REMEDIAL ACTION WORK PLAN

For

FORMER WILLOW SERVICE STATION (1802 LLC)
1802 27th AVENUE
ASTORIA, NEW YORK

Prepared For

1802 LLC

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Volume 1 of 2

Prepared by

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1.0 INTRODUCTION AND PURPOSE

This Remedial Work Plan (RAWP) was prepared by ESPL Environmental Consultants Corporation (ESPL), on behalf of 1802 LLC, to address subsurface contamination in association with the historic operations of the former Willow Service Station. This RAWP was developed in accordance with the terms of the Voluntary Cleanup Agreement (VCA) Index #02-0003-02-08, between 1802 LLC and the New York State Department of Environmental Conservation (NYSDEC).

Section 2 is the remedial action selection section. Section 3 provides plans and specifications for the proposed remedial actions. Section 4 provides a description of proposed institutional controls. Section 5 references a Health and Safety Plan for the proposed remedial actions. Section 6 references a QAPP Plan for the proposed remedial actions. Section 7 contains a proposed remedial action schedule. Section 8 contains proposed reporting activities during remedial actions. Section 9 contains the project organization for remedial actions.

1.1 Site Description

The subject site, 18-02 27th Avenue, is situated in a Commercial and Residential District C2-2/R6B of Astoria, Queens, New York. The subject site is bound by 27th Avenue to the north, 21st Street to the east, 18th Street to the west, and Astoria Boulevard to the south. It is geographically located at latitude 40.772700 and longitude 73.927400. The subject site is listed in the tax map as follows:

Building Number	Zone	Blk.	Lot	Usage/Structure
18-02 27th Avenue	C2-1 /R-5	541	7	4 Stories 16 units residential 1 unit commercial - R&R General Supply Basement-R&R General Supply storage

1.2 Site History

The site was previously the Willow Service Station. Since 1948 the site was a retail fuel filling station and automotive repair garage. The present owner, 1802 LLC, acquired the site in 2002. Demolition of the existing structures began in early 2003. Construction of a four story commercial/residential building with a basement followed immediately. The basement and ground floor are devoted solely to hardware storage. There is an on-site outdoor parking lot in the north–northwest corner of the site.

The present use and occupancy of the building is as follows:

Floor	**Use**	**Status**
Basement	Retail store storage, refuse room	Occupied
1st Floor	Commercial Retail store/R&R General Supply	Occupied
Mezzanine	R&R General Supply Offices & administration	Occupied
3rd Floor	6 units Residential Apt.	Occupied
4th Floor	6 units Residential Apt.	Occupied
Penthouse	5 units Residential Apt.	Occupied

1.3 Previous Investigations

A Tank Closure Report, prepared by Yellowstone Industries, Inc., indicated that a total of six (6) 550 gallon underground storage tanks (USTs) were located directly north of the original building; a second tank farm containing three (3) 550 gallon diesel USTs were buried south of the original building; and, a 2,000 gallon gasoline UST was located northeast of the building. See Figure 1 for the tank former locations, contents, and year of removal. In 1994, a leak was detected in one of the tanks located in the north tank farm and promptly reported to the NYSDEC. Spill # 94-16654 was assigned to the site.

The tanks in the north tank farm were pressure tested and one of the tanks failed the tightness test. The failed tank was subsequently abandoned in place. Then the six (6) 550-gallon USTs in the north tank farm were excavated and removed from site in December 1999.

As a part of the site's extensive construction activities in 2004, a total of 298 tons of contaminated soil, together with all the USTs and scrap metal, were removed and disposed of at an approved and duly licensed disposal facility. See Figure 2 for the soil excavation area. During the excavation, underground storage tanks 7 and 8 (see Figure 1) were discovered and removed. Since all USTs were removed, the sources of contamination no longer exist. Nevertheless, residual soil and groundwater sampling results confirmed BTEX/MTBE as the predominant contaminant remaining beneath the site.

Contaminated groundwater was detected in the shallow aquifer 13 to 19 feet below grade. The direction of site groundwater flow is generally northwesterly. A hydraulic gradient of 0.0056 ft/ft was determined from well monitoring data. This value is consistent with a predominantly silty lithology and yields a pore water velocity of 0.0012 ft/day.

The current site owner entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) in July of 2003, immediately upon site acquisition, and the site is duly listed on NYSDEC's Voluntary Cleanup database. The Contemplated Use of the site contained in the VCA is restricted commercial (excluding day care, child care, and medical care uses). However, construction of a 4-story commercial/residential building (hardware storage in the basement and first floor and 3 stories of apartments) began concurrently with soil remediation (excavation, screening, removal) in 2004. Pre-construction soil and groundwater sampling indicated that volatile organic compounds (BTEX), MTBE, and semi-volatile organic compounds, or SVOCs (Acenaphthene, Naphthalene, Pyrene, Fluoranthene, Phenanthrene) were present in the soil and groundwater at levels exceeding the NYSDEC Cleanup (TAGM) Criteria in effect at the time.

Remediation of the site's soil, via excavation and removal to a permitted off-site recycling facility for proper disposal has been completed. A total of 4,450 cubic yards of soil (6,027 tons) was removed. 84 tons of clean soil were disposed at Evergreen Recycling of Corona, NY, 2,303 tons of contaminated soil were disposed at Clean Earth of Philadelphia, and 3,640 tons of contaminated soil were disposed at Clean Earth of Carteret, NJ. Post-excavation confirmatory or end-point soil samples were collected. See Figure 3 for the sampling locations and Table 1 for the analytical results.

The excavation area was backfilled with clean fill. The backfill material consisted of recycled concrete and stone with an average thickness of 7 inches to 8 inches in the excavated area and behind site shoring.

A passive bailing system was installed in four monitoring wells equipped with a time pump-off device to remove any free product that may enter the monitoring wells; all free product within the monitoring wells has been removed.

Piping for a sub-slab depressurization system was installed beneath the basement floor slab during the building's construction in the event it was deemed necessary to remove residual soil vapors that may exist beneath the basement floor. Figure 4 shows the sub-slab piping and the riser locations in the floor.

To address the residual contamination after the previous remediation, an on-site and off-site remedial investigation work plan was submitted to and approved by NYSDEC. All remedial investigation work plan data have been collected and the findings are presented in the following sections.

1.4 Summary of Environmental Conditions

The previous sections indicated the initial investigation and remediation activities at the site. The results of 2006 off-site and on-site investigations are presented in the

Remedial Investigation Report (RIR), dated July 2007, which was approved by the NYSDEC on August 1, 2007. Please refer to the RIR for data referenced in this section. The following summarize the RIR observations:

Off-Site

Along 18th Street, the Part 375 residential soil cleanup objectives were not exceeded. The groundwater standards were exceeded at OSDP-2, 3, 4, 5, and 6.

A comparison of off-site soil vapor concentrations with outdoor background air quality guidance values indicated potential air quality impacts due to soil vapor intrusion and potential need for remediation. Since all off-site soil vapor locations had concentrations higher than outdoor background air quality guidance values, the horizontal extent of potential air quality impacts was not defined.

Along 18th Street, lower off-site soil vapor concentrations than on-site concentrations indicate that the 18-10 site is a source of off-site soil vapor contamination; however, off-site soil vapor chlorinated VOCs that were detected are not attributable to the 18-10 site and there is apparently another source of soil and/or groundwater contamination off-site which has not been identified.

On the eastern portion of the site, the off-site soil vapor concentrations were higher than the on-site concentrations (specifically for benzene and toluene), indicating that there is apparently another source of soil and/or groundwater contamination off-site which has not been identified.

The one outdoor air quality sample showed elevated levels of 16 substances. However, the soil vapor and outdoor air data indicated the main outdoor air contaminants (toluene, acetone, MEK, and 1,4-dichlorobenzene) were not the same as those present in off-site soil and groundwater. In addition, several chlorinated volatile organic compounds (VOCs) were present in soil vapor, which were not detected on-site or in off-site soil or groundwater. This indicates the presence of other off-site contaminants besides those identified on-site.

The presence of relatively impermeable subsurface soils at the site limits migration of contamination.

On-Site

On-site soil contamination was not investigated further as part of the latest remedial investigation work plan so the historical data are presented here for consideration in evaluating remedial actions. Figure 3 and Table 1 show the on-site post-excavation soil contamination levels, as determined in 2004. Also shown are the Part 375 residential Soil Cleanup Objectives (SCOs). The comparison with the SCOs in Table 1 indicates that 7 semi-volatile organic compounds (SVOCs) exceeded the Part 375 residential SCOs at two locations.

In the third round of sampling existing monitoring wells advanced through the slab, groundwater standards were exceeded in 12 of 17 wells, 4 of which contained low part-per-billion levels and 3 of which contained free product.

As discussed at the end of Section 5.5 of the Remedial Investigation Report, groundwater migration beneath the slab is not significant, based on mapped water level gradients beneath the slab, the presence of native silt and clay soils, and the close proximity of highly contaminated monitoring wells to relatively clean monitoring wells.

Indoor air samples in the 1802 basement showed 15 substances at levels above background indoor air quality guidelines by an order of magnitude or more. Indoor air quality samples in Building A (basement and first floor) showed 2 substances at levels above background indoor air quality guidelines by an order of magnitude or more.

With the exception of toluene and acetone, the indoor air contaminants were not present in sub-slab groundwater. Some of the indoor contaminants (ethylbenzene, toluene, o-xylene, m&p-xylene, 1,2,4-trimethylbenzene, and 1,3,5,-trimethylbenzene) were present in the 2004 post-excavation soils (see Table 1).

The source(s) of the other 7 unaccounted for indoor air contaminants are not known. However, the indoor air quality is, with very few exceptions, the same as the 18th St. outdoor air quality, indicating that the source of the unaccounted for 1802 basement air contaminants is probably outdoor air and not sub-slab contamination.

1.5 Contemplated Use

The Contemplated Use contained in the Voluntary Cleanup Agreement is restricted commercial (excluding day care, child care, and medical care uses). However, residential apartments have been constructed at the site. Therefore, the Contemplated Use is commercial and residential. The remediation evaluations following are therefore based on providing cleanup sufficient to allow for the residential contemplated use of the site.

2.0 REMEDIAL ACTION SELECTION

2.1 Remedial Action Objectives

The following are the remedial action objectives (RAOs):

- Prevent human ingestion of groundwater containing contaminant concentrations above the applicable standards.

- Prevent human ingestion and dermal contact with contaminants in soil.

- Prevent inhalation of VOCs volatilizing from subsurface soil to indoor air.

The major SCGs are:

- 6 NYCRR Part 375 residential Soil Cleanup Objectives (SCOs).
- 6 NYCRR Part 703 standards for groundwater.
- Air Guideline Values and outdoor background air quality for off-site, outdoor air quality, per NYSDOH soil vapor intrusion guidance (October 2006).
- Air Guideline Values and indoor background air quality for on-site, indoor air quality, per NYSDOH soil vapor intrusion guidance (October 2006).
- Air Guide 1 – Guidelines for the Control of Toxic Ambient Air Contaminants (relevant to discharges associated with treatment).
- 6 NYCRR Part 371 – Identification and Listing of Hazardous Waste (relevant to residuals generated during treatment)...
- NYSDEC solid and hazardous waste regulations for transportation and disposal of contaminated soils and treatment residuals.
- NYSDEC requirements for Environmental Easements.

2.2 Remedial Action Alternatives and Evaluations

2.2.1 Evaluation Criteria

The remedial alternatives were evaluated with respect to the following criteria:

- Protection of Public Health and the Environment: The remedy's ability to protect public health and the environment for the contemplated use of the site, and to achieve the remedial action objectives.

- Compliance with Standards, Criteria and Guidance (SCGs): Whether or not a remedy will meet applicable environmental laws, regulations, standards and guidance; for those SCGs that will not be met, the need for waivers and impacts is discussed.
- Long-term Effectiveness and Permanence: Long-term effectiveness of the remedy after implementation, including permanence of the remedy due to treatment; for residual contamination, the magnitude of the remaining risks, adequacy and reliability of engineering and institutional controls are discussed.

- Reduction of Toxicity, Mobility, and Volume: The remedy's ability to reduce toxicity, mobility or volume of site contamination through treatment, including reversibility with time.

- Short-term Effectiveness: Potential short-term adverse impacts and risks of the remedy on the community, workers, and the environment during remedial action, and mitigation measures. The estimated time for remedial action is included.

- Implementability: The technical and administrative feasibility of implementing the remedy.

2.2.2 Off-site

2.2.2.1 Alternative 1 – No Action

This alternative would consist of no action with respect to off-site soil, groundwater, and outdoor air quality.

Protection of Public Health and the Environment

Soil contamination does not exceed the Part 375 residential soil cleanup objectives and is covered by the concrete sidewalk and asphalt pavement.

Human ingestion of groundwater contaminants does not occur under normal conditions as the affected area along 18th Street is covered by sidewalk and pavement, groundwater is not extracted for any use, and groundwater migration is limited by the impermeable subsurface formation. However, no action would not preclude accidental ingestion of groundwater containing contaminants above the groundwater standards as exposure could still occur during excavation work in the street, e.g., utilities work.

In summary, this alternative would not meet the groundwater Remedial Action Objective.

Compliance with SCGs

This alternative would comply with the soil cleanup objectives but not the groundwater standards. Waivers from the groundwater standards would be required.

Long-term Effectiveness and Permanence

This alternative would not involve implementation of a remedy involving treatment and the existing levels of contamination would remain.

Reduction of Toxicity, Mobility, and Volume

This remedy would not provide reduction of toxicity, mobility or volume of groundwater contamination through treatment; however, as noted in Section 1.4, mobility of subsurface contamination is limited.

Short-term Effectiveness

There are no potential short-term adverse impacts and risks associated with this alternative as no remedial action is proposed.

This alternative can be implemented immediately.

Implementability

This alternative is readily implementable technically and administratively as no remediation or institutional controls are proposed.

2.2.2.2 Alternative 2 - No Action with Groundwater Institutional Control

This alternative would consist of no action except for implementation of an environmental easement at 1802 27th Avenue restricting the use of groundwater off-site along 18th Street.

Protection of Public Health and the Environment

This evaluation is similar to that for Alternative 1, except that the environmental easement would preclude ingestion of groundwater contaminants.

In summary, this alternative would meet the Remedial Action objectives.

Compliance with SCGs

This evaluation is the same as for Alternative 1.

Long-term Effectiveness and Permanence

This evaluation is the same as for Alternative 1.

Reduction of Toxicity, Mobility, and Volume

This evaluation is the same as for Alternative 1.

Short-term Effectiveness

This evaluation is the same as for Alternative 1, except that obtaining an environmental easement could take on the order of 6 months.

Implementability

This alternative is readily implementable technically. Administratively, the environmental easement should be readily obtainable.

2.2.2.3 Alternative 3 - In-situ Groundwater Treatment

This alternative would consist of in-situ treatment of the contaminated groundwater along 18th Street around locations OSDP-2 to 6.

Chemical oxidation would be preferable over injection of an oxygen release compound at OSDP-2 because of the part-per-million groundwater contaminant levels. The other locations would be treated by injection of an oxygen release compound (ORC) to stimulate bioremediation of the lower part-per-billion contaminant levels.

Commercial formulations, Regenesis Regenox for chemical oxidation, and Regenesis ORC for bioremediation, or equivalent, would be the reagents. Reagents would have to be injected into the impermeable unsaturated and saturated zones on a tight grid, typically 5 ft. by 5 ft. for impermeable formations, 20 to 30 ft. below ground surface (assuming the vertical extent of contamination is 10 ft. beneath the water table), using direct-push geoprobe equipment. A monitoring well would be installed in the vicinity of OSDP-2 and in the vicinity of OSDP-4 to monitor chemical oxidation and bioremediation progress, respectively.

Figure 5 shows the location of the injection grids and monitoring wells on the east side of 18th Street. A utilities clearance would be required and the street would have to be closed off during injection operations. Approximately 8 chemical oxidation and 32 ORC injection points would be required for a 5 ft. grid spacing.

Based on guidance provided in Regenesis' Regenox Design and Application Manual, approximately 15 pounds of Regenox would need to be injected around OSDP-2. This is based on a total groundwater contaminant level of 10 ppm in the 10 ft. x 20 ft. area, a 10 ft. thickness of aquifer to treat, and an aquifer porosity of 0.3, resulting in a total contaminant mass of 0.4 pounds. Regenesis recommends adding 21 times the contaminant mass for stoichiometric requirements plus another 10 times the contaminant mass for natural oxidant demand. It is assumed that two rounds of injection would be required.

For ORC bioremediation for the 10 ft. x 80 ft. remainder of the area, approximately 1 pound of ORC would need to be injected. This is based on a total groundwater contaminant level of 0.15 ppm (maximum at OSDP-4), a 10 ft. thickness of aquifer to treat, and an aquifer porosity of 0.3, resulting in a total mass of contaminants of 0.02 pounds. The ORC demand is 30 times the contaminant mass for stoichiometric requirements plus another 10 times the contaminant mass for natural oxidant demand. It is assumed that two rounds of injection will be required.

The goal of treatment is to achieve the Part 703 groundwater standards. However, if significant contaminant reduction has been achieved with the first round of injection and additional reduction has been attained by a second round of injection, but not down to the groundwater standards, the Department will be petitioned for a variance from the groundwater standards. Significant contaminant reduction would provide more protectiveness than current conditions.

Protection of Public Health and the Environment

This evaluation is similar to that for Alternative 1, except that groundwater treatment and meeting the groundwater standards would preclude human ingestion of groundwater contaminants during any future off-site activity, including excavation work beneath the sidewalk.

Compliance with SCGs

This alternative complies with the soil cleanup objectives without groundwater treatment.

Groundwater treatment would either meet the groundwater standards or significantly reduce the existing levels of contamination beneath the sidewalk.

Long-term Effectiveness and Permanence

Chemical oxidation and bioremediation destruction of groundwater contaminants would be effective long-term and permanent for the groundwater medium. Repeated treatment applications would probably be necessary to make the treatment permanent.

Reduction of Toxicity, Mobility, and Volume

Chemical oxidation and bioremediation of groundwater would reduce existing contaminated groundwater toxicity, and volume; existing groundwater mobility is limited.

Short-term Effectiveness

Potential short-term risks to the community and workers during in-situ groundwater treatment would be minimal as the sidewalk cover would be maintained during reagent injection and the amount of contaminated vapor escaping during sidewalk coring and removal of injection devices would be limited. Workers could upgrade respiratory protection using normal means if necessary.

Implementation of this alternative would take on the order of one year.

Implementability

This alternative is readily implementable technically as in-situ groundwater treatment by the methods described has been widely used.

Administratively, this alternative should be readily implementable as remediation would be limited to the 1802 property (the east side of 18th Street) and access agreements with other property owners would not be required.

2.2.3 On-Site

2.2.3.1 Alternative 1 – No Action on Groundwater, Free Product Removal and Groundwater Monitoring, and Institutional Control

This alternative would consist of no action with respect to sub-slab soil, groundwater and soil vapor. However, the existing free product removal from monitoring wells W-7, W-13 and W-14 and groundwater monitoring would continue at existing monitoring wells MW-1 through 17 every 9 months. In addition, an environmental easement would be implemented to restrict use of sub-slab groundwater for any purpose and restrict contact with sub-slab soils.

Protection of Public Health and the Environment

Human ingestion and dermal contact with soil contaminants does not normally occur as the building slab caps the contaminated soil. However, the environmental easement would preclude ingestion and contact during any future excavation beneath the slab and continued free product removal would prevent further subsurface soil contamination.

Ingestion of groundwater contaminants does not normally occur as groundwater is not extracted from beneath the slab. However, the environmental easement would preclude the use of groundwater in the future and continued free product removal would prevent further groundwater contamination.

With respect to indoor air quality, this alternative would not mitigate VOCs volatilizing from the subsurface soil beneath the slab into the basement.

In summary, this alternative would not meet the indoor air Remedial Action Objective.

Compliance with SCGs

Soil would continue to exceed the Part 375 residential SCOs at two locations for 7 SVOC compounds.

Groundwater might continue to exceed the groundwater standards; however, as discussed in the RIR, dramatic reductions have occurred in groundwater contaminant concentrations in three sampling events over the last 1½ years, probably due to the low permeability and well recharge rates.
Indoor air contaminant levels would continue to be above background indoor air quality guidance values.

Long-term Effectiveness and Permanence

This alternative does not involve implementation of a remedy and, except for free product which would continue to be removed, the existing levels of contamination would remain.

Reduction of Toxicity, Mobility, and Volume

This remedy would not provide reduction of toxicity, mobility or volume of groundwater contamination through treatment; however, as noted in Section 3.3.1 and 3.3.2, mobility of subsurface contamination is limited.

Short-term Effectiveness

There are no potential short-term adverse impacts and risks associated with this alternative as no remedial action is proposed.

This alternative can be implemented immediately, except that obtaining the environmental easement could take on the order of 6 months.

Implementability

This alternative is readily implementable technically as the existing groundwater monitoring wells and free product removal facilities would be used. This alternative is readily implementable administratively as an environmental easement should be readily obtained.

2.2.3.2 Alternative 2 – Sub-Slab Depressurization; Groundwater Free Product Removal and Monitoring; Groundwater Institutional Control

This alternative would consist of implementing sub-slab depressurization; continued removal of free product from existing groundwater monitoring wells W-7, 13, and 14;

continued monitoring of all 17 existing wells; and an environmental easement restricting groundwater use beneath the slab for any purpose and sub-slab soil contact.

Because of the impermeable soils, sub-slab depressurization would serve only to remove contaminated soil vapor migrating into the 1-foot thick gravel layer beneath the slab and help mitigate any unacceptable soil vapor intrusion into the 1802 building; it would not act as a soil vapor extraction system to remediate the soils.

The existing horizontal ventilation pipes beneath the slab would be utilized. Figure 4 shows the locations of the 4-inch diameter perforated PVC lines that were placed in a 1 ft. thickness of gravel beneath the slab. The lines would rise vertically from each of the 8 riser locations shown in Figure 4 to the ceiling and be directed to one or more locations for connection to an exhaust fan(s) that would vent outside the building. The fan(s) would be located outside the building to prevent contamination in the event of a fan leak. The final exhaust point(s) would be located above the roof elevation to prevent contamination from entering the building. Each extraction line would have a vacuum gauge to confirm negative pressure in the line and a manual valve to isolate the line. Based on ventilating approximately 8,600 square feet at a 2 ft. depth, a 40 percent gravel and soil void fraction, and removal of one void volume per day, a total of approximately 7,000 cubic feet of sub-slab air would need to be removed per day, or approximately 5 cubic feet per minute. The fan and discharge configurations would have to be determined during design. Preliminary analysis indicates that explosion-proof fans would not be required, based on the maximum soil vapor concentrations measured to date. The need for vapor phase activated carbon prior to discharge to the atmosphere would have to be determined during design. Monthly inspections would be performed to observe operations. Semi-annual vapor samples on the influent and to the fan(s) and carbon unit effluent would be analyzed.

As discussed in Section 1.4, not all of the elevated indoor air contaminants are attributable to sub-slab soil or groundwater. Therefore, indoor and outdoor air quality would be measured annually to determine sub-slab ventilation is effective in reducing indoor air contaminants. However, the sub-slab depressurization system would not be taken out of operation without written approval from NYSDEC.

Protection of Public Health and the Environment

Sub-slab depressurization may remove some soil contamination exceeding the Part 375 residential SCOs; however, this would be minimal due to the impermeable soil. The slab capping the soil would continue to prevent human ingestion and dermal contact with contaminated soil under normal conditions. The easement would preclude ingestion and contact with soil contaminants under other conditions, e.g., excavation for utilities or site modifications.

Sub-slab depressurization may remove some groundwater contamination; however, this would be minimal due to the impermeable formation. The slab capping the soil and no withdrawal of groundwater would continue to eliminate human ingestion of groundwater contaminants under normal conditions. The environmental easement would preclude ingestion under other conditions, e.g., excavation for utilities or site modifications.

Sub-slab depressurization should be effective in reducing indoor air contaminants whose source is beneath the slab. Other contaminants, not present in sub-slab soil or groundwater, will not be reduced.

In summary, this alternative would meet the Remedial Action Objectives.

Compliance with SCGs

The existing exceedances of the Part 375 residential SCOs would be expected to continue as sub-slab depressurization would remove little if any contamination from the impermeable soils.

The existing exceedances of the groundwater standards would be expected to continue as sub-slab depressurization would remove little if any contamination from the impermeable soils. However, continued removal of free product should help reduce groundwater contamination.

The existing elevated levels of indoor air contaminants, whose source is beneath the slab, may be reduced to background guidance levels. Levels of contaminants whose source is not beneath the slab will not be reduced.

Long-term Effectiveness and Permanence

This alternative does not treat soils or groundwater so it does not provide permanent remediation. This alternative would be effective in reducing those indoor VOC air contaminants that are entering the basement by volatilizing from beneath the slab.

Reduction of Toxicity, Mobility, and Volume

Sub-slab soils and groundwater have limited mobility due to the impermeable soils and slab cap. This alternative would not reduce soil and groundwater toxicity and volume through treatment; however, free product removal would reduce contaminant volume.

This alternative would reduce indoor air contaminant mobility by capturing those sub-slab VOC contaminants volatilizing into the basement..

Short-term Effectiveness

Potential short-term risks to the community and workers during completion of the sub-slab depressurization system would be minimal as all work would be inside 1802 and the openings in the slab to connect the piping would be open for a relatively brief period of time. Employees could be kept out of the basement at this time and workers could upgrade respiratory protection by normal means if necessary.

Implementation of this alternative would be on the order of 6 months, including design, construction, and obtaining an air discharge permit equivalency; and obtaining the environmental easement.

Implementability

This alternative would be readily implementable technically as sub-slab depressurization is a conventional technology, commonly used in indoor radon gas mitigation.

Administratively, an air discharge permit equivalency would be required, which should not limit implementability. The easement should be readily obtainable.

2.2.3.3 Alternative 3 – No Action on Sub-slab Vapor; In-Situ Soil and Groundwater Chemical Oxidation

This alternative would consist of in-situ chemical oxidation of the contaminated unsaturated and saturated zones beneath the slab, including free product present in several wells. This would destroy the contaminants over a relatively short time frame and soil vapor and indoor air quality would not have to be addressed. Permanganate or a commercial formulation such as Regenesis Regenox would be candidate reagents. Reagents would have to be injected into the impermeable unsaturated and saturated zones on a tight grid, typically 5 ft. by 5 ft. for impermeable formations, 12 to 22 ft. beneath the slab (assuming the vertical extent of contamination is 10 ft. beneath the water table).

Groundwater and soil contamination is present above the cleanup standards throughout the 1802 basement, except in the area of MW-1, 3, and 4. Therefore, approximately 8,000 square feet would be treated. On 5 foot grid spacing, approximately 350 injection points would be required. Concrete cores would have to be cut in the slab at each location prior to injection.

Based on an 8,000 square foot area, 20 foot thickness, 0.3 porosity, and a total contaminant concentration of 67 ppm (sum of contaminant concentrations at SW-2), a contaminant mass of approximately 200 pounds needs to be treated. Based on Regenesis' recommendation to add Regenox at 21 times the contaminant mass for stoichiometric requirements and 10 times the contaminant mass for natural oxidant demand, a total of 6,200 pounds of Regenox would be required. It is assumed two rounds of injection would be required.

The existing monitoring wells would be sampled for two rounds after each injection to monitor remediation effectiveness.

Protection of Public Health and the Environment

This alternative would destroy soil and groundwater contamination and would eliminate the possibility of human ingestion and dermal contact with soil contaminants and ingestion of groundwater contaminants under conditions calling for opening the floor slab, e.g., utilities construction or site modifications. Exposure to soil contaminants is restricted by the slab under normal conditions.

Destroying soil and groundwater contamination would eliminate those indoor air VOC contaminants whose source is sub-slab soil and groundwater.

In summary, this alternative would meet the Remedial Action Objectives.

Compliance with SCGs

This alternative would meet the soil and groundwater SCGs.

Background indoor air quality guidance levels might be met for VOC contaminants whose source is sub-slab soil and groundwater. However, other contaminants at levels above indoor air quality guidance levels would not be met by treatment beneath the slab.

Long-term Effectiveness and Permanence

Treatment to destroy the contaminants would provide long-term effectiveness and permanence for the soil and groundwater mediums.

Treatment would destroy those VOC indoor air contaminants that have sub-slab soil and groundwater as their source.

Reduction of Toxicity, Mobility, and Volume

Treatment would reduce the toxicity and volume of the soil and groundwater contaminants.

Short-term Effectiveness

Potential impacts to the community would be minimal as remedial work would be performed inside. Because of the noise and obstructions created by the geoprobe rigs, employees probably could not be present during the injections (two periods of approximately 5 weeks). Potential impacts to remedial workers could be mitigation by normal means, e.g., upgrading respiratory protection.

This alternative would take on the order of one year to implement, due to the time required to work around the existing operations in the basement to implement the remediation.

Implementability

This alternative would be difficult to implement technically. A 5-foot grid spacing would be required to inject reagents effectively; however, a 5-foot grid would probably not be achievable due to the columns and other permanent facilities and equipment located through out the basement.

This alternative would be difficult to implement administratively as the business operator would have to agree to limit or cease operations for two 5 week periods.

2.3 RECOMMENDED REMEDIAL ACTIONS

2.3.1 Off-Site

No off-site action for soils is recommended as the contaminant levels are below the Part 375 residential SCGs.

In-situ groundwater treatment by bioremediation using an oxygen release compound at some locations and chemical oxidation in others, as described in Section 2.2.2.3 (Off-Site Alternative 3), is recommended as a means of meeting the groundwater standards.

These remedial actions would meet the Remedial Action Objectives and the SCGs. Groundwater treatment would provide a long-term, permanent solution, reducing the volume and toxicity of groundwater contaminants. There would be limited short-term adverse environmental impacts to the community as the reagent injection points would be limited in size. Workers could mitigate exposure to contaminants in the breathing zone during construction by normal respiratory protection means, if necessary. The treatment techniques are conventional technologies and therefore are readily implementable.

2.3.2 On-Site

Implementing sub-slab depressurization is recommended, along with indoor and outdoor air monitoring. The sub-slab depressurization system (SSDS) would act to remove those indoor air VOC contaminants whose source is beneath the slab

In addition, the existing free product recovery and monitoring of groundwater beneath the building would continue.

An environmental easement restricting sub-slab groundwater use and soil contact would be obtained. The SSDS would not be taken out of operation without written approval from the NYSDEC. Site maintenance for the sub-slab depressurization system and monitoring activities would be maintained, including annual certification of the operations and activities performed.

The soil and groundwater SCGs would not be met; however, the slab and the easement would act to preclude soil and groundwater contact so that the soil and groundwater Remedial Action Objectives could be met. Implementation of the SSDS would meet the Remedial Action Objective related inhalation of VOCs volatilizing from sub-slab soil to indoor air. These remedial actions do not provide a permanent solution, nor do they provide reduce contaminant volume and toxicity through treatment. However, the SSDS would reduce VOC air contaminant mobility. There would be no short-term adverse environmental impacts to the community as implementation of the SSDS would be indoors. In implementing the SSDS, using the existing sub-slab ventilation lines, workers could mitigate exposure to contaminants in the breathing zone during construction by normal respiratory protection means, if necessary. SSDS is a conventional technology and therefore is readily implementable.

3.0 PROJECT PLANS AND SPECIFICATIONS

See Appendix A for plans and specifications for the proposed off-site in-situ groundwater remediation treatment and sub-slab depressurization system.

4.0 INSTITUTIONAL CONTROLS

One institutional control is proposed – an environmental easement against extracting and using groundwater beneath the 1802 building slab for any purpose and precluding contact with on-site soils. In addition, the easement would include continued operation of the sub-slab depressurization system and implementation of the Site Management Plan.

5.0 REMEDIAL ACTION HEALTH AND SAFETY PLAN

See Appendix B for the remedial action Health and Safety Plan.

6.0 REMEDIAL ACTION QAPP PLAN

See Appendix C for the remedial action QAPP Plan.

7.0 REMEDIAL ACTION SCHEDULE

Following is the estimated schedule for the major remedial action activities, with the times indicated after approval of the RAWP by the Department:

<u>In-situ Groundwater Treatment</u>

- Complete requests for proposals to Contractors: 2 weeks
- Pre-bid field visit: 3 weeks
- Receive Contractor bids: 4 weeks
- Evaluate Contractor Bids, Award Contract: 5 weeks

- Utility Survey: 6 weeks
- Mobilize to site: 7 weeks
- In-Situ Groundwater Injection, Monitoring Well Installation: 9 weeks
- Sample Groundwater (4 months after treatment) 25 weeks
- Obtain Groundwater Sampling Results: 27 weeks
- Evaluate Need for Additional In-Situ Treatment: 28 weeks
- Additional In-Situ Treatment, if Necessary: 32 weeks
- Sample Groundwater, if necessary (4 mo. after treatment): 48 weeks
- Obtain Groundwater Sampling Results: 50 weeks
- Evaluate Need for Additional Treatment, Propose Closure: 51 weeks

In the meantime, free product recovery and groundwater monitoring inside the 1802 building will be performed every 9 months.

<u>Sub-slab Depressurization</u>

- Complete requests for proposals to Contractors: 2 weeks
- Pre-bid field visit: 3 weeks
- Receive Contractor bids: 4 weeks
- Complete application for environmental easement: 4 weeks
- Evaluate Contractor Bids, Award Contract: 5 weeks
- Complete design, apply for air discharge permit equivalency: 10 weeks
- Complete construction, receive air permit equivalency: 16 weeks
- Obtain environmental easement for groundwater: 24 weeks

8.0 REMEDIAL ACTION REPORTING

In accordance with the VCA, reporting will consist of monthly written progress reports, submitted to the Department by the 10th day of each month that will include:

- All actions performed on site during the previous period and those anticipated for the up coming period
- All results of sampling received during the previous period, including QA/QC information and interpretations with respect to cleanup levels
- Information on the schedule, including any delays that may affect the schedule and how delays can be mitigated

9.0 REMEDIAL ACTION PROJECT ORGANIZATION

The VCA respondents (18-02 LLC; R&R General Supply Company, Inc.) shall retain ESPL Environmental Consultants, Inc. to implement the RAWP.

This shall include ESPL retaining Contractor experienced in:

- Geoprobe application of in-situ groundwater remediation regents and installing groundwater monitoring wells
- Design and installation of sub-slab depressurization systems.

ESPL will continue to remove free product and sample groundwater from the existing wells inside the 1802 building, and will assist the respondents in applying for the environmental easement.

10.0 DRAFT SITE MANAGEMENT PLAN

See Appendix D for a draft stand-alone Site Management Plan which addresses operation, maintenance, and monitoring activities and implementation; institutional controls oversight; termination of treatment operations; and site closure.

Tables

TABLE 1

February 2004 Post-Excavation Soil Contamination Levels (ug/kg)

Parameter	PES-1	PES-2	PES-3	PES-4	PES-6	PES-7	PES-8	PES-9	PES-10	PES-11	PES-12	PES-13	SW-1	SW-2	SW-4	SW-5	Part 375 Residential Soil Cleanup Objectives
Volatile Organics																	
MTBE	---	61	348	20	7	---	---	---	---	---	---	---	---	---	---	---	NA
Benzene	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2,900
n-Propylbenzene	---	---	---	---	---	---	---	---	---	---	461	---	---	---	---	---	100,000
Ethylbenzene	---	11	---	---	---	---	---	---	---	---	1,727	---	---	---	---	---	30,000
Naphthalene	---	25	---	---	30	---	---	---	---	---	---	---	---	---	---	---	100000
Toluene	---	6	---	---	120	---	---	---	---	---	2,781	---	---	---	---	---	100,000
1,2,4-Trimethylbenzene	---	6	---	---	50	---	---	---	---	---	2,189	---	---	---	---	---	47,000
1,3,5-Trimethylbenzene	---	---	---	---	15	---	---	---	---	---	862	---	---	---	---	---	47,000
p&m-Xylenes	---	---	---	---	265	---	---	---	---	---	8,965	---	---	---	---	---	100,000
o-Xylenes	---	20	---	---	93	---	---	---	---	---	2,621	---	---	---	---	---	100,000
Semi-Volatile Organics																	
Naphthalene	---	---	---	---	---	331	---	---	---	---	---	---	---	383	---	---	100,000
Anthracene	---	---	---	---	---	910	---	81	46	---	---	---	---	2,837	---	---	100,000
Fluorene	---	---	---	---	---	226	---	---	---	---	---	---	---	1,044	---	---	100,000
Phenanthrene	---	---	---	---	---	5,384	---	400	79	---	---	---	---	12,096	---	---	100,000
Pyrene	---	---	---	---	---	6,942	---	370	610	---	73	---	---	11,617	---	---	100,000
Acenaphthene	---	---	---	---	---	242	---	---	---	---	---	---	---	1,143	---	---	100,000
Benzo(a)anthracene	---	---	---	---	---	**3,843**	---	176	359	---	---	---	---	**5,469**	---	---	1,000
Fluoranthene	---	---	---	---	---	7,943	---	444	740	---	---	---	---	12,974	---	---	100,000
Benzo(b)fluoranthene	---	---	---	---	---	**2,712**	---	110	220	---	---	---	---	**3,263**	---	---	1,000
Benzo(k)fluoranthene	---	---	---	---	---	**2,208**	---	96	199	---	---	---	---	**2,747**	---	---	1,000
Chrysene	---	---	---	---	---	**3,079**	---	159	269	---	---	---	---	**4,521**	---	---	1,000
Benzo(a)pyrene	---	---	---	---	---	**2,460**	---	110	233	---	---	---	---	**3,730**	---	---	1,000
Benzo(g,h,i)perylene	---	---	---	---	---	1,490	---	79	167	---	---	---	---	2,009	---	---	100,000
Indeno(1,2,3-cd)pyrene	---	---	---	---	---	**1,672**	---	88	196	---	---	---	---	**2,348**	---	---	500
Dibenzo(a,h)anthracene	---	---	---	---	---	**390**	---	---	70	---	---	---	---	**485**	---	---	330

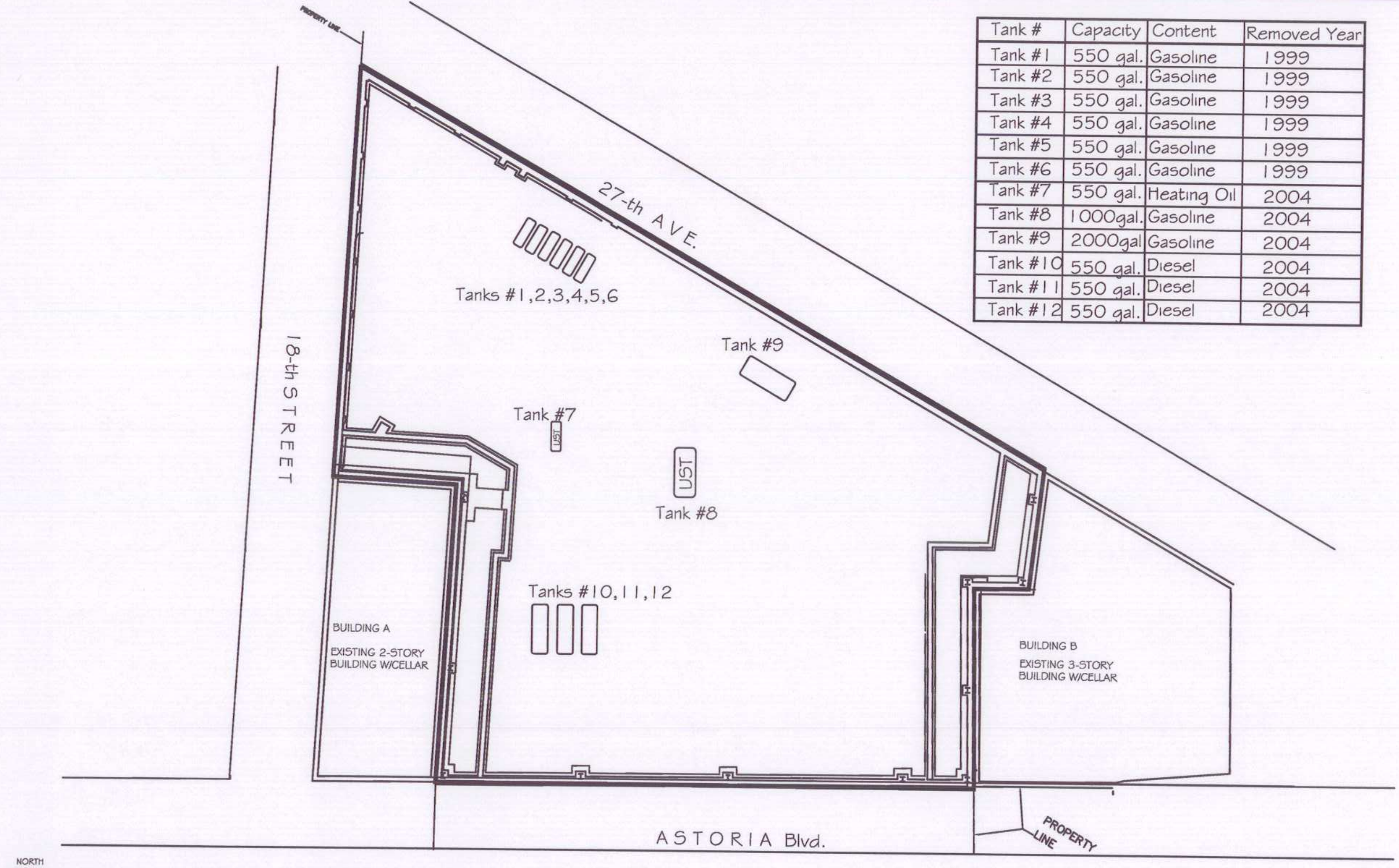
See Figure 1 for sampling locations

PES = post-excavation sample

SW = sidewall sample

▨ Values exceed soil cleanup objective

Figures



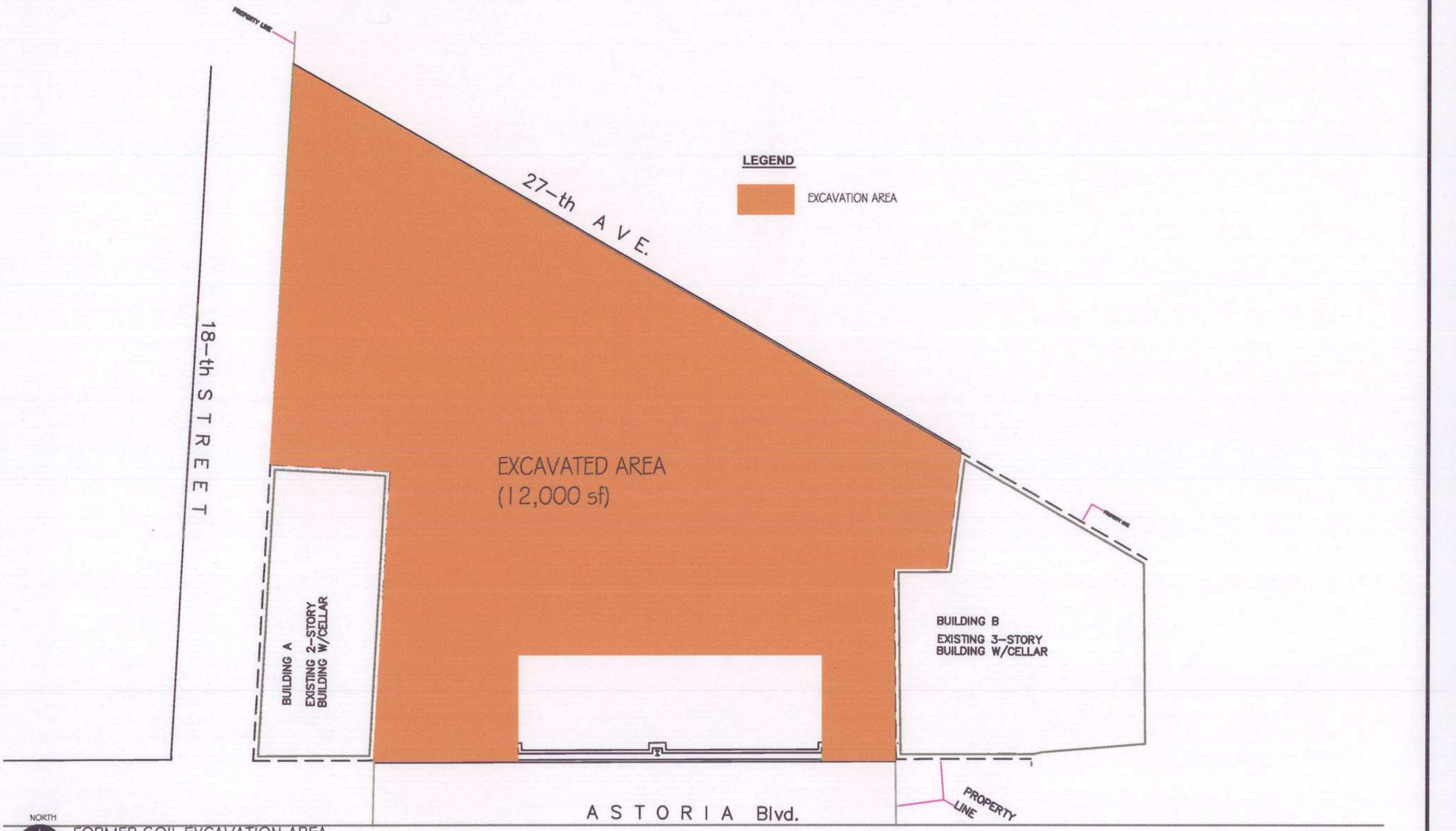
Tank #	Capacity	Content	Removed Year
Tank #1	550 gal.	Gasoline	1999
Tank #2	550 gal.	Gasoline	1999
Tank #3	550 gal.	Gasoline	1999
Tank #4	550 gal.	Gasoline	1999
Tank #5	550 gal.	Gasoline	1999
Tank #6	550 gal.	Gasoline	1999
Tank #7	550 gal.	Heating Oil	2004
Tank #8	1000gal.	Gasoline	2004
Tank #9	2000gal	Gasoline	2004
Tank #10	550 gal.	Diesel	2004
Tank #11	550 gal.	Diesel	2004
Tank #12	550 gal.	Diesel	2004

FORMER UNDERGROUND STORAGE TANK LOCATIONS

FIGURE 1

ESPL Environmental Consultants Corp.
Address: 106 West 32nd Street
NY 10001 Tel: 212-363-ESPL
Email: mail@espl.com www.espl.com

Sheet Title:	FORMER UNDERGROUND STORAGE TANK LOCATIONS	**Project #:** 25100	**Scale:** N.T.S.
Client:	18-02 LLC.	**Date:** 05.17.07	**Drawn By:** Z.P.
Address:	18-02 27th AVE ,ASTORIA NY 11102		**Created By:**



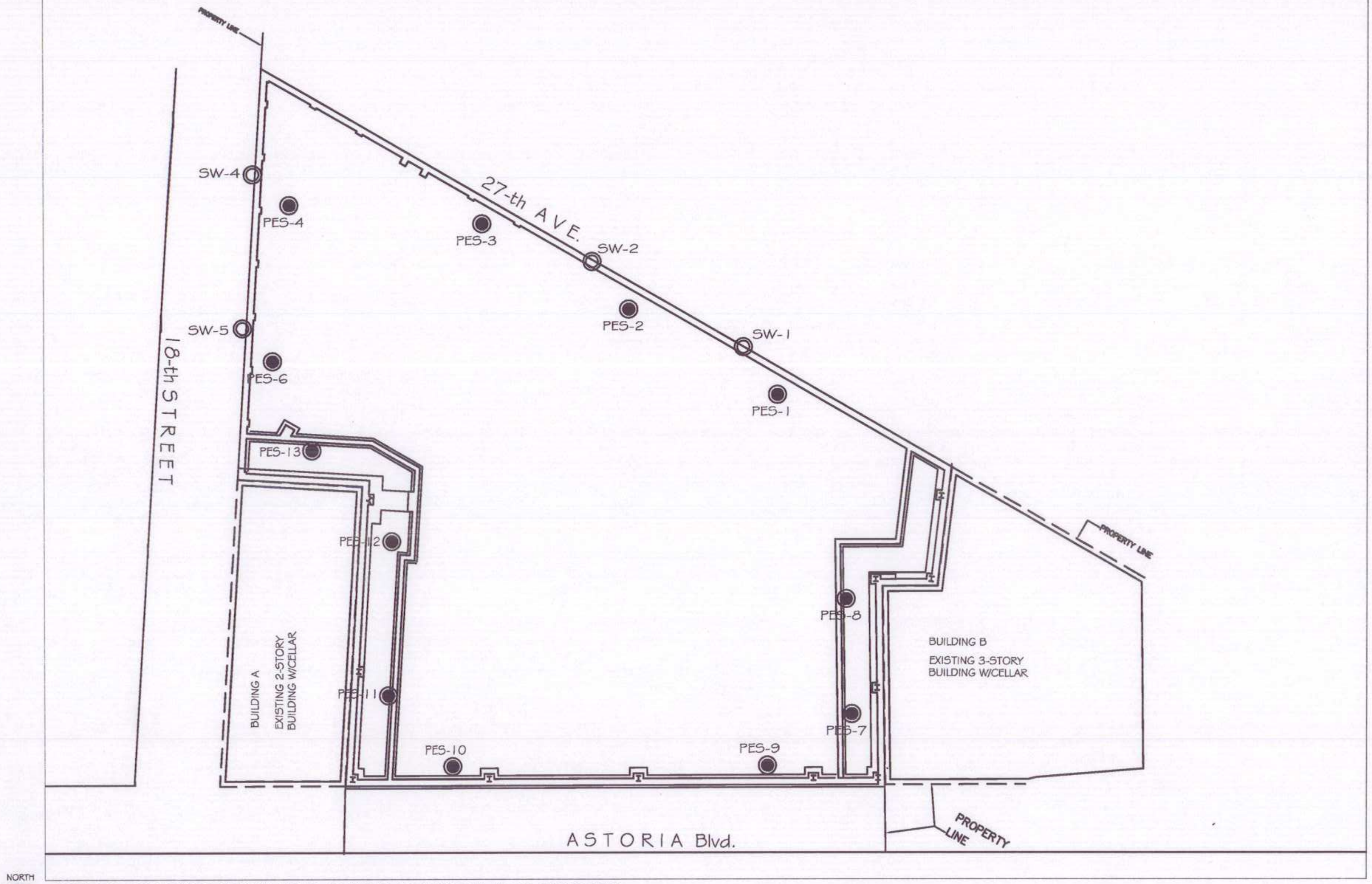
FORMER SOIL EXCAVATION AREA

FIGURE 2

ESPL Environmental Consultants Corp.

Address: 106 West 32nd Street
NY 10001 Tel: 212-363-ESPL
Email: mail@espl.com www.espl.com

Sheet Title:	FORMER SOIL EXCAVATION AREA	Project #:	25100	Scale:	N.T.S.
Client : Address:	18-02 LLC. 18-02 27th AVE ,ASTORIA NY 11102	Date:	05.17.07	Drawn By: Created By:	Z.P.



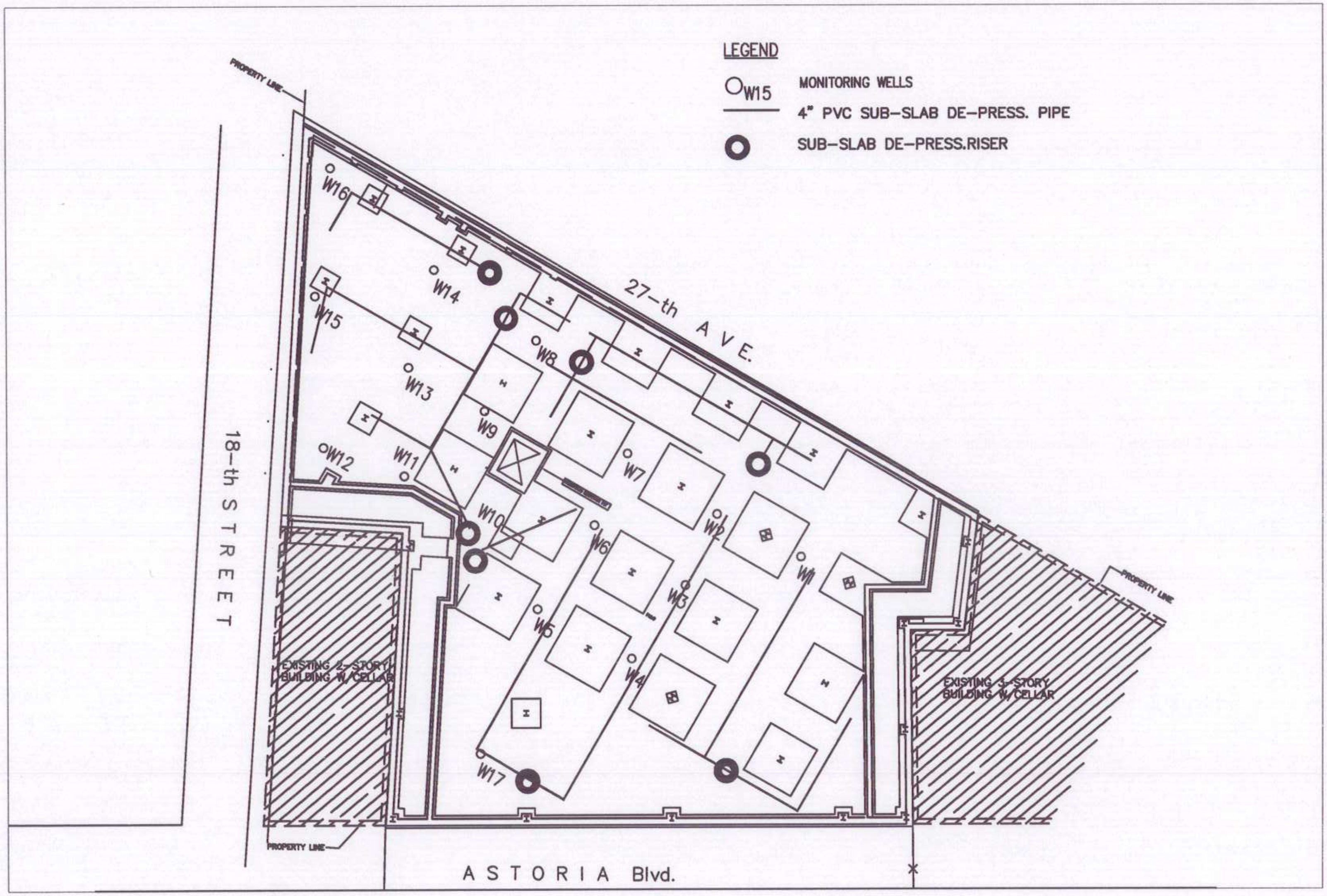
FORMER SOIL EXCAVATION AREA CONFIRMATORY SAMPLE LOCATIONS

FIGURE 3

ESPL Environmental Consultants Corp.

Address: 106 West 32nd Street
NY 10001 **Tel:** 212-363-ESPL
Email: mail@espl.com www.espl.com

Sheet Title:	FORMER SOIL EXCAVATION AREA CONFIRMATORY SAMPLE LOCATIONS
Project #:	25100
Scale:	N.T.S.
Client :	18-02 LLC.
Address:	18-02 27th AVE ,ASTORIA NY 11102
Date:	05.17.07
Drawn By:	Z.P.
Created By:	

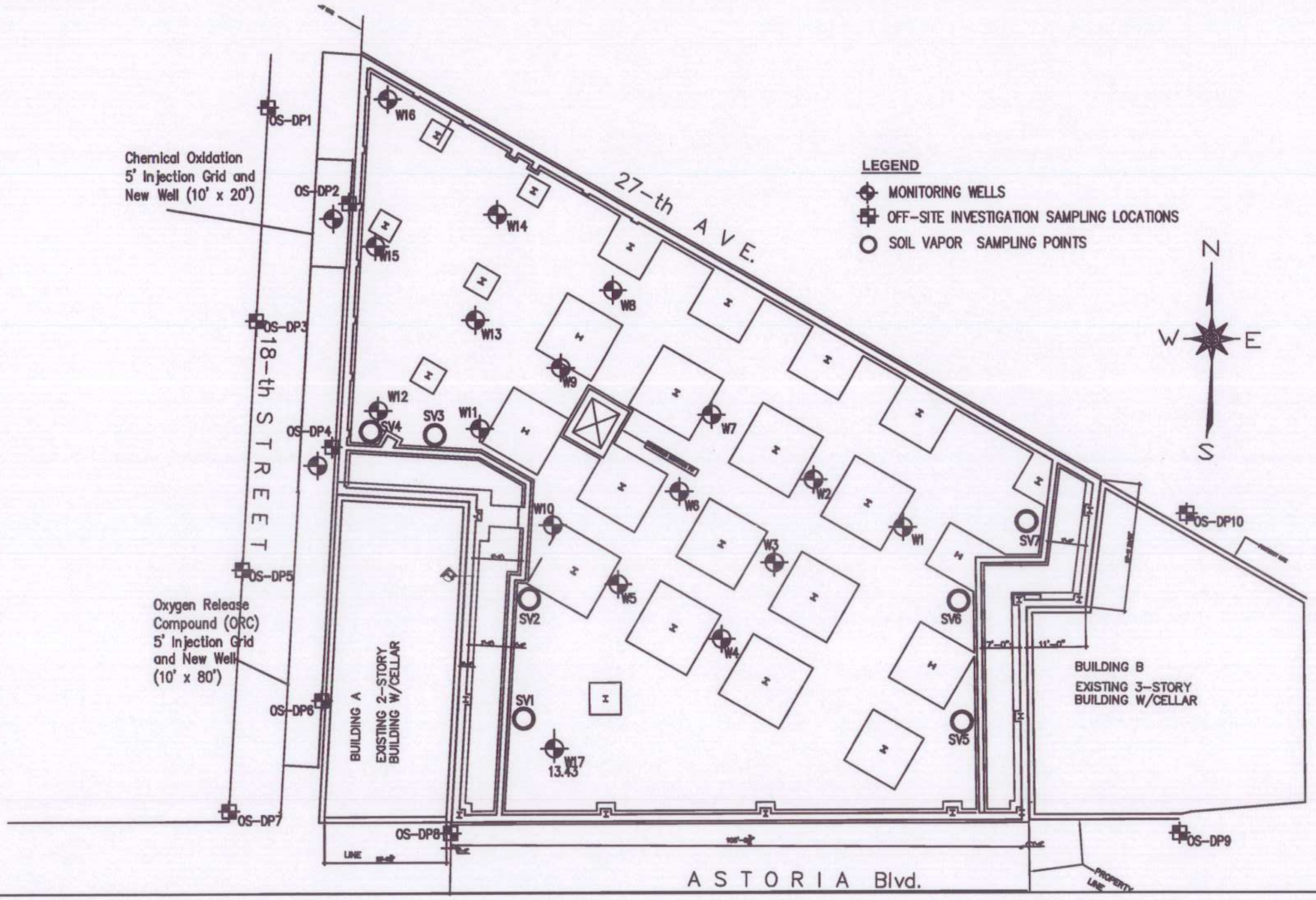


NORTH

EXISTING SUB-SLAB DEPRESSURIZATION PIPES

FIGURE 4

ESPL Environmental Consultants Corp. Address: 106 West 32nd Street NY 10001 Tel: 212-363-ESPL Email: mail@espl.com www.espl.com	Sheet Title: EXISTING SUB-SLAB DEPRESSURIZATION PIPES	Project #: 25100	Scale: N.T.S
	Client: 18-02 LLC Address: 18-02 27th Ave. Astoria, NY 11102	Date: 05.17.07	Drawn By: Z.P. Created By:



PROPOSED OFF- SITE GROUNDWATER REMEDIATION AREA

FIGURE 5

ESPL Environmental Consultants Corp.
Address: 106 West 32nd Street
NY 10001 Tel: 212-363-ESPL
Email: mail@espl.com www.espl.com

Sheet Title:	PROPOSED OFF-SITE GROUNDWATER REMEDIATION AREA	Project #:	25100	Scale:	N.T.S
Client: Address:	18-02 LLC 18-02 27th Ave. Astoria, NY 11102	Date:	05.17.07	Drawn By: Created By:	Z.P

Appendix A

Project Plans
and
Specifications

The major components of the proposed remedial actions are:

- Off-site in-situ groundwater treatment
- Implementing a sub-slab depressurization system inside the 1802 basement
- Collecting free product and monitoring groundwater at the existing wells in the 1802 basement

Figure A-1 shows the proposed off-site in-situ groundwater treatment locations and the location of the sub-slab depressurization piping.

The following sections provide specifications for each of these three major remedial components.

Off-site In-situ Groundwater Treatment

The Contractor shall provide all labor, equipment and materials to inject Regenesis Regenox chemical oxidant and Regenesis Oxygen Release Compound (ORC) at the locations shown in Figure A-1, including the following:

- Perform a utilities clearance prior to work
- Secure the work area and restrict access by the public
- Core the concrete at each grid point
- Apply a total of 15 pounds of Regenox over an interval of 0 to 10 feet into the water table (water table will be encountered approximately 20 to 25 feet below grade); mix with water and apply in accordance with Attachment A1
- Apply a total of 1 pounds of ORC over an interval of 0 to 10 feet into the water table; mix with water and apply in accordance with Attachment A2
- Patch the sidewalk cores

- Install permanent, cased, 2-inch diameter PVC monitoring wells, with flush mount locking casings, at the locations shown in Figure A-1 and develop the wells. 20 slot screens with gravel pack shall be installed from 0 to 10 feet into the water table. Drill cuttings and development water shall be contained and disposed off site.

<u>Sub-slab Depressurization System</u>

The Contractor shall provide all labor, equipment and materials to implement a radon gas mitigation-type sub-slab depressurization system to collect soil vapor from the 1-foot thick gravel layer beneath the concrete slab. Figure A-1 shows the location of 4-inch diameter perforated PVC piping placed beneath the slab prior to construction and riser locations.

Implementation shall include:

- A review of the site conditions and soil vapor contaminant levels
- Design of the system, including:
    - the number and sizing of extraction fans to provide depressurization beneath the entire slab, based on sub-slab communication testing on site, and using the piping network available (sub-slab communication testing shall consist of applying a vacuum on at least one suction point, an existing sub-slab piping network riser, and observing the downward flow of smoke in other risers, in order to determine the number of suction points and flows required to evacuate soil vapor beneath the entire slab)
    - the arrangement of piping from the riser points to manifolds prior to common fans or to individual fans, including valves to isolate lines and instrumentation to indicate system operation
    - the arrangement of final outdoor discharge piping, including elevation above the roof line
    - fans must be located outside to prevent indoor air contamination in the event of a fan leak

    - fans must be located outside to prevent indoor air contamination in the event of a fan leak
    - the electrical requirements (power needed, hazard area classification)
    - Submission of the design to ESPL for review and determination of discharge treatment requirements
- Installation of the system, including obtaining all local construction permits and approvals (e.g., electrical permit)

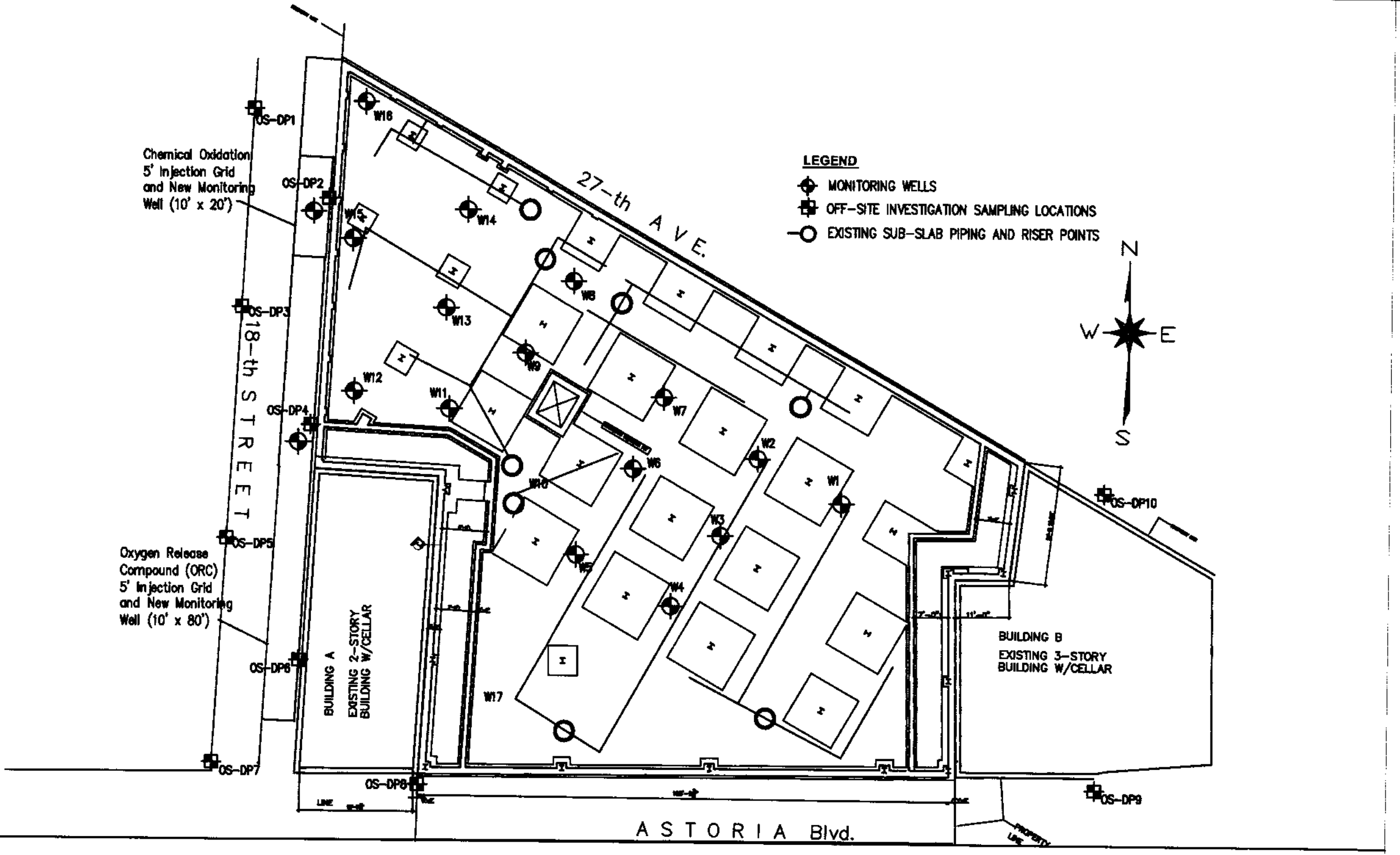
ESPL shall conduct annual indoor and outdoor air quality sampling to determine if the sub-slab depressurization system is providing contaminant reduction.

ESPL shall assist the respondents with an environmental easement application to restrict groundwater use beneath the slab for any purpose.

Sub-slab Free Product Collection and Groundwater Monitoring

ESPL shall continue to use the existing passive collection system at wells with free product.

ESPL shall continue to monitor groundwater as it does now, except sampling shall be conducted every nine months instead of every quarter. This reduces the frequency of sampling but will provide some seasonality data.



NORTH

PROPOSED REMEDIATION AREAS

FIGURE A-1

ESPL Environmental Consultants Corp.
Address: 106 West 32nd Street
NY 10001 Tel: 212-363-ESPL
Email: mail@espl.com www.espl.com

Sheet Title: PROPOSED REMEDIATION AREAS		Project #: 25100	Scale: N.T.S.
Client: 18-02 LLC. Address: 18-02 27th AVE ,ASTORIA NY 11102		Date: 05.17.07	Drawn By: Z.P. Created By:

REGENESIS

RegenOx™

CHEMICAL OXIDATION REDEFINED

RegenOx™ *In Situ* Chemical Oxidation Application Instructions

---

Using Direct-Push Injection (Step-by-Step Procedures)

RegenOx™ is the new generation of chemical oxidation. RegenOx™ is a proprietary (patent-applied-for) *in situ* chemical oxidation process using a solid oxidant complex (sodium percarbonate/catalytic formulation) and an activator complex (a composition of ferrous salt embedded in a micro-scale catalyst gel). RegenOx™ with its catalytic system has very high activity, capable of treating a very broad range of soil and groundwater contaminants including both petroleum hydrocarbons and chlorinated solvents.

Instructions

1) Prior to the installation of RegenOx™, any surface or overhead impediments should be identified as well as the location of all underground structures. Underground structures include but are not limited to utility lines; tanks; distribution piping; sewers; drains; and landscape irrigation systems. The planned installation locations should be adjusted to account for all impediments and obstacles. These considerations should be part of the SSHP or HASP.

2) Pre-mark the installation locations, noting any points that may have different vertical application requirements or total depth.

3) Set up the direct push unit over each point and follow the manufacturer standard operating procedures (SOP) for the direct push equipment. Care should be taken to assure that probe holes remain in the vertical.

4) For most applications, Regenesis suggests using 1.5-inch O.D./0.625-inch I.D drive rods. However, some applications may require the use of 2.125-inch O.D./1.5-inch I.D. or larger drive rods.

5) Advance drive rods through the surface pavement, as necessary, following SOP.

6) Push the drive rod assembly with an expendable tip to the desired maximum depth. Regenesis suggests pre-counting the number of drive rods needed to reach depth prior to starting injection activities.

7) After the drive rods have been pushed to the desired depth, the rod assembly should be withdrawn three to six inches. Then the expendable tip can be dropped from the drive rods, following SOP. If an injection tool was used instead of an expendable tip, the application of material can take place without any preliminary withdrawal of the rods.

8) In some cases, introduction of a large column of air prior to RegenOx™ application may be problematic because the air can block water flow to the treatment area. This is particularly the case in deep injections (>50 ft) with large diameter rods (>1.5-inch O.D.). To prevent the injection of air into the aquifer during RegenOx™ application, as well as to prevent problems associated with heaving sands, fill the drive rods with water, or the RegenOx™ mixture prior dropping the expendable tip or exposing the injection tool.

9) The RegenOx™ percent of the oxidizer in solution should range between 3% to 5%. Although solutions up to 8% may be used, this will likely increase the difficulty of injection due to reactivity. Solutions with greater than 8% oxidizer in solution will result in excess reaction and flocculation prior to injection and are not typically recommended

   Measure the appropriate quantity of RegenOx™ Oxidizer for one to four vertical foot of injection into a 55 gallon drum or mixing tank. The volume of water per injection location can be calculated from the following formula:

$$\frac{\text{RegenOx Oxidizer lbs/foot}}{(8.34\text{ lbs/gal water})(\%\,\mathrm{R}\mathit{egenOx\_Oxidizer}\text{ solids})}\left[1-(\%\,\mathrm{R}\mathit{egenOx\_Oxidizer}\text{ solids})\right]$$

   Tighter formations (clays and silts), and even some fine sand formations will likely require higher oxidant percentages since less volume can be injected per location. The following are guides to various RegenOx™ mixing ratios based on the above equation.

   - to make a roughly 3% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx™), use 38 gallons of water.
   - to make a roughly 4% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx™), use 28 gallons of water.
   - to make a roughly 5% oxidant solution for every 10 lbs of oxidant and 10 lbs of activator (20 lbs total RegenOx™), use 22 gallons of water.

10) Pour the pre-measured quantity of RegenOx™ Oxidizer into the pre-measured volume of water to make the desired target % oxidant in solution. NOTE: always pour the Oxidizer into water, do not pour water into the Oxidizer. Mix the water and oxidant with a power drill and paint stirrer or other mechanical mixing device to ensure that the Oxidizer has dissolved in the water.

11) Pour the applicable quantity of the pre-mixed RegenOx™ Activator into the oxidant:water solution. Mix the Oxidant and Activator using a power drill paint stirrer or other mechanical mixing device for at least 5 minutes until a homogenous mixture is formed. After mixing the RegenOx™ mixture should be injected into the subsurface as soon as possible.

12) Do not mix more RegenOx™ material than will be used over roughly 1 to 4 feet of injection so as to minimize potential above ground reaction/flocculation prior to injection.

    Transfer the contents of the mixing tank to the pump using gravity feed or appropriate transfer pump. (See Section 9.2: Pump Selection) For some types of pumps, it may be desirable to perform a volume check prior to injecting RegenOx™

13) Connect the delivery hose to the pump outlet and the delivery sub-assembly. Circulate RegenOx™ though the hose and the delivery sub-assembly to displace air in the hose. NOTE: an appropriately sized pressure gauge should be placed between the pump outlet and the delivery sub-assembly in order to monitor application pump pressure and detect changes in aquifer backpressures during application.

14) Connect the sub-assembly to the drive rod. After confirming that all of the connections are secure, pump the RegenOx™ through the delivery system to displace the water/fluid in the rods.

15) Slowly withdraw the drive rods. Commonly RegenOx™ injection progress at 1-foot intervals. However, continuous injection while slowly withdrawing single lengths of drive rod (3 or 4 feet) is an acceptable option. The pre-determined volume of RegenOx™ should be pumped into the aquifer across the desired treatment interval.

16) Remove one section of the drive rod. The drive rod may contain some residual RegenOx™. Place the RegenOx™-filled rod in a clean, empty bucket and allow the RegenOx to drain. Eventually, the RegenOx™ should be returned to the RegenOx™ pump hopper for reuse.

17) Monitor for any indications of aquifer refusal. This is typically indicated by a spike in pressure as indicated or (in the case of shallow applications) RegenOx™ "surfacing" around the injection rods or previously installed injection points. At times backpressure caused by reaction off-gassing will impede the pumps delivery volume. This can be corrected by bleeding the pressure off using a pressure relief/bypass valve (placed inline between the pump discharge and the delivery sub-assembly) and then resume pumping. If aquifer acceptance appears to be low, as indicated by high back pressure, allow sufficient time for the aquifer to equilibrate prior to removing the drive rod.

18) Repeat steps 13 through 23 until treatment of the entire contaminated vertical zone has been achieved. It is recommended that the procedure extend to the top of the capillary fringe/smear zone, or to the top of the targeted treatment interval.

19) Install an appropriate seal, such as bentonite, above the RegenOx™ material through the entire vadose zone. Prior to emplacing the borehole seal, we recommend placing clean sand in the hole to the top of the RegenOx™ treatment zone (especially important in holes that stay open). Bentonite chips or granular bentonite should be placed immediately above the treatment zone, followed by a cement/bentonite grout to roughly 0.5 feet below ground surface. Quick-set concrete should then be used as a surface seal.

20) Remove and clean the drive rods as necessary.

21) Finish the borehole at the surface as appropriate (concrete or asphalt cap, as needed). We recommend a quick set concrete to provide a good surface seal with minimal set up time.

22) A proper borehole and surface seal assures that the RegenOx™ remains properly placed and prevents contaminant migration from the subsurface. Each borehole should be sealed immediately following RegenOx™ application to minimize RegenOx™ surfacing during the injection process. If RegenOx™ continues to "surface" up the direct push borehole, an appropriately sized (oversized) disposable drive tip or wood plug/stake can be used to plug the hole until the aquifer pressures equilibrates and the RegenOx™ stops surfacing. If wells are used for RegenOx™ injection the RegenOx™ injection wells and all nearby groundwater monitoring wells should be tightly capped to reduce potential for surfacing through nearby wells.

23) Periodically compare the pre- and post-injection volumes of RegenOx™ in the holding tank or pump hopper using the pre-marked volume levels. Volume level may not be present on all tanks or pump hoppers. In this case, volume level markings can be temporarily added using known amounts of water and a carpenter's grease pencil (Kiel crayon).

24) Move to the next probe point, repeating steps 8 through 29. We recommend that the next RegenOx™ injection point be as far a distance as possible within the treatment zone from the previous RegenOx™ injection point. This will further minimize RegenOx™ surfacing and short circuiting up an adjacent borehole. When possible, due to the high volumes of liquid being injected, working from the outside of the injection area towards the center will limit expansion of the plume.

Pump Selection

Regenesis has evaluated a number of pumps and many are capable of delivering RegenOx™ to the subsurface at a sufficient pressure and volumetric rate. However, even though a number of the evaluated pumps may be capable of delivering the RegenOx™ to the subsurface based on adequate pressures and delivery rates, each pump has its own set of practical issues that may make it more or less difficult to manage in a field setting.

In general, Regenesis strongly recommends using a pump with a pressure rating of 200 pounds per square inch (psi) in sandy soil settings, and 800 psi in silt, clay or weathered bedrock settings. Any pump under consideration should have a minimum delivery rate of 5 gallons per minute (gpm). A lower gpm rated pump may be used; however, they are not recommended due to the amount of time required to inject the volume of liquids typically associated with a RegenOx™ injection (i.e. 1,000 lbs of RegenOx™ [500 lbs Oxidant/500 lbs Activator] require roughly 1,100 gallons of water to make a 5% Oxidant solution).

Quite often diaphragm pumps are used for the delivery of chemical oxidants. Generally, these pumps operate pressures from 50-150 psi. Some of these pumps do not have the pressure head necessary to overcome the back pressure encountered in silt and clay lenses. In these cases the chemical oxidant thus ends up being delivered to the surrounding sands (the path of least resistance) and is not delivered to soil with residual adsorbed contamination. The use of a positive displacement pump such as a piston pump or a progressing cavity pump is may be superior because these pumps have the pressure necessary to overcome the resistance of low permeability soils. NOTE: be aware that application at pressures that are too high may over-consolidate the soil and minimize the direct contact of the oxidant. The key is to inject at a rate and pressure that maximizes the radius of influence without causing preferential flow. This can be achieved by injecting at the minimum pressure necessary to overcome the particular pressures associated with your site soil conditions.

Whether direct injection or wells are used, it is best to start by injecting RegenOx™ outside the contaminated area and spiral laterally inwards toward the source. Similarly, RegenOx™ should be applied starting vertically at the bottom elevation of contamination, through the layer of contamination, and a couple of feet above the layer of contamination. The reagents can be pushed out from the well bore with some water.

Pump Cleaning

For best results, flush all moving parts and hoses with clean water at the end of the day; flush the injection system with a mixture of water and biodegradable cleaner such as Simple Green.

For more information or technical assistance please call Regenesis at 949-366-8000

REGENESIS

Oxygen Release Compound (ORC®) Installation Instructions

(Direct-Injection Slurry Application)

SAFETY:

Pure ORC is shipped to you as a fine powder rated at -325 mesh (passes through a 44 micron screen). It is considered to be a mild oxidizer and as such should be handled with care while in the field. Field personnel should take precautions while applying the pure ORC. Typically, the operator should work upwind of the product as well as use appropriate safety equipment. These would include eye and respiratory protection, and gloves as deemed appropriate by exposure duration and field conditions.

Personnel operating the field equipment utilized during the installation process should have appropriate training, supervision and experience.

GENERAL GUIDELINES:

ORC may be installed in the contaminated saturated zone in the ground utilizing hand augered holes, Geoprobe® type hydraulic punch equipment, or hollow stem augers. This set of instructions is specific for Geoprobe equipment. Alternate instructions may be obtained from the Regenesis Technical Support Department.

For optimum results the ORC slurry installation should span the entire vertical contaminated saturated thickness, including the capillary fringe and "smear zone".

Two general installation approaches are available. The first is to backfill only the probe hole with slurry. This is a simple approach, in that it is easy, straightforward, and the location of the ORC slurry is precisely known after installation. However, this method requires significantly more probe holes than the alternative, and may take more time for the completion of the remediation process. A separate set of instructions for this method utilizing Geoprobe equipment is available from Regenesis.

The second method is to inject the slurry through the probe holes into the contaminated saturated zone. This method requires fewer probe holes, is less disruptive to the site, and aids the spread of oxygen by spreading the ORC source material. However, it may be difficult to know the exact, final disposition of the ORC installed with this method. This is the method described in these instructions.

Note: It is important that the installation method and specific ORC slurry point location be established prior to field installation. It is also important that the ORC slurry volume and solids content for each drive point be predetermined. The Regenesis Technical Service Department is available to discuss these issues, and Helpful Hints at the end of these instructions offers relevant information. Regenesis also has available Technical Bulletins covering source treatments with ORC.

SPECIFIC INSTALLATION PROCEDURES

1. Identify the location of all underground structures, including utilities, tanks, distribution piping, sewers, drains, and landscape irrigation systems.
2. Identify surface and aerial impediments.
3. Adjust planned installation locations for all impediments and obstacles.
4. Pre-mark the installation grid point locations, noting any that have special depth requirements.
5. Set up the Geoprobe unit over each specific point, following manufacturer recommended procedures. Care should be taken to assure approximate vertical probe holes.
6. Penetrate surface pavement, if necessary, following standard Geoprobe procedures.
7. Drive the 1 1/2" (one-and-one-half inch) pre-probe (part #AT-148B) with the expendable tip (part #AT142B) to the desired maximum depth. Standard 1" (one inch) drive rods (part AT104B) should be used, after the pre-probe. (Hint: Pre-counted drive rods should be positioned prior to the installation driving procedure to assure the desired depth is reached.)
8. Disconnect the drive rods from the expendable tip, following standard Geoprobe procedures.
9. Mix the appropriate quantity of ORC slurry for the current drive point. (See separate "Directions for ORC® Slurry Mixing" and Helpful Hints). **Note: Do not mix more slurry than will be used within a 30 minute period.**
10. Set up and operate an appropriate slurry pump according to manufacturer's directions. Based on our experience, a Geoprobe model GS-1000 pump is recommended. Connect the pump to the probe grout pull cap (GS-1054) via a 1 inch diameter delivery hose. The hose is then attached to the 1" drive rod with its quick connector fitting. Upon confirmation of all connections add the ORC slurry to the pump hopper/tank.
11. Withdraw the pre-probe and drive stem 4' (four feet). (Also note Helpful Hints - Operations at end of instructions.)
12. Optional pretreatment step. (See Helpful Hints - Operations at end of instructions). Pump one to two gallons of tap water into the aquifer to enhance dispersion pathways from the probe hole.
13. Pump the predetermined quantity of ORC slurry for the depth interval being injected. Observe pump pressure levels for indications of slurry dispersion or refusal into the aquifer. (Increasing pressure indicates reduced acceptance of material by the aquifer).
14. Remove one 4' section of the 1" drive rod. The drive rod will contain slurry. This slurry should be returned to the ORC bucket for reuse.
15. Repeat steps 11, 13, and 14 until treatment of the entire affected thickness has been achieved. It is generally recommended that the procedure extend to the top of the capillary fringe/smear zone.
16. Install an appropriate seal, such as bentonite, above the ORC slurry through the entire vadose zone. This helps assure that the slurry stays in place and prevents contaminant migration from the surface. Depending on soil conditions and local regulations, a bentonite seal can be pumped through the slurry pump or added via chips or pellets after probe removal.
17. Remove and decontaminate the drive rods and pre-probe.

18. Finish the probe hole at surface as appropriate (concrete or asphalt cap, if necessary).
19. Move to the next probe point, repeating steps 5 through 18.

HELPFUL HINTS:

A. Physical characteristics

A1. Slurry

The ORC slurry is made using the dry ORC powder (rated at -325 mesh). It makes a smooth slurry, with a consistency that depends on the amount of water used.

A thick, but pumpable, slurry that approaches a paste can be made by using 65-67% solids. This material would normally be used for back-filling a bore or probe hole. It is especially useful where maximum density is desired such as where ground water is present in the hole or there are heaving sands.

Thinner slurries can be made by using more water. Typical solids for the thinner slurries content will range from 35% to 62%. Such slurries are useful for injecting through a probe or bore hole into the saturated aquifer.

As a rule, it is best to mix the first batch of slurry at the maximum solids content one would expect to use. It can then be thinned by adding additional water in small increments. By monitoring this process, the appropriate quantities of water for subsequent batches can be determined.

The slurry should be mixed at about the time it is expected to be used. It is best to not hold it for more than 30 minutes. Thinner slurries, especially, can experience a separation upon standing. All ORC slurries have a tendency to form cements when left standing. If a slurry begins to thicken too much, it should be mixed again and additional water added if necessary.

Care should be taken with slurry that may be left standing in a grout pump or hose. Problems can generally be avoided by periodically re-circulating the slurry through the pump and hose back into the pump's mixing or holding tank.

A2. Equipment

Most geotechnical grout pumping equipment has a holding tank with a capacity sufficient for injection.

When applying measured volumes of ORC slurry to probe holes, it is sometimes useful to know the volumes and content of the delivery system lines. The following information may be useful in this regard.

Geoprobe pump: At the end of a pump stroke virtually no deliverable slurry remains in the pump.

5/8" O.D. connecting hose (10 feet long):	0.2 gallons (26 fluid ounces).
Four foot (4') length of 1" drive rod:	.04 gallons (5 fluid ounces).
Three foot (3') length of 1 1/2" pre-probe:	.03 gallons (4 fluid ounces).

Cleaning and maintenance:

Pumping equipment and drive rods can be lightly cleaned by circulating clear water through them. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

B. Operating characteristics

B1. Operations - General

Judgment will be needed in the field when injecting ORC slurries. In general, it is relatively easy to inject ORC slurries into sandy soils, and this can usually be accomplished at very moderate pressures. Silts and clays require more pressure, and may accept less slurry.

Careful observation of pressure during slurry pumping is the best indication of the effectiveness of the slurry injection. To test the soil's ability to accept the slurry and to "precondition" the injection point for the slurry, it is sometimes useful to inject a small volume of plain water prior to the slurry. Normally, one-half (0.5) gallons to two (2) gallons would be appropriate.

During injection, increasing pressure and decreasing flow rate are signs of refusal by the soil matrix to accept the slurry. The site geologist should determine whether to increase pressure, and possibly fracture ("frac") the soil matrix to achieve ORC slurry installation in a tight site that has refused the slurry at lower pressures.

B2. Fill Volumes

Probe hole back-filling

Probe hole capacities:

Per 10' (Ten Foot) Length			
Theoretical		**Operating Volume**	
(Gallons/Fluid Ounces/Cubic Inches)		**(Gallons/Fluid Ounces)**	
Sand, Silts & Clay		**Sand**	**Silts & Clay**
1" Diameter	.41 gal/52 fl. oz./94.2 cu. in.	.61 gal/78 fl. oz.	.51 gal/65 fl. oz.
1 1/2" Diameter	.92 gal/117 fl. oz./212.0 cu. in.	1.38 gal/176 fl. oz.	1.15 gal/146 fl. oz.
2" Diameter	1.63 gal/209 fl. oz./376.8 cu. in.	2.44 gal/313 fl. oz.	2.04 gal/261 fl. oz.
2 1/4" Diameter	2.06 gal/264 fl. oz./476.9 cu. in	3.09 gal/396 fl. oz.	2.57 gal/330 fl. oz.

Note that the operating volumes include a 50% excess above the theoretical volume in sands and 25% in clays and silts. This is important to successful treatment. The additional material allows for a small degree of infiltration of the slurry into the surrounding soil and fractures, as well as hole diameter variability. It is important to assure that the entire contaminated saturated zone is treated (including the capillary fringe), since this is often the area of highest pollution concentration. Failure to treat this area due to improper installation can undermine an otherwise successful remediation effort.

For direct assistance or answers to any questions you may have regarding these instructions, contact Regenesis Technical Services at 949-366-8000.

REGENESIS, 2002
www.regenesis.com

Appendix B

Remedial Action Health and Safety Plan

SITE HEALTH AND SAFETY PLAN

For

FORMER WILLOW SERVICE STATION (1802 LLC)
1802 27th AVENUE
ASTORIA, NEW YORK

Prepared For

1802 LLC

May 2007
(Revised October 2007)

Prepared by

ESPL *ENVIRONMENTAL CONSULTANTS CORPORATION*
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Table of Contents

1.0 INTRODUCTION

This health and safety plan (HASP) describes the health and safety (HAS) guidelines developed for this site to protect on-site personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes. In accordance with the Occupational Safety and Health Administration (OSHA) at 29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response Final Rule, this HASP addresses the potential and actual safety and health hazards relating to of each phase of site operations.

This site-specific HASP is based on the best available information to date. The HASP may be revised when new information on site conditions is received or identified.

ESPL and contractor employees may be exposed to risks from hazardous conditions related to activities at this site. ESPL's policy is to minimize the possibility of work-related injury through aware and qualified supervision, health and safety training, medical monitoring, and the use of appropriate personal protective equipment.

This site-specific Health and Safety Plan (HASP) applies to ESPL and contractor personnel where operations involve actual or potential exposure to safety or health hazards. This HASP describes emergency response procedures for actual and potential physical and chemical hazards that have been identified by ESPL. This HASP is also intended to inform and guide all personnel entering an exclusion zone. ESPL's sub-contractors are retained as independent contractors and, are responsible for ensuring the health and safety of their own employees.

ESPL may require that its personnel take certain precautions in accordance with this HASP, and ESPL requests that others protect their personnel in a manner that they deem necessary or sufficient.

1.1 Brief Description of Project

Remedial action at the site is proposed to consist of in-situ groundwater treatment outside the 1802 building, but limited to 1802 property (the sidewalk along 18th Street). This will also include installation of two groundwater monitoring wells and sampling to measure remediation progress.

In addition, a sub-slab depressurization system will be installed, utilizing the existing sub-slab PVC horizontal piping beneath the slab.

In addition, free product recovery and groundwater sampling will be conducted as in the past, using the existing wells inside the 1802 building in the basement..

1.2 Site History

The Willow Service Station has been in operation for more then 30 years. A tank field with a total of six (6) 550-gallon underground storage tanks was located directly north of the building. In 1994 a leak was discovered in one of the tanks and a spill was reported to the NYSDEC. Consequently the NYSDEC issued Spill # 94-16654 to the above referenced site. The leaking tank was abandoned in place and all other tanks were upgraded to federal standards.

In December of 1999 all six (6) UST's were removed. Impacted soil was observed during the excavation and 298 tons of contaminated soil was removed. Based upon the above referenced observations the NYSDEC required a further investigation to determine the total extent of impacted soil and groundwater.

During October 2000 a partial investigation was completed, however based on migration of groundwater contamination over the last three years, additional work needs to be completed to determine the full extent of contamination present before a remediation system can be designed and installed.

1.3 Known Site Contamination

The site is contaminated with gasoline, which contains the following compounds:

- Benzene
- Toluene
- o, m, and p-xylene
- Ethylbenzene
- Chlorobenzene
- Dichlorobenzene
- Methyl tert-butyl Ether
- Semi-Volatile Organic Compounds

The material data safety sheets for these compounds are presented at the end of the plan.

1.4 Synopsis of Remedial Actions

A contractor shall be retained to perform in-situ groundwater treatment outside the 1802 building by injecting oxygen release and chemical oxidation reagents into the subsurface using direct push geoprobe techniques. Therefore, the remediation operation will be similar to obtaining soil borings and groundwater samples by this technique, except reagent handling must be considered as well.

A contractor shall be retained to install PVC piping to connect to the existing sub-slab PVC piping in order to collect sub-slab vapors, including associated valves and pressure gauges to monitor vacuum conditions. The contractor will also provide a central fan or individual fans to collect vapors, and discharge piping to the outside of the building, including all associated electrical connections and instrumentation.

Existing free product collection and groundwater sampling within the 1802 building will be conducted.

1.5 Site Operations to be performed

Geoprobe boring installation, well drilling, well sampling, remedial pilot studies, remediation system construction and operation.

2.0 ORGANIZATIONAL STRUCTURE

Principal in Charge: Ray Kahn

Project Supervisor / Overall Project Manager: Margaret Tavares, Mike O'Hara

Site Safety and Health Officer: Margaret Tavares

Additional Site Personnel: Mir Fazlul Karim

Title	Name
Project Manager	Ray Kahn, P. E.
Field Supervisor	Margaret Tavares, Mike O'Hara
Health and Safety Officer	Margaret Tavares
Administration / Clerical	Sandra Tavares
Chemical Analysis	Accredited Laboratories, Inc.

2.1 Roles and Responsibilities

The ESPL Project Supervisor is responsible for overall project administration and for supervising implementation of the HASP by ESPL personnel on site. All applicable OSHA health and safety (HAS) standards shall be applied. Each subcontractor (defined as an OSHA employer) is also responsible for the health and safety of its employees. If there is any dispute with regard to HAS or project activities, on-site personnel shall attempt to resolve the issue. If the issue cannot be resolved, in the work zone, then the project superintendent shall be consulted.

The ESPL Site Safety Officer is also responsible for coordinating HAS standards on-site. The Site Safety Officer will have met the emergency response and hazardous materials handling training requirements of OSHA 29 CFR Part 1910.120, completed supervisors training, and have appropriate experience pertinent to the on-site work. The Site Safety Officer is authorized to suspend site work based on safety concerns, and is responsible for:

1. Indoctrinating personnel with regard to all of the information in this HASP and any other safety requirements to be observed during site operations, including, but not limited to, decontamination procedures, designation of work zones and levels of protection, air monitoring, fit testing, and emergency procedures dealing with fire and medical situations;

2. Coordinating site safety decisions with the Project Supervisor and the Principal in Charge;

3. Maintaining the designation of exclusion, decontamination, and support zones on a daily basis;

4. Monitoring the condition and status of known on-site hazards, and

maintenance and implementation of the air quality-monitoring program specified in this HASP;

5. Maintaining the Site Personnel log;

6. Maintaining records of safety problems encountered, corrective actions taken, and documentation of any chemical exposures or physical injuries. The Site Safety Officer will document these conditions in a bound notebook and maintain a copy of this log on-site; and

7. Periodic inspections of the site to determine the effectiveness of the HASP.

Any person who observes safety concerns or potential hazards that have not been addressed in the daily safety meetings should immediately report observations/concerns to the ESPL Site Safety Officer or other appropriate key personnel.

3.0 HAZARD ASSESSMENT

This section identifies the activity-specific hazards associated with site operations and standard operating procedures (SOPs) that should be implemented to reduce the hazards; identifies general physical hazards that can be expected at most sites; and presents a summary of documented or potential chemical hazards at the site. Every effort must be made to reduce or eliminate these hazards. Those that cannot be eliminated must be guarded against by using engineering controls and/or personal protective equipment.

3.1 Activity-Specific Hazards and Standard Operating Procedures

In-situ Groundwater Remediation:

Geoprobe borings, solid reagent mixing with water, liquid reagent pressure injection, well installation for monitoring and remediation, system design, system construction, and system operation.

Identification of the Hazards associated with each task:

Geoprobe Borings, Reagent Pressure Injection, and Monitoring Well Installation

Drilling operations may expose workers to rotating equipment, heavy moving objects and overhead hazards. Booms and derricks shall not be raised unless the area is clear of overhead hazards such a tree limbs and electrical power lines. Underground utilities may pose a hazard if encountered during drilling.

Oxygen release and chemical oxidation reagents shall be handled by the Contractor in accordance with the suppliers' recommendations and precautions, including storage, mixing with water, injection, and personal protection procedures.

Mechanical System Construction:

Mechanical system construction will include piping and electrical construction that involves the use of standard tools and electrical equipment such as hammers, saws, power cutting tools, drills and other equipment. These types of tools shall be used in accordance with manufactures recommendations for specific hazards posed by each.

System Operation:

The operation of a system in a petroleum-contaminated site may require field visits and well monitoring operations such as depth to water measurements, depth to product measurements, air, soil and groundwater sample collection. The hazard associated with this task is the possible worker exposure to gasoline in liquid and vapor forms.

Required Hazard Controls or SOP:

1. Use tools in accordance with manufactures specifications.
2. Use ground fault circuit interrupters for all electrical work.
3. Avoid wearing loose clothing around rotating machinery associated with well drilling equipment.
4. Use OSHA compliant personal protective equipment.
5. Hand digging and site mark outs shall be performed prior to commencement of drilling operations to avoid underground utilities. Overhead inspections shall be performed prior to raising drill rig derricks and booms.

3.2 General Site Hazards

Applicable OSHA 29 CFR 1910.120(m) standards for illumination shall apply. Generally, all work at this site will be conducted during daylight hours.

All electrical power must be connected to a ground fault circuit interrupter. All equipment that will enter excavations must be suitable and approved (i.e. intrinsically safe) for use in potentially explosive environments. Applicable OSHA 29 CFR 1926 Subpart K standards for use of electricity shall apply.

Work in which a worker could fall will be performed using appropriate ladders and/or protection (e.g. body harness and lifeline). All work at this site is expected to be conducted at the ground surface.

When the temperature is above 70°F and personnel are wearing protective clothing, a heat stress-monitoring program shall be implemented. Employees shall be allowed break periods and beverages as necessary. All personnel routinely working on site (including the support zone) shall be familiar with the symptoms, signs, and emergency care associated with heat stress, heat exhaustion, and heat stroke as discussed in Section 6 of this HASP.

Cold stress is a result of cold, wetness, and wind. A worker's susceptibility to cold stress can vary according to his/her physical fitness, degree of acclimatization to cold weather, age, and diet. A cold stress-monitoring program shall be implemented as appropriate. Employees shall have access to break periods, shelter, and beverages as necessary. All personnel routinely working on-site (including the support zone) shall be familiar with the symptoms, signs, and emergency care associated with cold stress, hypothermia, and frostbite as discussed in Section 6 of this HASP.

In accordance with 29 CFR 1910.151(c), all site related operations involving possible eye injury, (chemical splash, etc.), must have approved eye wash units readily available (in the Site Safety Officer's vehicle and in the job trailer). Protective eyewear shall be donned in Level D, when directed by the site safety officer. (The full-face APR required by Level C and the pressure demand self-contained breathing apparatus mask required by Level B serve as eye protection.)

Operations creating the potential for fire hazards shall be conducted in a manner that minimizes risk. Non-sparking tools and fire extinguishers shall be used or available as directed by the site safety officer when potentially explosive atmospheres may be encountered. Ignition sources shall be removed from work areas. When necessary, explosion-proof instruments and/or bonding and grounding will be used to prevent fire or explosion.

Overhead and underground utilities shall be identified and/or inspected and appropriate safety precautions taken before conducting operations involving potential contact or interference.

3.3 Biological Hazards

Biological hazards can cause infection or disease in people, plants, animals, or microorganisms. These hazards are divided in to five categories: viral, rickettsial/chlamydia, bacterial, fungal, and parasitic.

Biological agents may be dispersed by wind or water. Many biological agents require a carrier (e.g. bees, ticks, snakes) to infect a host; therefore, controlling the agent may require controlling or avoiding the carrier. Contact with some biological agents may be avoided by using personal protective equipment similar to that used for chemical hazards.

4.0 TRAINING REQUIREMENTS

All personnel entering an exclusion zone or decontamination zone must have met training requirements for hazardous waste site operations and emergency response operations in accordance with OSHA 29 CFR 1910.120(e).

Documentation of personnel training is maintained on file, and each employee will have copies of his/her applicable 40-Hour OSHA Training, 8-Hour Refresher Training, and Supervisor Training certificates on-site (located in job trailer files). A summary of personnel training status and HAS training records is shown in Table 1-1. Each subcontractor working on the job must provide the site safety officer with training documentation for its personnel.

TABLE 1-1

HEALTH AND SAFETY TRAINING RECORDS

Personnel	Date of 40 Hours	Last 8-Hour Refresher	Supervising Training	Last Physical	Fit Testing Last
Ray Kahn	2004		2005	2007	
Margaret Tavares			2006	2007	

Notes:

(1) Physicals will be completed before site work begins.

(2) An 8-hour refresher course including respirator fit testing will be conducted before site work begins.

(3) Union employees working in the exclusion zone will have 40-hours training. Additional workers, who meet all requirements specified in this plan, will be supplied by the local unions as needed.

5.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) shall be selected in accordance with the site air monitoring program and hazard assessment, OSHA 29 CFR 1910.120(.c) and (g), and 1910.132. Protective equipment shall be NIOSH-approved and respiratory protection shall conform to OSHA 29 CFR Part 1910.133 and 1910.134 specifications; head protection shall conform to 1910.135; eye and face protection shall conform to 1910.133; and foot protection shall conform to 1910.136.

The level of personnel protection for site activities described in the hazard assessment is as follows:

Location	Job Function	Level of Protection			
Exclusion Zone	D	A	B	C	D
		A	B	C	D
		A	B	C	D
		A	B	C	D
Decontamination Zone	D	A	B	C	D
		A	B	C	D
		A	B	C	D
		A	B	C	D

Specific protective equipment for each level of protection is as follows:

Level A		**Level B**	
Level C		**Level D**	Hardhat and safety boots

List type of air-purifying canister to be used if required. ________________________

Other PPE not listed above:

____

____

____

____

NO CHANGES TO THE SPECIFIED LEVELS OF PROTECTION SHALL BE MADE WITHOUT THE APPROVAL OF THE SITE SAFETY OFFICER.

A description of typical PPE for each protection level is as follows:

5.1 Level A Protection

1. PPE:

a. Supplied-air respirator approved by the Mine Safety and health Administration (MSHA) and NIOSH. Respirators may be:
   - Positive-pressure SCBA; or
   - Positive-pressure airline respirator (with escape bottle for immediately Dangerous to Life and Health (IDLH) or potential for IDLH atmosphere).

b. Fully encapsulating chemical-resistant suit.

c. Coveralls.

d. Cotton long underwear*.

e. Gloves (inner), chemical-resistant.

f. Boots, chemical-resistant, steel toe and shank. (Depending on suit construction, worn over or under suit boot.

g. Hard hat (under suit)*.

h. Disposable gloves and boot covers (worn over fully encapsulating suit).

i. Cooling unit *.

j. Two-way radio communications (inherently safe)*.

*Optional

2. Criteria for Selection:

Meeting any of these criteria warrants use of Level A protection:

a. The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on:
   - Measures (or potential for) high concentration or atmospheric vapors, gases, or particulate, or
   - Site operations and work functions involve high potential for splash, immersion, or exposure to unexpected vapors, gases, or particles of materials highly toxic to the skin.

b. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible.

c. Operations must be conducted in confined, poorly ventilated areas until the absences of substances requiring Level A protection is determined.

d. Direct readings on field Flame Ionization Detectors (FID) or phototoionization Detectors (PID) and similar instruments indicate high levels of unidentified vapors and gases in the air.

3. Guidance on Selection

a. Fully encapsulating suits are primarily designed to provide gas or vapor-tight barrier between the wearer and atmospheric conditions.

Therefore Level A is generally worn when high concentrations of airborne substances could severely affect the skin. Since Level A required the use of SCBA, the eyes and respiratory system are also more protected.

Until air surveillance data become available to assist in the selection of the appropriate level of protection, the use of Level A may have to be based on indirect evidence of the potential for atmospheric contamination or other means of skin contact with severe skin affecting substances.

Conditions that may require Level A protection include:

- Confined spaces: Enclosed, confined, or poorly ventilated areas are conducive to the build up of toxic vapors, gases, or particles. (Explosive or oxygen-deficient atmospheres are also more probable in confined spaces). Confined-space entry does not automatically warrant wearing Level A protection, but should serve as a cue to carefully consider and to justify a lower level of protection.
- Suspected / known highly toxic substances: Various substances that are highly toxic, especially skin absorption, for example, fuming corrosives, cyanide compounds, concentrated pesticides, Department

of Transportation Poison “A” materials suspected carcinogens, and infectious may be known or suspected to be involved. Field instruments may not be available to detect or quantify air concentrations of these materials. Until these substances are identified and concentrations measured maximum protection may be necessary.

- Visible emissions: Visible air emissions from leaking containers or railroad / vehicular tank cars, as well smoke from chemical fires and others indicate high potential for concentrations or substances that could be extreme respiratory or skin hazards.
- Job functions: Initial site entries are generally walk-through, in which instruments and visual observations are used to make a preliminary evaluation of the hazards.

In initial site entries, Level A should be worn when:

- There is a probability for exposure to high concentrations of vapors, gases, or particulates; and
- Substances are known or suspected of being extremely toxic directly to the skin or by being absorbed.

Subsequent entries are to conduct the many activities needed to reduce the environmental impact of the incident. Levels of protection for later operations are based not only on data obtained from the initial and subsequent environmental monitoring, but also on the probability of contamination and ease of decontamination.

Examples of situations where Level A has been worn are:

- Excavating of soil to sample buried drums suspected of containing high concentrations of dioxin;

- Entering a cloud of chlorine to repair a valve broken in a railroad accident;
- Handling and removing drums known to contain petroleum; and
- Responding to accidents involving cyanide, arsenic, and undiluted pesticides.

The fully encapsulating suit provides the highest degree of protection to skin, eyes, and respiratory system if the suit material resists chemicals during the time the suit is worn. While Level A provides maximum protection, all suit material may be rapidly permeated and degraded by certain chemicals from extremely high air concentrations, splashes, or an immersion of boots or gloves in concentrated liquids or sludges. These limitations should be recognized when specifying the type of fully encapsulating suit. Whenever possible, the suit material should be matched with the substance it is used to protect against.

5.2 Level B Protection

1. PPE:

a. Positive-pressure SCBA (MSHA\NIOSH approved); or

b. Positive-pressure air line respirator (with escape bottle for IDLH potential for IDLH atmosphere) MSHA/NIOSH approved;

c. Chemical resistant clothing (overalls and long-sleeved jacket; coveralls or hooded one-or two-piece chemical splash suit; disposable chemical-resistant, one-piece suits);

d. Cotton long underwear*;

e. Coveralls;

f. Gloves (outer), chemical-resistant;

g. Gloves (inner), chemical-resistant;

h. Boots (inner), leather work shoe with steel toe and shank;

i. Boots (outer), chemical-resistant, (disposable);

j. Hard hat (face shield*);

k. 2-way radio communication*; and

l. Taping between suit and gloves; and suit and boots.

* Optional

2. Criteria for Selection

Any one of the following conditions warrants use of Level B Protection:

a. The type and atmospheric concentration of toxic substances have been identified and require a high level of respiratory protection, but less skin protection than Level A. These atmospheres would be:

  - Have IDLH concentrations; or
  - Exceed limits of protection afforded by an air-purifying mask; or
  - Contain substances requiring air-supplied equipment, but

substances and/or concentrations do not represent a serious skin hazard.

b. The atmosphere contains less than 19.5% oxygen.

c. Site operations make it highly unlikely that the work being done will generate high concentrations of vapors, gases or particulates, or splashes of material that will affect the skin of personnel wearing Level B protection.

d. Working in confined spaces.

e. Total atmospheric concentrations, sustained in the breathing zone, of unidentified vapors or gases range from 5 ppm above background to 500 ppm above background as measured by direct reading instruments such as the ID or PID or similar instruments, but vapors and gases are not suspected of containing high levels of chemicals toxic to skin

3. Guidance on Selection Criteria:

Level B equipment provides a reasonable degree of protection against splashes and to lower air concentrations, but a somewhat lower level of protection to skin than Level A. The chemical-resistant clothing required in Level B is available in a wide variety of styles, materials, construction detail, permeability, etc. Taping joints between the gloves, boot and suit, and between the hood and respirator reduces the possibility for splash and vapor or gas penetration. These factors all affect the degree of protection afforded. Therefore the Safety Officer should select the most effective chemical-resistant clothing based on the known or anticipated hazards and/or job function.

Level B does provide a high level of protection to the respiratory tract. Generally, if SCBA is required, Level B clothing rather that a fully encapsulating suit (Level A) is selected based on needing less protection against known or anticipated substances affecting the skin. Level B skin protection is selected by:

a. Comparing the concentrations of known or identified substances in air with skin toxicity data.
b. Determining the presence of substances that are destructive to or readily absorbed through the skin by liquid splashes, unexpected high levels of gases, vapor or particulates, or other means of direct contact; and
c. Assessing the effect of the substance (at its measure air concentrations or splash potential) on the small area of the head and neck left unprotected by chemical-resistant clothing.

For initial site entry at an open site, Level B protection should protect site personnel, providing the conditions described in selecting Level A are known of judged to be absent.

5.3 Level C Protection

1. PPE

a. Full-face, air purifying, cartridge- or canister-equipped respirator (MSHA/NIOSH approved) with cartridges appropriate for the respiratory hazards;

b. Chemical-resistant clothing (coveralls, hooded, one-or two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls;

c. Coveralls;

d. Cotton long underwear*;

e. Gloves (outer), chemical resistant;

f. Gloves (inner), chemical-resistant

g. Boots (inner), leather work shoes with steel toes and shank;

h. Boots)outer), chemical-resistant (disposable)*;

i. Hard hat (face shield)*;

j. Escape SCBA of at least 5 minute duration;

k. 2-way radio communications (inherently safe)*; and

l. Taping between suit and boots, and suit and gloves.

* Optional

2. Criteria for Selection

Meeting all of these criteria permits use of Level C protection:

a. Measured air concentrations of Identified substances will be reduced by the respirator to, at, or below the substance’s Threshold Limit Value (TLV) or appropriate occupational exposure limit and the concentration is within the service limit of the canister.

b. Atmospheric contaminate concentrations do not exceed IDLH levels.

c. Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of the skin left unprotected by chemical-resistant clothing.

d. Job functions do not require SCBA;

e. Total readings register between background and 5 ppm above background as measured by instruments such as the FID of PID.

f. Oxygen concentration is not less than 19.5% by volume.

g. Air will be monitored continuously.

3. Guidance on Selection Criteria

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditions permit wearing air-purifying devices. The air-purifying device must be a full-face mask (MSHA/NIOSH approved) equipped with a cartridge suspended from the chin or on a harness. Cartridges must be able to remove the substances encountered.

A full-face air purifying mask can be used only if:

a. Oxygen content of the atmosphere is at least 19.5% by volume;

b. Substance(s) is identified and its concentration(s) measured;

c. Substance(s) has adequate warning properties;

d. Individual passes a qualitative fit-test for the mask; and

e. Appropriate cartridge is used, and its service limits concentration is not exceeded.

An air-monitoring program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be monitored thoroughly when personnel are wearing air-purifying respirators (Level C). Continual surveillance using direct reading instruments and air sampling is needed to detect any changes in air quality necessitating a higher level of respiratory protection. Total unidentified vapor/gas concentrations exceeding 5 ppm above background required Level B.

5.4 Level D Protection

1. PPE

a. Coveralls, chemical-resistant;

b. Gloves (outer), chemical resistant;

c. Gloves (inner), chemical-resistant*;

d. Boots (inner), leather work shoes with steel toes and shank;

e. Boots (outer), chemical-resistant (disposable)*;

f. Hard hat;

g. Face shield*;

h. Safety glasses with side shields or chemical splash goggles*; and

i. Taping between suit and boots, and suit and gloves.

* Optional

2. Criteria for Selection

a. No atmospheric contamination is present.

b. Direct reading instruments do not indicate any readings above background.

c. Job functions have been determined not to require respirator protection.

3. Guidance on Selection Criteria

Level C protection is distinguished from Level D protection in the requirement for respiratory protection. Level D is used for non-intrusive activities or intrusive activities with continuous air monitoring. It can be worn only in areas where there is no possibility of contact with contamination.

6.0 TEMPERATURE EXTREMES

6.1 Heat Stress

Site personnel who wear protective clothing allow body heat to be accumulated with an elevation of the body temperature. Heat cramps, heat exhaustion, and heat stroke can be experienced, which, if not remedied, can threaten life or health. Therefore an American Red Cross Standard First Aid book or equivalent will be maintained on site at all time so that the SO and site personnel will be able to recognize symptoms of heat emergencies and be capable of controlling the problem. When protective clothing is worn, especially Levels A and B, the suggested guidelines for ambient temperature and maximum wearing time per excursion are:

Ambient Temperature (F)	**Max. Wearing Time per Excursion (min)**
Above 90	15
85 to 90	30
80 to 85	60
70 to 80	90
60 to 70	120
50 to 60	180

One method of measuring the effectiveness of employees' rest-recovery regime is by monitoring the heart rate. The Brouha guideline is one such method.

- During a three minute period, count the pulse rate for at least 30 seconds of the first minute, the last 30 seconds of the second minute, and the last 30 seconds of the third minute.
- Double the count.

If the recover pulse rate during the last thirty seconds of the first minute is at 110 beats/minute or less and the deceleration between the first, second, and third minutes is at least 10 beats/minute, the work-recovery regime is acceptable. If the employee's rate is above that specified, a longer rest period is required, accompanied by an increased intake of fluids.

In the case of heat cramps or heat exhaustion, "pediolite" or its equivalent is suggested as part of the treatment regime. The reason for this type of liquid refreshment is that such beverages will return much needed electrolytes to the system. Without these electrolytes, body systems cannot function properly, thereby increasing the represented health hazard. Also in the more extreme instances, inundation with cool water is recommended to lower the body temperature as rapidly as possible.

This liquid refreshment will be stored in a cooler at the edge of the decontamination zone in plastic squeeze bottles. The plastic bottle swill be marked with the individual's names. Disposable cups with lids and straws may be used in place of the squeeze bottles. Prior to drinking within the decontamination zone, the project personnel shall follow the following decontamination procedures:

A. Personnel shall wash and rinse their outer gloves and remove them.

B. Personnel shall remove their hard hats and respirators and place on table.

C. Personnel shall remove their inner gloves and place them on table.

D. Personnel shall wash and rinse their face and hands.

E. Personnel shall carefully remove their personal bottle or cup from the cooler to ensure that their outer clothes do not touch any bottle, cups, etc.

F. The used bottle or cups will not be returned to the cooler, but will be placed in a receptacle or container to be cleaned or disposed of.

G. Personnel shall replace their respirators, hard hats gloves and tape gloves prior to re-entering the hazardous zone.

When personnel are working in situations where the ambient temperatures and humidity are high--and especially in situations where protection Levels A, B, and C are required the must:

- Assure that all employees drink plenty of fluids ("Pediolite or its equivalent);

- Assure that frequent breaks are scheduled so overheating does not occur; and,

- Revise work schedules, when necessary, to take advantage of the cooler parts of the day (i.e., 5:00 a.m. to 1:00 p.m., and 6:00 p.m. to nightfall).

6.2 Cold Stress

Whole-body protection shall be provided to all site personnel that have prolonged exposure to cold air. The right kind of protective clothing shall be provided to site personnel to prevent cold stress. The following dry clothing shall be provided by the Contractor as deemed necessary by the SO:

- Appropriate underclothing (wool or other);
- Outer coats that repel wind and moisture;
- Face, head, and ear coverings;
- Extra pair of socks;
- Insulated safety boots; and
- Glove liners (wool) or wind-and water repellent gloves.

The SO will use the equivalent chill temperature when determining the combined cooling effect of wind and low temperatures on exposed skin or when determining clothing insulation requirements.

Site personnel working continuously in the cold are required to warm themselves on a regular basis. Warm, sweet drinks will also be provided to site personnel to prevent dehydration. The SO will follow the work practices and recommendations for cold stress threshold limit values as stated by the 1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices by the American Conference of Governmental Industrial Hygienists or equivalent cold stress prevention methods.

7.0 MEDICAL MONITORING REQUIREMENTS

All personnel and visitors entering an exclusion zone or decontamination zone must have completed appropriate medical monitoring requirements required under OSHA 29 CFR 1910.120(f). Medical monitoring enables a physician to monitor each employee's health and physical condition, fitness to wear respiratory protective equipment, and fitness to carry out on-site tasks.

If there are additional medical monitoring requirements for a site, evidence of compliance must be included. Documentation of ESPL personnel medical monitoring is maintained on file and summarized in Table 1-1. Subcontractors working on the job must provide the site safety officer with documentation on their medical monitoring programs.

7.1 Fit-Testing Requirements

All personnel and visitors entering an exclusion zone or decontamination zone using a negative pressure air purifying respirator (APR) must have successfully passed a qualitative respirator fit-test in accordance with OSHA 29 CFR 1910.134 or the American National Standards Institute.

Documenting fit-testing is the responsibility of each subcontractor. Documentation of ESPL personnel fit-testing is maintained on file and summarized in Table 1-1.

8.0 AIR MONITORING

According to 29 CFR 1910.120(h) air shall be monitored to identify and quantify levels of airborne hazardous substances and health hazards, and to determine the appropriate level of worker protection.

Air may be monitored for oxygen content, explosive levels (LEL), quantitative and qualitative toxic gas levels. Portable gas monitors will be used based on the hazard assessment. This section describes the type, purpose and method of air monitoring to be used on site.

8.1 Routine Air Monitoring Requirements

Type of Air Monitor to be Used
MSA Four GAS Meter

Purpose
To monitor oxygen content, explosive levels (LEL), quantitative and qualitative toxic gas levels.

Method (continuous or periodic)
Continuous

Method of Maintenance and Calibration
Annual Calibration by Manufacture

Maintenance and Calibration Log

Date of Last Maintenance	Date of Last Calibration
____________________	____________________
____________________	____________________

Air will be monitored when any of the following conditions apply within the exclusion zone:

- Initial site entry;
- A potential IDLH condition or flammable atmosphere has developed;
- Work begins on another portion of the site;
- Contaminants, other than those previously identified, have been discovered;
- Each time a different task or activity is initiated; or
- During trenching and/or excavation work.

All air monitoring data will be documented in a site log book by the Site Safety Officer. Air monitoring instruments will be calibrated and maintained in accordance with the manufacturer's specifications.

Below are guidelines for actions to be taken based on routine air monitoring within the exclusion zone if the hazard assessment warrants. These are:

Oxygen readings between 19.5% and 25%: continue.
Oxygen readings <19.5%: SCBA required, CGI not reliable.
Oxygen readings >25%: exit.
CGI readings of <10% LEL: continue
CGI readings of 10 to 20% LEL: proceed with caution
CGI readings >20% LEL: exit.

OVA/Microtip readings for VOCs sustained between background and 5 ppm over site specific background in breathing zone:

Continue OVA/Microtip readings for VOCs sustained between 5 and 10 ppm over site-specific background in breathing zone: Level C PPE. (See Note)

OVA/Microtip readings for VOCs >10 ppm over site-specific background in breathing zone: Level B PPE.

Note: To ensure readings are not generated by methane, screen vapors with a PID. If the PID reading is less than 5 ppm continue work (assume vapors are methane). If PID readings are over 5 ppm allow the work zone to vent. If PID and OVA reading continue to persist over 5 ppm screen the area with compound specific detector tubes for vinyl chloride and benzene. If these compounds are not present then level C can be worn.

9.0 SITE CONTROL AND STANDARD OPERATING PROCEDURES

9.1 Work Zones

The primary purpose for site controls is to establish the perimeter of a hazardous area, to reduce migration of contaminants into clean areas, and to prevent access or exposure to hazardous materials by unauthorized persons. The Project Superintendent shall designate an exclusion zone, a decontamination zone, and a support zone. These zones will float (move around the site) depending on the tasks being performed on any given day. The Site Safety Officer will outline these locations during the daily site safety meetings. This information shall be recorded by the Site Safety Officer in the site log.

Tasks requiring the OSHA 40-hour Hazardous Waste Operations and Emergency Response Operations training are carried out in the exclusion zone. The exclusion zone will be defined by the Site Safety Officer but will typically be a 50-foot area around work activities.

Protective equipment shall be removed within the decontamination zone. Disposable protective equipment shall be stored in receptacles staged in the decontamination zone, and non-disposable equipment will be decontaminated according to the procedures outlined in Section 10.0. All personnel and equipment will exit the exclusion zone through the decontamination zone. If, during certain steps of the work, a decontamination trailer is provided, first aid equipment, an eye wash unit, and drinking water shall be kept in the decontamination trailer.

The support zone will be used for the office trailers, for vehicle parking, daily safety meetings, and supply storage. Eating, drinking, and smoking are permitted only in the support zone. When a decontamination trailer is not provided, the eye wash unit, first aid equipment, and drinking water shall be kept at the command post. Gross decontamination (as determined by the site Health and Safety Officer) will be conducted in the exclusion zone, all other decontamination will be performed in the decontamination trailer. This HASP, HASP attachments, a site map indicating the three work zones, and a telephone will be kept in a designated office trailer. An eyewash and fire extinguisher shall be kept in the decontamination trailer or the command post.

9.2 General Field Safety and Standard Operating Procedures

ESPL's policy is to control hazards for all site areas by limiting entrance to exclusion zones to essential personnel, and by implementing the following:

- Non-essential (as judged by the Site Safety Officer) personnel and unauthorized persons will not enter the exclusion or decontamination zone.

- Before entering the exclusion or decontamination zones, all personnel must be familiar with emergency response procedures (Section 11.0), site safety locations, first aid and communication equipment, and the locations of the map to the hospital and the list of emergency telephone numbers.

- Before entering the exclusion or decontamination zones, all personnel must be familiar with emergency response procedures (Section 11.0), site safety locations, first aid and communication equipment, and the locations of the map to the hospital and the list of emergency telephone numbers.

- The buddy system will be used at all times by field personnel in the exclusion zone; no one is to perform work within the exclusion zone alone. When in Level D or C, visual contact or radio contact shall be maintained at all times. In Level A or B, visual contact shall be maintained at all times, and radio contact shall be maintained with the decontamination and/or support zone.

- Contact with contaminated and potentially contaminated surfaces should be avoided. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or set equipment on the ground. Protect equipment from contamination.

- All personnel exiting the exclusion zone must exercise the decontamination procedures described in Section 11.0 of this HASP.

- Beards or other facial hair that interferes with respirator fit will preclude admission to the exclusion zone. Contact lenses shall not be worn in the exclusion or decontamination zones, or if the worker may be expected to enter these zones under routine or emergency situations.

- Eating, drinking, or smoking is permitted only in designated areas in the support zone.

- Each worker must be supplied with and maintain his/her own personal protective equipment.

Note: These policies will be enforced by the ESPL Site Safety Officer with the delegated power of the Principal in Charge.

10.0 DECONTAMINATION PROCEDURES

The standard level D decontamination protocol shall be used in the decontamination zone.

All equipment and PPE exiting the exclusion zone must be decontaminated or properly discarded upon exit. All personnel must enter and exit the exclusion zone through the decontamination area. Due to the nature of the site work, the exclusion and decontamination zones may change. Plastic bags containing personal protective clothing and equipment will be placed in designated receptacles.

All boots and other potentially contaminated garments that have come in contact with the MSW will be cleaned in wash tubs with detergent/water solution and rinsed with water and must remain on site at all times. The wash water, rinse water, and residues will be collected and properly stored until sampling results are received and the final method of disposal can be determined. Disposable PPE, including spent respirator cartridges and canisters, will be properly bagged and disposed of. All contaminated boots, clothing, and equipment (e.g. leather boots, equipment carrying straps) that cannot be decontaminated will be disposed of with the disposable garments or left on site in the decontamination trailer.

Heavy equipment will be decontaminated on a pad constructed of concrete or plastic sheeting that will allow water and residues to be collected in a trench. The decontamination water and residues will be drummed, sealed, and properly stored on-site to await proper disposal. The pad will serve a dual purpose, for decontamination, and to stop equipment leaving the site from tracking materials off site.

The **minimum** measures for Level B doffing and decontamination are:

- Deposit equipment used on site on plastic drop cloths;
- Scrub outer boots and gloves with a water and detergent solution and rinse off;
- Remove outer boots and outer gloves. Discard disposable outer garments in receptacle provided;
- Remove SCBA and face piece and place on rack provided;
- Remove tyvek/outer garment and place in receptacle provided;
- Remove inner gloves and deposit in receptacle provided; and
- Shower/wash face and hands.

The **minimum** measures for Level C doffing and decontamination are:

- Deposit equipment used on site on plastic drop cloths;
- Scrub outer boots and gloves (if worn) with a water and detergent solution and rinse off;

- Remove outer boots and outer gloves. Discard disposable outer garments in receptacle provided;

- Remove tyvek/outer garment and place in receptacle provided;

- Remove first pair of inner gloves;

- Remove respirator (using "clean" inner gloves) and place on rack provided;

- Remove last pair of inner gloves and deposit in receptacle provided; and,

- Shower/wash face and hands

The second to last item to be removed should be the APR, and the last item to be removed should be the last of several pairs of surgical gloves. Wearing several pairs of inner gloves permits layers to be removed as needed during various stages of the doffing procedure, and if the APR inadvertently becomes contaminated, inner gloves guard against bare hands contacting the APR.

11.0 CONTINGENCY PLAN/EMERGENCY RESPONSE PLAN

Site personnel must be prepared in the event of an emergency. Emergencies can take many forms: illnesses, injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather.

Emergency telephone numbers and a map to the hospital will be posted in the command post. Site personnel should be familiar with the emergency procedures, and the locations of site safety, first aid, and communication equipment.

11.1 Emergency Equipment On-Site / Site Communications

Type	Location
Private Telephones:	Site personnel
Two-Way Radios:	Site personnel, if required
Emergency Alarms	On-site vehicle horns*
First Aid Kits:	On-site
Fire Extinguisher:	On-site

* Horns: Air horns will be supplied to personnel at the discretion of the Project Superintendent or Site Safety Officer.

11.2 Emergency Telephone Numbers and Hospital Information

Police	(718) 626-9311
Fire and Ambulance	(718) 626-9311
Local Hospital(Mount Sinai)	(718) 932-1000
Local Health Department	(718) 476-7645
NYS Health Department	(518) 458-6309
National Response Center	(800) 424-8802
Poison Control	(800) 282-3171
Chemical Emergency Advice	(800) 424-9300
NYSDEC	(914) 255-5453
ESPL Environmental	(212) 330-7501

11.3 Personnel Responsibilities During an Emergency

The **Project Superintendent** is primarily responsible for responding to and correcting emergency situations. However, in the absence of the Project Superintendent, the **Safety Officer** shall act as the Project Superintendent's on-site designee, and perform the following tasks:

- Take appropriate measures to protect personnel including: withdrawal from the exclusion zone, total evacuation and securing of the site, or upgrading or downgrading the level of protective clothing and respiratory protection;

- Ensure that appropriate federal, state, and local agencies are informed, and emergency response plans are coordinated; In the event of fire or explosion, the local fire department should be summoned immediately. If toxic materials are released to the air, the local authorities should be informed in order to assess the need for evacuation;
- Ensure appropriate decontamination, treatment, or testing for exposed or injured personnel;

- Determine the cause of the incident and make recommendations to prevent recurrence; and,

- Ensure that all required reports have been prepared.

The emergency coordinators for this work are:

Project Superintendent - Margaret Tavares
Site Safety Officer - Margaret Tavares

11.4 Medical Emergencies

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. First aid should be administered while awaiting an ambulance or paramedics.

11.5 Fire or Explosion

In the event of a fire or explosion, the local fire department should be summoned immediately. The Project Superintendent or his designated alternate will advise the fire commander of the location, nature and identification of the hazardous materials on-site. If it is safe to do so, site personnel may:

- Use fire fighting equipment available on site; or,
- Remove or isolate flammable or other hazardous materials that may contribute to the fire.

11.6 Evacuation Routes

Evacuation routes established by work area locations for this site will be highlighted on a site map and periodically reviewed during the daily safety meetings. As the work areas change, the evacuation route and map will be altered accordingly, and the new route will be reviewed during the daily safety meetings. A landfill site plan with idealized evacuation routes is shown in Appendix H.

Under extreme emergency conditions, evacuation should be conducted immediately, without regard for equipment. The evacuation signal will be a continuous blast of a vehicle horn, if possible, and/or by verbal/radio communication. When evacuating the site, personnel shall follow these instructions:

- Keep upwind of smoke, vapors, or spill location.
- Exit through the decontamination corridor if possible.

- If evacuation through the decontamination corridor is not possible, site personnel should remove contaminated clothing once they are in a safe location and leave it near the exclusion zone or in a safe place.

- The Project Superintendent or Site Safety Officer will conduct a head count to ensure that all personnel have been evacuated safely. The head count will be correlated to the site and/or exclusion zone entry/exit log.

- If emergency site evacuation is necessary, all personnel are to escape the emergency situation and decontaminate to the maximum extent practical.

11.7 Spill Control Procedures

In the event of a leak or a release, site personnel will:

- Inform their supervisor immediately;

- Locate the source of the spillage and stop the flow if it can be done safely; and,

- Begin containment and recovery of the spilled materials.

Equipment on-site shall be sufficient to handle any spills. Equipment shall be diked and containerized appropriately. Field monitoring equipment and spill control equipment are shown in Table 11-1.

11.8 Vapor Release Plan

The site work will be suspended if air monitoring at the site perimeter shows air contaminants above acceptable concentrations. Off-site readings will be taken within 20 feet of the nearest residential or commercial property. If efforts to mitigate the emission source are unsuccessful for 30 minutes then the ESPL Site Safety Officer will:

- contact the local police,
- continue to monitor air every 30 minutes, 20 feet from the closest off-site property. If two successive readings are within acceptable levels, off-site air monitoring, would be halted.

All property line and off-site air monitoring locations and results associated with vapor releases shall be recorded in the site safety log book.

11.9 Communication Procedures

Type of communication to be used:
(i.e. cellular phone, Two-way radio, etc.)

<u>Cell phones</u>

The following standard hand signals will be used in case of failure of communication equipment:

Hand gripping throat …………………..	Out of air, can't breathe
Grip partners wrist or both hands around waist………………………………	Leave area immediately
Hand on top of head……………………..	Need assistance
Thumbs up………………………………..	OK, I am all right, I understand
Thumbs down…………………………….	No, negative

TABLE 11-1

FIELD EQUIPMENT/SPILL CONTROL EQUIPMENT

Equipment	Location/Use

12.0 CONFINED SPACE

On January 14, 1993, OSHA published its Final Rule on permit required confined spaces for General Industry at 29CFR 1910.146 et seq., with an implementation date of April 15, 1993. The rule specifically excludes agriculture, construction, or shipyard employment, but prudence requires that this HASP cover confined space entry and the OSHA rule will be followed. OSHA defines confined space as:

1. is large enough and so configured that an employee can bodily enter and perform assigned work;

2. has limited or restricted areas for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited entry); and

3. is not designed for continuous employee occupancy.

OSHA further requires that an "entry supervisor" (the site safety officer) decides at the time of entry whether the space is permit required or non-permit required space. Once designated the site safety officer will monitor the space two hours prior to entry and continuously during work to ensure that the atmosphere is not hazardous. OSHA defines as hazardous atmosphere as:

1. Flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit (LEL);

2. Airborne combustible dust at a concentration that meets or exceeds its LEL;
   NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

3. Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;
4. Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z. Toxic and Hazardous Substances, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit;

5. Any other atmospheric condition that is immediately dangerous to life or health.

The space is non-permit required if none of the above defined hazardous conditions are present. OSHA requires an attendant (e.g., an individual stationed outside one or more spaces who monitors the entrants and who performs air monitoring of the space(s) be assigned for each space. The attendant is not allowed to perform any rescue duties but simply must communicate with the entrant and call for coordinates rescue procedures if required.

12.1 Confined Space Entry Procedure

Confined space entry that will require a permit may be required during construction at the site. If the Site Safety Officer determines that an excavation meets the definition of a confined space then natural or mechanical ventilation will be employed to ensure that the space meets the requirements of non-permit required confined space. The Site Safety Officer will perform continuous air monitoring one hour before and during entry work to ensure that the space remains non-permit required.

A confined space entry permit must be filled out and signed by the Site Safety Officer. By signing this, the supervisor certifies that the space does not contain a hazardous atmosphere, and that the atmosphere will be monitored. A confined space entry permit form is located in New York State Department of Labor, Employer Guide and Model (Permit Required Confined Space Entry Plan (29 CFR Part 1910.146) located at the end of this section or at the ESPL office. This permit will be modified by the Site Safety Officer for different confined spaces.

Blowers will be utilized to ventilate the space.

When workers are in the excavation, the space must be continuously monitored for the hazardous atmosphere parameters using appropriate instrumentation. The Site Safety Officer or delegee must log the meter readings every 30 minutes while the confined space is occupied.

If a hazardous atmosphere is detected, employees must leave confined space until monitoring shows that there is no atmosphere hazard. Engineering controls will be used to dissipate the atmosphere if it does not dissipate naturally.

13.0 DAILY SAFETY MEETINGS

Safety or pre-entry meetings will be held each day before work begins, to ensure that all on-site personnel understand site conditions and operating procedures, and to address safety questions and concerns. The Site Safety Officer or the Project Superintendent will lead the meetings. All personnel trained and prepared to enter exclusion and decontamination zones will attend the meetings.

The site safety officer shall maintain a log of each meeting.

14.0 WORK PLAN

14.1 Work Tasks, Objectives and Methods for Implementation

(Describe specifically who will be working on tasks to be performed and their functions.)

Margaret Tavares, overall site supervisor to coordinate all field activities related to environmental investigations.
Margaret Tavares, site health and safety officer to coordinate and ensure compliance to all site-specific safety plans.

Location of Exclusion, Decontamination and Support Zones. (Include a location drawing if necessary)

____

____

____

14.2 Clean Up / Decontamination Activities and Procedures

(Describe specifically who will be working on tasks to be performed and their functions.)

Field

Supervisor____

____

____

____

____

14.3 Informational Programs

To ensure that employees, contractors, and subcontractors (or their representatives) are aware of this plan all persons engaged in operations at this site must sign the Site Personnel Form indicating that they are familiar with this Site Health and Safety Plan prior to commencing operations.

Site Personnel Log

I have reviewed and am familiar with the Site Health and Safety Plan for the following site:

Site: **Former Willow Service Station**
1802 27th Avenue
Astoria, Queens, New York

Name	Company or Affiliation	Date	Remarks

14.4 Medical Surveillance Program

Refer to Section 7.0

14.5 Personnel Requirements

Refer to Section 2.0

14.6 - Training Implementation

Refer to Section 4.0

15.0 COMMUNITY AIR MONITORING PLAN (CAMP)

A Community Air Monitoring Plan will be implemented during the course of this investigation activity. The objective of CAMP is to provide real-time monitoring for volatile organic compounds at the downwind end of the site during soil and groundwater sampling activities. It is also intended to provide a measure of protection to the downwind community from potential air borne contaminants released as a result of on-site investigative activities.

The contaminants at the site are predominantly volatile organics and mainly BTEX / MTBE. A continuous air monitoring will be performed throughout the duration of the investigative activities. MiniRAE-2000 will be used to monitor the volatile organics in the air, and provides 10 hours of continuous monitoring. It has an extended range of 0 – 10,000 ppm and up to 100 feet downwind of the site. Prior to monitoring, the upwind concentrations will be obtained to establish the background conditions. The following actions will be implemented if:

- the ambient air concentration exceeds 5 ppm, the field activities must be temporarily stopped, and monitoring continued. If the total VOCs decreases below 5 ppm over the background, the field activities will resume with continuous monitoring
- the VOCs at the downwind area persist at levels in excess of 5 ppm but less than 25 ppm, the field activities must be stopped, and the source of vapors identified and corrected. If the VOCs levels decrease below 5 ppm, fieldwork will resume.
- the organic vapor is above 25 ppm at the perimeter of the work area, field activities must be shut down.

The particulate concentrations will be monitored at the upwind and downwind perimeters using Thermo MIE pDR DataRam with a range of measurements from 0.001 – 400 mg/m3. It is equipped with an audible alarm that alerts you in seconds and allows you take immediate corrective action. The following actions will be implemented if:

- the downwind PM-10 particulate level is 100 mcg/m3 greater than the background or if air borne dust is observed in the work area, dust suppression techniques (wetting) must be employed. Provided that the PM-10 particulate levels do not exceed 150 mcg/m3, field activities will continue
- the dust control technique fails, and downwind PM-10 particulate levels are greater than 150mcg/m3, field activities must stop, and a re-evaluation of field activities performed.

All readings will be logged in the field notebook and will be available to the State (DEC and DOH) for review.

Material
Safety
Data
Sheets

NFPA 704 (Section 16)

AMERADA HESS CORPORATION

MATERIAL SAFETY DATA SHEET

Methyl tert-Butyl Ether (MTBE) **MSDS No. 9922**

1. CHEMICAL PRODUCT and COMPANY INFORMATION (rev. Apr-98)

Amerada Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732) 750-6000

SYNONYMS: 2-methoxy-2-methyl propane; Methyl t-butyl ether; MTBE; t-butyl methyl ether

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS (rev. Sep-94)

INGREDIENT NAME	EXPOSURE LIMITS		CONCENTRATION PERCENT BY WEIGHT
Methyl-tertiary butyl ether (MTBE) CAS NUMBER: 1634-04-4	OSHA PEL-TWA/STEL: ACGIH TLV-TWA:	None established 40 ppm, A3	> 97%

MTBE ($C_5H_{12}O$) is used as an octane booster and oxygenate for unleaded gasoline.

3. HAZARDS IDENTIFICATION (rev. Apr-98; Tox-98)

EMERGENCY OVERVIEW

DANGER!

EXTREMELY FLAMMABLE - EYE AND MUCOUS MEMBRANE IRRITANT - EFFECTS CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

Contact may cause eye, skin and mucous membrane irritation. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs).

EYES

Contact with the eye may cause slight to mild irritation.

SKIN

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting, and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest and death may occur.

INHALATION

Excessive exposure may cause irritation to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY

This product has produced cancer, developmental and systemic toxicity in laboratory animals following repeated exposure. The significance of these results to human exposures has not been determined – see Section 11, Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash) conditions. Chronic respiratory disease, or pre-existing central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES (rev. Apr-98; Tox-98)

EYES

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION

Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES (rev. Nov-96)

FLAMMABLE PROPERTIES:

FLASH POINT:	-14 °F (-25 °C)
AUTOIGNITION TEMPERATURE:	AP 815 °F (435 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1B (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.6
UPPER EXPLOSIVE LIMIT (%):	8.4

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

This product burns with a blue flame which is often less visible than gasoline or other petroleum hydrocarbons flames.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam suitable for polar solvents. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Firefighting foam suitable for polar solvents is recommended - refer to NFPA 11 "Low Expansion Foam ."

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES (rev. Apr-98)

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE (rev. Apr-98)

HANDLING PRECAUTIONS

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION (rev. Nov-96)

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as of E.I. DuPont Tychem ®, Barricade ®, or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

9. PHYSICAL and CHEMICAL PROPERTIES (rev. Sep-94)

APPEARANCE

A clear, water-like liquid

ODOR

A sweet, ether-like odor.

ODOR THRESHOLD

Odor detectable at 0.05 ppm and recognizable at 0.13 ppm. Highly odorous.

BASIC PHYSICAL PROPERTIES

BOILING POINT:	131 °F (55 °C)
VAPOR PRESSURE:	7.8 PSI @ 100 °F (38 °C)
VAPOR DENSITY (air = 1):	3.1
SPECIFIC GRAVITY (H_2O = 1):	0.74
EVAPORATION RATE:	ND - probably high
PERCENT VOLATILES:	100 %
SOLUBILITY (H_2O):	AP 5% @ 68 °F (20 °C)

10. STABILITY and REACTIVITY (rev. Sep-94)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

INCOMPATIBLE MATERIALS
Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide, non-combusted hydrocarbons (smoke), irritating aldehydes and ketones, and other toxic vapors.

11. TOXICOLOGICAL PROPERTIES (rev. Apr-98)

ACUTE EFFECTS

Acute Dermal:	LD50 (rabbit): >10 g/kg	Eye Irritation (rabbits):	mild to moderate
Acute Inhalation:	LC50 (rat): 35,000 ppm	Dermal irritation (rabbit):	slight
Acute Oral:	LD50 (rat): 4.0 ml/kg	Dermal Sensitization:	negative

CHRONIC EFFECTS AND CARCINOGENICITY
Carcinogenic: **IARC:** NO **NTP:** NO **OSHA:** NO **ACGIH:** A3 (animal carcinogen)
MTBE has demonstrated some evidence of developmental toxicity in animal models.

MUTAGENICITY (genetic effects)
MTBE was positive in a single mutagenicity study following activation.

12. ECOLOGICAL INFORMATION (rev. Apr-98)
Keep out of sewers, drainage and waterways. Report spills and releases, as applicable, under Federal and State regulations. If released, MTBE will be expected to exhibit fairly high mobility in soil, and therefore may leach into groundwater. Refer to API Publication 4497, "Cost-Effective, Alternative Treatment Technologies For Reducing the Concentrations of Ethers and Alcohols in Groundwater."

13. DISPOSAL CONSIDERATIONS (rev. Apr-98)
Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION (rev. Sep-94)

PROPER SHIPPING NAME:	Methyl tert-butyl ether
HAZARD CLASS AND PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 2398
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

15. REGULATORY INFORMATION (rev. Nov-96)

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION
This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, to state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the federal, state and/or local level. Consult those regulations applicable to your facility / operation. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)
Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)
MTBE is a CERCLA hazardous substance and as such is subject to CERCLA and SARA federal reporting requirements. Reportable Quantity (pounds): 1000

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME	CONCENTRATION PERCENT BY WEIGHT
Methyl-tertiary butyl ether (MTBE) CAS NUMBER: 1634-04-4	> 97

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2, Subdivision B (Toxic by other means)

16. OTHER INFORMATION (rev. Nov-96)

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	3	High
	REACTIVITY:	0	Negligible
HMIS® HAZARD RATING	HEALTH:	1*	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Negligible * Chronic

SUPERSEDES MSDS DATED: 11/21/96

ABBREVIATIONS:

AP = Approximately
N/A = Not Applicable
< = Less than
N/D = Not Determined
> = Greater than
ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212)642-4900
API	American Petroleum Institute 202)682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General Info: (800)467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

MATERIAL SAFETY DATA SHEET

Benzene **MSDS No. 0166**

EMERGENCY OVERVIEW

DANGER!

FLAMMABLE - BLOOD TOXIN AND CARCINOGEN - ABSORBED THROUGH THE SKIN - CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER:	**CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours):	Corporate EHS 732-750-6000
MSDS Internet Website:	www.hess.com

SYNONYMS: Benzol; Coal Naphtha; coal tar naphtha; Cyclohexatriene; Phenyl hydride
See Section 16 for abbreviations and acronyms.

2. COMPOSITION and CHEMICAL INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Benzene (71-43-2)	100

3. HAZARDS IDENTIFICATION

EYES

Moderate to severe irritant. Contact with liquid or vapor may cause irritation.

SKIN

Moderate to severe irritant. May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritation to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

Effects to the blood (including decreased platelet and white blood cell counts), cardiovascular system, nervous system, retina, lungs, gastrointestinal system, spleen, and kidneys have been reported from large, acute (short) and repeated or prolonged exposures.

CHRONIC EFFECTS and CARCINOGENICITY
Benzene is a regulated human carcinogen. Benzene has the potential to cause bone marrow depression, aplastic anemia (low red blood cell count) and other blood diseases, including leukemia, after repeated and prolonged exposure. Benzene can cause liver and kidney toxicity.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Pre-existing chronic respiratory disease, liver or kidney dysfunction, or blood, cardiovascular and central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

NOTE TO PHYSICIAN
OSHA and US Coast Guard require that a person exposed to benzene in an emergency have a urine sample taken at the end of the shift and have a urine phenol test performed within 72 hours. For results equal to or greater than 75 ml/L of urine, employees must have a complete blood count every month for three months after the emergency exposure. See OSHA 29 CFR 1910.1028 or USCG 49 CFR 193.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	12 °F (-11°C)
AUTOIGNITION TEMPERATURE:	928 °F (498 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1B (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.3%
UPPER EXPLOSIVE LIMIT (%):	7.9%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Product may release substantial amounts of flammable vapors and gases (e.g., methane, ethane, and propane), at or below ambient temperature depending on source and process conditions and pressure.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection - do not discharge solid water stream patterns into the liquid resulting in splashing.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING and STORAGE PRECAUTIONS

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

		Exposure Limits	
Components (CAS No.)	**Source**	**TWA/STEL**	**Note**
Benzene (71-43-2)	OSHA	PEL = 1ppm; STEL = 5 ppm	A1; skin; BEI
	ACGIH	TLV = 0.5 ppm; STEL = 2.5 ppm	

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as of E.I. DuPont Tyvek-Saranex 23 ®, Tychem®, Barricade® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH -approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE

A clear, water-like liquid

ODOR

A sweet, aromatic odor.

ODOR THRESHOLD

4.7 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	176 °F (80 °C)
VAPOR PRESSURE:	74.6 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	2.8
SPECIFIC GRAVITY (H_2O = 1):	0.87
EVAPORATION RATE:	High
PERCENT VOLATILES:	100 %
SOLUBILITY (H_2O):	Insoluble to slightly soluble

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS

Material is stable under normal conditions. Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY

Acute Dermal LD50 (rabbits): > 9.4 ml/kg
Acute inhalation LC50: 10,000 ppm (rat; 7 hours)
Primary dermal irritation (rabbits): mild to moderate

Acute Oral LD50 (mouse): 4.7 g/kg
Eye irritation (rabbit): mild to moderate

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: YES IARC: (1) NTP: YES ACGIH: (A1)

Numerous epidemiological (human) and animal studies have reported an increased incidence or a causal relationship between leukemia and benzene exposure.

Mutagenicity: positive

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME:	Benzene
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1114
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

PLACARD:

15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

Benzene is a CERCLA Section 103 "hazardous substance" subject to CERCLA and SARA Section 304 reporting requirements.

Reportable Quantity: 10 pounds

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

	INGREDIENT NAME	CONCENTRATION PERCENT BY WEIGHT
Benzene	CAS NUMBER: 71-43-2	< 0.1 to 2

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B Division 2 (Flammable Liquid)
Class D Division 2 Subdivision A (Very toxic by other means)
Class D Division 1 Subdivision A (Very toxic acute)
Class D Division 2 Subdivision B (Toxic by other means)

CALIFORNIA PROPOSITON 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	Date Listed
Benzene	2/27/1987

NFPA® HAZARD RATING

HEALTH:	2
FIRE:	3
REACTIVITY:	0

Refer to NJPA 704 "Identification of the Fire Hazards of Materials" for further information

HMIS® HAZARD RATING

HEALTH:	3 *	Slight
FIRE:	3	Moderate
PHYSICAL:	0	Negligible
		* Chronic

SUPERSEDES MSDS DATED: 01/14/1999

ABBREVIATIONS:

AP = Approximately
< = Less than
> = Greater than
N/A = Not Applicable
N/D = Not Determined
ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212) 642-4900
API	American Petroleum Institute (202) 682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General info: (800) 467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

MATERIAL SAFETY DATA SHEET

Toluene **MSDS No. 1813**

EMERGENCY OVERVIEW
DANGER!
FLAMMABLE - IRRITANT - ABSORBED THROUGH THE SKIN - CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects. Excessive exposure may affect the liver and kidneys.

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER:	**CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours):	Corporate EHS 732-750-6000
MSDS Internet Website:	www.hess.com

SYNONYMS: Methyl Benzene
See Section 16 for abbreviations and acronyms.

2. COMPOSITION and CHEMICAL INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Toluene (108-88-3)	100

3. HAZARDS IDENTIFICATION

EYES
Moderate to severe irritant. Contact with liquid or vapor may cause irritation.

SKIN
Moderate to severe irritant. May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION

Excessive exposure may cause irritation to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

Effects to the blood (including decreased platelet and white blood cell counts), cardiovascular system, nervous system, retina, lungs, gastrointestinal system, spleen, and kidneys have been reported from large, acute (short) and repeated or prolonged exposures.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Pre-existing chronic respiratory disease, liver or kidney dysfunction, or blood, cardiovascular and central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES

EYES

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION

Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	12 °F (-11°C)
AUTOIGNITION TEMPERATURE:	928 °F (498 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1B (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.3%
UPPER EXPLOSIVE LIMIT (%):	7.9%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Product may release substantial amounts of flammable vapors and gases (e.g., methane, ethane, and propane), at or below ambient temperature depending on source and process conditions and pressure.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection - do not discharge solid water stream patterns into the liquid resulting in splashing.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING and STORAGE PRECAUTIONS

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Components (CAS No.)	Source	Exposure Limits TWA/STEL	Note
Toluene (108-88-3)	OSHA	PEL = 200ppm; C = 300ppm; Peak= 500 ppm	
	ACGIH	TLV = 50 ppm	A4; skin:BEI 2006 NOIC: 20 ppm

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as of E.I. DuPont Tyvek-Saranex 23 ®, Tychem®, Barricade® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH -approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE

A clear, water-like liquid

ODOR
A sweet, aromatic odor.

ODOR THRESHOLD
0.2 - 5 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	231 °F (111 °C)
VAPOR PRESSURE:	22 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	3.2
SPECIFIC GRAVITY (H_2O = 1):	0.86
EVAPORATION RATE:	High
PERCENT VOLATILES:	100 %
SOLUBILITY (H_2O):	Insoluble to slightly soluble

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS
Material is stable under normal conditions. Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY
Acute Oral LD50 (rats): 2.6 to 7.5 g/kg
Acute inhalation LC50: 8,000 ppm (rat; 4 hours)
Eye irritation (human): 400 ppm
Primary dermal irritation (rabbits): mild to moderate

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: NO IARC: NO NTP: NO ACGIH: NO

Breathing large amounts of toluene for short periods of time adversely effect the human nervous system, the kidneys, liver, and the heart. Repeatedly breathing large amounts of toluene as when "sniffing glue" or paint can cause permanent brain damage. Human exposure studies and animal studies suggest that exposure to large amounts of toluene during pregnancy can adversely effect the developing fetus.

Mutagenicity: negative

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

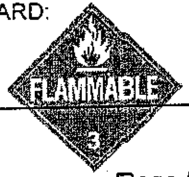
13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME:	Toluene
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1294

PLACARD:



15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

Toluene is a CERCLA Section 103 "hazardous substance" subject to CERCLA and SARA Section 304 reporting requirements.

Reportable Quantity: 1000 pounds

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Toluene (108-88-3)	100

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2B (Toxic by other means)

CALIFORNIA PROPOSITON 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	Date Listed
Toluene	1/1/1991

NFPA® HAZARD RATING		
	HEALTH:	2
	FIRE:	3
	REACTIVITY:	0

Refer to NJPA 704 "Identification of the Fire Hazards of Materials" for further information

HMIS® HAZARD RATING

HEALTH:	3 *	Slight
FIRE:	3	Moderate
PHYSICAL:	0	Negligible
		* Chronic

SUPERSEDES MSDS DATED: 01/29/1999

ABBREVIATIONS:

AP = Approximately
< = Less than
> = Greater than
N/A = Not Applicable
N/D = Not Determined
ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212) 642-4900
API	American Petroleum Institute (202) 682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General info: (800) 467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

NOVA Chemicals®

Material Safety Data Sheet

Material Name: Ethylbenzene **MSDS ID: NOVA-0083**

Section 1 - Product and Company Identification

Synonyms: Ethylbenzol; EB; Phenyl ethane; Ethyl Benzene
Chemical Name: Ethylbenzene
Chemical Family: Petrochemical
Material Use: Solvent, used in production of styrene
Chemical Formula: C_8H_{10}

NOVA Chemicals
P.O. Box 2518, Station M
Calgary, Alberta, Canada T2P 5C6

Product Information: 1-412-490-4063

EMERGENCY Telephone Numbers:
North America (Canada and US):
1-800-561-6682, 1-403-314-8767 (NOVA Chemicals) (24 hours)
1-800-424-9300 (CHEMTREC-USA) (24 hours)
1-613-996-6666 (Canutec-Canada) (24 hours)
Mexico and South America: +44 208 762 8322 (NCEC) (24 hours)

Section 2 - Composition / Information on Ingredients

CAS #	Component	Percent by Wt.
100-41-4	Ethylbenzene	100

Additional Information

This product is considered to be hazardous under 29 CFR 1910.1200 (Hazard Communication).
This material is a controlled product under Canadian WHMIS regulations.
This product is regulated as a hazardous material / dangerous goods for transportation (See Section 14).
See Section 8 for applicable exposure limits. See Section 11 for applicable toxicity data.

Section 3 - Hazards Identification

HMIS Ratings: Health: 2* **Fire:** 3 **Physical Hazard:** 0
*Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard*

NFPA Ratings: Health: 2 **Fire:** 3 **Reactivity:** 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Emergency Overview

WARNING FLAMMABLE! Product is a colorless liquid with a distinctive aromatic odor. Flammable liquid and vapor can accumulate static charge. Vapors are heavier than air and may travel along ground and flashback along vapor trail. Liquid will float and may reignite on surface of water. Vapor may cause headache, nausea, dizziness, drowsiness, confusion, unconsciousness and possibly death. Aspiration hazard - swallowing or vomiting of liquid may cause aspiration into the lungs. POTENTIAL CARCINOGEN.

Potential Health Effects: Eyes

Vapors from this product are irritating to the eyes.

Potential Health Effects: Skin

This product is rapidly absorbed through the skin and is irritating to skin. Prolonged and/or repeated skin contact with this product may cause drying, defatting, and irritation.

Potential Health Effects: Ingestion

Ingestion can cause gastrointestinal irritation, nausea, vomiting and diarrhea. Ingestion of this product may result in adverse central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision.

Potential Health Effects: Inhalation

This product is irritating to the respiratory system. Repeated inhalation of vapors may be harmful; lung irritation and serious central nervous system disorders may result.

Section 4 - First Aid Measures

First Aid: Eyes

Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.

First Aid: Skin

Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist.

First Aid: Inhalation

Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband. Assist breathing if necessary. Seek immediate medical attention. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary exposure risk to the rescuer. Avoid mouth-to-mouth contact by using mouth shield or guard to perform artificial respiration.

First Aid: Ingestion

DO NOT INDUCE VOMITING. If vomiting occurs naturally, lean affected individual forward to reduce risk of aspiration. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

First Aid: Notes to Physician

An Emergency Medical Response Protocol is available for this product. These are available to first responders and medical personnel. 1-800-561-6682, 1-403-314-8767 (24 hours NOVA Chemicals Emergency Response) Aspiration of this product during induced emesis can result in lung injury. If induced emesis is considered to be necessary, protect the airway and use the method least likely to cause aspiration, such as gastric lavage.

Section 5 - Fire Fighting Measures

See Section 9: Physical Properties for flammability limits, flash point and autoignition information.

General Fire Hazards

Highly flammable in presence of open flame, sparks, and heat. Flammable liquid and vapor can accumulate static charge. Vapors are heavier than air and may travel along ground and flashback along vapor trail. Liquid will float and may reignite on surface of water. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

Explosion Hazards

Vapors may form explosive mixture with air. Vapors are heavier than air and may travel along the ground to some distant source of ignition and flash back. Keep containers away from source of heat or fire. Containers may explode when involved in a fire.

Hazardous Combustion Products

Upon decomposition, this product emits carbon monoxide, carbon dioxide, and/or low molecular weight hydrocarbons.

Extinguishing Media

Dry chemical, foam, carbon dioxide, or water fog or spray.

Fire Fighting Equipment/Instructions

Evacuate the area promptly. Keep unnecessary personnel away. Stay upwind of spilled material and isolate exposure. Fire fighters should wear full-face, self-contained breathing apparatus and thermal protective clothing. Move containers from fire area if you can do so without risk. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Immediately withdraw in case of fire and tank venting or heat discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Use of water spray when fighting fire may be inefficient. Avoid inhaling any smoke and combustion products. Remove and clean or destroy any contaminated clothing. Control runoff waters to prevent entry into sewers, drains, underground or confined spaces and waterways.

Section 6 - Accidental Release Measures

Evacuation Procedures

Isolate area. Keep unnecessary personnel away. Alert stand-by emergency and fire fighting personnel. Evacuate the area promptly.

Small Spills

Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions. Restrict access of unprotected personnel. SCBA and protective clothing must be worn during cleanup. Stay upwind of spilled material. Stop source of leak if possible and eliminate ignition sources. Ventilate closed spaces before entering. Use water to disperse flammable vapors. Clean up spills using appropriate techniques such as inert sorbent materials. Use appropriate, non-sparking tools/shovel to put the spilled material in an appropriate waste disposal container. Prevent material from entering sewer, drains, or waterways.

Large Spills

As above, but consider initial downwind evacuation for at least 300 meters (1000 feet). Monitor surrounding area for build-up of flammable air concentrations. Consider use of foam to suppress flammable vapors.

Special Procedures

Contact local police/emergency services and appropriate emergency telephone numbers provided in Section 1.
Ensure that statutory and regulatory reporting requirements in the applicable jurisdiction are met.
Wear appropriate protective equipment and clothing during clean-up.
Individuals without appropriate protective equipment should be excluded from area of spill until cleanup has been completed.

See Section 8 for recommended Personal Protective Equipment and see Section 13 for waste disposal considerations.

Section 7 - Handling and Storage

Handling Procedures

Wear appropriate personal protective equipment when working with this product. Keep away from heat, ignition sources and incompatible materials. Use in minimal quantities in a well-ventilated area separate from the storage area. Use non-sparking, grounded ventilation systems separate from other exhaust systems.
Ground all equipment that contains this material. Dissipate static electricity during transfer by grounding and bonding containers and equipment. Use spark-resistant tools. Flammable liquid and vapor from this product can accumulate static charge. Vapors are heavier than air and may travel along the ground and flashback along vapor trail. Liquid will float and may reignite on water surface.

See Section 8: Exposure Controls/Personal Protection for appropriate Personal Protective Equipment.

Storage Procedures

Store according to applicable regulations for flammable materials for storage tanks, containers, buildings, rooms, cabinets, and allowable quantities and minimum storage distances. Store in a cool, dry, well-ventilated area away from incompatible materials such as strong oxidizing agents. Store and use away from heat, sparks, open flame, or any other ignition source. Storage area should be clearly identified, well-illuminated, and clear of obstruction. Store away from process and production areas, elevators, and building and room exits. Store in labeled containers in areas appropriate for storing flammable liquids - bond and ground metal containers. Equip storage tank vents with a flame arrestor. Consider leak detection and alarm equipment for storage area. Keep absorbents for leaks and spills readily available. Maintain appropriate extinguishing capability in storage area (e.g., sprinkler system, portable fire extinguishers). Provide adequate security so that unauthorized personnel do not have access to product.

See Section 10: Stability & Reactivity for information on incompatible materials.

Section 8 - Exposure Controls / Personal Protection

Exposure Guidelines

A: General Product Information

Refer to published exposure limits - utilize effective control measures and PPE to maintain worker exposure to concentrations that are below these limits. Ensure that eyewash stations and safety showers are proximal to work locations.

B: Component Exposure Limits

ACGIH, OSHA, NIOSH, EPA, Alberta, and Ontario exposure limit lists have been checked for major components listed with CAS registry numbers. Other exposure limits may apply, check with proper authorities.

Ethylbenzene (100-41-4)

ACGIH:	100 ppm TWA; 125 ppm STEL
OSHA:	100 ppm TWA; 435 mg/m3 TWA 125 ppm STEL; 545 mg/m3 STEL
NIOSH:	100 ppm TWA; 435 mg/m3 TWA 125 ppm STEL; 545 mg/m3 STEL 800 ppm IDLH
Alberta:	100 ppm TWA; 434 mg/m3 TWA 125 ppm STEL; 543 mg/m3 STEL
Ontario:	100 ppm TWAEV; 435 mg/m3 TWAEV 125 ppm STEV; 540 mg/m3 STEV

ENGINEERING CONTROLS

Maintain worker exposure below recommended exposure limits by providing adequate local exhaust ventilation. Use non-sparking, grounded ventilation systems separate from other exhaust systems. Ensure that eyewash stations and safety showers are proximal to the workstation location.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear safety glasses; chemical goggles are recommended if splashing is possible, or to prevent eye irritation from vapors.

Personal Protective Equipment: Skin/Hands/Feet

Use impervious gloves. Wear chemical-resistant safety footwear with good traction to prevent slipping. Work clothing sufficient to prevent all skin contact should be worn, such as coveralls and long sleeves. Fire resistant(i.e., NOMEX) or natural fiber clothing (i.e., cotton or wool) is recommended. Synthetic clothing can generate static electricity and is not recommended where flammable vapors release may occur.

Personal Protective Equipment: Respiratory

If engineering controls and ventilation is not sufficient to prevent buildup of aerosols, vapors or dusts, appropriate NIOSH/MSHA approved air-purifying respirators or self-contained breathing apparatus (SCBA) appropriate for exposure potential should be used. Air supplied breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air-purifying respirators.

Personal Protective Equipment: General

Personal protective equipment (PPE) should not be considered a long-term solution to exposure control. Employer programs to properly select, fit, maintain, and train employees to use equipment must accompany PPE. Consult a competent industrial hygiene resource, the PPE manufacturer's recommendation, and/or applicable regulations to determine hazard potential and ensure adequate protection.

Section 9 - Physical & Chemical Properties

Physical State and Appearance:	Clear, colorless liquid	**Color:**	Clear, colorless
Odor:	Aromatic	**Odor Threshold:**	0.02 to 0.1 ppm
pH:	Not available	**Vapor Pressure:**	7 mmHg (at 20°C)
Vapor Density @ 0°C (Air=1):	3.66	**Boiling Point:**	136.2°C (277.2°F)
Melting Point:	-95°C (-139°F)	**Solubility (H2O):**	Very slightly
Specific Gravity (Water=1):	0.867	**Dispersion Properties:**	Dispersed in water, methanol, diethyl ether, n-octanol, acetone
Octanol/H2O Coeff.:	3.15	**Flash Point:**	12.8°C (55°F)
Flash Point Method:	Pensky-Martens Closed Cup	**Upper Flammable Limit (UFL):**	6.7%
Lower Flammable Limit (LFL):	0.8%	**Flammability Classification:**	Flammable
Auto Ignition:	432.22°C (810°F)		

Section 10 - Stability & Reactivity Information

Chemical Stability

This is a product is stable under normal use conditions for shock, vibration, pressure, or temperature.

Instability

No additional information available.

Chemical Stability: Conditions to Avoid

Avoid strong oxidizing agents.

Incompatibility

Highly reactive with oxidizing agents.

Hazardous Polymerization

Will not occur.

Hazardous Decomposition

Upon decomposition, this product emits carbon monoxide, carbon dioxide and/or low molecular weight hydrocarbons

Section 11 - Toxicological Information

A: Acute Toxicity - General Material Information

Ethylbenzene causes severe eye and nose irritation. It causes CNS depression at high concentrations and can be fatal. It can be absorbed through the skin. Aspiration of the liquid into the lungs may cause chemical pneumonitis.

B: Acute Toxicity - LD50/LC50

Ethylbenzene (100-41-4)

Oral LD50 Rat: 3500 mg/kg; Dermal LD50 Rabbit: 17800 µL/kg

C: Chronic Toxicity - General Material Information

Prolonged exposure to **ethylbenzene** may result in CNS, upper respiratory tract, and liver disorders.

Ethylbenzene has been classified in group 2B, "possibly carcinogenic to humans" by IARC based on the National Toxicology Program's two year study of very high exposure levels on rats and mice (NTP, 1999). Rats and mice were exposed to concentrations of 0, 75, 250 or 750 ppm ethylbenzene for 6 hours a day, 5 days a week, for 104 and 103 weeks, respectively. Significant, dose-related increases in kidney tumors in male and female rats at 750 ppm were noted compared to control rats.

There were also statistically significant increases in the incidence of lung tumors in male mice and liver tumors in female mice exposed to 750 ppm of **ethylbenzene**. The relevance of these data to human exposure is presently being evaluated.

D: Chronic Toxicity - Carcinogenic Effects

ACGIH, EPA, IARC, OSHA, and NTP carcinogen lists have been checked for selected similar materials or those components with CAS registry numbers.

Ethylbenzene (100-41-4)

ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans
EPA: Classification: not classifiable as to human carcinogenicity; basis: nonclassifiable due to lack of animal bioassays and human studies.
IARC: Monograph 77, 2000 (Group 2B (possibly carcinogenic to humans))

Section 12 - Ecological Information

Ecotoxicity

A: General Product Information

Toxic to aquatic life.

B: Component Analysis - Ecotoxicity - Aquatic/Terrestrial Toxicity

Ethylbenzene (100-41-4)

Freshwater

fish 96-h LC50: 4.7 mg/L (predicted); fish (guppy) 96-h LC50: 9.9 mg/l (measured);fish (rainbow trout) 96-h LC50: 4.2 mg/l (measured); fish (fathead minnow) 96-h LC50: 12.1 mg/l (measured); daphnid 48-h LC-50: 5.5 mg/l (predicted); daphnid 48-h LC-50: 3.2 mg/l (modeling);daphnid 48-h LC-50: >1.81 mg/L (measured); green algal 96-h EC-50 (Biomass as cell/ml) = 3.7 mg/L (predicted);green algal 96-h EC-50 (growth rate): 3.7 mg/l fish Chronic value (ChV): 0.750 mg/L (predicted); fish (fathead minnow) ChV > 0.440 mg/L (measured) daphnid 21-d ChV - 0.500 mg/l (predicted); daphnid 7-day ChV - 1.3 mg/L (measured); algal ChV -0.790 mg/L (predicted); algal ChV -3.4 mg/L (measured)

Saltwater

fish 96-h LC50: 2.0 mg/L (predicted);fish (atlantic silverside)96-h LC50: 5.4 mg/L (measured) mysid 96-h LC50: 0.540 mg/L (predicted); mysid 96-h LC-50: 2.6 mg/L (measured); bay shrimp 96-h LC50: 0.490 mg/l (measured); crab LC-50: 13.0 mg/L (measured); green algal 96-h EC-50 (growth rate): 7.7 mg/l (measured); fish ChV -0.200 mg/L acute to chronic ratio is 10 mysid ChV - 0.050 mg/L (predicted, acute to chronic ratio is 10); bay shrimp ChV - 0.050 mg/L (predicted; acute to chronic ratio is 10); algal ChV - 4.5 mg/L (measured).

Environmental Fate/Mobility

This product has not been tested.

Persistence/Degradability

Relatively non-persistent in the environment.

Bioaccumulation/Accumulation

Not expected to bioaccumulate significantly.

Section 13 - Disposal Considerations

U.S./Canadian Waste Number & Descriptions

A: General Product Information

This product is known to be a hazardous waste according to US and Canadian regulations. The use, mixing or processing of this material may alter this product. Contact federal, provincial/state and local authorities in order to generate or ship a waste material associated with this product to ensure materials are handled appropriately and meet all criteria for disposal of hazardous waste. Vent to a burning flame at an approved facility. DO NOT ATTEMPT TO DISPOSE OF BY UNCONTROLLED IGNITION. Since emptied containers retain product residue, follow safe handling/label warnings even after container is emptied.

See Section 7: Handling and Storage and Section 8: Exposure Controls/Personal Protection for additional handling information that may be applicable for safe handling and the protection of employees.

Waste generator is advised to carefully consider hazardous properties and control measures needed for other materials that may be found in the waste.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Waste Disposal

If discarded, this product is considered a US RCRA ignitable waste, D001.

Section 14 - Transportation Information

US DOT Information

Shipping Name: Ethylbenzene
UN# 1175 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): FLAMMABLE LIQUID
Additional Info.: NOTE: The Reportable quantity for ethylbenzene is 1000 lbs (454kg) . For shipments, in a single container, exceeding the RQ for ethylbenzene the letters RQ must appear in the proper shipping name. North American E.R.G. # 130

Canadian TDG Information

Shipping Name: Ethylbenzene
UN# 1175 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): FLAMMABLE LIQUID
Additional Info.: North American E.R.G. # 130

International Air Transport Association (IATA) and ICAO Regulations

Shipping Name: Ethylbenzene
UN# 1175 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): FLAMMABLE LIQUID

International Maritime Dangerous Goods (IMDG) Regulations

Shipping Name: Ethylbenzene
UN# 1175 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): FLAMMABLE LIQUID
Additional Info.: EmS No.: F-E, S-D

Section 15 - Regulatory Information

A: International Regulations

Components of this product have been checked against the following Chemical Control Inventories.

Component Analysis - International Inventory Status

Component	CAS #	US - TSCA	CANADA - DSL	EU - EINECS
Ethylbenzene	100-41-4	Yes	Yes	Yes

B: USA Federal & State Regulations

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or State regulations. Check for applicable regulations.

USA OSHA Hazard Communication Class

This product is considered to be hazardous under 29 CFR 1910.1200 (Hazard Communication).
HCS Class: Irritating substance.
HCS Class: Target organ effects.
HCS Class: Flammable liquid with a flash point lower than 37.8°C (100°F).
HCS Class: MAY CAUSE CANCER.

USA Right-to-Know - Federal

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Ethylbenzene (100-41-4)

SARA 313: 0.1 % de minimis concentration
CERCLA: 1000 lb final RQ; 454 kg final RQ

USA Right-to-Know - State

The following components appear on one or more of the following state hazardous substances lists. Some components (including those present only in trace quantities, and therefore not listed in this document) may be included on the Right To Know lists of other U.S. states. The reader is therefore cautioned to contact his or her NOVA Chemicals representative or NOVA Chemicals' Product Integrity group for further U.S. State Right To Know information.

Component	CAS	NJ	PA
Ethylbenzene	100-41-4	Yes	Yes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):
WARNING! This product contains a chemical known to the state of California to cause cancer.

C: Canadian Regulations - Federal and Provincial

Canadian Environmental Protection Act (CEPA): All components of this product are on the Domestic Substances List (DSL), and are acceptable for use under the provisions of CEPA.

WHMIS Ingredient Disclosure List (IDL)

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List (IDL):

Component	CAS #	Minimum Concentration
Ethylbenzene	100-41-4	0.1 % (English Item 697, French Item 854)

WHMIS Classification

This material is a controlled product under Canadian WHMIS regulations.
Workplace Hazardous Materials Information Systems (WHMIS): This product has been classified in accordance with Canadian Controlled Product Regulations (CPR) hazard criteria and this MSDS contains complete CPR-required information.
WHMIS Class B2: Flammable Liquid
WHMIS Class D2A: Carcinogen, very toxic
WHMIS Class D2B: Skin irritation

Provincial Regulations

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or Provincial regulations. Check for applicable regulations.

Section 16 - Other Information

Label Information

PRECAUTIONS:
WARNING FLAMMABLE! Product is a colorless liquid with a distinctive aromatic odor. Flammable liquid and vapor can accumulate static charge. Vapors are heavier than air and may travel along ground and flashback along vapor trail. Liquid will float and may reignite on surface of water. Vapor may cause headache, nausea, dizziness, drowsiness, confusion, unconsciousness and possibly death. Aspiration hazard - swallowing or vomiting of liquid may cause aspiration into the lungs. POTENTIAL CARCINOGEN.

FIRST AID:
SKIN: Remove contaminated clothing and shoes. Wash immediately with soap and water. Seek medical attention if symptoms develop or persist.

EYES: Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.
INHALATION: Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband. Assist breathing if necessary. Seek immediate medical attention. WARNING: Contact through mouth-to-mouth resuscitation may pose a secondary exposure risk to the rescuer. Avoid mouth-to-mouth contact by using mouth shield or guard to perform artificial respiration.
INGESTION: DO NOT INDUCE VOMITING. If vomiting occurs naturally, lean affected individual forward to reduce risk of aspiration. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

IN CASE OF A LARGE SPILL: Consider initial downwind evacuation for at least 300 meters (1000 feet). Monitor surrounding area for build-up of flammable air concentrations. Consider use of foam to suppress flammable vapors. Restrict access of unprotected personnel. SCBA and protective clothing must be worn during cleanup. Stay upwind of spilled material. Stop source of leak if possible and eliminate ignition sources. Ventilate closed spaces before entering. Use water to disperse flammable vapors. Clean up spills using appropriate techniques such as inert sorbent materials. Use appropriate, non-sparking tools/shovel to put the spilled material in an appropriate waste disposal container. Prevent material from entering sewer, drains, or waterways.

References

Available on request.

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; BLEVE = Boiling Liquid Expanding Vapor Explosion; BOD = Biochemical Oxygen Demand; CAS = Chemical Abstracts Service; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CPR = Controlled Products Regulations; DOT = Department of Transportation; DSL = Domestic Substances List; EINECS = European Inventory of Existing Commercial Substances; EPA = Environmental Protection Agency; EU = European Union; FDA = Food and Drug Administration; IARC = International Agency for Research on Cancer; IDL = Ingredient Disclosure List; Kow = Octanol/water partition coefficient; LEL = Lower Explosive Limit; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; RCRA = Resource Conservation and Recovery Act; SARA = Superfund Amendments and Reauthorization Act; TDG = Transportation of Dangerous Goods; TSCA = Toxic Substances Control Act.

MSDS Prepared by: NOVA Chemicals

MSDS Information Phone Number: 1-412-490-4063

Other Information

Notice to Reader

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This is the end of MSDS # NOVA-0083.

MATERIAL SAFETY DATA SHEET

Xylene, Mixed **MSDS No. 1812**

EMERGENCY OVERVIEW
DANGER!
FLAMMABLE - IRRITANT - ABSORBED THROUGH THE SKIN - CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects. Excessive exposure may affect the liver and kidneys.

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER:	**CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours):	Corporate EHS 732-750-6000
MSDS Internet Website:	www.hess.com

SYNONYMS: Dimethyl benzene; Mixed xylenes; M (meta) – xylene; O (ortho) – xylene; P (para) – xylene; Xylol

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and CHEMICAL INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Xylene, Mixed Isomers (1330-20-7)	100

3. HAZARDS IDENTIFICATION

EYES
Moderate to severe irritant. Contact with liquid or vapor may cause irritation.

SKIN
Moderate to severe irritant. May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritation to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

Effects to the blood (including decreased platelet and white blood cell counts), cardiovascular system, nervous system, retina, lungs, gastrointestinal system, spleen, and kidneys have been reported from large, acute (short) and repeated or prolonged exposures.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Pre-existing chronic respiratory disease, liver or kidney dysfunction, or central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	81 °F (27°C)
AUTOIGNITION TEMPERATURE:	867 °F (463 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1C (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	0.9%
UPPER EXPLOSIVE LIMIT (%):	7.0%

FIRE AND EXPLOSION HAZARDS
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Product may release substantial amounts of flammable vapors and gases (e.g., methane, ethane, and propane), at or below ambient temperature depending on source and process conditions and pressure.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection - do not discharge solid water stream patterns into the liquid resulting in splashing.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING and STORAGE PRECAUTIONS

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

Components (CAS No.)	Source	Exposure Limits TWA/STEL	Note
Xylene, Mixed Isomers (1330-20-7)	OSHA ACGIH	PEL = 100ppm TLV = 100 ppm; STEL = 150 ppm	A4; BEI

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as of E.I. DuPont Tyvek-Saranex 23 ®, Tychem®, Barricade® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH -approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE
A clear, water-like liquid

ODOR
A sweet, aromatic odor.

ODOR THRESHOLD
0.2 - 5 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	AP 279 °F (137 °C)
VAPOR PRESSURE:	6.7 mm Hg @ 70 °F (21 °C)
VAPOR DENSITY (air = 1):	AP 3.6
SPECIFIC GRAVITY (H_2O = 1):	0.86
EVAPORATION RATE:	High
PERCENT VOLATILES:	100 %
SOLUBILITY (H_2O):	Insoluble to slightly soluble

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS
Material is stable under normal conditions. Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY
Acute Oral LD50 (rats): 3.5 to 8.6 g/kg
Acute inhalation LC50: 6,700 ppm (rat; 4 hours)
Eye irritation (human): 200 ppm
Acute dermal LD50 (rabbits): > 5 ml/kg

In humans, the inhalation of xylene for short periods of time may cause decreased respiratory rate, altered liver and kidney function, hearing loss, and central nervous system depression. Animals exposed to high concentrations of xylene exhibited impaired eye function.

CARCINOGENICITY
Carcinogenicity: OSHA: NO IARC: (3) NTP: NO ACGIH: A4

Mutagenicity: negative

12. ECOLOGICAL INFORMATION

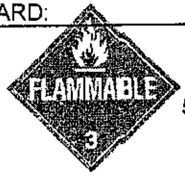
Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

PLACARD:



Appendix C

Remedial Action QAPP

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1.0 INTRODUCTION

The objective of this Quality Assurance Project Plan (QAPP) is to provide a mechanism of control over all sample collection and handling procedures in order to ensure sample integrity and usability.

The QAPP sampling program will consist of groundwater sampling at various locations and depths to determine the progress of groundwater remediation.

The following steps will be implemented prior to initiating any field activities to ensure that the sampling is in accordance with the sampling plan.

- The field supervisor will notify the contract laboratory of the upcoming sampling events so that the laboratory can prepare the appropriate types and numbers of sample containers. The anticipated number of sampling locations, the list of sampling parameters to be analyzed for each location and the number of extra bottles needed for quality control testing will be specified to the laboratory manager.
- All field equipment intended to be used during sampling will be inspected
- All forms to be used in the field, including the field logbook, chain of custody forms and sample analyses request forms will be assembled.
- If appropriate, sample bottles will be pre-labeled during sampling activities. Pertinent information such as well and soil identification numbers, sample location, sample type, preservatives and type of parameters will be identified on the label with permanent ink during pre-sampling activities. The labels will be covered with transparent tape to protect them from getting wet in the ice packs.
- The sampling personnel will review proper sampling protocols. The project health and safety plan will be reviewed frequently to minimize the risk of injuries during the sampling activities.

  For groundwater sampling, all on-site wells will be allowed to stabilize before sampling. Groundwater sampling will proceed from the assumed cleaner wells and progress to those with highest suspected contamination. The static water level will be obtained using an electronic water level indicator.

Each well will be purged of three to five standing volumes of water using a centrifugal or submersible pump with dedicated polyethylene tubing. No headspace or air bubble in the VO sample bottles will be allowed. Samples will be collected in the following order at each monitor well location.

Volatile Organic Compounds, MTBE and TBA

Semi-Volatile Organics (PAHs)

Targeted Compounds List (TCL), unfiltered

Samples will be collected and containerized in appropriate pre-cleaned sample containers. The table below presents the requirements for sample containers, volumes to be collected, preservatives and holding times by parameter and matrix:

TABLE 1

Sample Containers, Volumes to be Collected,
Preservatives and Holding Times by Parameter and Matrix

Aqueous Samples

Parameter	Container	Volume to be Collected	Preservative	Holding Times
Volatile Organic Compounds (VOCs)	Glass	3 x 40 ml VOA vials	Cool (4°C)	7 days
Semi-Volatile Organic Compounds (SVOCs)	Glass	2 x 1 liter	Cool (4°C)	7 days until extraction, then 40 days for analysis

2.0 DATA QUALITY CONTROL SAMPLES

As part of data quality assurance program, several quality control samples will be required to provide control over the collection and subsequent review, interpretation and validation of the generated data. Three QA / QC samples will be prepared or collected namely, trip (travel) blanks, field (equipment rinse) blanks, and duplicate (laboratory performance) samples.

Trip blanks consist of a set of sample bottles filled with the laboratory demonstrated analyte free water. Trip blanks accompany the sample bottles that are prepared in the laboratory to the field and back to the laboratory, along with samples collected for analyses. Trip blanks will not be opened in the field and will be shipped back to the laboratory with the same set of bottles they accompanied to the field. The primary purpose of trip blanks is to detect additional sources of contamination that could potentially influence contaminant values reported in actual samples, both qualitatively and quantitatively. Trip blanks serve as a mechanism of control on sample bottle preparation, blank water quality and sampling handling.

Field blanks are to provide an additional check on possible sources of contamination beyond those intended for trip blanks. Field blanks are primarily used to indicate potential contamination from ambient air and from sampling instruments used to collect and transfer samples from point of collection into sample containers. Field blanks are collected in the field by passing analyte free water through clean sampling equipment. Field blanks must be returned to the laboratory with the same set of sample bottles they accompanied to the field.

Duplicate samples provide an opportunity to evaluate a laboratory’s performance by comparing analytical results of two samples taken from the same location. A total of four duplicate samples will be collected and analyzed for volatile and semi-volatile organics. Aqueous matrix duplicate samples will be obtained by filling sample containers from the same sampling device for each parameter to be analyzed. Soil field duplicates to be analyzed for parameters other than volatile organics will be obtained by first homogenizing the sample aliquots prior to filling sample containers. Filling a clean stainless steel tray and mixing it with a clean stainless steel trowel until consistent physical appearance is accomplished will achieve homogenization. The sample is then divided into two halves and sample containers filled by scooping sample material alternately from each half. Soil duplicates to be analyzed for volatile organics will be collected as grab samples, composting or mixing will result in loss of volatile constituents. The duplicate samples will be assigned fictitious sample numbers, which will be recorded in the field notebook.

3.0 DECONTAMINATION OF SAMPLING EQUIPMENT

During mobilization phase and prior to sampling activities, all sampling equipment will be decontaminated according to the procedures described below. These procedures are designed to prevent cross-contamination between different sampling locations, spread of contamination from one location to another by sampling equipment, and minimize contact time between sampling crews with contaminated media.

All sampling and other equipments that make direct contact with samples, such as split spoons and trowels must be decontaminated after each use. Equipment will be washed thoroughly with tap water and detergent. The equipment will be rinsed with deionized water and allowed to air dry for about 24 hours. To prevent contamination during transport, decontaminated equipment intended to be used during sampling will be wrapped in new aluminum foil. These procedures will be repeated at each sampling location.

a. DOCUMENTATION

Detailed documentation of all site activities is important for tracking the acquisition and handling of samples from the time of collection, through shipment to the laboratory for analysis, to ultimate disposition of the samples. Documentation is also important in support of potential enforcement actions that may arise in relation to the remedial investigation at the site. The following will be used as forms of documentation at the site; Field notebook, monitor well logs and photo-documentation.

b. PROJECT PROGRESS REPORT

The project manager will maintain a project file containing complete project documentation. This file will include project plans and specifications, field notebooks, data records, photographs, maps and drawings, sample identification documents, chain of custody records, entire analytical data package. The project file will also contain lithologic logs of soil borings and monitor wells, regulatory and other reference materials, and other pertinent information. The above file will be stored and maintained at ESPL office at 2 West 32nd Street, 5th Floor, Suite 504 New York, N. Y. 10001. The information contained in the files will be used to generate monthly progress reports for submittal to the NYSDEC Case Manager.

The quarterly progress report will include analytical data for soil and groundwater samples, documentation and water table contour maps. A final report will be prepared to discuss the implementation of site findings.

A copy of the approved Site Health and Safety Plan (SHSP) will be kept at the site throughout the duration of field activities.

Appendix D

Draft
Site Management Plan

See **Remedial Action Work Plan - Volume 2 of 2** for a draft stand-alone Site Management Plan.