERENCES

1.0 GENERAL INFORMATION

Compliance with this Health and Safety Plan ("HASP") is required of all Lightship Engineering, LLC ("Lightship Engineering") personnel who enter this site and are associated with this fieldwork. The content of this HASP may change or undergo revision, based upon additional information made available to Health and Safety personnel, monitoring results, or changes in the technical scope of work. Any changes proposed must be reviewed and approved by the Lightship Engineering's Site Health and Safety Officer ("SHSO") and Lightship Engineering's Health and Safety Coordinator ("HSC").

The HASP is comprised of two volumes. Volume 1 contains site-specific information; Volume 2 contains non-site-specific health and safety procedures. Both volumes must be on-site during field activities.

Lightship Engineering accepts no responsibility for any uses of its HASP as a reference by any other contractors on-site. It is the contractors' own responsibility to generate and become familiar with their own plan and to conform to its requirements. Assistance in implementing this Plan can be obtained from the HSC and SHSO.

2.0 SITE INFORMATION

Site Location:	Jones Environmental Services (northeast), Inc. 263 Howard Street Lowell, Massachusetts (See Figure 1-1)
Owner/Operator of Site:	Jones Environmental Services (northeast), Inc.
Lightship Engineering Reference No.:	542.1.1
Project Dates:	July, 2002 to March, 2004
Scope of Work:	Refer to Proposal dated March 6, 2002
Topography:	Flat
Surrounding Population:	Commercial
Additional Information:	
Prevailing Wind Condition:	To be determined by SHSO on-Site (The CRZ will be upwind of the EZ)

2.1 SITE CLASSIFICATION (Check all that apply):

X	Active (currently in use)	__	Gas Station
__	Inactive	__	R & D Facility
X	Commercial Facility	__	Military base
__	Industrial facility	X	Other (specify) T.S.D.F.

2.2 SITE RELEASE HISTORY (Check all that apply):

Soil Impact:		Groundwater Impact:	
__	Suspected	__	Suspected
_X_	Confirmed	_X_	Confirmed
___	Unknown	___	Unknown

3.0 SITE ACTIVITIES

This HASP has been prepared to address the following Site activities:

SVE/AS Well Installation

Lightship Engineering proposes to install 3 AS injection and 5 SVE extraction wells surrounding MW-4. Prior to installation, Lightship Engineering will core 8 six-inch diameter holes in the concrete floor at the proposed SVE/AS well locations. Lightship Engineering assumes the floor is not reinforced with steel and the concrete is 12 inches thick. The SVE/AS wells will be installed using the direct-push drilling method. Lightship Engineering will collect continuous soil samples in 4-foot long acetate sleeves. Soil samples will be screened for total organic vapors ("TOVs") using a photo-ionization detector with an 11.7 electron volt bulb and the DEP jar headspace method. The AS wells will be constructed with 2 foot long 1-inch diameter stainless steel screen and approximately 15 feet of 1-inch diameter of black iron riser. The AS well screen will be set approximately 10 feet into the groundwater table (approximately 17 to 18 feet below grade). Lightship Engineering will placed three feet of sand pack around the AS screen and finish the borehole to grade with a bentonite/grout mixture. The SVE extraction wells will be constructed of 10 feet of 1-inch diameter PVC 0.010 slot screen set two feet into groundwater with 2-inch diameter PVC riser to grade. Lightship Engineering will place sand pack to within three feet of grade and finish the borehole with a 2-foot bentonite/grout seal. SVE/AS well heads will be set in 8-inch diameter steel road boxes set flush with the finished floor elevation.

SVE/AS Subsurface Piping Installation

Lightship Engineering proposes to install the SVE/AS transport piping beneath the concrete floor to minimize surface obstructions in the vicinity of MW-4. Lightship Engineering will bring the subsurface piping to above grade along the nearest wall or column and continue the piping above grade to the equipment area. Lightship Engineering assumes the concrete floor is not reinforced with steel and is 12 inches thick. Lightship Engineering will saw cut trenches in the existing concrete floor and remove the concrete and approximately 6 inches of soil. SVE/AS piping will be set in the subsurface trenches and backfilled with 6-inches of compacted stone dust and finished to grade with 3,000 pounds per square inch ("psi") concrete. Lightship Engineering assumes the excavated soil and concrete will be suitable for fill at the Site and will not require disposal as hazardous material. SVE transport piping will be 2-inch diameter schedule 80 PVC with welded joints. AS piping will be 1-inch diameter high-density polyethylene ("HDPE") with mechanical joints. All above grade piping will be fastened to existing structures with uni-strut and metal pipe clamps as necessary.

4.0 HAZARD ASSESSMENT

At the beginning of the project, each work shift, and as often as necessary to ensure safety, the SHSO or designee shall conduct an area survey to locate work place hazards and determine appropriate safety control measures. Chemical and physical hazards expected to be encountered during the field activities are summarized below:

4.1 PHYSICAL HAZARDS

Hazard Identification	Hazard Present	Comments
Heavy Equipment		
Backhoe		
Drill Rig	X	Hollow-Stem Auger
Loader		
Dump Truck		
Crane		
Other	X	Small excavator
Materials Handling		
Flammable Liquid	X	Methanol for decontamination and sample preservation
Corrosive Liquid	X	Acids for sample preservation and decontamination. HCl
Manual Lifting		
Thermal Stress		
Heat		High Temperatures possible
Cold	X	Low Temperatures possible
Site Hazards		
Noise Exposure	X	Drill Rig
Excavations	X	Excavator
Underground Utilities	X	Review Dig Safe markings.
Overhead Utilities	X	Identify potential overhead hazards prior to work.
Electric Equipment		
Other	X	Concrete saw cutting

Natural Hazards		
Direct Sunlight		
Poisonous Plants		
Poisonous Animals		

4.2 CHEMICAL HAZARDS

The Occupational Safety and Health Administration ("OSHA") Permissible Exposure Limits ("PELs") for each chemical previously identified, or anticipated to be encountered, on site are listed in Table 4.1. A list of relevant OSHA PELs is included in Appendix B.

Table 4.1
Chemicals of Concern

Chemicals of Concern	Highest Concentrations Identified to Date		OSHA Limits		Other Limits (If No OSHA Limit)		IDLH or Ceiling Limit (ppmv)	Primary Hazard
	Groundwater (mg/l)	Soil (mg/kg)	PEL (ppmv)	STEL (ppmv)	TWA (ppmv)	STEL (ppmv)		
Tetrachloroethylene ("PCE")	6.7	2.1	1	5	NA	NA	150	CA; Inh, Abs Ing, Con
Trichloroethylene ("TCE")	84	45	100	200	NA	NA	1000	Inh, Abs Ing, Con
1,1,1,-Trichloroethane	360	4	350	1900	NA	NA	NA	Inh, Abs Ing, Con
1,2 cis Dichloroethene	11	.038	200	790	NA	NA	1000	Inh, Abs Ing, Con
1,1- Dichlorethene	Nd	.34			5	20	NA	Inh, Abs Ing, Con
1,1- Dichloroethane	24	0.150	100	400	NA	NA	3000	Inh, Abs Ing, Con
Vinyl Chloride	Nd	NA	1	5	NA	NA	NA	CA; Inh, Con
Toluene	120	0.30	200	300	NA	NA	500	Inh, Abs Ing, Con

PEL = Permissible Exposure Limit for an 8 hour work shift in a 40 hour work week
STEL = Short Term Exposure Limit, a 15 minute TWA
TWA = Time Weighted Average for and 8 hour day or up to a 10 hour day (RELs) during a 40 hour work week
IDLH = Immediately Dangerous to Life and Health
Ceiling Limit = An STEL that con not be exceeded at any point in the work day
ppmv=parts per million by volume
NA= No Exposure Limit established
ND = Not Detected
*NIOSH = National Institute for Occupational Safety and Health
**ACGIH= American Conference of Government/Industrial Hygienists
***DFG = Deutsche Forschungsgemeinschaft
Inh. = Inhalation
Abs. = Skin absorption
Ing. = Ingestion
Con = Skin and/or eye contact
CA = Carcinogenic

5.0 MONITORING AND PERSONAL PROTECTION

5.1 AIR MONITORING AND ACTION LEVELS FOR CHEMICAL HAZARDS

Monitoring of the Breathing Zone ("BZ") will be performed periodically with a photo-ionization detector ("PID") during field operations. The level of protection will be upgraded from level D, if the instrument level continuously exceeds the respective action level for personal protection upgrade for a period of 2 minutes; the level of protection may be upgraded sooner if deemed necessary by the SHSO. Action levels and associated Personal Protection Equipment are listed in Appendix I.

The Site Specific Action Level for this Site is based on vinyl chloride since it is the chemical of concern with the lowest PEL (or equivalent). The OSHA PEL for this chemical is 1 ppmv and the response factor on the Thermo 580B is 0.6. The action level for this Site is 1 ppmv as read on the PID. Therefore, when the PID reads 1 ppmv for two (2) minutes in the BZ evacuate the work area and call the Health and Safety Coordinator to discuss upgrading PPE levels or instituting appropriate engineering controls to decrease the hazard. The IDLH or Ceiling Limit for vinyl chloride not determined based on its Cancer Risks therefore, a conservative 1 ppmv value will be used as the IDLH action level.

5.2 PHYSICAL HAZARD MANAGEMENT

Heavy Equipment Do not wear loose clothing that could get caught in moving parts of heavy equipment.

Materials Handling Methanol and acids are used for sample preservation and sampling equipment decontamination. Always wear proper PPE when handling this material (including gloves and safety glasses), point spray away from the body and face during use and use in well ventilated areas.

Fire Hazards Smoking is prohibited at the Site. Fire extinguishers must be available at all times during operations on Site.

Traffic Hazards Use traffic cones to fence off the work area, wear traffic vests.

Thermal Stress Heat: Monitor the air temperature and take frequent breaks as necessary.

Cold: Wear insulating clothing and gloves. Never handle tools or sampling equipment without gloves at temperatures below 19.4 °F (ACGIH). Take breaks in a warm location, e.g. inside a heated building or vehicle, as necessary. Note that wind chill increases the effect of severe cold. Cease non-emergency activities below -40 °F.

Direct Sunlight Use sun block and/or wear clothing that covers exposed skin.

Poisonous Plants Identify areas impacted with poisonous plants at the Site and avoid contact with those areas. If work is required in areas covered with poisonous plants, first clear the area using hand tools or available excavating equipment. Wear clothing that covers the entire body.

Poisonous Insects Use insect repellant or wear long legged/sleeved clothing.

Poisonous Animals Avoid overgrown areas which poisonous animals are likely to inhabit and wear leatherwork boots and long pants.

Noise Exposure Use earplugs or earmuffs during operation of noisy equipment.

Excavations NEVER enter any unshored excavations or trenches greater than 3 feet deep. Collect samples from excavations using the excavating equipment.

Dust When conducting activities that disturb impacted or potentially impacted soil, use appropriate dust control techniques including spraying water on loose soils, immediately covering excavated soils and/or drill cuttings with polyethylene sheeting or place the soils in drums.

Underground Utility Lines Call DigSafe for utility clearance and have the facility engineer mark out all underground utility lines prior to commencing any subsurface work.

Overhead Utility Lines Be aware of overhead utility lines and do not use any equipment within 20 feet of these lines. (20 feet is a conservative distance. However, if the voltage of the lines is over 350,000 Volts this distance will need to be increased).

Electric Equipment Contact the owner or operator of the equipment to disconnect or de-energize the equipment and do not commence activities associated with the equipment until it is locked out and tagged out.

5.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Hazards at this Site warrant the use of Level D PPE (see Appendix H) that includes:

- Steel toed, steel shank work boots;
- Hard Hat;
- Long pants;
- Long sleeved shirt;
- Safety Glasses;
- Ear plugs or muffs; and
- Chemically resistant Nitrile® gloves.

If Site conditions change such that a higher level of PPE is indicated, leave the Site and consult with the HSC. This HASP requires modifying prior to upgrading the PPE level.

6.0 EMERGENCY INFORMATION

Emergency Contacts:

Fire:	911
Police:	911
Rescue:	911
Massachusetts Poison Control Center:	1-800-682-9211
First Aid Center/Hospital:	978-937-9448, Main Number
Dig Safe Contact Number:	1-888-344-7233
Lightship Engineering Contractor ID No.:	37844
Dig Safe Permit Number:	TBA

Hospital Name and Address:

Lowell General Hospital
17 Warren Street
Lowell, Massachusetts

Directions to Hospital:

See Figure 6-1 and attached directions.

6.1 EMERGENCY PLAN

As a result of the hazards at the Site, and the conditions under which operations are conducted, the possibility of an emergency situation developing is real. An emergency plan is required to be available on Site during operations covered by this HASP. Emergency procedures are outlined in Appendix K, attached in Volume 2 of this plan.

6.1.1 Site Emergency Coordinator:

The SHSO will be responsible for coordinating the evacuation, emergency treatment, emergency transport of site personnel as necessary, and notification of emergency response units and the appropriate management staff. The SHSO will relinquish coordination of emergency response actions only to professional rescue

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Lowell General Hospital

Overview

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Lowell, MA 01852
978-937-9448
Driving Directions | What's Nearby?

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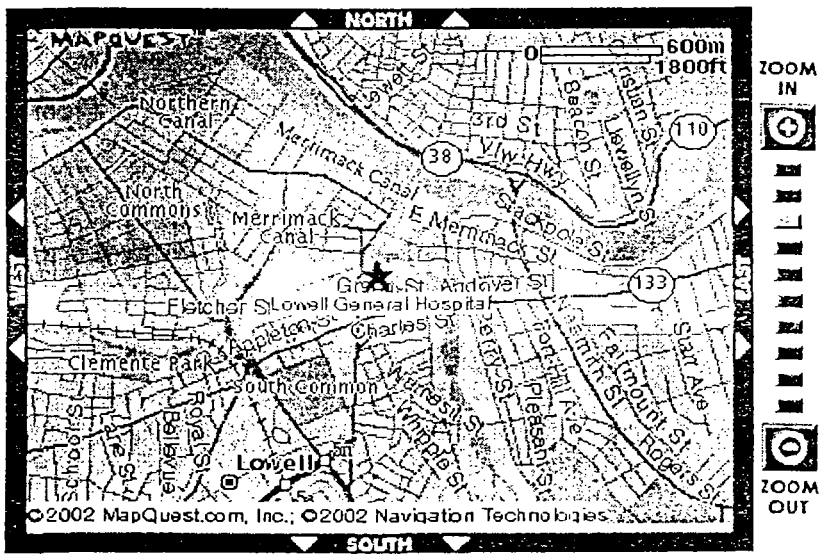

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Overview

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Driving Directions

Driving Directions

Starting Point:
263 HOWARD ST
LOWELL, MA 01852

Destination Point:
Lowell General Hospital
17 Warren St
Lowell, MA 01852
978-937-9448

1: Start out going Northwest on HOWARD ST towards HALE ST.	0.1 Miles (0.15 Km)
2: Turn RIGHT onto HALE ST.	0.1 Miles (0.10 Km)
3: HALE ST becomes YMCA DR.	0.1 Miles (0.20 Km)
4: Turn RIGHT onto MA-3A/THORNDIKE ST.	0.0 Miles (0.03 Km)
5: Turn LEFT onto S HIGHLAND ST.	0.1 Miles (0.20 Km)
6: Turn LEFT onto GORHAM ST.	0.3 Miles (0.44 Km)
7: Turn SLIGHT RIGHT onto SHERATON WAY.	0.1 Miles (0.19 Km)
8: Turn SLIGHT LEFT onto CENTRAL ST.	0.0 Miles (0.06 Km)
9: Turn RIGHT onto CHURCH ST/MA-110 E.	0.1 Miles (0.14 Km)
10: Turn SLIGHT LEFT onto GEORGE ST.	0.1 Miles (0.14 Km)
11: Turn LEFT onto WARREN ST.	0.1 Miles (0.13 Km)
Total Distance:	1.1 miles (1.77 Km)
Estimated Time:	4 minutes.

Starting Point:

Address: 263 HOWARD ST
City: LOWELL
State: MA ZIP code: 01852 Get Directions

SAVE TIME! To save your personal addresses for faster searching, click here.

Destination Point:

Lowell General Hospital
17 Warren St
Lowell, MA 01852

Get directions from this business

personnel (e.g. police, fire) upon their arrival. The SHSO will continue to provide assistance to rescue personnel if requested and able.

6.1.2 Evacuation Point

Should evacuation of the Site be necessary all Site workers should reassemble across Leland Street, opposite the site.

6.1.3 Lightship Engineering Emergency Phone Numbers

(During Office Hours 8:00 a.m. - 5:00 p.m.)

Name: Lightship Engineering, LLC
Phone Number: (508) 830-3344

Name	Pager	Car	Home
Timothy Condon	781-458-4108	617-291-8916	508-888-6966
Joseph O'Brien	781-458-4107	617-291-8915	508-224-1445
Amy Roth	781-458-4113	617-291-8933	508-477-7446
Michael J. Pierdinock	781-458-4106	617-291-8914	781-934-2806

7.0 LIGHTSHIP ENGINEERING FIELD PERSONNEL REVIEW

All Lightship Engineering field personnel will sign this section after site-specific training is completed and before permission to work on-site.

Site Location: Jones Environmental Services (northeast), Inc.
263 Howard Street
Lowell, Massachusetts

Lightship Engineering Reference No.: 542.1.1

Project Dates: July, 2002 – March, 2004

I have read and understand this HASP. I will comply with the provisions contained therein. I understand that no changes to personal protective equipment shall be made without approval of the SHSO.

Name Printed	Signature	Date

8.0 HASP APPROVAL

By their signature, the undersigned certify that this Site-specific HASP is approved.

Site Location: Jones Environmental Services (northeast), Inc.
263 Howard Street
Lowell, Massachusetts

Lightship Engineering Reference No.: 542.1.1

Project Dates: July, 2002 – March, 2004

_____ _____
Joe O'Brien Date
Health and Safety Coordinator

_____ _____
John Mesheau Date
Site Health and Safety Officer

HEALTH AND SAFETY PLAN

Prepared by:

Lightship Engineering, LLC
36 Cordage Park Circle, Suite 312
Plymouth, Massachusetts 02360

VOLUME 2

APPENDICES

LIGHTSHIP ENGINEERING, LLC, AND LIGHTSHIP ENGINEERING'S SUBCONTRACTORS, DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE HAZARDOUS NATURE OF THIS SITE, AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE, AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

LIST OF APPENDICES

APPENDIX A

DEFINITIONS AND ACRONYMS

APPENDIX B

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
B.1 PRIMARY GASOLINE CONSTITUENTS
B.2 SECONDARY GASOLINE CONSTITUENTS
B.3 FUEL OIL CONSTITUENTS
B.4 METALS
B.5 POLYNUCLEAR AROMATICS HYDROCARBONS
B.6 CONSTITUENTS IN PESTICIDES
B.7 ENTIRE REGISTRY OF COMPOUNDS

APPENDIX C

ASSIGNMENT OF RESPONSIBILITIES
C.1 LIGHTSHIP ENGINEERING HEALTH AND SAFETY DIRECTOR
C.2 SITE HEALTH AND SAFETY OFFICER
C.3 FIELD SAMPLING PERSONNEL RESPONSIBILITIES
C.4 SUBCONTRACTOR RESPONSIBILITIES
C.5 TRENCHING AND EXCAVATION LEADER

APPENDIX D

TRAINING, MEDICAL SURVEILLANCE, AND SITE CLEARANCE REQUIREMENTS
D.1 BASIC TRAINING REQUIRED
D.2 SITE-SPECIFIC TRAINING
D.3 SAFETY BRIEFINGS
D.4 FIRST AID
D.5 MEDICAL SURVEILLANCE
D.5.1 GROUNDWATER SAMPLING
D.5.2 SOIL BORINGS AND SUBSURFACE SOIL SAMPLINGS
D.5.3 GENERAL SITE SAFETY REQUIREMENTS

APPENDIX E

OPERATING ZONES
E.1 SITE ZONES
E.1.1 EXCLUSION ZONE (EZ)
E.1.2 CONTAMINATION REDUCTION ZONE (CRZ)
E.1.3 SUPPORT ZONE (SZ)

APPENDIX F

SAFETY CONSIDERATIONS FOR SITE OPERATIONS:
F.1 GENERAL

F.2 INITIAL RECONNAISSANCE
F.3 EXCAVATION SAFETY
F.4 HEAVY EQUIPMENT OPERATION
F.5 FIRE SAFETY
F.6 CONFINED SPACE ENTRY

APPENDIX G

MONITORING PROCEDURES FOR SITE OPERATIONS
G.1 GENERAL
G.2 AIR MONITORING

APPENDIX H

PERSONNEL PROTECTION
H.1 GENERAL
H.2 RESPIRATORY PROTECTION
H.3 CLOTHING
H.4 INITIAL LEVELS OF PROTECTION
H.5 SAFETY EQUIPMENT
H.6 COMMUNICATIONS
H.7 SITE CONTROL

APPENDIX I

ACTION LEVELS AND LEVELS OF PROTECTION FOR VARIOUS INSTRUMENT READINGS
I.1 TOTAL VOCs/SEMI-VOCs- UNKNOWN COMPOUNDS
I.2 POTENTIAL EXPLOSIVE CONDITION
I.3 PARTICULATE DUST MONITORING
I.4 POTENTIAL OXYGEN DEPLETION/ENRICHMENT CONDITION

APPENDIX J

DECONTAMINATION PROCEDURES
J.1 PERSONNEL DECONTAMINATION PROCEDURE
J.2 EQUIPMENT DECONTAMINATION
J.3 SAMPLE CONTAINERS
J.4 MONITORING EQUIPMENT
J.5 RESPIRATORS
J.6 LABORATORY EQUIPMENT
J.7 HEAVY EQUIPMENT

APPENDIX K EMERGENCY PROCEDURES
K.1 EVACUATION
K.2 POTENTIAL OR ACTUAL FIRE OR EXPLOSION
K.3 ENVIRONMENTAL INCIDENT (RELEASE OR SPREAD OF CONTAMINATION
K.4 PERSONNEL INJURY
K.5 OVERT PERSONNEL EXPOSURE
K.6 ADVERSE WEATHER CONDITIONS

APPENDIX L

REFERENCES

APPENDIX A

DEFINITIONS AND ACRONYMS

ACRONYMS FOR HEALTH AND SAFETY PLAN

BZ	-	BREATHING ZONE
CFR	-	CODE OF FEDERAL REGULATIONS
CGI	-	COMBUSTIBLE GAS INDICATOR
CRZ	-	CONTAMINATION REDUCTION ZONE
CPR	-	CARDIOPULMONARY RESUSCITATION
dBA	-	DECIBELS, A WEIGHTING NETWORK
EPA	-	ENVIRONMENTAL PROTECTION AGENCY
EZ	-	EXCLUSION ZONE
GW	-	GROUNDWATER
H & S	-	HEALTH AND SAFETY
HASP	-	HEALTH AND SAFETY PLAN
IDLH	-	IMMEDIATE DANGER TO LIFE AND HEALTH
ING	-	INGESTION
INH	-	INHALATION
LEL	-	LOWER EXPLOSIVE LIMIT
OSHA	-	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
PEL	-	PERMISSIBLE EXPOSURE LIMIT
PID	-	PHOTO IONIZATION DETECTOR
PM	-	PROGRAM MANAGER
PPE	-	PERSONAL PROTECTIVE EQUIPMENT
PPM	-	PARTS PER MILLION
SCBA	-	SELF CONTAINED BREATHING APPARATUS
SHSD	-	Lightship Engineering HEALTH AND SAFETY DIRECTOR
SHSO	-	SITE HEALTH AND SAFETY OFFICER
SVE	-	SOIL VAPOR EXTRACTION
STEL	-	SHORT-TERM EXPOSURE LIMIT
SZ	-	SUPPORT ZONE
TWA	-	TIME WEIGHTED AVERAGE
TLV	-	THRESHOLD LIMIT VALUE

DEFINITIONS

A. Confined Space:
Normally considered to be enclosures having limited means for entry and natural ventilation, which could contain or produce dangerous air contaminants, flammable or explosive atmospheres, and/or oxygen deficiency. Confined spaces may include storage tanks, excavations, or trenches, natural depressions, vaults, and basements.

B. Excavation:
Any man-made cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal, and producing unsupported earth conditions by reasons of the excavation.

C. Excavation and Trenching Leader:
A person, such as a supervisor or engineer, who is capable of identifying existing and predictable hazards in the excavation/trenching work area, and who has the authority to take prompt corrective measures to eliminate them.

D. Immediate Danger to Life and Health (IDLH):
Maximum level at which one would be exposed to an agent and not suffer irreparable effects if exposure was longer than about one-half hour.

E. Ignition Source:
Refers to a heat source of sufficient energy to cause ignition of flammable vapors. The most commonly encountered categories of ignition sources in industry are open flames, hot surfaces, and electrical or frictional sparks.

F. Lower Explosive Limit (LEL):
The minimum concentration of a combustible gas or vapor in air (usually expressed in percent by volume at Lightship Engineering level), which will ignite if an ignition source is present.

G. Oxygen Deficiency:
For the purpose of this directive, any atmosphere containing less than 19.5 percent oxygen shall be considered oxygen deficient and immediately dangerous to life and health.

H. Purging:
The method by which gases, vapors, or other airborne impurities are displaced from a confined space. This may involve such measures as mechanical ventilation, steam ventilation, or introducing another gas, such as nitrogen or carbon dioxide, to control flammable vapors.

I. Trench:
An excavation made below the surface of the ground. In general, the depth is greater than the width at the bottom, but the width of a trench at the bottom is not greater than 15 feet.

APPENDIX B

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
LISTING B.1 : PRIMARY GASOLINE CONSTITUENTS

Compounds of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
Gasoline	300 ppm**	500 ppm**	Irritant to eyes, skin, mucous membrane, dermatitis, headache, fatigue, blurred vision, dizziness, slurred speech, confusion, convulsions, chemical pneumonia, possible liver, and kidney damage, carcinogen
Benzene	1 ppm	5 ppm	Irritant to eyes, skin, nose and respiratory system, giddiness, headache, nausea, staggering, fatigue, anorexia, lassitude, dermatitis, bone marrow depression, carcinogen
1,2,4-trimethylbenzene	25 ppm	NA	Irritant to eyes, skin, nose and respiratory system, bronchitis, hypochromic anemia, headache, drowsiness, fatigue, dizziness, nausea, incoherence, vomiting, confusion, chemical pneumonia
1,3,5-trimethylbenzene	25 ppm	NA	Irritant to eyes, skin, nose and respiratory system, bronchitis, hypochromic anemia, headache, drowsiness, fatigue, dizziness, nausea, incoherence, vomiting, confusion, chemical pneumonia
Toluene	200 ppm	500 ppm (10min max any day)	Irritant to eyes, nose, fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupil, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis, liver/kidney damage.
Naphthalene	10 ppm	15 ppm*	Irritant to eyes, headache, confusion, excitement, malaise, nausea, vomiting, abdominal pain, irritated bladder, profuse sweating, jaundice, hematuria, hemoglobinuria, renal shutdown, dermatitis, optical neuritis, corneal damage
Ethylbenzene	100 ppm	125 ppm*	Irritant to eyes, skin and mucus membrane, headache, dermatitis, narcosis, coma.
Xylenes/ dimethyethylbenzene	100 ppm	150 ppm*	Irritant to skin, eyes, mucus membrane and throat, dizziness, excitement, drowsiness, incoherence, staggering, corneal vacuolization, anorexia, nausea, vomiting , abdominal pain, dermatitis
Trimethyl benzene (mixed isomers)	25 ppm*	NA	NA
Lead	0.05 mg/m^3	NA	Weakness, lassitude, insomnia, facial pallor, pale eyes, anorexia, low weight, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremors, paralyzed wrists and ankles, encephalopathy, kidney disease, irritated eyes, hypertension
Tetraethyl lead	0.075 mg/m^3	NA	insomnia, lassitude, anxiety, tremors, hyper-re-flexion, spasticity, bradycardia, hypertension, hypothermia, pallor, nausea, anorexia, low weight, confusion, disorientation, hallucinations, psychosis, mania, convulsions,

Compounds of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
			coma, eye irritation
Ethylene Dibromide/ 1,2-dibromoethane	20 ppm	50 ppm (5 min max peak in 3 hrs)	Irritant to eyes, skin and respiratory system, dermatitis with vesiculation, damage to liver, heart, spleen and kidney, reproductive effects, carcinogen
Ethylene dichloride/ 1,2-dichloroethane	50 ppm	200 ppm (5 min max peak in 3 hrs)	Irritant to eyes, corneal opacity, central nervous system depression, nausea, vomiting, dermatitis with vesiculation, damage to liver, heart, spleen and kidney, reproductive effects, carcinogen
Ethanol/ethyl alcohol	1,000 ppm	NA	Irritant to eyes, skin and nose, headache, drowsiness, fatigue, narcosis, cough, liver damage, anemia, reproductive and teratogenic effects
MTBE	NA	NA	NA
Tert-amyl methyl	NA	NA	NA
Ethyl-tert-butyl ether	5 ppm*	NA	NA
n-Hexane	500 ppm	NA	Irritant to eyes, skin and nose, lightheadeness, nausea, headache, peripheral neuropathy, numb extremities, muscular weakness, dermatitis, giddiness, chemical pneumonia
n-Heptane	500 ppm (85 ppm*)	440 ppm*	Lightheadeness, giddiness, stupor, vertigo, incoordination, loss of appetite, dermatitis, chemical pneumonia, unconsciousness
Hexanes (other isomers)	100 ppm*	NA	Irritant to eyes skin and respiratory system, headache, giddiness, dizziness, , lightheadeness, nausea, chemical pneumonia, dermatitis
Pentane/n-Pentane	1,000 ppm	610 ppm*	Irritant to eyes, skin and nose, dermatitis, chemical pneumonia, drowsiness, narcosis in animals
Butane/n-Butane	800 ppm*	NA	Drowsiness, narcosis, asphyxia, (frostbite -liquid)
Cyclohexane	300 ppm	NA	Irritant to eyes, skin and respiratory system, drowsiness, dermatitis, narcosis, coma

* NIOSH Standard
** ACGIH Standard
NA - Not Available

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
LISTING B.2 : SECONDARY GASOLINE CONSTITUENTS

Compounds of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
Propane	1,000 ppm	NA	Dizziness, confusion, excitation, asphyxiation, (frostbite-liquid)
Isobutane	800 ppm*	NA	Drowsiness, narcosis, asphyxiation, (frostbite-liquid)
n-Butane	800 ppm*	NA	Drowsiness, narcosis, asphyxiation, (frostbite-liquid)
n-Pentane	1,000 ppm	610 ppm*	Irritant to eyes, skin and nose, dermatitis, chemical pneumonia, drowsiness, narcosis in animals
Cyclopentane	600ppm*	NA	Irritant to eyes, skin, nose, throat, dizziness, lightheadeness, euphoria, incoherence, nausea, vomiting, stupor, dry cracking skin, narcosis in animals
Methylcyclohexane	500 ppm	NA	Irritant to eyes, skin, nose ,throat, lightheadeness, drowsiness, narcosis in animals
Octane	500 ppm	385 ppm*	Irritant to eyes, nose, drowsiness, dermatitis, chemical pneumonia, narcosis in animals

* NIOSH Standard
** ACGIH Standard
NA - Not Available

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
LISTING B.3 : FUEL OIL/DIESEL FUEL CONSTITUENTS

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
Fuel Oil	NA	NA	NA
Benzene	1 ppm	5 ppm	Irritant to eyes, skin, nose and respiratory system, giddiness, headache, nausea, staggering, fatigue, anorexia, lassitude, dermatitis, bone marrow depression, carcinogen
Toluene	200 ppm	500 ppm (10min max any day)	Irritant to eyes, nose, fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupil, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis, liver/kidney damage.
Ethylbenzene	100 ppm	125 ppm*	Irritant to eyes, skin and mucus membrane, headache, dermatitis, narcosis, coma.
Xylenes/ dimethyethylbenzene	100 ppm	150 ppm*	Irritant to skin, eyes, mucus membrane and throat, dizziness, excitement, drowsiness, incoherence, staggering, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
Naphthalene	10 ppm	15 ppm*	Irritant to eyes, headache, confusion, excitement, malaise, nausea, vomiting, abdominal pain, irritated bladder, profuse sweating, jaundice, hematuria, hemoglobinuria, renal shutdown, dermatitis, optical neuritis, corneal damage
Lead	0.05 mg/m^3	NA	Weakness, lassitude, insomnia, facial pallor, pale eyes, anorexia, low weight, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremors, paralyzed wrists and ankles, encephalopathy, kidney disease, irritated eyes, hypertension
Tetraethyl lead	0.075 mg/m^3	NA	Insomnia, lassitude, anxiety, tremors, hyper-reflexia, spasticity, bradycardia, hypertension, hypothermia, pallor, nausea, anorexia, low weight, confusion, disorientation, hallucinations, psychosis, mania, convulsions, coma, eye irritation
Ethylene Dibromide/ 1,2-dibromoethane	20 ppm	50 ppm (5min max peak in 3hrs)	Irritant to eyes, skin and respiratory system, dermatitis with vesiculation, damage to liver, heart, spleen and kidney, reproductive effects, carcinogen
Ethylene Dichloride/ 1,2-dichloroethane	50 ppm	200 ppm (5min max peak in 3hrs)	Irritant to eyes, corneal opacity, central nervous system depression, nausea, vomiting, dermatitis, liver, kidney and cardiovascular system damage, carcinogen

* NIOSH Standard
** ACGIH Standard
NA - Not Available

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
LISTING B.4 : METALS

Compounds of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
Antimony	0.5 mg/m^3	NA	Irritant to eyes, skin, nose, throat and mouth, coughing, dizziness, headaches, nausea, vomiting, diarrhea, stomach cramps, insomnia, anorexia, inability to smell properly
Arsenic (inorganic compounds)	0.01 mg/m^3	NA	Ulceration of nasal septum, , dermatitis, gastro intestinal disturbances, peripheral neuropathy, respiratory irritation, hyper pigment of skin, carcinogen, respiratory irritation, carcinogen, ulceration of nasal septum
Arsenic (organic compounds)	0.5 mg/m^3	NA	In animals: irritant to skin, dermatitis, respiratory distress, diarrhea, kidney damage, muscular tremor, seizures, possible gastro intestinal tract, teratogen, reproductive effects, possible liver damage
Beryllium	0.002 mg/m^3	0.005 mg/m^3	Berylliosis (chronic exposure) anorexia, low weight, weakness, chest pain, coughing, clubbing of fingers, cyanosis, pulmonary insufficiency, irritant to eyes, dermatitis, carcinogen
Cadmium (fumes)	0.005 mg/m^3	NA	Pulmonary edema, dyspnea, breathing difficulty, cough, tight chest, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, emphysema, proteinuria, anosmia, mild anemia, carcinogen
Chromium	1 mg/m^3	NA	Irritant to eyes and skin, lung fibrosis
Copper (as dust)	1 mg/m^3,	NA	Irritant to eyes, nose and pharynx, nasal perf, dermatitis, metallic taste, in animals lung, liver and kidney damage, anemia
Lead	0.05 mg/m^3	NA	Weakness, lassitude, insomnia, facial pallor, pale eyes, anorexia, low weight, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremors, paralyzed wrists and ankles, encephalopathy, kidney disease, irritated eyes, hypotension
Mercury	0.05 mg/m^3*	0.01 mg/m^3	Irritant to eyes and skin, coughing, chest pain, dyspnea, bronchial pneuitis, tremors, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, gastro intestinal disturbances, low weight, proteinuria
Nickel	1 mg/m^3, 0.015 mg/m^3*	NA	Sensitive dermatitis, allergic asthma, pneuitis, carcinogen
Selenium	0.2 mg/m^3	NA	Irritant to skin, eyes, nose and throat, visual disturbance, headaches, chills, fever, dyspnea, bronchitis, metallic taste, garlic breath, gastro intestinal disturbances, eye and skin burns, dermatitis

Compounds of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
Silver	0.01 mg/m^3	NA	Blue-gray eyes, irritant to nasal septum, throat and skin, ulceration of skin, gastro intestinal disturbances
Thallium	0.1 mg/m^3	NA	Nausea, diarrhea, abdominal pain, vomiting, ptosis, strabismus, peri neuritis, tremor, tight chest, chest pain, pulmonary edema, seizures, chorea, psychosis, liver and kidney damage, alopecia, paresthesia to legs
Zinc as ZnCl fumes	1 mg/m^3	2 mg/m^3*	Irritation of eyes, skin, nose and throat, conjunctivitis, cough, copious sputum, dyspnea, chest pain, pulmonary edema, bronchopneumonia, pulmonary fibrosis, cor pulminale, fever, cyanosis, tachypnea, skin burns

* NIOSH Standard
** ACGIH Standard
NA - Not Available

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
LISTING B.5 : POLYNUCLEAR AROMATIC HYDROCARBONS

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
Naphthalene	10 ppm	15 ppm*	Irritant to eyes, headache, confusion, malaise, excitement, nausea, vomiting, abdominal pain, irritated bladder, profuse sweat, jaundice, hematuria, hemoglobinuria, renal shutdown, dermatitis, optical neuritis, corneal damage
Benz (a) anthracene	NA	NA	Carcinogen
Benzo (b) fluoranthene	NA	NA	Carcinogen
Coal Tar Pitch Volatiles (pyrene, phenanthrene, acridine, chrysene, anthracene and benzo(a)pyrene)	0.2 mg/m^3	NA	Dermatitis, bronchitis, carcinogen

* NIOSH Standard
** ACGIH Standard
Ca - carcinogen
NA - Not Available

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
LISTING B.6 : CONSTITUENTS IN PCBs AND PESTICIDES

Compounds of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
PCBs (42% chlorine)	1 mg/m^3 0.001 mg/m^{3*}	NA	Irritant to eyes, chloracne, liver damage, reproductive effects, carcinogen
PCBs (54% chlorine)	0.5 mg/m^3 0.001 mg/m^{3*}	NA	Irritant to eyes, chloracne, liver damage, reproductive effects, carcinogen
Aldrin	0.25 mg/m^3	NA	Headaches, dizziness, nausea, vomiting, malaise, myoclonic jerks of limbs, clonic and tonic convulsions, coma, hematuria, azotemia, carcinogen
Captan	5 mg/m^{3*}	NA	Irritating to eyes, skin, upper respiratory system, blurred vision, dermatitis, skin sensitivity, dyspnea, vomiting, diarrhea, carcinogen
Chlordane	0.5 mg/m^3	NA	Blurred vision, confusion, ataxia, delirium, coughing, abdominal pain, nausea, vomiting, diarrhea, irritability, tremors, convulsions, anuria, carcinogen; in animals lung, liver and kidney damage
DDT	1 mg/m^3, 0.5 mg/m^{3*}	NA	Irritating to eyes and skin, paresthesia tongue, lips and face, tremors, apprehension, dizziness, confusion, malaise, headache, fatigue, headache, convulsions, paresis hands, vomiting, carcinogen
Dieldrin	0.25 mg/m^3	NA	Headache, dizziness, nausea, vomiting, malaise, sweating, myoclonic limb jerks, clonic and tonic convulsions, coma, carcinogen; in animals liver and kidney damage
Endosulfan	0.1 mg/m^{3*}	NA	Irritant to skin, nausea, confusion, agitation, flushing, dry mouth, tremors, convulsions, headaches; in animals liver and kidney damage
Endrin	0.1 mg/m^3	NA	Epileptic convulsions, stupor, headaches, dizziness, abdominal discomfort, nausea, vomiting, insomnia, aggressiveness, confusion, lethargy, weakness, anorexia; in animals liver damage
Heptachlor	0.5 mg/m^3	NA	In animals tremors, convulsions, liver damage
Malathion	15 mg/m^3, 10 mg/m^{3*}	NA	Irritation of the eyes and skin, myosis, aching eyes, blurred vision, lacrimation, salivation, anorexia, nausea, vomiting, abdominal cramps, diarrhea, giddiness, confusion, ataxia, rhinorrhea, headaches, tight chest, wheezing, laryngeal spasm

Compounds of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects
Methoxychlor	15 mg/l	NA	In animals: fasiculation, trembling, convulsions, kidney and liver damage, carcinogen
Methyl parathion	0.2 mg/m^{3*}	NA	Irritation of eyes and skin, nausea, vomiting, abdominal cramps, diarrhea, salivation, headaches, giddiness, vertigo, weakness, rhinorrhea, tight chest, blurred vision, myosis, cardiac irregularities, muscle fasiculation, dyspnea
Parathion	0.1 mg/m^3, 0.05 mg/m^{3*}	NA	Irritation to eyes, skin, respiratory system, miosis, rhinorrhea, headache, chest tightness, wheezing, laryngeal spasms,, salivation, cyanosis, anorexia, nausea, vomiting, abdominal cramps, diarrhea, sweating, muscle fasiculation, weakness, paresthesia, dizziness, confusion, ataxia, convulsions, coma, low blood pressure, cardiac irregularities
Toxaphene/ chlorinated camphrene	0.5 mg/m^3	1 mg/m^{3*}	Nausea, confusion, agitation, tremors, convulsions, unconsciousness, dry red skin

* NIOSH Standard
** ACGIH Standard

LISTING OF PEL'S FOR COMMONLY ENCOUNTERED COMPOUNDS
LISTING B.7 : ENTIRE REGISTRY OF COMPOUNDS

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
Gasoline	300 pp m**	500 ppm**	Irritant to eyes, skin, mucous membrane, dermatitis, headache, fatigue, blurred vision, dizziness, slurred speech, confusion, convulsions, chemical pneumonia, possible liver, and kidney damage, carcinogen
Benzene	1 ppm	5 ppm	Irritant to eyes, skin, nose and respiratory system, giddiness, headache, nausea, staggering, fatigue, anorexia, lassitude, dermatitis, bone marrow depression, carcinogen
1,2,4-trimethylbenzene	25 ppm	NA	Irritant to eyes, skin, nose and respiratory system, bronchitis, hypohromic anemia, headache, drowsiness, fatigue, dizziness, nausea, incoherence, vomiting, confusion, chemical pneumonia
1,3,5,-trimethylbenzene	25 ppm	NA	Irritant to eyes, skin, nose and respiratory system, bronchitis, hypochromic anemia, headache, drowsiness, fatigue, dizziness, nausea, incoherence, vomiting, confusion, chemical pneumonia
1,2-dichlorobenzene	25 ppm *	50 ppm	Irritant to eyes, nose, liver, kidney damage, skin blisters
1,4-dichlorobenzene	75 ppm	NA	Irritant to eyes, periorbital swelling, profuse rhinitis, headache, anorexia, nausea, vomiting, low-weight, jaundice, cirrhosis, in animals: liver/kidney damage, carcinogen
1,2,5-trimethylbenzene	25 ppm *	NA	NA
1,2,6-trimethylbenzene	25 ppm *	NA	NA
Toluene	200 ppm	500 ppm (10 min max any day)	Irritant to eyes, nose, fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupil, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis, liver/kidney damage
o-chlorotoluene,	50 ppm *	75 ppm *	Irritant to eyes, skin, mucous membranes, dermatitis, drowsiness, incoordination, anesthesia, cough, liver/kidney injury
Naphthalene,	10 ppm	15 ppm*	Irritant to eyes, headache, confusion, malaise, excitement, nausea, vomiting, abdominal pain, irritated bladder, profuse sweat, jaundice, hematuria, hemoglobinuria, renal shutdown, dermatitis,

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
			optical neuritis, corneal damage
Ethylbenzene,	100 ppm	125 ppm*	Irritant to eyes, skin and mucus membrane, headache, dermatitis, narcosis, coma
Xylenes (dimethylbenzene)	100 ppm	150 ppm*	Irritant to eyes, skin, nose, throat, dizziness, excitement, drowsiness, incoordination, staggering gait, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
1,2,4-trichlorobenzene		NA	Irritant to eyes, skin, mucous membranes, in animals liver and kidney damage, possible teratogenic effects
Lead	0.05 mg/m^3	NA	Weakness, lassitude, insomnia, facial pallor, pale eyes, anorexia, low weight, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremors, paralyzed wrists and ankles, encephalopathy, kidney disease, irritated eyes, hypertension
Tetraethyl lead	0.075 mg/m^3	NA	Insomnia, lassitude, anxiety, tremors, hyper-reflexia, spasticity, bradycardia, hypertension, hypothermia, pallor, nausea, anorexia, low weight, confusion, disorientation, hallucinations, psychosis, mania, convulsions, coma, eye irritation
Ethylene Dibromide /1,2-dibromoethane	20 ppm	50 ppm (5min max peak any 3 hours)	Irritant to eyes, skin and respiratory system, dermatitis with vesiculation, damage to liver, heart, spleen and kidney, reproductive effects, carcinogen
Ethylene Dichloride/ 1,2-dichloroethane	50 ppm	200 ppm (5 min max peak any 3 hours)	Irritant to eyes, corneal opacity, central nervous system depression, nausea, vomiting, dermatitis, liver, kidney and cardiovascular system damage, carcinogen
Xylenes	100 ppm	150 ppm*	Irritant to skin, eyes, mucus membrane and throat, dizziness, excitement, drowsiness, incoherence, staggering, corneal vacuolization, anorexia, nausea, vomiting , abdominal pain, dermatitis
MTBE	NA	NA	NA
Propane	1000ppm	NA	Dizziness, confusion, excitation, asphyxiation, (frostbite-liquid)

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
1,2-dichloropropane,	75 ppm	400 ppm	Irritant to eyes, skin and respiratory system, drowsiness, lightheadedness, damage to liver, and kidney; in animals; central nervous system depression, carcinogen
1,2,3-trichloropropane	50 ppm	10 ppm *	Irritant to eyes, nose and throat, central nervous system depression, in animals: liver and kidney injury, carcinogen
1,3-dichloropropene	1 ppm *	NA	Irritant to eyes, skin and respiratory system, eye and skin burns, lacrimation, headaches, dizziness, in animals: liver and kidney damage, carcinogen
Isobutane	800 ppm *	NA	Drowsiness, narcosis, asphyxiation, (frostbite-liquid)
Butane/n-Butane,	800 ppm *	NA	Drowsiness, narcosis, asphyxiation, (frostbite-liquid)
2,3-dimethylbutane, 2-methylpentane, 3-methylpentane	100 ppm	510 ppm	Irritant to eyes, skin, respiratory system, headaches, giddiness, dizziness, lightheadedness, nausea, chemical pneumonia (aspiration liquid)
Pentane/n-Pentane,	1000 ppm 120 ppm *	610 ppm *	Irritant to eyes, skin and nose, dermatitis, chemical pneumonia, drowsiness, narcosis in animals
Cyclopentane,	600 ppm *	NA	Irritant to eyes, skin, nose, throat, dizziness, lightheadeness, euphoria, incoherence, nausea, vomiting, stupor, dry cracking skin, narcosis in animals
n-Hexane,	500 ppm, 50 ppm*	NA	Irritant to eyes, nose, lightheadeness, nausea, numb extremities, chemical pneumonia
2-Hexanone	100 ppm 1 ppm *	NA	Irritant to eyes, nose, peripheral neuropathy, dermatitis, headaches, drowsiness
Cyclohexane	300 ppm	NA	Irritant to skin, eyes, respiratory system, drowsiness, dermatitis
n- Heptane,	500 ppm, 85 ppm	440 ppm *	Light headiness, stupor, vertigo, loss of appetite, nausea, chemical pneumonia, dermatitis, giddiness
Methylcyclohexane	500 ppm, 400 ppm*	NA	Irritant to eyes, skin, nose ,throat, lightheadeness, drowsiness, narcosis in animals
Octane	500 ppm	385 ppm*	Irritant to eyes, nose, drowsiness, dermatitis, chemical pneumonia, narcosis in animals

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
n-Octane	500 ppm, 75 ppm*	385 ppm *	Irritant to eyes, nose, drowsiness, dermatitis, chemical pneumonia, nacrosis in animals
Antimony	0.5 mg/m^3	NA	Irritant to eyes, skin, nose, throat and mouth, coughing, dizziness, headaches, nausea, vomiting, diarrhea, stomach cramps, insomnia, anorexia, inability to smell properly
Arsenic- organic	0.05 mg/m^3	NA	In animals: irritant to skin, dermatitis, respiratory distress, diarrhea, kidney damage, muscular tremor, seizures, possible gastro-intestinal tract, teratogen, reproductive effects, possible liver damage
Arsenic - inorganic compounds	0.01 mg/m^3	0.002 mg/m^3 (15 minute)	Ulceration of nasal septum, dermatitis, gastro-intestinal disturbances, peripheral neuropathy, respiratory irritation, hyper pigment of skin, carcinogen, respiratory irritation, carcinogen, ulceration of nasal septum
Beryllium	0.002 mg/m^3	0.025 mg/m^3 (30 min max peak)	Berylliosis (chronic exposure) anorexia, low weight, weakness, chest pain, coughing, clubbing of fingers, cyanosis, pulmonary insufficiency, irritant to eyes, dermatitis, carcinogen
Cadmium (fumes)	0.005 mg/m^3	NA	Pulmonary edema, dyspnea, breathing difficulty, cough, tight chest, substernal pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, emphysema, proteinuria, anosmia, mild anemia, carcinogen
Chromium (II and III)	0.5 mg/m^3	NA	Irritant to eyes and skin, lung fibrosis
Chromium (VI) or CrO3	0.001*	0.1 mg/m^3	Irritant to respiratory system, nasal septum perforation, liver/kidney damage, leukocytosis, leukopenia, monocytosis, eosinophilia, eye injury, conjunctivitis, skin ulcers, sensitization dermatitis, carcinogen
Copper (dusts and mists)	1 mg/m^3,	NA	Irritant to eyes, nose pharynx, nasal, dermatitis, metallic taste, dermatitis, in animals: lung, live and kidney damage, anemia
Copper (fumes)	0 .1 mg/m^3 as fumes	NA	Irritant to eyes, upper respiratory system, metal fume fever, chills, muscle ache, nausea, fever, dry throat, cough weakness, lassitude, metallic or sweet taste, skin and hair discoloration
Mercury compunds (except organo-alkyls)	Hg vapor 0.05 mg/m^3	0.1 mg/m^3	Irritant to eyes and skin, coughing, chest pain, dyspnea, bronchial pneumonitis, tremors, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, gastro intestinal disturbances, low weight, proteinuria
Mercury (organo)			Parathesia, ataxia, dysarthria, vision and hearing disturbances, spasticity, jerking limb, dizziness,

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
alkyl compounds	0.01 mg/m^3	0.04 mg/m^3	salivation, lacrimation, nausea, vomiting, diarrhea, constipation, skin burns, emotional disturbance, kidney injury, possible teratogenic effects
Nickel	1 mg/m^3,	NA	Sensitive dermatitis, allergic asthma, pneumonitis, carcinogen
Selenium	0.2 mg/m^3	NA	Irritant to skin, eyes, nose and throat, visual disturbance, headaches, chills, fever, dyspnea, bronchitis, metallic taste, garlic breath, gastro intestinal disturbances, eye and skin burns, dermatitis
Silver	0.01 mg/m^3	NA	Blue-gray eyes, irritant to nasal septum, throat and skin, ulceration of skin, gastro intestinal disturbances
Thallium	0.1 mg/m^3	NA	Nausea, diarrhea, abdominal pain, vomiting, ptosis, strabismus, peri neuritis, tremor, tight chest, chest pain, pulmonary edema, seizures, chorea, psychosis, liver and kidney damage, alopecia, parestlhesia to legs
Zinc as ZnCl	1 mg/m^3	2 mg/m^3 *	Irritation of eyes, skin, nose and throat, conjunctivitis, cough, copious sputum, dyspnea, chest pain, pulmonary edema, bronchopneumonia, pulmonary fibrosis, pulminale, fever, cyanosis, tachypnea, skin burns
Naphthalene	10 ppm	15 ppm *	Irritant to eyes, head, excitement, nausea, vomiting
Chrysene	0.2 mg/m^3 0.1 mg/m^3 *	NA	Dermatitis, bronchitis, carcinogen
Phenanthrene	0.2 mg/m^3	NA	Dermatitis, bronchitis, carcinogen
Pyrene,	0.2 mg/m^3 0.1 mg/m^3 *	NA	Dermatitis, bronchitis, carcinogen
Benzo(a) pyrene	0.2 mg/m^3 0.1 mg/m^3 *	NA	Dermatitis, bronchitis, carcinogen
Methylene Chloride	500 ppm	125 ppm	Irritant to eyes, skin, fatigue, weakness, somnolence, lightheadeness, numbness, tingling limbs, nausea, carcinogen
1,1 Dichloroethane,	100 ppm	NA	Irritant to skin, central nervous system depression, damage to lung, kidney, liver
1,2-dichloroethane	50 ppm 1ppm*	100 ppm 2 ppm *	Irritant to eyes, corneal opacity, central nervous system depression, nausea, vomiting, dermatitis, liver, kidney and cardiovascular system damage, carcinogen

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
Chloroform	NA	50 ppm 2 ppm*	Irritant to eyes, skin, dizziness, mental dullness, nausea, enlarged liver, carcinogen
Carbon tetrachloride	10 ppm	25 ppm 200 ppm (5 min peak in 4hrs) 2 ppm * (60 minute peak)	Irritant to eyes, skin, central nervous system depressor, nausea, vomiting, liver and kidney damage
trichlorofluoro-methane,	1000 ppm	NA	Incoherence, tremors, dermatitis, cardiac arrhythmia, cardiac arrest, asphyxiation, liquid: frostbite
1,1,2-Trichloroethane,	10 ppm	NA	Irritant to eyes, nose, CNS depressant, damage to liver and kidney, dermatitis, carcinogen
1,1,1-Trichloroethane	350 ppm	450 ppm*	Irritant to eyes, skin, head, CNS depressor, lassitude, cardiac arrhythmia, poor equilibrium, dermatitis, liver damage
Bromoform	0.5 ppm	NA	Irritant to eyes, skin respiratory system, CNS depression, damages liver, kidney
1,1,2,2-tetrachloroethane	5 ppm 1 ppm*	NA	Nausea, vomiting, abdominal pain, tremor fingers, jaundice, hepatitis, kidney and liver damage, dermatitis, carcinogen
1,1,1,2-tetrachloroethane	none, *handle with caution*	NA	Irritation to eyes, skin, weakness, restlessness, irregular respiration
Vinyl Chloride	1ppm	5 ppm (ceiling)	Weakness, abdominal pain, GI bleeding, enlarged liver, frostbite, carcinogen
1,1-Dichloroethene,	100 ppm		Irritant to eyes, skin, nose, throat, dizziness, headaches, nausea, dyspepsia, liver and kidney dis-function, pneumonitis, carcinogen
Trichloroethene	100 ppm	200 ppm 300 ppm (5min max in 2hrs)	Irritant to eyes, skin, headaches, vertigo, visual disturbances, fatigue, giddiness, tremors, somnolence, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia, liver injury, carcinogen
Styrene	100 ppm 50 ppm*	200 ppm;600 ppm (5min max in 3hrs) 100 ppm*	Irritant to eyes, nose, respiratory system, fatigue, dizziness, weakness, possible liver injury and reproductive effects.

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
1, 2 Dibromoethane	20 ppm, 0.045 ppm *	30 ppm; 50 ppm (5 min max peak) 0.013 ppm *	Irritation to eyes, skin, respiratory system, dermatitis with vesiculation, liver, heart, spleen and kidney damage, reproductive effects, carcinogen
Dichlorodifluoro-methane	1000 ppm, 10 ppm *	NA	Asphyxiation, cardiac arrhythmia, cardiac arrest, liquid: frostbite
Acetone	1000 ppm	NA	Irritation to eyes, nose, throat, head, dizziness, CNS depression
Carbon Disulfide	20 ppm	100 ppm (30 min max peak)	Dizziness, headaches, fatigue, Parkinson-like syndrome, heart disease, kidney and liver injury, reproductive effects, skin burns
Vinyl Acetate	10 ppm*	4 ppm (15 minute) *	Irritation to eyes, skin, nose, throat, hoarseness, cough, loss of smell, eye burns, skin blisters
Acrolein	0.1 ppm	0.3 ppm*	Irritating to eyes, skin, nose, decreased pulmonary function, chronic respiratory disease
Acrylonitrile	2 ppm, 1ppm *	10 ppm (Ceiling)	Irritation to eyes, skin, asphyxiation, sneezing, nausea, vomiting, weakness, lightheadeness
Bromochlorometh ane	200 ppm	NA	Irritation to eyes, skin, throat, confusion, dizziness, central nervous system depression, pulmonary edema
Chlorobenzene	75 ppm	NA	Irritation to eyes, skin, nose, drowsiness, CNS depression
Ethyl ether	400 ppm	500 ppm*	Irritation to eyes, skin, upper respiratory system, dizziness, drowsiness, headaches, nausea, vomiting
PCB'S (Araclor) (42% chlorine)	1 mg/m^3 0.001 mg/m^3 *	NA	Irritant to eyes, chloracne, liver damage, reproductive effects, carcinogen
PCB'S (Araclor) (54%chlorine)	0.5 mg/m^3 0.001mg/m^3 *	NA	Headaches, dizziness, nausea, vomiting, malaise, myoclonic jerks of limbs, clonic and tonic convulsions, coma, hematuria, azotemia, carcinogen
Aldrin	0.25 mg/m^3	NA	Headaches, dizziness, nausea, jerks of limbs, convulsions, coma, carcinogen
Captan	5 mg/m^3*	NA	Irritating to eyes, skin, upper respiratory system, blurred vision, dermatitis, skin sensitivity, dyspnea, vomiting, diarrhea, carcinogen
			Blurred vision, confusion, ataxia, delirium, coughing, abdominal pain, nausea, vomiting, diarrhea,

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
Chlordane	0.5 mg/m^3	NA	irritability, tremors, convulsions, anuria, carcinogen; in animals lung, liver and kidney damage
4,4'-DDT,	1 mg/m^3, 0.5 mg/m^3 *	NA	Irritating to eyes and skin, paresthesia tongue, lips and face, tremors, apprehension, dizziness, confusion, malaise, headache, fatigue, headache, convulsions, paresis hands, vomiting, carcinogen
Endosulfan I,	*0.1 mg/m^3*	NA	Irritant to skin, nausea, confusion, agitation, flushing, dry mouth, tremors, convulsions, headaches; in animals liver and kidney damage,
Endrin	0.1 mg/m^3	NA	Epileptic convulsions, stupor, headaches, dizziness, abdominal discomfort, nausea, vomiting, insomnia, aggressiveness, confusion, lethargy, weakness, anorexia; in animals liver damage
Heptachlor, Heptachlor epoxide,	0.5 mg/m^3	NA	In animals: tremor, convulsions, liver damage, carcinogen
Dieldrin	0.25 mg/m^3	NA	Headache, dizziness, nausea, vomiting, malaise, sweating, myoclonic limb jerks, clonic and tonic convulsions, coma, carcinogen; in animals liver and kidney damage
Malathion	15 mg/m^3, 10 mg/m^3*	NA	Irritation of the eyes and skin, myosis, aching eyes, blurred vision, lacrimation, salivation, anorexia, nausea, vomiting, abdominal cramps, diarrhea, giddiness, confusion, ataxia, rhinorrhea, headaches, tight chest, wheezing, laryngeal spasm
Methoxychlor	15 mg/l	NA	In animals: fasiculation, trembling, convulsions, kidney and liver damage, carcinogen
Methyl parathion	0.2 mg/m^3 *	NA	Irritation of eyes and skin, nausea, vomiting, abdominal cramps, diarrhea, salivation, headaches, giddiness, vertigo, weakness, rhinorrhea, tight chest, blurred vision, myosis, cardiac irregularities, muscle fasiculation, dyspnea
Parathion	0.1 mg/m^3, 0.05 mg/m^3 *	NA	Irritation to eyes, skin, respiratory system, myosis, rhinorrhea, headache, chest tightness, wheezing, laryngeal spasms,, salivation, cyanosis, anorexia, nausea, vomiting, abdominal cramps, diarrhea, sweating, muscle fasiculation, weakness, paresthesia, dizziness, confusion, ataxia, convulsions, coma, low blood pressure, cardiac irregularities
Pentachloronitro-benzene (PCNB)	1.0 mg/m^3 0.5 mg/m^3*	NA	Anoxia, unpleasant taste, anemia, methemoglobinemia, in animals: hematuria, hemoglobinuria, spleen, kidney and bone marrow changes, reproductive effects, carcinogen

Compound of Concern	PELs 8hr TWA (OSHA Standards unless otherwise noted)	STELs 15min TWA (OSHA Standards unless otherwise noted)	Acute/Chronic Effects of Concern
Toxaphene /chlorinated camphrene	0.5 mg/m^3	1 mg/m^{3*}	Nausea, confusion, agitation, tremors, convulsions, unconsciousness, dry red skin, carcinogen

* NIOSH standard
**ACGIH standard
NA Not Available

APPENDIX C

ASSIGNMENT OF RESPONSIBILITY

ASSIGNMENT OF RESPONSIBILITY

The following briefly describes the Health and Safety designations and general responsibilities which will be employed for execution of the Site Remediation. The titles have been established to accommodate the site needs and requirements and in order to insure the safe conduct of on-site work.

C.1 LIGHTSHIP ENGINEERING HEALTH AND SAFETY DIRECTOR

The Lightship Engineering Health & Safety Director ("SHSD") has overall responsibility for development and implementation of this "HASP." He also shall approve any changes to this plan due to modifications of procedures or newly-proposed site activities.

C.2 SITE HEALTH AND SAFETY OFFICER

The Site Health & Safety Officer ("SHSO") will be present on-site during all field operations and will be responsible for health and safety activities. Like the "SHSD," the "SHSO" also has responsibility for the resolution of any outstanding safety issues that arise during the conduct of site work. Before personnel may work on-site, their current medical examination, respirator fit test, and health and safety training (basic, refresher, supervisory) must be approved by the "SHSO." The "SHSO" has "Stop Work" authorization, which the "SHSO" will execute upon determination of an imminent safety hazard, emergency situation, or other potentially dangerous situations, (e.g., weather conditions) where this action is appropriate. The "SHSO" will initiate and execute all contact with support facilities and personnel when this action is appropriate.

C.3 FIELD SAMPLING PERSONNEL RESPONSIBILITIES

The field sampling personnel are responsible for the proper collection and handling of samples. They are also responsible for following the established protocol in the LIGHTSHIP ENGINEERING Sampling and Analysis Plan and this "HASP" during all field activities.

C.4 *SUBCONTRACTOR RESPONSIBILITIES*

Subcontractors performing work for Lightship Engineering during the investigation and construction activities are responsible for compliance with all new and existing Federal, State, and local statutes, ordinances, or regulations regarding Health and Safety. In conformance with this "HASP," the subcontractor shall identify a lead individual responsible for Health and Safety compliance for each of their employees, lower-tier subcontractors, and consultants. This person will be responsible for reporting to the "SHSO," and demonstrating compliance with the procedures for Health and Safety outlined in the "HASP."

C.5 TRENCHING AND EXCAVATION LEADER

When trenching and/or excavation activities are conducted, the Trenching and Excavation Leader is responsible for the proper collection and handling of soil during excavation activities. He/she is also responsible for following the established protocol and this "HASP" during the excavation activities

APPENDIX D

TRAINING, MEDICAL SURVEILLANCE, AND SITE CLEARANCE REQUIREMENTS

TRAINING, MEDICAL SURVEILLANCE, AND SITE CLEARANCE REQUIREMENTS

D.1 BASIC TRAINING REQUIRED

Completion of forty (40) hours of Health and Safety training and an 8-hour annual refresher Health & Safety training, consistent with the requirement of 29 CFR 1910.120(e), is required for all Lightship Engineering employees, subcontractor, and others who will perform work in the exclusion zone (EZ) and contamination reduction zone (CRZ) areas. Supervisors are also required to have supervisory training, in accordance with 29 CFR 1910.120(e).

D.2 SITE-SPECIFIC TRAINING

Prior to entering an EZ, all employees must receive training from the "SHSO" that specifically addresses the activities, procedures, monitoring, and equipment for the site operations. It will include site and facility layout, hazards, and emergency services at the site, and will detail provisions contained within this "HASP." 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.

D.3 SAFETY BRIEFINGS

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

D.4 FIRST AID

The "SHSO" will ensure that at least one (1) individual trained in First Aid is present during field activities. The training should be consistent with the requirements of the American Red Cross.

D.5 MEDICAL SURVEILLANCE PROCEDURES

All personnel and subcontractors who will be performing field work in the Exclusion Zone at the site will be required to pass a medical surveillance examination, consistent with the requirements of 29 CFR 1910.120(f). A release for work, signed by a physician, will be provided to the "SHSO" before an employee can begin hazardous activities. Additional medical testing may be required by the "SHSO" 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.

D.5.1 Groundwater Sampling

In order to ensure the health and safety of all LIGHTSHIP ENGINEERING personnel, the standard operating procedures for groundwater sampling from a monitoring well will be strictly followed. These procedures are laid out in the Sampling and Analysis Plan.

D.5.2 Soil Borings and Subsurface Soil Sampling

In order to ensure the health and safety of all LIGHTSHIP ENGINEERING personnel, the standard operating procedures for installing soil borings and collecting subsurface soil samples will be strictly followed. These procedures are laid out in the Sampling and Analysis Plan.

D.5.3 General Site Safety Requirements

a. Selection of personnel protective equipment shall be reviewed by the Lightship Engineering "SHSO," and shall be subject to the general provisions of 29 CFR Parts 1910 and 1926.

b. Hearing protection shall be utilized when noise levels in the work area exceeds 85 dBA, or when indicated by the "HASP."

c. Good housekeeping practices shall be implemented on site.

d. Food articles or smoking materials will not be allowed in the work area.

e. All Lightship Engineering procedures applicable to each specific job are to be followed

f. Adequate provisions shall be made for:
   (1.) Washing of hands and face prior to eating, drinking or consuming tobacco products.
   (2.) Providing drinking water to site personnel. During the summer months particularly, electrolyte replacement fluids, such as Gatorade, should be made available.

APPENDIX E

OPERATING ZONES

OPERATING ZONES

E.1 SITE ZONES

As required, a three (3) zone approach to site operations will be employed to control the potential spread of contamination. The three zones are the Exclusion Zone ("EZ"), the Contamination Reduction Zone ("CRZ") and the Support Zone ("SZ"). Within the EZ, specific activities may require their own protection levels depending upon the operation. These will be established by the "SHSO," under consultation with the "SHSD." Individual hazardous locations within the site may be identified and isolated, as well.

For all field operations, only authorized personnel will be permitted to enter the EZ and a log of personnel entering this zone during Levels B, C, Modified Level D and D activities will be maintained by the "SHSO." When possible, emergency service access to areas when specific site operations are being conducted will be established in order to provide entry to the various work locations.

E.1.1 Exclusion Zone (EZ)

Those areas in which excavation or sampling activities are to take place in addition to the area(s) that contain, or are suspected of containing, hazardous materials will be considered the EZ The "SHSO" may establish more than one restricted area within the EZ in which different levels of protection may be employed or different hazards exist. No personnel will be allowed in the EZ without: 1.) a buddy; 2.) the proper personal protection equipment; 3.) medical authorization; and 4.) Hazardous Waste Site Training certification. All Health and Safety-related documentation will be located on-site in the project file.

E.1.2 Contamination Reduction Zone (CRZ)

A CRZ will be established between the EZ and the SZ. The CRZ contains the CRC to provide for full personnel and equipment decontamination. The CRZ is to be used for site entry and egress, in addition to access for heavy equipment. The CRZ and/or the SZ will contain appropriate safety and emergency equipment, such as a fire extinguisher and first aid kit.

E.1.3 Support Zone (SZ)

The SZ is considered the uncontaminated area and will be separated from the CRZ by the "Contamination Control Line." The majority of site operations will be controlled from this location as well as site access of authorized persons. The Command Post should be located upwind of site operations if possible and should be considered as a potential evacuation point in the event of an emergency. No potentially contaminated materials are allowed in this zone except appropriately packaged/decontaminated and labeled samples. Meteorological conditions should be observed and noted from this zone, as well as those factors pertinent to heat and cold stress.

APPENDIX F

SAFETY CONSIDERATIONS FOR SITE OPERATIONS

F.1 GENERAL

All field sampling will be performed under the levels of protection described in Section 4.3 and APPENDIX I.

On-site activities shall be limited to daylight hours and normal weather conditions unless additional lighting is provided on-site. Inclement weather includes extremes in temperature, high wind, heavy rain, and lightning. Wind direction will be observed periodically. In the event of an emergency evacuation, site personnel will exit the site into the wind, if possible.

Personnel entering the site shall observe the buddy system at all times and enter through the access control point. No smoking, eating, or drinking will be allowed on-site or before personal decontamination. Personnel will keep hands, tools, samples, and equipment away from face and exposed skin.

Team members will maintain visual contact with one another and will be familiar with hand signals.

F.2 INITIAL RECONNAISSANCE

Safety considerations during the initial site walkover are important, since the walkover will precede all other field operations. The team will maintain line of sight with each other at all times and maintain communications. Monitoring will be performed as indicated in APPENDIX K and will be used to alert the decon team if a dangerous situation exists. It will also aid in the choice of appropriate levels of personal protection for future site operations, site layout, and identify areas of particular hazard.

F.3 EXCAVATION SAFETY

a. All work involving excavation or trenching shall be subject to the requirements of 29 CFR 1926 Subpart P, Excavations.

b. Personnel will not enter an excavation during field activities until a determination is made to assure that the stability of adjacent structures will not be affected by the excavation. Sidewalks, pavements, and appurtenant structures shall not be undermined unless a method of protection is provided to protect employees from the possible collapse of such structures.

c. Daily inspections of an excavation shall be made by the Trenching and Excavation Leader. The inspection should be documented in the project field logbook. If there is evidence of possible cave-ins or slides, all work in the excavation shall cease until the necessary safeguards have been taken.

d. All soil shall be located at least two feet from the edge of the excavation to prevent soil from falling back into the excavation. NOTE: Since surface subsidence indicators, such as fissures or cracks, usually occur within a four-foot distance from the edge of the excavation, it is important that consideration be given to placing soil at a greater distance from the edge so that surface indicators are not obscured. No method that disturbs the soil in place (such as driving stakes) shall be used to contain soil material. If the soil is considered contaminated, effective steps to control the spread of contamination shall be taken.

e. All excavations shall be backfilled as soon as practical after work is completed and all associated equipment removed.

F.4 HEAVY EQUIPMENT OPERATION

a. Only experienced, demonstrably proficient, equipment operators will be used to operate such heavy equipment as backhoes, front-end loaders, cranes, etc. Where certification or licensing requirements exist, such personnel shall possess appropriate certification and/or licensing for operating specified heavy equipment.

b. While operating heavy equipment in the work area, the equipment operator shall maintain communication with a designated signalman through either direct voice contact or approved, standard hand signals. In addition, all site personnel in the immediate work area shall be made aware of the equipment operations.

c. All equipment, such as pipe, rebar, etc., shall be kept out of traffic lanes and access ways. Equipment shall be stored so as not to endanger personnel at any time.

d. Employees shall not be permitted under suspended loads at any time.

F.5 FIRE SAFETY

a. Equipment on-site shall be bonded and grounded, spark-proof and explosion resistant, as appropriate.

b. A fire extinguisher with a minimum rating of 10B:C shall be strategically located in the area of active work.

c. No smoking shall be allowed in the work area.

F.6 CONFINED SPACE ENTRY

No personnel should enter into a confined space.

APPENDIX G

MONITORING PROCEDURES FOR SITE OPERATIONS

MONITORING PROCEDURES FOR SITE OPERATIONS

G.1 GENERAL

Environmental monitoring will be performed during the field investigations, utilizing a PHOTO IONIZATION Detector (PID) to monitor total volatile organic compounds. A copy of the instrument's manual will be stored in the SZ. All action level criteria are measured in the worker's BZ.

For all operations proposed, specific monitoring procedures to be employed by Health & Safety staff will be identified and may be modified by the on-site "SHSO" to ensure the safe conduct of site operations.

Calibration of field instruments will be performed in accordance with the manufacturer's specifications. The calibrations will be performed before each day's use and a record of the calibrations will be entered into the Equipment Calibration Log.

G.2 AIR MONITORING

a. Air monitoring for volatile organics shall be conducted to determine the presence and concentration of chemical contaminants in the surrounding soils and the BZ. Operations that require air monitoring include:

   (1.) Subsurface soil exploration
   (2.) Subsurface soil sampling
   (3.) SVE/AS well installation
   (4.) Air Emission sampling
   (5.) Impacted soil excavation and post-excavation soil sampling

b. Additional tests shall be selected and performed to the satisfaction of a qualified person or "SHSO." All tests shall be repeated as often as necessary to assure safety since changing conditions may result in varying atmospheric contaminant concentrations.

c. Proper maintenance and operation of air monitoring equipment is an essential component of any site investigation:

   (1.) All equipment calibration data and field measurements shall be recorded in the project documentation.

d. PID shall be used to monitor volatile organic compounds for responding to the action levels that are listed in APPENDIX I.

APPENDIX H

PERSONNEL PROTECTION

PERSONNEL PROTECTION

H.1 GENERAL

The level of protection to be worn by field personnel will be defined and controlled by the "SHSO" with approval of the "SHSD." Where more than one hazard area is indicated, further definition shall be provided by review of site hazards, conditions, and proposed operational requirements and monitoring of the particular operation being conducted. Protection may be upgraded or downgraded, as appropriate, by the "SHSO." In addition, selection of respiratory protection will be based on assessment of a variety of factors including, but not limited to, the result of direct reading instruments and/or the judgement of the "SHSO." All field work in the EZ and CRZ will initially take place in Level D protection with the ability to upgrade as per Section 4.3 And APPENDIX B.

H.2 RESPIRATORY PROTECTION

(1.) Level B - Air supplied respirator or self contained breathing apparatus (SCBA).

(2.) Level C - Full Face Air Purifying Respirator with GMC-H combination cartridges.

(3.) Modified Level D - No respirator will be worn. Based on air monitoring results, certain operations may require a face shield, or that a respirator be carried by personnel.

(4.) Level D - No respirator will be worn. Based on air monitoring results, certain operations may require a face shield, or that a respirator be carried by personnel.

H.3 CLOTHING

(1.) Levels B and C Protective Clothing:

- Chemical protective suit (i.e., Saranex®/Poly coated Tyvek® for Level C; Saranex® for Level B);
- Coveralls;
- Gloves, inner (surgical type);
- Gloves, outer (Nitriles);
- Boots (steel toe/steel shank);
- Outer Boots (Chemical-Protective); and
- Hard hat (in areas of overhead hazards).

(2.) Modified Level D Protective Clothing:

- Tyvek®/Saranex®;
- Chemically resistant gloves;
- Boots/shoes (steel toe/steel shank);
- Safety Glasses (task dependent);
- Outer Boots (Chemical-protective); and
- Hard hat (task dependent).

(3.) Level D Protective Clothing:

- n Chemically resistant gloves;
- n Boots/shoes (steel toe/steel shank);
- n Safety Glasses (task dependent);
- n Hard hat (task dependent).

H.4 INITIAL LEVELS OF PROTECTION

The decision to upgrade or downgrade the level of respiratory protection will be made by the "SHSO" as determined by air monitoring results in the breathing zone during all site activities. (See action levels in section 4.3)

H.5 SAFETY EQUIPMENT

Basic emergency and first aid equipment will be available at the SZ and/or the CRZ, as appropriate. This shall include "HASP"-specified fire extinguishers, portable eye wash station, first aid kit, and other safety-related equipment for site operation. Safety equipment may be located at the site of specific operations, e.g., fire extinguishers.

H.6 COMMUNICATIONS

- n Telephones - A portable telephone will be in the possession of the "SHSO" for communication with emergency support services/facilities.

- n Hand Signals - To be employed by downrange field teams. These signals are important when working with heavy equipment or in high-noise situations. They shall be known by the entire field team before operations commence and covered during site-specific training.

H.7 SITE CONTROL

Site access must be controlled to eliminate risk of spreading contaminants and to protect the public. All work areas will be demarcated by appropriate warning signs. Except in an emergency, all personnel shall enter and exit through the Contamination Reduction Corridor (between the CRZ and the SZ).

APPENDIX I

ACTION LEVELS AND LEVELS OF PROTECTION FOR VARIOUS INSTRUMENT READINGS

ACTION LEVELS AND LEVELS OF PROTECTION FOR VARIOUS INSTRUMENT READINGS

I.1 TOTAL VOCs/SEMI-VOCs - UNKNOWN COMPOUNDS

Instrument	Action Levels for Unknown (Steady Concentrations >15mins)	Level of Protection/Action
PID/FID	Background to 1 ppmv TWA above background in BZ	Level D
PID/FID	1-5 ppmv TWA above background in BZ	Level C, notify SHSO immediately
PID/FID	5-500 ppmv TWA above background in BZ	Level B, notify SHSO immediately
PID/FID	above 500 ppmv TWA above background in BZ	Evacuate area immediately and notify SHSO

Key:
TWA = Time Weighted Average (8 hours/day, 40 hours/week)
FID = Flame Ionization Detector
PPMV = Parts Per Million Volume
PID = Photo-Ionization Detector
BZ = Breathing Zone

I.2 POTENTIAL EXPLOSIVE CONDITION

Instrument	Action Levels for Unknown (Steady Concentrations >15mins)	Level of Protection/Action
CGI	0 to 10% LEL within 5 feet radius around and above borehole	Normally proceed
CGI	10 to 25% LEL within 5 feet radius around and above borehole	Proceed with continuous monitoring and notify SHSO immediately
CGI	greater than 25% LEL within 5 feet radius around and above borehole	Stop work, allow to vent and notify SHSO immediately

Key:
LEL = Lower Explosive Limit
CGI = Combustible Gas Indicator

I.3 PARTICULATE DUST MONITORING

Instrument	Action Levels for Unknown (Steady Concentrations >15mins)	Level of Protection/Action
Dust Monitor	Development of site specific particulate dust monitoring action levels is set forth below.	Level D
Dust Monitor	Development of site specific particulate dust monitoring action levels is set forth below.	Level C

The site specific action level of particulate dust monitoring is required and should utilize the equation set forth below and specify the action level in Volume I Section 4.3.

PARTICULATE DUST MONITORING ACTION LEVEL(mg/M^3)

The assumption made in this calculation is that respirable airborne particles will contain the same proportion of the "compound of concern" as found in soil at the site.

1. Estimate average concentration of the "compound of concern" detected in soil.

   ex. (Arsenic avg. conc. soil = 1,000 mg/Kg (ppm)) which is equivalent to

   ($1{,}000/1 \times 10^6$) = 0.001 arsenic particles to one (1) part soil or 0.1%

2. Determine the OSHA Permissible Exposure Level ("PEL") for the airborne "compound of concern"

   ex. Arsenic = 0.01 mg/M^3

3. Estimate site specific action level as set forth in the equation below:

$$\frac{[\text{OSHA PEL } (mg/M^3)]}{[\text{fraction of compound of concern in soil}]} = \frac{[\text{Action Level Conc. } (mg/M^3)]}{[\text{1.0 part (dust cloud)}]}$$

ex. $\frac{0.01\ (mg/M^3)}{0.001^*\ \text{part}} = \frac{\text{Action Level } (mg/M^3)}{1.0\ \text{part}}$

* assumed particles per 1.0 part soil

therefore:

Action Level (mg/M^3) = 10 mg/M^3

Note: 10 mg/M^3 airborne level is typically a visible dust cloud.

I.4 POTENTIAL OXYGEN DEPLETION/ENRICHMENT CONDITION

Instrument	Action Levels for Unknown (Steady Concentrations >15mins)	Level of Protection/Action
Oxygen meter	< 19.5%, >23.5%	Evacuate area immediately and notify SHSO

APPENDIX J

DECONTAMINATION PROCEDURES

DECONTAMINATION PROCEDURES

J.1 PERSONNEL DECONTAMINATION PROCEDURE

Decontamination procedures are carried out by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination. The following generalized procedure will be used for removal of protective clothing:

EZ:

1. Equipment drop.
2. Wash gloves and boot covers with alconox and water.
3. Rinse gloves and boot covers with water.
4. Remove outer gloves.
5. Remove boot covers.

CRZ:

6. Remove coverall by rolling down.
7. Remove eye protection, if worn.
8. Remove respiratory protection, if worn.
9. Remove inner gloves (dispose).

SZ:

10. Wash hands and arms thoroughly in a clean area as soon as possible and before eating or drinking.
11. A total body wash should be performed as soon as possible after leaving the site for the day.

Note:

Disposable items (Tyvek® coveralls, inner gloves, and latex overboots) will be changed on an as needed basis. Dual respirator cartridges will be changed daily unless more frequent changes are deemed appropriate due to air monitoring results or personnel assessment.

All personnel protective equipment will be placed into plastic bags and remain on-site. Personnel and equipment decontamination wash water, and site-derived wastes, will be placed into 55-gallon drums for subsequent disposal at an approved facility.

Pressurized sprayers with soap and water or other designated equipment will be available in the decontamination area for wash down and cleaning of personnel, equipment, and samples.

J.2 EQUIPMENT DECONTAMINATION

Equipment requiring decontamination may include tools, monitoring equipment, respirators, sample containers and laboratory equipment.

All decontamination will be done by personnel in protective gear appropriate for the level of decontamination to be determined by the "SHSO." The decontamination work tasks will be divided and rotated among support and work crews.

J.3 SAMPLE CONTAINERS

Exterior surfaces of sample bottles will be decontaminated prior to packing for transportation to the analytical laboratory. Sample containers will be wiped clean at the sample site. The samples will be taken to the decontamination area. They will then be transferred to a clean carrier, sample identities noted, and checked off against the chain-of-custody record. The samples, now in a clean carrier, will be stored in a secure area prior to shipment.

J.4 MONITORING EQUIPMENT

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as practical with plastic without hindering the operation of the unit.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable-paper wipe. The units can then be taken inside in a clean plastic tub, wiped off with damp disposable wipes, and dried. The units will be checked, standardized, and recharged as necessary for the next day's operation. They will be prepared with new protective coverings.

J.5 RESPIRATORS

Respirators will be decontaminated daily. Taken from the drop area, the masks will be disassembled, the cartridges set aside and the parts placed in a cleansing solution. After 10 minutes within the solution, the parts will be removed and rinsed with tap water. (Additional cleaning of respirators may be performed off-site.) Used cartridges will be marked and replaced with new cartridges daily. In the morning, the masks will be re-assembled and new cartridges installed. Personnel will inspect their own masks to be sure of proper adjustment. The use and management of the respirators will be in accordance with the protocol outlined in 29 CFR 1910.

J.6 LABORATORY EQUIPMENT

Sample handling areas and equipment will be cleaned and wiped down daily. Disposable wipes will be used and discarded in a plastic bag. The bags will subsequently be taken and placed in the disposal drum for final disposition. For final cleanup, all equipment will be disassembled and decontaminated. Any equipment which cannot be satisfactorily decontaminated will be thrown away, (e.g., glassware, covers for surfaces), as previously indicated.

APPENDIX K

EMERGENCY PROCEDURES

EMERGENCY PROCEDURES

K.1 EVACUATION

In the event of an emergency situation, such as fire, explosion, significant release of toxic gases, etc., the Site Emergency Coordinator will initiate emergency procedures. All personnel in both the EZ and SZ will evacuate and assemble within the SZ and then move to exit the site from the main entrance. For efficient and safe site evacuation and assessment of the emergency situation, the Emergency Coordinator 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" must see that access for emergency equipment is provided and that all sources of combustion have been shut down 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. The evacuation procedure will be discussed regularly with on-site personnel. A drill will also be performed at the start of site activities.

K.2 POTENTIAL OR ACTUAL FIRE OR EXPLOSION

Immediately evacuate the site (air horn will sound three times at five second intervals). Notify the local fire and police department, and other appropriate emergency response groups if LEL values remain above ten (10) percent in the work zone for 10 minutes or longer or if an actual fire or explosion has taken place.

K.3 ENVIRONMENTAL INCIDENT (RELEASE OR SPREAD OF CONTAMINATION)

Control or stop the spread of contamination if possible. The emergency coordinator should instruct a person on site to immediately contact local authorities to inform them of the possible or immediate need for neighborhood evacuation. If a significant release has occurred, the National Response Center should then be contacted at 1-800-424-8802. This group will alert National or Regional Response Teams, as necessary. Following these emergency calls, the reporting individual should then notify the "SHSO," "SHSD" and FHSM. Massachusetts Department of Environmental Protection will be notified in the event of any exposure to individuals/residents off-site, and in the event of any fire or explosion on-site.

K.4 PERSONNEL INJURY

Emergency first aid will be applied on-site as deemed necessary. If needed, decontaminate and transport the individual to the hospital specified in Volume I, Section 5.0. The "SHSO" will supply medical data sheets to appropriate medical personnel and complete the incident report.

The rescue squad will be contacted for transport as necessary in an emergency. However, since some situations may require transport of an injured party by other means, a hospital route has been identified. During the initial reconnaissance a primary hospital and back-up facility were located and routes to and from the site identified, with details of the route delineated. The primary hospital route location map will be conspicuously posted in the command post.

K.5 OVERT PERSONNEL EXPOSURE

Generic and specific first aid procedures are included in this section. General first aid procedures include:

Skin Contact: Use copious amounts of soap and water. Wash/rinse affected area at least 15 minutes, then provide appropriate medical attention. An eyewash station will be provided on site at the CRZ and/or SZ as appropriate.

Inhalation (INH): Move to fresh air and/or, if necessary, decontaminate and transport to hospital.

Ingestion (ING): Decontaminate and transport to emergency medical facility.

Puncture Wound or Laceration: Decontaminate and transport to emergency medical facility. "SHSO" will provide medical data sheets to medical personnel as requested

In the event of cyanide exposure, specific first aid procedures will include:

Skin Contact:	Wash with copious amounts of soap and water. Get immediate medical attention.
INH:	Remove to fresh air. Get immediate medical attention.
ING:	Get immediate medical attention.

K.6 ADVERSE WEATHER CONDITIONS

Inclement Weather Procedures:

In the event of rain or snow, conditions will be assessed on-site to determine if field operations can proceed safely. If it is determined that the weather poses a significant additional hazard, site operations will be stopped and re-scheduled. Some of the items to be considered prior to determining if work should continue are:

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

HYPOTHERMIA: FROSTBITE
ACTION LEVELS

Shivering	Cease operation, seek warm surrounding.
Body core temperature < 90° (speech difficulty, mental confusion, muscle rigidity)	Seek medical attention immediately.
Frostbite	Wrap victim in woolen cloth - do not rub.

HEAT STRESS
ACTION LEVELS

Heat rash	**Adjust work schedule to have more frequent water breaks.**
Heat cramps (cramps, pains, faintness or profuse perspiration)	Adjust work schedule to have more frequent water breaks.
Heat exhaustion (weak pulse, rapid breathing, pale, dizziness or unconsciousness)	Cease work immediately, seek cool sheltered area, drink water. Seek medical attention immediately.
Heat stroke (dry hot skin, dilated pupils, unconsciousness, fast pulse, muscle twitching)	Seek medical attention immediately.

APPENDIX L

REFERENCES

REFERENCES

A. *Pocket Guide to Chemical Hazards*, National Institute of Occupational Safety and Health, June 1997.

B. *1999 TLVs® and BEIs® Based on the Documents for Threshold Limit Values for Chemical Substances and Physical Agents Biological Exposure Indices*, American Conference of Government Industrial Hygienists, 1999.

C. *Guide to Occupational Exposure Values - 1999*, American Conference of Government Industrial Hygienists, 1999.

D. Title 29, Code of Federal Regulations (CFR), Part 1910.120 and 1926.65, Hazardous Waste Operations and Emergency Response.

E. Title 29, CFR, Part 1910.134, Respiratory Protection Standard.

F. Title 29, CFR, Part 1910 and 1926, Construction Industry Standards.

G. Title 49, CFR, Parts 171 to 177, Department of Transportation Hazardous Materials Regulations