

SITE INVESTIGATION/REMEDIAL
ALTERNATIVE WORKPLAN
ENVIRONMENTAL RESTORATION
PROJECT NUMBER B00136-3

FORMER JONAS AUTOMOTIVE FACILITY
86 WISNER AVENUE
NEWBURGH, NEW YORK 12550

Prepared for:

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TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
ENVIRONMENTAL SETTING	2
GENERAL INFORMATION	2
SITE HISTORY	2
REGIONAL DATA	4
GEOLOGY AND HYDROGEOLOGY	4
SITE SPECIFIC DATA	4
TOPOGRAPHY AND DRAINAGE	4
GEOLOGY AND HYDROGEOLOGY	4
AREAS OF POTENTIAL ENVIRONMENTAL CONCERN AND PROPOSED INVESTIGATION ACTIVITIES	5
AREA 1- DRUM STORAGE AREA	5
MEDIA TO BE SAMPLED	6
SAMPLE DEPTHS	6
ANALYTICAL PARAMETERS	7
AREA 2 - OVERHEAD CRANE AREA	7
MEDIA TO BE SAMPLED	8
SAMPLE DEPTHS	8
ANALYTICAL PARAMETERS	8
AREA 3 - LOW-LYING GROUND	8
MEDIA TO BE SAMPLED	9
SAMPLING DEPTHS	9
ANALYTICAL PARAMETERS	9
AREA 4 - DRYWELL AND LEACHFIELD	9

MEDIA TO BE SAMPLED	10
SAMPLING DEPTHS	10
ANALYTICAL PARAMETERS	10
AREA 5 - CATCH BASIN	11
MEDIA TO BE SAMPLED	11
SAMPLING DEPTHS	11
ANALYTICAL PARAMETERS	11
AREA 6 - UNDERGROUND STORAGE TANK	12
MEDIA TO BE SAMPLED	12
SAMPLING DEPTHS	13
ANALYTICAL PARAMETERS	13
AREA 7 - ABOVE GROUND STORAGE TANK	13
MEDIA TO BE SAMPLED	13
SAMPLING DEPTHS	14
ANALYTICAL PARAMETERS	14
AREA 8 - DRAINS AND SUMPS	14
MEDIA TO BE SAMPLED	14
SAMPLING DEPTHS	14
ANALYTICAL PARAMETERS	15
AREA 9 - GROUNDWATER	15
MONITORING WELL INSTALLATION AND SAMPLING PROCEDURES	16
ANALYTICAL PARAMETERS	16
SITE INVESTIGATION/REMEDIAL ALTERNATIVES REPORT (SIR/RAR)	17

LIST OF TABLES

TABLE

1	Schedule of Activities
2	Sampling Summary

LIST OF FIGURES

FIGURE

1	Site Location Map
2	Proposed Sampling Locations
3	Well Construction Diagram

ATTACHMENTS

ATTACHMENT A	UST Activities & Procedures
ATTACHMENT B	Health and Safety Plan
ATTACHMENT C	Quality Assurance/Quality Control Plan
ATTACHMENT D	Citizen Participation Plan
ATTACHMENT E	Cost Estimate

INTRODUCTION

First Environment, Inc. (First Environment) was retained by the City of Newburgh to conduct site investigation and remediation activities at the former Jonas Automotive facility located at 86 Wisner Avenue, Newburgh, New York. The activities outlined in this workplan are based on a site inspection conducted on February 8, 2000 between members of the New York Department State Of Environmental Conservation (NYSDEC), McGoey Hauser and Edsall and First Environment. In attendance were Mssrs. David Camp and Larry Ricci of the NYSDEC, Mr. William Hauser of McGoey, Hauser and Edsall and Mssrs. Thomas Bambrick and Scott Green of First Environment.

The City of Newburgh is conducting the activities under the municipal assistance environmental restoration projects "Brownfields Program". The following workplan details the initial site investigation activities to be completed at the site. The activities include: the overpacking, characterization and disposal of stored drums; the collection and analysis of soil samples; the installation, sampling and analysis of groundwater monitoring wells, including slug tests; the closure of the underground storage tank; the removal of the aboveground tank; and the preparation of a Site Investigation/Remedial Alternative Report (SI/RAR). All work will be performed in accordance with applicable state and local requirements.

ENVIRONMENTAL SETTING

GENERAL INFORMATION

The Jonas Facility is located at 86 Wisner Avenue, Newburgh, New York. The property is located in a mixed commercial and residential use area. The adjoining properties west and north of the subject property are residential. The adjacent properties to the south include Prime, Inc., a Planet Wings restaurant and a Nissan Used Car Authority located on Broadway Avenue (Route 17-K). To the east is an open low-lying parcel of land that appears to be a wetlands.

The subject property comprises approximately 1.5 acres. The land in which the facility lies is covered with gravel and cinders including earthen fill and vegetation. One concrete pad, where an overhead crane operated and former rail spur, is present immediately west of the facility building

The Former Jonas building consists of one slab-on-grade concrete structure. This building encompasses approximately 16,000 square feet and is currently vacant. The location of the facility is illustrated on the Newburgh Quadrangle United States Geological Survey (USGS) 7.5 Minute Topographic Map (revised 1977) as Figure 1.

SITE HISTORY

Historic information was discussed for the subject facility during a site inspection with the NYSDEC conducted on February 8, 2000. This information indicated that the facility was used by Jonas for the dismantling of Automobile Motors. In addition, a database search and review of city tax records were conducted for the subject property. The subject property address, 86 Wisner Avenue, was identified in the Environmental Data Resources (EDR) Radius Search for three companies, Jonas Automotive, Poughkeepsie Iron Fabricators and Poughkeepsie Trim & Steel. According to city tax records and the EDR Report, Poughkeepsie Iron Fabricators operated at the site from 1963 until the early 1990's. From the early 1990's to August 1993, it is believed that Poughkeepsie Trim and Steel operated at the site. Jonas Automotive operated the facility from August 1993 until March 1999 when the City of Newburgh acquired the property.

As Jonas Automotive, the site is listed in the New York Spills database. According to the EDR Report, motors were being dumped in the rear of the property, and fluids were visible on the ground. The release was reported to the NYSDEC by a citizen on March 2, 1998 and the site was assigned spill case #9713317. Thereafter, the responsible party stockpiled the contaminated soil on the site and filed to properly dispose of it.

The prior occupant of the subject property, Poughkeepsie Iron Fabricators, is listed in the UST and AST databases. According to these listings, there exists one UST and four ASTs on the property. The UST is a 1000-gallon steel vessel used to store gasoline. The tank was installed in August 1962, and remains in service. In addition, according to the EDR report, there are two 1000-gallon (diesel and waste fluids), one 500-gallon (gasoline) and one 275-gallon (fuel oil) ASTs on-site.

During a site inspection on February 8, 2000, First Environment identified one 275-gallon (fuel oil) AST and one 275-gallon cutting oil AST. In addition, one 1000-gallon AST used to store waste fluids was located on the Jonas property behind the building. The other 500 and 1000 gallon ASTs, listed in the EDR Report, were not identified on the property.

Poughkeepsie Trim & Steel (PTS) is also listed in the New York Spills database. The "spiller" is identified as Jonas Auto Rebuilders. The PTS listing is similar to the spill case described above in that motor blocks were reportedly being dumped on an on-site concrete pad and surrounding soil. On July 6, 1994, the spill was reported to the NYSDEC by the Newburgh Building Inspector, and assigned spill case #9404697. According to the report, a willing responsible party existed and corrective action was taken. The spill case was subsequently closed on July 11, 1994.

Although there are other environmental issues in the immediate vicinity of the Jonas property (e.g. leaking underground storage tanks), there were no additional listings in the EDR Radius Search regarding the site itself.

REGIONAL DATA

GEOLOGY AND HYDROGEOLOGY

The former Jonas property lies within the Valley and Ridge Physiographic Province. The predominant features associated with this province are narrow valleys and ridges formed as a result of differential erosion of the underlying sandstone and shale formations. Specifically, the Newburgh area is characterized by alluvial deposits underlain by meta-sedimentary and sedimentary bedrock formations.

Alluvium in the area is comprised of flood plain sediments (sand, silt and clay) associated with the Hudson River. Glacial deposition in the area consists primarily of till and unsorted outwash. The outwash is predominantly a mixture of gravel, sand, silt and clay. The bedrock underlying this region consists of middle Ordovician Taconic Sequence, primarily shales and graywackes.

SITE SPECIFIC DATA

TOPOGRAPHY AND DRAINAGE

The USGS 7.5 Minute Topographic Map for the Newburgh Quadrangle included as Figure 1 shows the area in which the Jonas Facility is located. The Facility is approximately 205 feet above mean sea level and the surrounding topography is relatively flat. The Facility and surrounding land are urban to residential. The nearest surface water body is Gidneytown Creek located approximately 1500 feet to the east. The topographic map does not indicate any wetlands in the immediate area. However, a low-lying wet area was observed along the rear of the facility just off-site. Site surface water drainage runs to the street storm sewers that surround the facility.

GEOLOGY AND HYDROGEOLOGY

Based on the findings of a site investigation conducted at a nearby facility, the site-specific geology is believed to be comprised of a thin layer of fill material underlain by unconsolidated glacial sediments consisting of sand, silt and clay. Shallow groundwater is anticipated to be under unconfined conditions with the depth to groundwater less than 15 feet. The depth to bedrock is anticipated to be less than 30 feet.

AREAS OF POTENTIAL ENVIRONMENTAL CONCERN AND PROPOSED INVESTIGATION ACTIVITIES

Based on the findings of the February 8, 2000 site inspection, nine (9) areas of potential environmental concern were preliminarily identified. These areas include:

- Area 1- Drum Storage Area
- Area 2- Overhead Crane Area
- Area 3- Low-lying Ground
- Area 4- Drywell and Leachfield
- Area 5- Catch Basin
- Area 6- Underground Storage Tank
- Area 7- Aboveground Storage Tank
- Area 8- Drains and Sumps
- Area 9- Groundwater

The areas, the potential concerns, and the proposed investigation activities are discussed in further detail below. Table 1 summarizes the schedule of activities at the former Jonas Automotive Facility, not necessarily listed by area

AREA 1- DRUM STORAGE AREA

The former Jonas Facility does not currently generate any hazardous or used oil wastes which require disposal. However, during a site inspection, fourteen (14) drums were identified along the north side of the building and two (2) drums were identified along the east side of the building near the drywell.

During the February 8, 2000 site inspection by First Environment and the NYSDEC, one drum was identified as leaking petroleum material. This drum was identified as a potential threat to the environment and was overpacked on February 20, 2000.

Based on initial screening, the drums at the Jonas site contain petroleum products and waste oils. The drums will be characterized by a field chemist using physical methods with confirmation samples taken whenever necessary. The physical methods include: identifying drum markings, visual inspection of drum contents utilizing a glass drum sleeve, and obtaining MSDS's when possible. An OVA will also be utilized to monitor organic vapors. The field chemist also will perform field screening for pH and perform flash point tests in the field. Lastly, the chemist will perform field solubility and reactivity screening to determine solubility and/or reactivity of the petroleum contents.

Confirmation composite sampling for PCB's, Total Organic Halides, and Flashpoint will be conducted on drums that contain waste oil and petroleum contaminated solids. The analytical methods used for drum characterization will be as follows: total organic halides using EPA SW-846 method 3540A/9020A; ignitability using SW-846 methods 1020; and PCBs using SW-846 methods 3540A/9020A. A composite sample will be taken from no more than 10 drums for the analyses. Any drums failing the screening for field ignitability will be analyzed to confirm the flash point by certified laboratory procedures. Integrated Analytical Laboratories, a New York State Department of Health & Environmental Laboratory Approval Program (NYSDOH ELAP) certified laboratory, will perform the lab analyses. Based on preliminary testing, it is anticipated that approximately 10% of the drums will be hazardous and the other 90%, non-hazardous.

In addition to characterizing the drums for disposal, the storage area will be evaluated through soil sampling to determine if the underlying soils have been imported by the drum storage activities.

MEDIA TO BE SAMPLED

Based on the fact that the drums are currently staged on an unpaved portion of the property, soil samples will be collected to determine if there has been any adverse impact to the environment.

SAMPLE DEPTHS

A total of five soil samples will be collected from five locations. Sample depths will be 0 to 2-inches below grade.

ANALYTICAL PARAMETERS

Based on the type of operations historically conducted at the site and the observations made during the site inspection, the 0 to 2-inch samples will be submitted for analysis for base neutral compounds, PCBs and priority pollutant metals using EPA Methods 8270, 608/8082, and 6020, respectively.

A summary of the sampling activities is provided in Table 2. The sampling locations are illustrated on Figure 2.

AREA 2 - OVERHEAD CRANE AREA

Based on discussions with Mr. Larry Ricci of the NYSDEC during the site inspection, the area under the overhead crane historically received run off and was prone to flooding. A concrete pad exists below the overhead crane. The pad was previously used to store automotive parts and engines. Soil below the crane and adjacent to the pad was impacted by petroleum.

According to site observations and discussions with NYSDEC, runoff from engine fluids flowed from the concrete pad, which is located immediately below the overhead crane, through to a trough around the concrete pad and then into a catch basin located adjacent to the pad. Stormwater runoff from the pad area periodically overflowed into a dry well (Area 4) located near the loading dock which is believed to have been piped to a leach field north of the concrete pad. During later facility operations, the engine fluids were collected and pumped into a 1000-gallon AST located adjacent to the concrete pad.

As a result of poor housekeeping, the concrete pad area was observed to have significant amounts of free product and product staining in the shallow soil. According to Mr. Ricci, the stained shallow soil adjacent to the concert pad was removed at Mr. Ricci's direction, using an excavator and stockpiled for off-site disposal. The soil was subsequently characterized as non-hazardous soil and properly disposed off-site by First Environment in December 1999. Based on past operations conducted at the site, the visual observations made at the time of the site inspection and the descriptions of site conditions provided by Mr. Ricci, this area is believed to

have been adversely impacted by petroleum related products. Therefore, soil sampling is proposed to evaluate the area.

MEDIA TO BE SAMPLED

Based on the fact that this area is currently unpaved and was subject to historic flooding and releases of petroleum, soil samples will be collected at six sample locations to determine the nature and extent of any impacts from the past petroleum releases to the environment exist. The soils will be screened visually and with a PID. If visible contamination, staining or odors are identified, deeper soil intervals will also be sampled and analyzed.

SAMPLE DEPTHS

Sample depths include 0 to 2-inches and 18 to 24-inches below grade at six locations.

ANALYTICAL PARAMETERS

Based on the type of operations historically conducted at the site and the observations made during the site inspection, the 0 to 2-inch samples will be submitted for analysis for base neutral compounds, PCBs and priority pollutant metals using EPA Methods 8270, 608/8082, and 6020, respectively. The 18 to 24-inch sample will include the above analysis plus volatile organic compounds using EPA method 8260.

A summary of the sampling activities is provided in Table 2. The sampling locations are illustrated on Figure 2.

AREA 3 - LOW-LYING GROUND

During the site inspection, low-lying ground was identified immediately adjacent to the overhead crane area. According to the NYSDEC, this area was observed to have flooded in the past. Accordingly, samples will be collected and analyzed to determine if contaminants from the concrete pad area migrated into this area through surface runoff.

MEDIA TO BE SAMPLED

Four soil sample locations have been identified to determine if petroleum contaminants have impacted the underlying soils. The final sample locations will be field determined and biased towards areas where runoff could have occurred.

SAMPLING DEPTHS

At each location, soil sample will be collected at depths of 0 to 2-inches below grade and 12-18 inches below grade.

ANALYTICAL PARAMETERS

The 0 to 2-inch samples will be submitted for analysis for base neutral compounds and priority pollutant metals using EPA Methods 8270 and 6020, respectively. The samples collected at 12 to 18-inches will be submitted for analysis for base neutral compounds EPA Methods 8270, volatile organic compounds using EPA method 8260 and priority pollutant metals using EPA Method 6020.

A summary of the proposed sampling activities is provided in Table 2. The sample locations are illustrated on Figure 2.

AREA 4 - DRYWELL AND LEACHFIELD

Based on discussions with Mr. Larry Ricci of the NYSDEC, the drywell at the rear of the facility historically received run off from the concrete pad beneath the overhead crane and was also prone to flooding. According to the NYSDEC, stormwater runoff from the pad periodically overflowed into the dry well located near the loading dock. It is believed that the drywell was piped to a leach field located north of the waste fluids AST. According to Mr. Ricci, petroleum impacted stormwater would enter the drywell and leach field during periods of high precipitation. Based on past operations conducted at the site, the visual observations made at the time of the site inspection and the descriptions provided by Mr. Ricci, the drywell and leach field have the potential to have been adversely impacted by petroleum related products.

Accordingly, soil sampling is proposed to evaluate the potential impacts to the drywell and leachfield. To verify the leachfield presence and location, a backhoe will be used to excavate soil to the bottom of the drywell and follow the leachfield line. Soil samples will be screened using a PID and at least 2 samples will be collected from the leachfield area for analysis as described below.

MEDIA TO BE SAMPLED

To assess the potential impacts, the drywell and leach field, soil samples will be collected and analyzed. A total of five soil borings will be installed to characterize the soil to the water table in both areas. Three borings will be installed to evaluate the dry well and two borings will be installed in the leachfield. Soil will be characterized for soil type and screened using a PID to detect VOCs. In the event elevated PID readings are encountered, additional sampling may be required. In addition, a sample of the sediment that may have accumulated in the bottom of the drywell will be collected and analyzed.

SAMPLING DEPTHS

The three sample locations associated with the drywell will be collected at depths of 0 to 2-inches and 18 to 24-inches below grade. In addition, one soil sample will be collected at the interval corresponding to 0 to 6-inches above groundwater immediately adjacent to the dry well. Also, a sample of any sediments observed in the drywell will be collected for analysis. Soil will be collected for analysis at the invert of the leachfield at two septic sample locations.

ANALYTICAL PARAMETERS

The 0 to 2-inch samples will be submitted for analysis for base neutral compounds and priority pollutant metals. The samples collected at 18 to 24-inches, the samples at the invert of the leach field, the drywell sediment sample and the soil samples collected at 0 to 6-inches above groundwater will be submitted for analysis for base neutral compounds using EPA Method 8270, volatile organic compounds using EPA method 8260 and priority pollutant metals using EPA Method 6020.

A summary of the proposed sampling activities is provided in Table 2. The sample locations are illustrated on Figure 2.

AREA 5 - CATCH BASIN

Based on discussions with Mr. Larry Ricci of the NYSDEC during the site inspection, the catch basin area located along the rear of the facility historically received run off and was prone to flooding. In addition, as a result of poor housekeeping, this area was observed to have significant amounts of free product and product staining in the shallow soil and catch basin area. According to Mr. Ricci, petroleum impacted storm water would enter the catch basin during periods of high precipitation. Based on past operations conducted at the site, the visual observations made at the time of the site inspection and the descriptions provided by Mr. Ricci, this area has the potential to have been adversely impacted by petroleum related products. Therefore, soil sampling is proposed to evaluate this area.

MEDIA TO BE SAMPLED

To assess the potential impacts associated with the catch basin, soil samples will be collected and analyzed. A total of three borings will be installed to characterize the soil to the water table. Soil will be characterized for soil type and screened using a PID to detect VOCs. In the event elevated PID readings are encountered, additional sampling may be required. In addition, the catch basin will be inspected to confirm it has a concrete bottom and a sediment sample will be collected for analysis.

SAMPLING DEPTHS

Soil samples associated with the catch basin will be collected at depths of 0 to 2-inches and 18 to 24-inches below grade. Also a sample will be collected at the invert elevation of the catch basin to determine if any impact occurred immediately below the structure.

ANALYTICAL PARAMETERS

The 0 to 2-inch samples will be submitted for analysis for base neutral compounds and priority pollutant metals using EPA Methods 8270 and 6020, respectively. The samples collected at 18

to 24-inches, below the invert of the catch basin and any sediment within the basin will be submitted for analysis for base neutral compounds using EPA Methods 8270, volatile organic compounds using EPA method 8260 and priority pollutant metals using EPA Method 6020.

A summary of the proposed sampling activities is provided in Table 2. The sample locations are illustrated on Figure 2.

AREA 6 - UNDERGROUND STORAGE TANK

During the site inspection, a dispensing pump was identified on the south wall of the facility. Based on the EDR report and during the site inspection discussions, it is believed that there is one underground storage tank at this facility. The tank is believed to be a 1,000-gallon gasoline tank. The City of Newburgh is proposing to remove this tank and evaluate any potential impact this tank may have had on the environment.

The UST excavation, removal and disposal activities will include pumping residual gasoline material; excavation of significantly impacted soil; and removal of the existing UST, piping, dispenser and concrete pad. Prior to the UST removal, the tank will be inerted, pumped, and cleaned of any residual petroleum materials as described in First Environment's UST closure activities and procedures included as Attachment A.

First Environment estimates approximately 200 gallons of gasoline and water will be pumped from the UST prior to removal. Once the UST has been cleaned, the tank will be removed and taken to a scrap-metal facility for disposal. During the removal First Environment estimates between 5 to 15 cubic yards of contaminated soil will be excavated and stockpiled for waste classification and disposal. The health and safety measures to be implemented during the excavation and removal of the UST are summarized in the Health and Safety Plan which is provided in Attachment B.

MEDIA TO BE SAMPLED

Soil samples will be collected to assess any environmental impacts that the tank operations may have had on the subsurface. The soils will be screened visually and with a PID. If visible contamination, staining or odors are encountered, additional soil samples may be collected

pursuant to First Environment's sampling procedures as described in the Quality Assurance/Quality Control Plan which is included in Attachment C.

SAMPLING DEPTHS

Once the tank and any contaminated soil have been excavated, post excavation samples will be collected at the UST excavation in accordance with NYSDEC STARS and SPOTS. A total of five post-excavation soil samples will be collected from the UST excavation sidewall and base. The sampling will include one composite sample from each of the four sidewalls and one from the base. Also, one soil sample per 20 linear feet of piping run will be collected and analyzed.

ANALYTICAL PARAMETERS

For soil impacted by gasoline compounds, the STARS guidance document specifies analysis for VOCs using Method 8021. Accordingly, the past excavation samples will be analyzed following this method. In addition to the post excavation sampling, one soil waste classification sample will be collected to characterize the waste soil for disposal.

AREA 7 - ABOVE GROUND STORAGE TANK

During the site inspection, a 1,000-gallon waste fluids storage tank was located under the overhang along the rear of the facility. According to the NYSDEC, the 1000-gallon AST was used to containerize waste engine fluids. The City of Newburgh is proposing to pump out any residual product and/or water (estimated at 50 gallons) remaining in this tank and disposing of the tank off-site. Following the removal of the tank, the underlying soil will be evaluated.

MEDIA TO BE SAMPLED

Once the tank has been disposed off-site, three soil samples will be collected to determine if spills associated with past tank operations have impacted the underlying soils.

SAMPLING DEPTHS

Three soil samples will be collected at depths of 0 to 2-inches below grade and screened using a PID to detect VOCs. In the event elevated PID readings are encountered, additional sampling may be required.

ANALYTICAL PARAMETERS

The soil samples will be submitted for analysis for base neutral compounds using EPA Method 8270.

A summary of the proposed sampling activities is provided in Table 2. The sample locations are illustrated on Figure 2.

AREA 8 - DRAINS AND SUMPS

A building inspection will be conducted to identify all drains and sumps within the building. If available, building floor plans will be used to identify any sumps and drains within the building. The sumps near the engine trough will be cleaned, inspected and sampled; and a determination will be made to where each discharges.

MEDIA TO BE SAMPLED

An estimated 4 soil/sediment samples of sediment and or oil will be collected from the sumps and drains within the building.

SAMPLING DEPTHS

The samples will be collected from the base of the sumps and/or drains.

ANALYTICAL PARAMETERS

Samples will be submitted for analysis for volatile organic compounds, base neutral compounds, PCBs and priority pollutant metals using EPA method 8260, 8270, 608/8082, and 6020, respectively.

A summary of the proposed sampling activities is provided in Table 2. The sample locations are illustrated on Figure 2.

AREA 9 - GROUNDWATER

First Environment will conduct a water-well survey to identify any potable groundwater users down gradient of the Jonas site. First Environment will also contact the local Health and Water Department, review the EDR data base for water supply wells in the area, as well as contact the adjacent residences to determine if they are currently using any domestic water supply wells. The results of this evaluation will be provided in the SIR/RAR.

To evaluate the potential impact past operations may have had on the groundwater beneath the site, the City of Newburgh is proposing to install five (5) two-inch monitoring wells at the site. The wells will be installed in the unconsolidated overburden. One well will be installed at the location of the underground storage tank along the south side of the facility. The remaining 4 wells will be installed adjacent to the catch basin, drywell, drum storage area and east of the concrete pad as shown in Figure 2. Upon completion, the wells will be surveyed by a licensed New York land surveyor for the purpose of determining the direction of groundwater flow at the site.

Once the monitoring wells have been surveyed, First Environment will conduct rising and falling head slug tests at each of the 5 monitoring wells in an effort to determine the permeability of the unconsolidated water-bearing zone. This data will be used to characterize the site hydrogeology and will be included in the SI/RAR.

MONITORING WELL INSTALLATION AND SAMPLING PROCEDURES

As per Section 5.5.3.2 – “Permanent Monitoring Wells,” of the NYSDEC Sampling Guidelines and Protocols, the wells will be installed using hollow stem augers or continuous flight augers. Casings with well screens will be installed in the unconsolidated soils to prevent soil and other foreign material from entering the well during pumping. The annular space surrounding the screen will be backfilled with sand and filter pack. The remainder of the annular space surrounding the casing above the screen will be backfilled with natural clay, bentonite, and/or cement bentonite grout, depending on the conditions of the site. The wells will be constructed of 2-inch PVC well materials and finished with a flush mount round box with lockable inner caps. A typical well construction diagram for unconsolidated material has been provided as Figure 3.

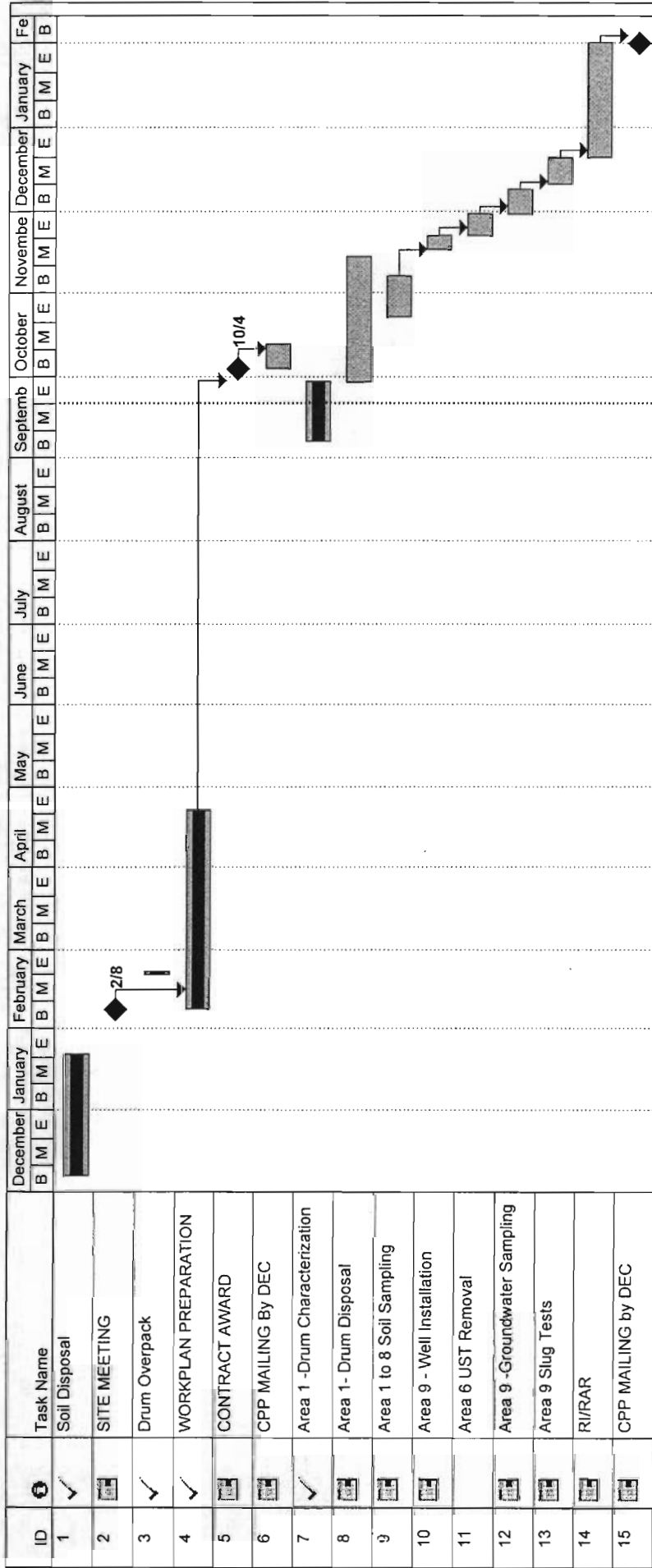
Once the wells have been installed, they will be developed to a sediment free discharge. Following a two-week period to allow the wells to stabilize, an initial round of groundwater samples will be collected. First Environment’s sampling procedures are described in the Quality Assurance/Quality Control Plan as Attachment C.

ANALYTICAL PARAMETERS

All groundwater samples will be analyzed for volatile organic compounds (Method 8260), including MTBE, base neutral compounds (method 8270) and priority pollutant metals (method 6020).

SITE INVESTIGATION/REMEDIAL ALTERNATIVES REPORT (SI/RAR)

Upon completion of the activities described in this Work Plan, First Environment will prepare a SI/RAR that documents the findings of the site investigation and proposed remedial alternative activities. The report will summarize the soil sampling activities; results of the UST excavation, removal and subsequent post-excavation soil sampling activities; soil disposal activities; and groundwater monitoring results. The report will evaluate potential remedial alternatives and provide recommendations in accordance with 6NYCRR Part 375-1.10(c)(1-7) and guidelines specified in STARS for the management of excavated contaminated soil. Remedial alternatives for soil, as well as active groundwater remediation alternatives, including but not limited to Risk Based Corrective Action Measures, will be included in the SI/RAR.



Task

Split

Progress

Milestone

Summary

Rolled Up Task

Rolled Up Split

Rolled Up Milestone

Rolled Up Progress

External Tasks

Project Summary

TABLE 1.

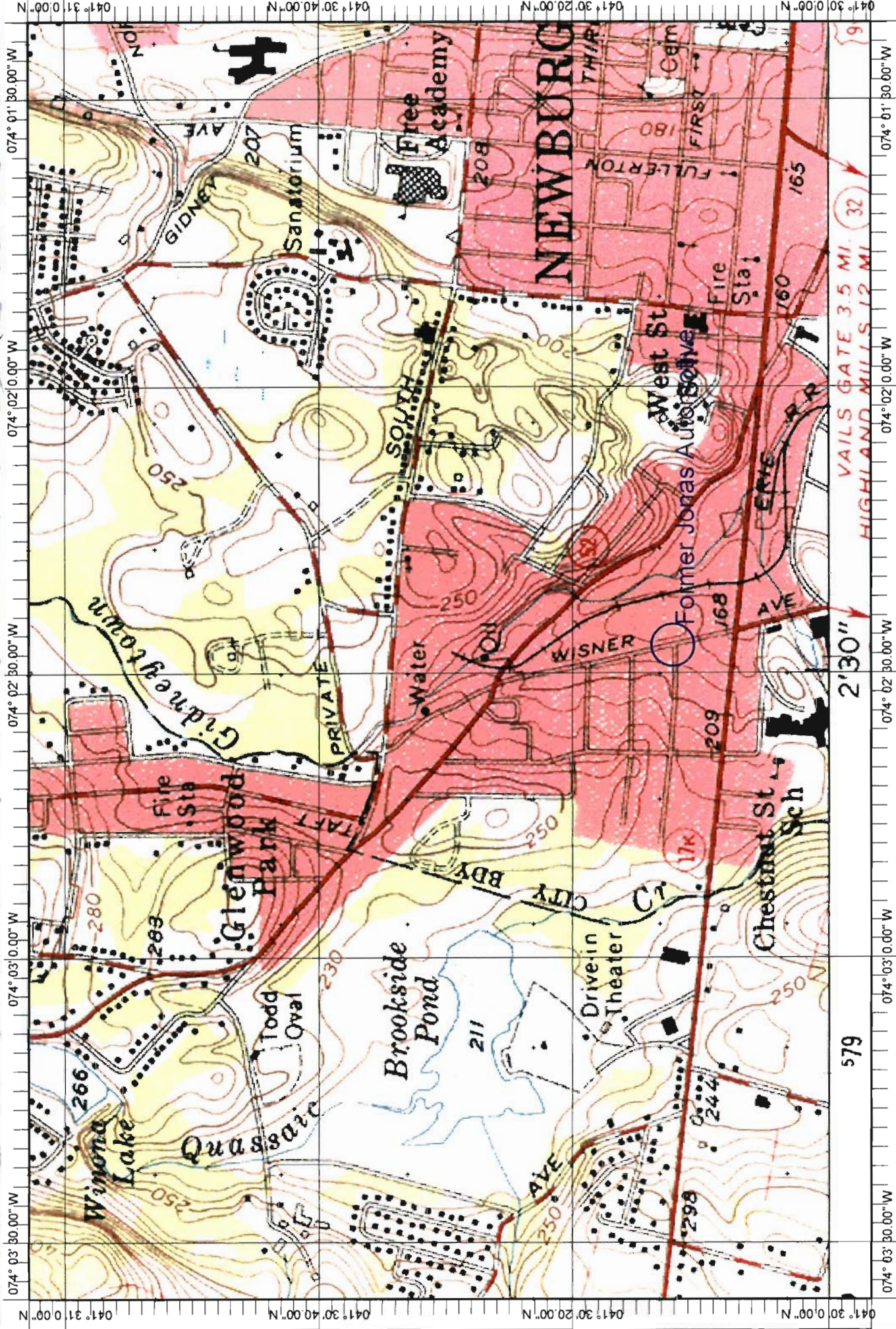
SCHEDULE OF ACTIVITIES

Page 1

TABLE 2
Jonas Automotive
Sampling Summary

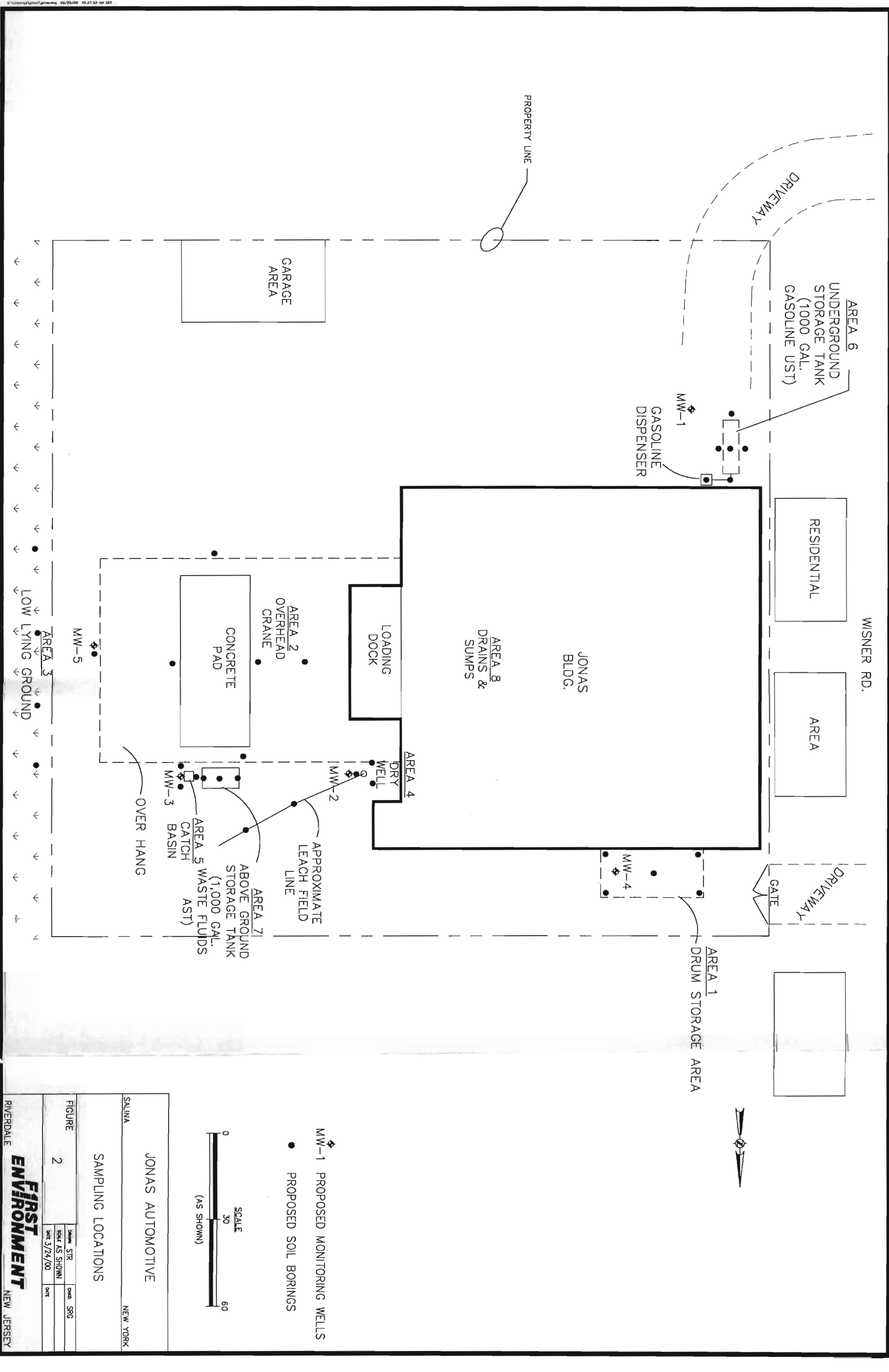
Area	Sampling No.	Depth	Laboratory Analysis
Area 1	S-1 to S-5	0-2"	BNs, PCBs, PPMs
Area 2	S-6 to S-11	0-2" 18-24"	BNs, PCBs, PPMs BNs, PCBs, PPM, VOCs
Area 3	S-12 to S-15	0-2" 12-18"	BNs, PPMs BNs, PPMs, VOCs
Area 4	S-16 to S-20	0-2" 18-24"	BNs, PPMs BNs, PPMs, VOCs
	S-21	0-6" Above W.T.	BNs, PPMs, VOCs
	S-22	Drywell Sediment	BNs, PPMs
	S-23 to S-24	Leachfield Invert	BNs, PPMs, VOCs
Area 5	S-25 to S-27	0-2" 18-24"	BNs, PPMs BNs, PPMs, VOCs
	S-28	Invert of Basin	BNs, PPMs, VOCs
Area 6	S-29 to S-34 S-35	Sidewall & Base Pipe Run	VOCs
Area 7	S-36 to S-38	0-2"	BNs
Area 8	S-39 to S-42	Drain/Sump Base	VOCs, BNs, PCBs, PPMs
Area 9	MW1 to MW5	Groundwater	VOCs, BNs, PPMs

Notes: PCBs- Polychlorinated Biphenols
VOCs- Volatile Organic Compounds
BNs- Base Neutrals
PPMs- Priority Pollutant Metals
Soil sampling at Area 1 to Area 8
Groundwater Sampling at Area 9

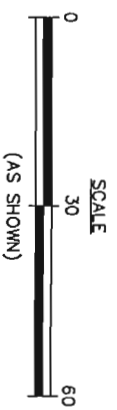


Name: NEWBURGH
 Date: 4/4/100
 Scale: 1 inch equals 1000 feet

Location: 041° 30' 29.7" N 074° 02' 28.9" W
 Caption: FIGURE 1
 Former Jonas Automotive
 Newburgh, New York



MW-1 PROPOSED MONITORING WELLS
• PROPOSED SOIL BORINGS



JONAS AUTOMOTIVE

SALINA

NEW YORK

SAMPLING LOCATIONS

FIGURE 2

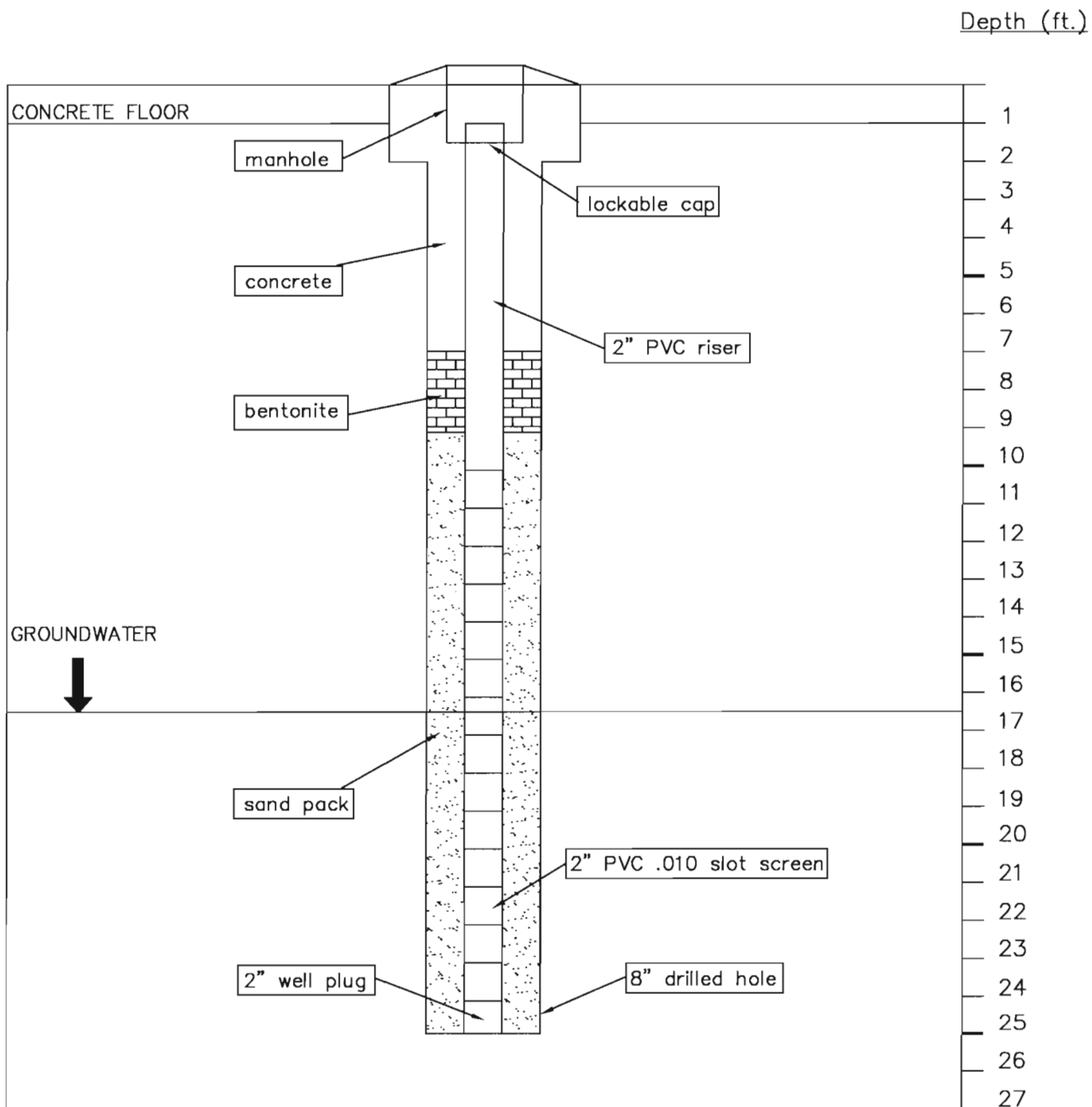
DRAWN STR	CHECK SRG
SCALE AS SHOWN	
DATE 3/24/00	DATE

RIVERDALE

NEW JERSEY

FIRST ENVIRONMENT

NEW JERSEY



JONAS AUTOMOTIVE			
NEWBURGH		NEW YORK	
WELL CONSTRUCTION DIAGRAM			
FIGURE	3	DATE	DATE
		DATE	DATE
RIVERDALE		NEW JERSEY	

FIRST ENVIRONMENT

UST ACTIVITIES & PROCEDURES

The following activities will be conducted as part of the underground storage tank removal process.

- All work will be performed in accordance with the appropriate industry standard, American Petroleum Institute publication API 1604, ANSI, NFPA and all other applicable government regulations.
- Acquisition of all required permits including notification for the appropriate oversight authority.
- Overseeing the activities required to ensure proper closure of the tank including excavation, cleaning, safety monitoring, and backfilling to grade.
- Soil sampling the tank excavation (in accordance with NYSDEC STARs and SPOTs).
- Preparing the required closure documentation.

Upon receipt of the required state and local permits, the following tank decommissioning procedures will be employed at the site.

TANK DECOMMISSIONING PROCEDURES

Upon receipt of all permits and approvals, the underground storage tank will be scheduled for removal. Tank decommissioning will be implemented following the appropriate industry standards, as stated above. The tank decommissioning procedures are described below.

TANK PREPARATION

Prior to excavation, the following activities will be performed:

- Underground utilities will be identified by knowledgeable persons.
- Before initiating work in the tank area, a monitoring instrument will be used to assess vapor and oxygen concentrations in the work area.
- All material transfer piping will be drained, cut and plugged with an impermeable material, or capped to avoid any spillage.
- Residual product found in the tank will be pumped out and containerized for proper off-site disposal or recycling.

REMOVAL PROCEDURES

The following tank removal procedures will be conducted:

- After removing or disconnecting the transfer piping, the soils around the tank will be excavated.
- The excavation will conform to the applicable trenching and shoring requirements.
- Upon removal, the tank will be placed on plastic and secured prior to inspection and cleaning.
- The tank will be labeled "do not re-use" after removal from the ground and before removal from the site.
- The tank will be removed from the site as promptly as possible.

SITE ASSESSMENT

Site assessment activities required by the NYSDEC will be performed to determine if the previous operation of the underground storage tank or piping has impacted the underlying soils at the site. The site assessment activities will include visually inspecting the tank, excavation and collecting soil samples for certified laboratory analysis as required by NYSDEC STARS and SPOTs.

SAMPLING AND ANALYSIS

First Environment will field screen all excavated soil with a portable photoionization detector to evaluate potential soil contamination. In accordance with NYSDEC STARS Guidance Document, one post excavation soil sample will be collected at each side-wall and one composite sample at the tank base. One soil sample will be collected six-inches below the transfer piping for every 20 feet of transfer piping. Soil samples will be collected by First Environment and submitted to a NYSDEC certified laboratory for analysis as per STARS requirements for tank contents.

SITE HEALTH AND SAFETY PLAN
FIRST ENVIRONMENT, INC.

SITE NAME Former Jonas Automotive Facility

SITE ADDRESS 86 Wisner Avenue CLIENT Former Jonas Automotive Facility

Newburgh, New York 12550

PROJECT # JONAS001

SITE PHONE _____ REVISION # _____ DATE 2/25/2000

CONTACT Bill Hauser (City of Newburgh)

CONTACT PHONE (914)-562-8642

OBJECTIVES: (Summarize below)

Removal of Diesel & gasoline underground storage tanks, the installation of soil borings and groundwater monitoring wells, waste Drum removal, and excavation, stockpiling and disposal of contaminated soil.

TYPE OF SITE: (Check as many as applicable)

() Active (X) Secure () Enclosed space () Uncontrolled () Recovery (X) Remediation () Unknown
(X) Inactive () Unsecure () Landfill () Industrial () Well Field () Other: (specify)

DESCRIPTION AND FEATURES: Summarize below. Include principal operations and unusual features (size, containers, buildings, dikes, power line, terrain, etc.).

Site is currently unoccupied.

SURROUNDING AREA/DIRECTION: (X) Residential () Industrial (X) Commercial () Rural () Urban () Other:

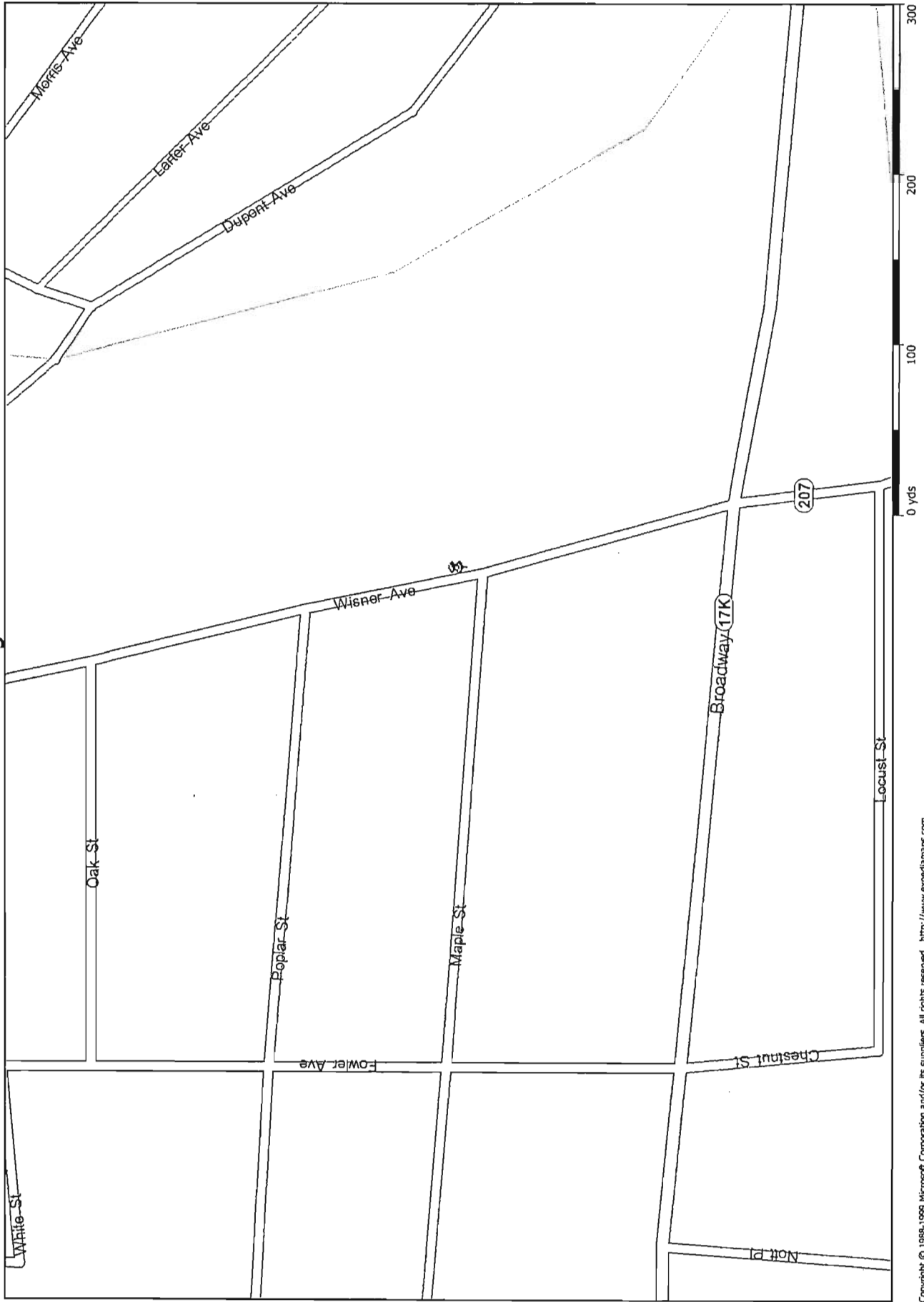
DISTANCE TO NEAREST ENVIRONMENTALLY SENSITIVE RECEPTORS:

Water Body 2 Miles Wetlands Potable Well School Residence

Hospital 1.5 Miles Public Building Other Depth to Groundwater

Water Body (Hudson River); Hospital (St. Luke's Hospital)

Newburgh area



HISTORY: (Summarize below. In addition to history, include complaints from public, previous agency actions, known exposures or injuries, etc.) Facility reconditioned auto parts. Currently out of business. Drums on-site contain oils. Drums recently overpacked due to public complaints and DEC request. No known exposures.

WASTE TYPES: (X) Liquid (X) Solid (X) Soil (X) Sludge () Gas () Unknown () Other: (specify)

WASTE CHARACTERISTICS: (Check as many as applicable.)

() Corrosive (X) Flammable () Radioactive
() Toxic (X) Volatile () Reactive
(X) Inert () Unknown () Other: (specify)

Potential for unknown contaminants during soil excavation

PRINCIPAL DISPOSAL METHODS AND PRACTICES:

Tank contents will be pumped out and transported off site for disposal by a licensed waste hauler. Drums and excavated soil will be transported off site by a licensed waste hauler and disposed of off site. All waste will be disposed of at NYDEC licensed

Facilities.

HAZARDS OF CONCERN:

(X) Heat Stress (attach guidelines) (X) Noise () Biological (animals, insects, plants)
(X) Cold Stress (attach guidelines) () Inorganic Chemicals (X) Physical (terrain, water bodies)
(X) Explosive/Flammable (X) Organic Chemicals (X) Electrical
(X) Oxygen Deficient () Radiological (X) Mechanical (machinery/equipment)
() Other: (specify)

Heat Stress/Cold Stress hazards depend on current temperatures during work activities.

HAZARDOUS MATERIAL SUMMARY: (Circle waste type and estimate amounts by category.)

CHEMICALS: Amount/Units:	SOLIDS: Amount/Units:	SLUDGES: Amount/Units:	SOLVENTS: Amount/Units:	OILS: Amount/Units:	OTHER: Amount/Units:
Acids	Asbestos	Aluminum	Halogenated Solvents	Oily Wastes	Hospital
Caustics	Ferrous Smelter	Metals	Non-Halogenated Solvents	Other (specify):	Laboratory
Cyanides	Flyash	Paint Pigments	Other (specify):	Waste Oil/sludge	Municipal
Dyes/Inks	Milling/Mine Tailings	POTW Sludge			Radiological
Halogens	Non-Ferrous Smelter	Refinery			Other (specify):
Metals	Paint Chips	Tank Bottoms			55-Gallon Drums & Stockpiled Soil
PCBs	Other (specify):	Other (specify):			
Pest/Herbicide					
Phenols					
Pickling Liquors					
Other (specify): Tank Bottoms					

OVERALL HAZARD EVALUATION: () High (X) Medium () Low () Unknown (Where tasks have different hazards, evaluate each.)

JUSTIFICATION:

There are unknown contaminant concentrations within the tank bottoms and contaminated soil to be excavated. Contaminant concentrations Typical from petroleum based UST's rarely are hazardous so an interim medium hazard evaluation has been designated.

FIRE/EXPLOSION POTENTIAL: () High (X) Medium () Low () Unknown

Fire/explosion hazards do exist when removing gasoline USTs. The gasoline USTs to be removed will be inerted prior to removal.

RISK ANALYSIS:

KNOWN CONTAMINANTS	HIGHEST OBSERVED CONCENTRATION (specify units and media)	PEL/TLV ppm or mg/m ³ (specify)	IDLH ppm or mg/m ³ (specify)	SYMPTOMS/EFFECTS OF ACUTE EXPOSURE

(VOLATILES)

Benzene (MSDS attached)		1 ppm	1,000 ppm	See MSDS
Toluene (MSDS attached)		100 ppm	2,000 ppm	See MSDS
Ethylbenzene (MSDS attached)		100 ppm	2,000 ppm	See MSDS
Xylenes (MSDS attached)		100 ppm	1,000 ppm	See MSDS

(SEMI-VOLATILES)

Acenaphthene (MSDS attached)
 Benzo(a)pyrene (MSDS attached)
 Bromodichloromethane (MSDS attached)
 Methyl Ethyl Ketone (MSDS attached)
 Dichlorodifluoromethane (MSDS attached)
 1,2-Dichloroethane (MSDS attached)
 1,2-Dichloroethylene (MSDS attached)
 Dichlorobenzene (MSDS attached)
 Naphthalene (MSDS attached)
 Phenanthrene (MSDS attached)
 Pyrene (MSDS attached)

NA = Not Available
 NE = None Established
 U = Unknown

S = Soil
 GW = Groundwater
 SW = Surface Water

A = Air
 F = Flyash
 SL = Sludge

D = Drums
 TK = Tanks
 L = Lagoon

FIELD ACTIVITIES COVERED UNDER THIS PLAN									
TASK DESCRIPTION/SPECIFIC TECHNIQUE/STANDARD OPERATING PROCEDURES/SITE LOCATION (Attach additional sheets as necessary.)									
		TYPE		LEVEL OF PROTECTION				SCHEDULE	
				PRIMARY		CONTINGENCY			
TASK 1		Intrusive		A	B	C	D	A	B C D
UST Removal		Non-Intrusive		Modified		Modified			
TASK 2		Intrusive		A	B	C	D	A	B C D
Soil Borings/Well Installations		Non-Intrusive		Modified		Modified			
TASK 3		Intrusive		A	B	C	D	A	B C D
Drum Removal		Non-Intrusive		Modified		Modified			
TASK 4		Intrusive		A	B	C	D	A	B C D
Soil Excavation/Stockpiling/Disposal		Non-Intrusive		Modified		Modified			

PROTECTIVE EQUIPMENT: (Specify by task.) UST REMOVAL

TASKS: 1 2 3 4 (X) Primary (XX) Contingency
LEVEL: A B C D Modified

RESPIRATORY: (X) Not Needed

() SCBA, Airline: _____
() APR: _____
(XX) Cartridge: _____
() Escape Mask: _____
() Other: _____

HEAD AND EYE: () Not Needed

(X) Safety Glasses: (XX) _____
() Face Shield: _____
() Goggles: _____
(X) Hard Hat: (XX) _____
(X) Ear Protection: (XX) _____
() Other: _____

BOOTS: () Not needed

Boots: (X), (XX) - Steel Toe

Overboots: _____

PROTECTIVE CLOTHING: (X) Not Needed

() Encapsulating Suit: _____
() Splash Suit: _____
() Apron: _____
(XX) Tyvek Coverall: _____
() Saranex Coverall: _____
() Coverall: _____
() Other: _____
GLOVES: () Not Needed
() Undergloves: _____
(X) Gloves: (XX) - Nitrile and/or latex
() Overgloves: _____
OTHER: (specify)

PROTECTIVE EQUIPMENT: (Specify by task.) SOIL BORING/WELL INSTALLATION

TASKS: 1 2 3 4 (X) Primary (X) Contingency

LEVEL: A B C D Modified

RESPIRATORY: (X) Not Needed

() SCBA, Airline: _____

() APR: _____

(XX) Cartridge: _____

() Escape Mask: _____

() Other: _____

HEAD AND EYE: () Not Needed

(X) Safety Glasses: (XX) _____

() Face Shield: _____

() Goggles: _____

(X) Hard Hat: (XX) _____

(X) Ear Protection: (XX) _____

() Other: _____

BOOTS: () Not needed

Boots: (X), (XX) - steel toe

Overboots: _____

PROTECTIVE CLOTHING: (X) Not Needed

() Encapsulating Suit: _____

() Splash Suit: _____

() Apron: _____

(XX) Tyvek Coverall: _____

() Saranex Coverall: _____

() Coverall: _____

() Other: _____

GLOVES: () Not Needed

() Undergloves: _____

(X) Gloves: (XX) - nitrile and/or latex

() Overgloves: _____

OTHER: (specify) _____

PROTECTIVE EQUIPMENT: (Specify by task.) DRUM REMOVAL

TASKS: 1 2 3 4 (X) Primary (XX) Contingency

LEVEL: A B C D Modified

RESPIRATORY: (X) Not Needed

() SCBA, Airline: _____

() APR: _____

(XX) Cartridge: _____

() Escape Mask: _____

() Other: _____

HEAD AND EYE: (X) Not Needed

(XX) Safety Glasses: _____

() Face Shield: _____

() Goggles: _____

(XX) Hard Hat: _____

(XX) Ear Protection: _____

() Other: _____

BOOTS: () Not needed

Boots: (X), (XX) _____

Overboots: _____

PROTECTIVE CLOTHING: (X) Not Needed

() Encapsulating Suit: _____

() Splash Suit: _____

() Apron: _____

(XX) Tyvek Coverall: _____

() Saranex Coverall: _____

() Coverall: _____

() Other: _____

GLOVES: () Not Needed

() Undergloves: _____

(X) Gloves: (XX) - nitrile and/or latex _____

() Overgloves: _____

OTHER: (specify) _____

PROTECTIVE EQUIPMENT: (Specify by task.) SOIL EXCAVATION/STOCKPILING/DISPOSAL

TASKS: 1 2 3 4 (X) Primary (XX) Contingency

LEVEL: A B C D Modified

RESPIRATORY: (X) Not Needed

() SCBA, Airline: _____

() APR: _____

(XX) Cartridge: _____

() Escape Mask: _____

() Other: _____

HEAD AND EYE: () Not Needed

(X) Safety Glasses: (XX) _____

() Face Shield: _____

() Goggles: _____

(X) Hard Hat: (XX) _____

(X) Ear Protection: (XX) _____

() Other: _____

BOOTS: () Not needed

Boots: (X), (XX) _____

Overboots: _____

PROTECTIVE CLOTHING: (X) Not Needed

() Encapsulating Suit: _____

() Splash Suit: _____

() Apron: _____

(XX) Tyvek Coverall: _____

() Saranex Coverall: _____

() Coverall: _____

() Other: _____

GLOVES: () Not Needed

() Undergloves: _____

(X) Gloves: (XX) - nitrile and/or latex

() Overgloves: _____

OTHER: (specify)

MONITORING EQUIPMENT: (Specify by task.)

INSTRUMENT	TASK	ACTION GUIDELINES	COMMENTS
Combustible Gas Indicator	1 2 3 4	<p><10% LEL Continue monitoring.</p> <p>10-20% LEL Potential explosion hazard, notify SHSC</p> <p>>20% LEL Explosion hazard; interrupt task/evacuate</p> <p>21.0% 0 2 Oxygen normal</p> <p><21.0% 0 2 Oxygen Deficient, notify SHSC</p> <p><19.5% 0 2 Interrupt task/evacuate</p>	() Not Needed
Radiation Survey Meter	1 2 3 4	<p>3 x Background: Notify SHSC</p> <p>>2 mR/hr Interrupt task/evacuate</p> <p>Note: Annual exposure not to exceed 100 mrem/yr or 50 Φrem/hr average</p>	() Not Needed
Photoionization Detector	1 2 3 4	Specify:	() Not needed
() 11.7 ev (X) 10.6 ev () 10.2 ev () 9.8 ev () ___ ev			
Type: _____			
Flame Ionization Detector	1 2 3 4	Specify:	() Not Needed
Type: _____			
Personal Gas Detector	1 2 3 4	Specify:	() Not Needed
Type: _____			
Dust Monitor	1 2 3 4	Specify:	() Not Needed
Type: _____			
Other, Specify:	1 2 3 4	Specify:	
Type: _____			
Discharge Control Measures:			
Drainage Structures	1 2 3 4	Specify: Hay bails(if needed)	() Not Needed
Surface Water	1 2 3 4	Specify: Booms(if necessary)	() Not Needed
Groundwater	1 2 3 4	Specify:	(X) Not Needed
Soil	1 2 3 4	Specify:	(X) Not Needed
Dust	1 2 3 4	Specify:	(X) Not Needed
Vapors	1 2 3 4	Specify:	(X) Not Needed

DECONTAMINATION PROCEDURES:

All equipment that comes in contact with contaminated soil/materials will be decontaminated on-site prior to removal from the site. If necessary, decontamination water will be drummed on-site for future disposal.

PERSONNEL DECONTAMINATION:

All PPE that comes in contact with contaminated soil/materials will be removed on-site and disposed of along with the contaminated soils/materials generated on-site.

Containment and Disposal Method:

() Not Needed

SAMPLING EQUIPMENT DECONTAMINATION:

All sampling equipment used will be disposable (one time use only) and will be disposed of following use. When split spoons are used, During soil borings and well installation, the spoon will be decontaminated with DI water and alconox detergent. If necessary, the decontamination water will be drummed on-site for future disposal.

Containment and Disposal Method:

() Not Needed

HEAVY EQUIPMENT DECONTAMINATION: (Summarize below and/or attach diagram; discuss use of work zones).

All equipment that comes in contact with contaminated with contaminated soil/materials will be decontaminated on-site prior to removal from the site. If necessary, decontamination water will be drummed on-site for future disposal.

Containment and Disposal Method:

() Not Needed

EMERGENCY RESPONSE EQUIPMENT: (check all that apply) /

(XX) 20 lb ABC Fire Extinguisher	() Shower
(XX) First Aid Kit	(XX) PPE
() Stretcher or Blanket	() SCBA
(XX) Potable Water	(XX) Spill Control Equipment
() Eye Wash	(XX) Radio/Phone
() Other	

EMERGENCY CONTACTS:

PHONE

Water Supply:

Telephone:

Gas:

Electric:

Sewer Authority

Dept of Public Works:

DOT Hazardous Materials Information:

National Response Center Hotline:

CMA Chemical Referral Center:

CHEMTREC:

Other:

CONTINGENCY PLANS:

See First Environment, Inc. Emergency Response Plan.

NOTE: This Health and Safety Plan has been written for the use of First Environment, Inc. and its employees. The plan is written for specific trained personnel who are under medical surveillance. The plan is applicable for the specific purposes, and objectives stated and is representative of conditions believed to exist at the time of its preparation. First Environment, Inc., claims no responsibility for its use by others.

HEALTH AND SAFETY PLAN APPROVALS

Prepared by

Date

Reviewed by

Date

HSM Signature

Date

EMERGENCY CONTACTS:

NAME

PHONE

24-Hour Emergency Line:

Health and Safety Manager:

Site Supervisor:

Site H & S Coordinator:

Project Manager:

Personnel Manager

Site Owner:

Site Operator:

EPA Contact:

State Environmental Agency:

State Spill Contractor:

Fire Department:

Police Department:

State Police:

Health Department:

MEDICAL EMERGENCY

MEDICAL EMERGENCY

Ambulance:

Paramedic:

Medical Consultant:

Hospital Name:

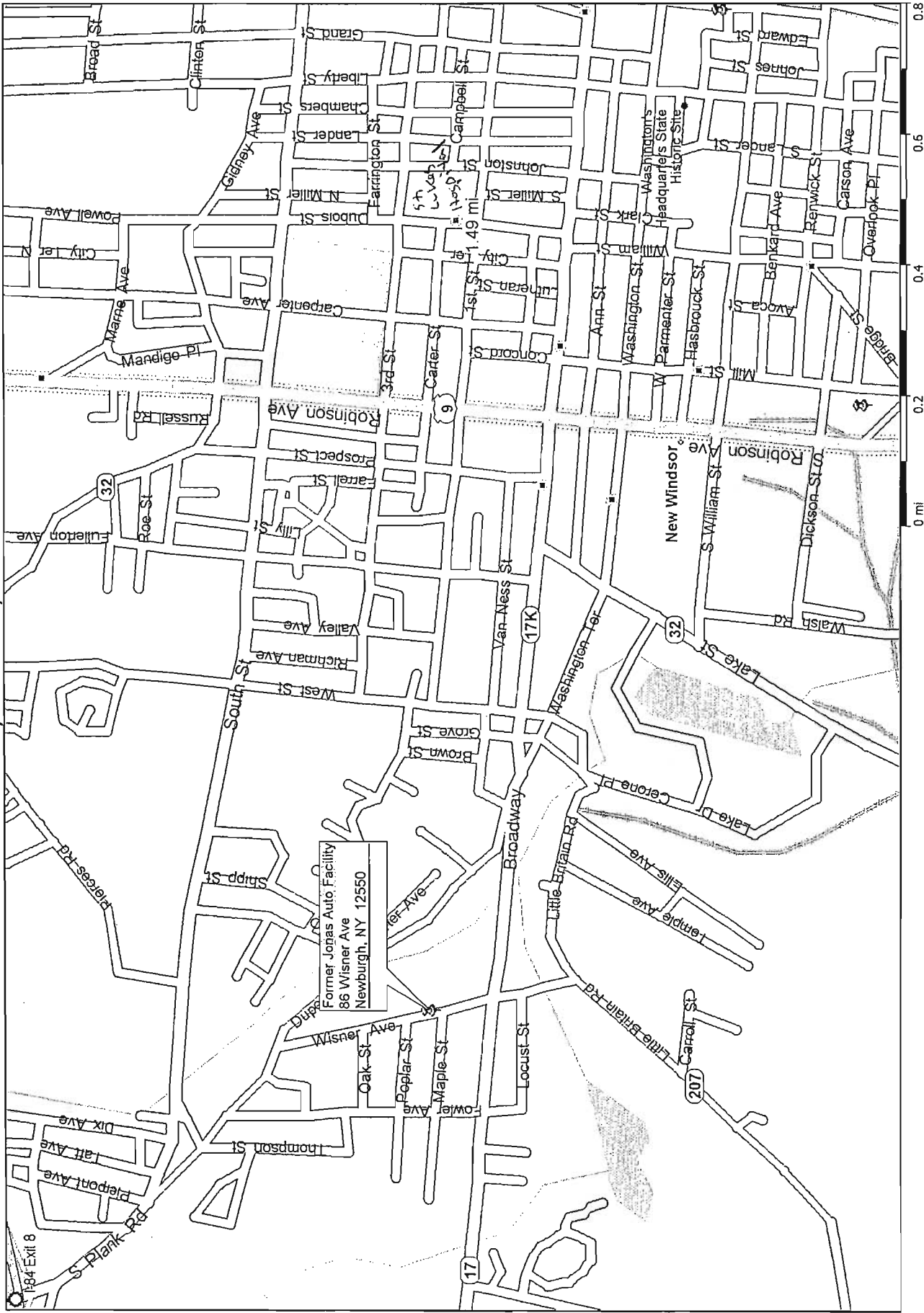
Hospital Address:

Name of Contact at Hospital:

Distance to Hospital:

(Attach map and description of route to hospital)

New Windsor, New York, United States

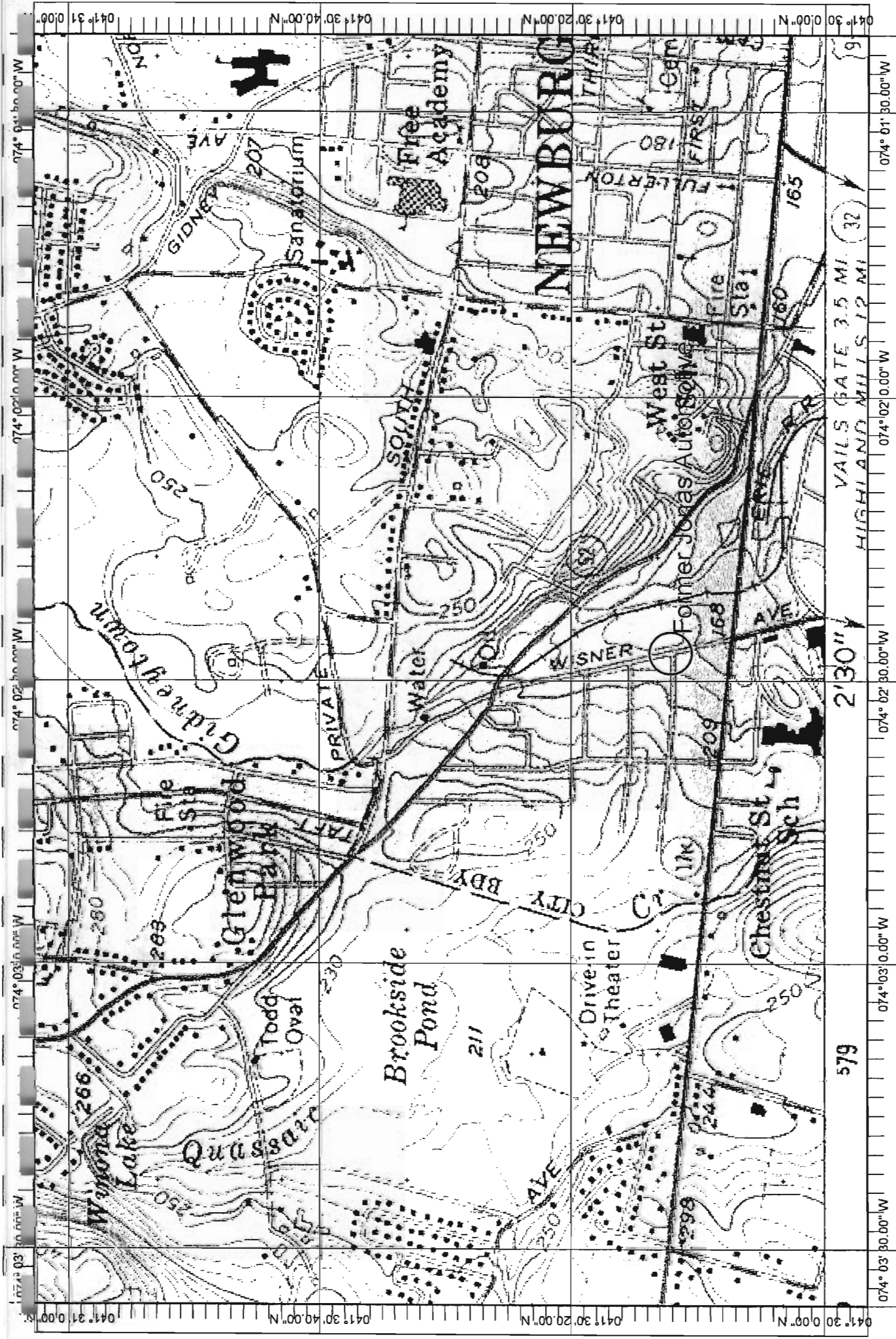


PERSONNEL & RESPONSIBILITIES: (Attach additional sheets as necessary.)

NAME	FIRM	HEALTH/TRAINING CLEARANCE	RESPONSIBILITIES	SITE TASK	SIGNATURE	DATE
1. Tom Bambrick	First Environment	YES	Project Manager	1 2 3 4		
2. Corey Nachshen	First Environment	Yes	Site Supervisor	1 2 3 4		
3.				1 2 3 4		
4.				1 2 3 4		
5.				1 2 3 4		
6.				1 2 3 4		
7.				1 2 3 4		
8.				1 2 3 4		
9.				1 2 3 4		
10.				1 2 3 4		
UTILITY MARK-OUT: Date notified: _____ Confirmation Number: _____				Initials: _____		

All First Environment personnel assigned to work on-site have attended a 40-hour hazardous materials site operations and safety training course or have met the equivalent experience and training provision of 29 CFR 1910.120, and have been certified medically fit by a qualified occupational physician to work on hazardous sites and to wear a respirator.

By signing above, employees and subcontractors acknowledge that they have read and understand this Site Health and Safety Plan. All site workers under the direction of First Environment must sign this sheet before commencing the site tasks to which they have been assigned for this site.



Name: NEWBURGH
 Date: 4/4/100
 Scale: 1 inch equals 1000 feet

Location: 041° 30' 29.7" N 074° 02' 28.9" W
 Caption: FIGURE 1
 Former Jonas Automotive
 Newburgh, New York

Cold Stress Hazards

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances, in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in Table 4-2.

TABLE 4-2
WIND CHILL TEMPERATURE CHART

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.				GREAT DANGER Flesh may freeze within 30 seconds.			
	Trench foot and Immersion foot may occur at any point on this chart.											

[This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA (Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents)].

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- **Frost Nip or Incipient Frostbite** - characterized by suddenly blanching or whitening of skin.
- **Superficial Frostbite** - skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- **Deep Frostbite** - tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; 4) freezing of the extremities; and 5) death. Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. To avoid cold stress, personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be utilized to prevent cold stress.

Safety Precautions for Cold Stress Prevention

- For air temperature of 0°F or less, the hands should be protected by mittens. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.
- At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.
- If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must ensure that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.
- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.
- Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

Safe Work Practices

- Direct contact between bare skin and cold surfaces ($\leq 20^{\circ}\text{F}$) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.
- For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.
- Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.
- Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat rashes are the one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much and too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of work load and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should not be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described in the Table 4-1. Additional personnel must be provided to allow appropriate rest to prevent heat-related illness, as necessary to maintain required production and job continuity.

TABLE 4-1
WORK/REST SCHEDULE

<i>Adjusted Temperature^a</i>	<i>Work-Rest Regimen Normal Work Ensemble^b</i>	<i>Work-Rest Regimen Impermeable Ensemble</i>
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (30.8°-32.2°C)	After each 150 minutes of work	After each 120 minutes of work

- ^a For work levels of 250 kilocalories/hour (Light-Moderate Type of Work)
- ^b Calculate the adjusted air temperature ($t_{a\text{ adj}}$) by using this equation: $t_{a\text{ adj}}^{\circ}\text{F} = t_a^{\circ}\text{F} + (13 \times \% \text{ sunshine})$. Measure air temperature (t_a) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
- ^c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.
- ^d The information presented above was generated using the information provided in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) Handbook.

In order to determine if the work rest cycles are adequate for the personnel and specific project site conditions additional monitoring of individuals heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period

Additional one or more of the following control measures can be used to help control heat stress and are mandatory if any worker has a heart rate (measure immediately prior to rest period) exceeding of 115 beats per minute:

- Workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-site drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.

- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Personnel should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Personnel must not be assigned to other tasks during breaks.
- Personnel must remove impermeable garments during rest periods. This includes white Tyvek-type garments.
- All personnel must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
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No. 316

BENZENE
(Revision D)
Issued: November 1978
Revised: April 1988

SECTION 1: MATERIAL IDENTIFICATION

25

Material Name: BENZENE

Description (Origin/Uses): Used in the manufacture of medicinal chemicals, dyes, linoleum, airplane dopes, varnishes, and lacquers; and as a solvent for waxes, resins, and oils.

Other Designations: Benzol; Phene; Phenylhydride; C_6H_6 ; NIOSH RTECS No. CY1400000;
CAS No. 0071-43-2

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS

H 2

F 3

R 0

PPG*

*See sect. 8

R 1

I 4

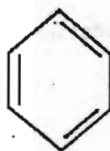
S 2

K 4



SECTION 2: INGREDIENTS AND HAZARDS

Benzene, CAS No. 0071-43-2



*See NIOSH, RTECS, for additional data with references to irritative, mutagenic, tumorigenic, and reproductive effects.

%

Ca 100

EXPOSURE LIMITS

OSHA PEL

8-Hr TWA: 1 ppm

15-Min Ceiling: 5 ppm

Action Level: 0.5 ppm

ACGIH TLV, 1987-88

TLV-TWA: 10 ppm, 30 mg/m³

Toxicity Data*

Human, Inhalation, LC₅₀: 2000 ppm/5 Min

Human, Oral, TD₅₀: 130 mg/kg

Human, Inhalation, TC₅₀: 210 ppm

SECTION 3: PHYSICAL DATA

Boiling Point: 176°F (80°C)

Melting Point: 42°F (5.5°C)

Vapor Pressure: 75 Torrs at 68°F (20°C)

Vapor Density (Air = 1): >1

Water Solubility (%): Slight

% Volatile by Volume: 100

Molecular Weight: 78 Grams/Mole

Specific Gravity (H₂O = 1): 0.87865 at 68°F (20°C)

Appearance and Odor: A colorless liquid; characteristic aromatic odor.

SECTION 4: FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

12°F (-11.1°C) CC

928°F (498°C)

% by Volume

1.3%

7.1%

Extinguishing Media: Use dry chemical, foam, or carbon dioxide to put out benzene fires. Water may be ineffective as an extinguishing agent because it can scatter and spread the fire. Use water to cool fire-exposed containers, flush spills away from exposures, disperse benzene vapor, and protect personnel attempting to stop an unignited benzene leak.

Unusual Fire or Explosion Hazards: Benzene vapor is heavier than air and can collect in low-lying areas such as sumps or wells.

Eliminate all sources of ignition there to prevent a dangerous flashback to the original liquid benzene. Danger: Explosive and flammable benzene vapor-air mixtures can easily form at room temperature; always use this material in a way that minimizes dispersion of its vapor into general work areas.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5: REACTIVITY DATA

Benzene is stable in closed containers during routine operations. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Hazardous chemical reactions involving benzene and the following materials are reported in Genium reference 84: bromine pentafluoride, chlorine, chlorine trifluoride, chromic anhydride, nitryl perchlorate, oxygen, ozone, perchlorates, perchloryl fluoride and aluminum chloride, permanganates and sulfuric acid, potassium peroxide, silver perchlorate, and sodium peroxide.

Conditions to Avoid: Avoid all exposure to sources of ignition and to incompatible chemicals.

Hazardous Products of Decomposition: Toxic gases like carbon monoxide (CO) may be produced during benzene fires.

SECTION 6. HEALTH HAZARD INFORMATION

Benzene is listed as a suspected human carcinogen by the ACGIH.

Summary of Risks: Prolonged skin contact with benzene or excessive inhalation of its vapor may cause headache, weakness, loss of appetite, and lassitude. Continued exposure can cause collapse, bronchitis, and pneumonia. The most important health hazards are cancer (leukemia), bone marrow effects, and injuries to the blood-forming tissue from chronic low-level exposure.

Medical Conditions Aggravated by Long-Term Exposure: Ailments of the heart, lungs, liver, kidneys, blood, and central nervous system (CNS) may be worsened by exposure. Administer preplacement and periodic medical exams emphasizing these organs' functions and reassign workers who test positive. **Target Organs:** Blood, CNS, bone marrow, eyes, and upper respiratory tract (URT). **Primary Entry:** Skin contact, inhalation. **Acute Effects:** Dizziness, mental dullness, nausea, headache, fatigue, and giddiness. **Chronic Effects:** Possible cancer (leukemia).

FIRST AID

Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.

Skin: Immediately wash the affected area with soap and water.

Inhalation: Remove the exposed person to fresh air; restore and/or support his or her breathing as needed.

Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. Do not induce vomiting because of the possibility of aspiration.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately. Cleanup personnel need protection against contact with and inhalation of vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations for disposal. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U019

CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow the eye- and face-protection guidelines in 29 CFR 1910.133. **Respirator:** Wear a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent any possibility of skin contact with this suspected human carcinogen. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of benzene below the OSHA PEL standard cited in section 2.

Safety Stations: Make eyewash stations, washing facilities, and safety showers available in use and handling areas. **Contaminated**

Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale benzene vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store benzene in a cool, dry, well-ventilated area away from sources of ignition and incompatible chemicals.

Special Handling/Storage: Protect containers from physical damage. Electrically ground and bond all metal containers used in shipping or transferring operations. Follow all parts of 29 CFR 1910.1028.

Engineering Controls: All engineering systems (production, transportation, etc.) must be of maximum explosion-proof design (non-sparking, electrically grounded and bonded, etc.)

Comments: If possible, substitute less toxic solvents for benzene; use this material with extreme caution and only if it is absolutely essential.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Benzene

DOT Class: Flammable Liquid

DOT Label: Flammable Liquid

DOT ID No. UN1114

IMO Label: Flammable Liquid

IMO Class: 3.2

References: 1, 2, 12, 73, 84-94, 100, 103.

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Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD



Section 1. Material Identification

43

Toluene (C₇H₈) Description: Derived from petroleum i.e., dehydrogenation of cycloparaffin fractions followed by the aromatization of saturated aromatic hydrocarbons or by fractional distillation of coal-tar light oil and purified by rectification. Used widely as a solvent (replacing benzene in many cases) for oils, resins, adhesives, natural rubber, coal tar, asphalt, pitch, acetyl celluloses, cellulose paints and varnishes; a diluent for photogravure inks, raw material for organic synthesis (benzoyl & benzilidene chlorides, saccharine, TNT, toluene diisocyanate, and many dyestuffs), in aviation and high octane automobile gasoline, as a nonclinical thermometer liquid and suspension solution for navigational instruments.

Other Designations: CAS No. 108-88-3, Methacide, methylbenzene, methylbenzol, phenylmethane, toluol, Tolu-sol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

R 1 NFPA
I 3
S 2*
K 3
* Skin absorption

HMIS
H 2 Chronic effects
F 3
R 0
PPE-Sec. 8

Cautions: Toluene is an eye, skin, and respiratory tract irritant becoming narcotic at high concentrations. Liver and kidney damage has occurred. Pregnant women chronically exposed to toluene have shown teratogenic effects. Toluene is highly flammable.

Section 2. Ingredients and Occupational Exposure Limits

Toluene, < 100%; may contain a small amount of benzene (~ 1%), xylene, and nonaromatic hydrocarbons.

1991 OSHA PELs

8-hr TWA: 100 ppm (375 mg/m³)

15-min STEL: 150 ppm (560 mg/m³)

1990 IDLH Level

2000 ppm

1990 NIOSH RELs

TWA: 100 ppm (375 mg/m³)

STEL: 150 ppm (560 mg/m³)

1992-93 ACGIH TLV (Skin)

TWA: 50 ppm (188 mg/m³)

1990 DFG (Germany) MAK*

TWA: 100 ppm (380 mg/m³)

Half-life: 2 hr to end of shift

Category II: Substances with systemic effects

Peak Exposure Limit: 500 ppm, 30 min

average value, 2/shift

1985-86 Toxicity Data†

Man, inhalation, TC_{Lo}: 100 ppm caused hallucinations, and changes in motor activity and changes in psychophysiological tests.

Human, oral, LD_{Lo}: 50 mg/kg; toxic effects not yet reviewed

Human, eye: 300 ppm caused irritation.

Rat, oral, LD₅₀: 5000 mg/kg

Rat, liver: 30 µmol/L caused DNA damage.

* Available information suggests damage to the developing fetus is probable.

†See NIOSH, RTECS (XS5250000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 232 °F (110.6 °C)

Melting Point: -139 °F (-95 °C)

Molecular Weight: 92.15

Density: 0.866 at 68 °F (20/4 °C)

Surface Tension: 29 dyne/cm at 68 °F (20 °C)

Viscosity: 0.59 cP at 68 °F (20 °C)

Refraction Index: 1.4967 at 20 °C/D

Water Solubility: Very slightly soluble, 0.6 mg/L at 68 °F (20 °C)

Other Solubilities: Soluble in acetone, alcohol, ether, benzene, chloroform, glacial acetic acid, petroleum ether, and carbon disulfide.

Vapor Pressure: 22 mm Hg at 68 °F (20 °C); 36.7 mm Hg at 86 °F (30 °C)

Saturated Vapor Density (Air = 0.075 lb/ft³ or 1.2 kg/m³): 0.0797 lb/ft³ or 1.2755 kg/m³

Odor Threshold (range of all referenced values): 0.021 to 69 ppm

Appearance and Odor: Colorless liquid with a sickly sweet odor.

Section 4. Fire and Explosion Data

Flash Point: 40 °F (4.4 °C) CC

Autoignition Temperature: 896 °F (480 °C)

LEL: 1.27% v/v

UEL: 7.0% v/v

Extinguishing Media: Toluene is a Class 1B flammable liquid. To fight fire, use dry chemical carbon dioxide, or 'alcohol-resistant' foam. Water spray may be ineffective as toluene floats on water and may actually spread fire. Unusual Fire or Explosion Hazards: Concentrated vapors are heavier than air and may travel to an ignition source and flash back. Container may explode in heat of fire. Toluene's burning rate = 5.7 mm/min and its flame speed = 37 cm/sec. Vapor poses an explosion hazard indoors, outdoors, and in sewers. May accumulate static electricity. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing provides only limited protection. Apply cooling water to sides of tanks until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from fire and let burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire because a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Toluene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization can't occur. **Chemical Incompatibilities:** Strong oxidizers, concentrated nitric acid, nitric acid + sulfuric acid, dinitrogen tetroxide, silver perchlorate, bromine trifluoride, tetranitromethane, and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidinedione. **Conditions to Avoid:** Contact with heat, ignition sources, or incompatible. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of toluene can produce carbon dioxide, and acid, irritating smoke.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,⁽¹⁶⁴⁾ NTP,⁽¹⁶⁹⁾ and OSHA⁽¹⁶⁴⁾ do not list toluene as a carcinogen. **Summary of Risks:** Toluene is irritating to the eyes, nose, and respiratory tract. Inhalation of high concentrations produces a narcotic effect sometimes leading to coma as well as liver and kidney damage. 93% of inhaled toluene is retained in the body of which 80% is metabolized to benzoic acid, then to hippuric acid and excreted in urine. The remainder is metabolized to *o*-cresol and excreted or exhaled unchanged. Toluene metabolism is inhibited by alcohol ingestion and is synergistic with benzene, asphalt fumes, or chlorinated hydrocarbons (i.e. perchloroethylene). Toluene is readily absorbed through the skin at 14 to 23 mg/cm²/hr. Toluene is absorbed quicker during exercise than at rest and appears to be retained longer in obese versus thin victims; presumably due to its lipid solubility. There is inconsistent data on toluene's ability to damage bone marrow; chronic poisoning has resulted in anemia and leucopenia with biopsy showing bone marrow hypo-plasia. These reports are few and some authorities argue that the effects may have been due to benzene contaminants. Chronic inhalation during pregnancy has been associated with teratogenic effects on the fetus including microcephaly, CNS dysfunction, attentional deficits, developmental delay + language impairment, growth retardation, and physical defects including a small midface, short palpebral fissures, with deep-set eyes, low-set ears, flat nasal bridge with a small nose, micrognathia, and blunt fingertips. There is some evidence that toluene causes an autoimmune illness in which the body produces antibodies that cause inflammation of its own kidney.

Continue on next page

Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Alcoholism and CNS, kidney, skin, or liver disease. **Target Organs:** CNS, liver, kidney, skin. **Primary Entry Routes:** Inhalation, skin contact/absorption. **Acute Effects:** Vapor inhalation causes respiratory tract irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, watering eyes, nervousness, insomnia, parasthesia, and vertigo progressing to narcotic coma. Death may result from cardiac arrest due to ventricular fibrillation with catecholamines loss. Liquid splashed in the eye causes conjunctival irritation, transient corneal damage and possible burns. Prolonged skin contact leads to drying and fissured dermatitis. Ingestion causes GI tract irritation and symptoms associated with inhalation. **Chronic Effects:** Symptoms include mucous membrane irritation, headache, vertigo, nausea, appetite loss and alcohol intolerance. Repeated heavy exposure may result in encephalopathies (cerebellar ataxia and cognitive dysfunction), liver enlargement, and kidney dystrophy (wasting away). Symptoms usually appear at workdays end, worsen at weeks end and decrease or disappear over the weekend.

IRST AID **Eyes:** Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult an ophthalmologist immediately. **Skin:** Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that conscious and alert person drink 1 to 2 glasses of water to dilute. Do not induce vomiting because of danger of aspiration into the lungs. Gastric lavage may be indicated if large amounts are swallowed; potential toxicity needs to be weighed against aspiration risk when deciding for or against gastric lavage. **Note to Physicians:** Monitor cardiac function. If indicated, use epinephrine and other catecholamines carefully, because of the possibility of a lowered myocardial threshold to the arrhythmogenic effects of such substances. Obtain CBC, electrolytes, and urinalysis. Monitor arterial blood gases. If toluene has > 0.02% (200 ppm) benzene, evaluate for potential benzene toxicity. **BEI:** p-aminic acid in urine, sample at shift end (2.5 g/g creatinine); Toluene in venous blood, sample at shift end (1.0 mg/L).

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel protect against inhalation and skin/eye contact. Use water spray to cool and disperse vapors but it may not prevent ignition in closed spaces. Cellosolve, hycar absorbent materials, and norocarbon water can also be used for vapor suppression/containment. Take up small spill with earth, sand, vermiculite, or other absorbent, noncombustible material. Dike far ahead of large spills for later reclamation or disposal. For water spills, (10 ppm or greater) apply activated carbon at 1X the spilled amount and remove trapped material with suction hoses or use mechanical dredges/lifts to remove immobilized masses of pollutants and precipitates. Toluene can undergo fluidized bed incineration at 842 to 1796 °F (450 to 980 °C), rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C), or liquid injection incineration at 1202 to 2912 °F (650 to 1600 °C). Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity values:** Blue gill, LC₅₀ = 17 mg/L/24 hr; shrimp (*Crangonfraxis coron*), LC₅₀ = 4.3 ppm/96 hr; fathead minnow (*Pimephales promelas*), LC₅₀ = 36.2 g/L/96 hr. **Environmental Degradation:** If released to land, toluene evaporates and undergoes microbial degradation. In water, toluene volatilizes and biodegrades with a half-life of days to several weeks. In air, toluene degrades by reaction with photochemically produced hydroxyl radicals.

Disposal: Treat contaminated water by gravity separation of solids, followed by skimming of surface. Pass through dual media filtration and carbon sorption units (carbon ratio 1 kg to 10 kg soluble material). Return waste water from backwash to gravity separator. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

PA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U220
 ARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
 Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg)
 [* per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307 (a)]
 Listed as a SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses with shatter-resistant glass and side-shields or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use any chemical cartridge respirator with appropriate organic vapor cartridges, any supplied-air respirator (SAR), or SCBA. For < 2000 ppm, use any SAR operated in continuous-flow mode, any SAR or SCBA with a full facepiece, or any air-purifying respirator with a full facepiece having a chin-style, front or back mounted organic vapor canister. For emergency or nonroutine operations (cleaning stills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polyvinyl alcohol with a breakthrough time of > 8 hr, Teflon and Viton are recommended as suitable materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾ **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove toluene from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from ignition sources and incompatibles. Outside or detached storage is preferred. If stored inside, use a standard flammable liquids warehouse, room, or cabinet. To prevent static sparks, electrically ground and bond all equipment used with toluene. Do not use open lights in toluene areas. Install Class 1, Group D electrical equipment. Check that toluene is free of or contains < 1% benzene before use. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Adopt controls for confined spaces (29 CFR 1910.146) if entering areas of unknown toluene levels (holes, wells, storage tanks). Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, liver, kidney, and skin. Include hemocytometric and thrombocyte count in cases where benzene is a contaminant of toluene. Monitor air at regular intervals to ensure effective ventilation.

Transportation Data (49 CFR 172.101)

OT Shipping Name: Toluene	Packaging Authorizations	Quantity Limitations	Vessel Stowage Requirements
OT Hazard Class: 3	a) Exceptions: 150	a) Passenger Aircraft or Railcar: 5L	Vessel Stowage: B
UN No.: UN1294	b) Non-bulk Packaging: 202	b) Cargo Aircraft Only: 60L	Other: --
OT Packing Group: II	c) Bulk Packaging: 242		
OT Label: Flammable Liquid			
Special Provisions (172.102): T1			

SDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 140, 148, 153, 159, 163, 164, 167, 169, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; Industrial Hygiene Review: PA Roy, CIH, MPH; Medical Review: AC Darlington, MD, MPH

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Material Safety Data Sheets Collection:

Sheet No. 385
Ethylbenzene

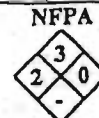
Issued: 8/78

Revision: B, 9/92

Section 1: Material Identification

Ethylbenzene (C_8H_{10}) Description: Derived by heating benzene and ethylene in presence of aluminum chloride with subsequent distillation, by fractionation directly from the mixed xylene stream in petroleum refining, or dehydrogenation of naphthenes. Used as a solvent, an antiknock agent in gasoline; and as an intermediate in production of synthetic rubber, styrene, cellulose acetate, diethylbenzene, acetophenone, ethyl anthraquinone, propyl oxide, and α -methylbenzyl alcohol. Other Designations: CAS No. 100-41-4, ethylbenzol, EB, phenylethane, NCI-CS6393. Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

R 1
I 3
S 2*
K 4
* Skin
absorption



HMIS
H 2†
F 3
R 0
PPE - Sec. 8
† Chronic
effects

Cautions: Ethylbenzene is a skin and mucous membrane irritant considered the most irritating of the benzene series. Inhalation causes acute and chronic central nervous system (CNS) effects. It is highly flammable and forms explosive mixtures with air.

Section 2: Ingredients and Occupational Exposure Limits

Ethylbenzene, ca >99.0%. Impurities include ~0.1% *meta* & *para* xylene, ~0.1% cumene, and ~0.1% toluene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m³)
15-min STEL: 125 ppm (545 mg/m³)
Action Level: 50 ppm (217 mg/m³)

1990 IDLH Level
2000 ppm

1990 NIOSH REL
TWA: 100 ppm (435 mg/m³)
STEL: 125 ppm (545 mg/m³)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m³)
STEL: 125 ppm (545 mg/m³)
1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m³)
Category 1: local irritants
Peak Exposure Limit: 200 ppm, 5 min
momentary value, max of 8/shift
Danger of cutaneous absorption

1985-86 Toxicity Data*

Human, inhalation, TC_{Lo} : 100 ppm/8 hr caused eye effects, sleep, and respiratory changes.
Human, lymphocyte: 1 mmol/L induced sister chromatid exchange.
Rat, oral, LD_{50} : 3500 mg/kg; toxic effects not yet reviewed
Rat (female), inhalation, TC_{Lo} : 1000 ppm/7 hr/day, 5 days/wk, for 3 wk prior to mating and daily for 19 days of gestation produced pups with high incidence of extra ribs.⁽¹⁷⁹⁾

* See NIOSH, *RTECS* (DA0700000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3: Physical Data

Boiling Point: 277 °F (136 °C)
Melting Point: -139 °F (-95 °C)
Surface Tension: 31.5 dyne/cm
Ionization Potential: 8.76 eV
Viscosity: 0.64 cP at 77 °F (25 °C)
Refraction Index: 1.4959 at 68 °F (20 °C)
Relative Evaporation Rate (ether = 1): 0.0106
Bulk Density: 7.21 lb/Gal at 77 °F (25 °C)
Critical Temperature: 651 °F (343.9 °C)
Critical Pressure: 35.6 atm

Molecular Weight: 106.16
Density: 0.863 at 77 °F (25 °C)
Water Solubility: Slightly, 14 mg/100 mL at 59 °F (15 °C)
Other Solubilities: Miscible in alcohol, ether; soluble in carbon tetrachloride, benzene, sulfur dioxide, and many organic solvents; insoluble in ammonia
Odor Threshold: 2.3 ppm
Vapor Pressure: 7.1 mm Hg at 68 °F (20 °C); 10 mmHg at 78.62 °F (25.9 °C); 100 mm Hg 165.38 °F (74.1 °C)
Saturated Vapor Density ($Alr = 0.075$ lb/ft³ or 1.2 kg/m³): 0.0768 lb/ft³ or 1.2298 kg/m³

Appearance and Odor: Colorless, flammable liquid with a pungent odor.

Section 4: Fire and Explosion Data

Flash Point: 64 °F (18 °C) CC

Autoignition Temperature: 810 °F (432 °C)

LEL: 1.0% v/v

UEL: 6.7% v/v

Extinguishing Media: Class 1B Flammable liquid. For small fires, use dry chemical, carbon dioxide, or 'alcohol-resistant' foam. For large fires, use fog or 'alcohol-resistant' foam. Use water only if other agents are unavailable; EB floats on water and may travel to an ignition source and spread fire. **Unusual Fire or Explosion Hazards:** Burning rate = 5.8 mm/min. Vapors may travel to an ignition source and flash back. Container may explode in heat of fire. EB poses a vapor explosion hazard indoors, outdoors, and in sewers. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Cool container sides with water until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Withdraw immediately if you hear rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5: Reactivity Data

Stability/Polymerization: Ethylbenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Reacts vigorously with oxidizers.

Conditions to Avoid: Exposure to heat and oxidizers.

Hazardous Products of Decomposition: Thermal oxidative decomposition of EB can produce acrid smoke and irritating fumes.

Section 6: Health Hazard Data

Carcinogenicity: The IARC,⁽¹⁶⁴⁾ NTP,⁽¹⁶⁹⁾ and OSHA⁽¹⁶⁴⁾ do not list EB as a carcinogen. **Summary of Risks:** Occupational exposure to EB alone is rare since it is usually present together with other solvents. EB is irritating to the eyes, skin, and respiratory tract. Vapor inhalation produces varying degrees of CNS effects depending on concentration. The liquid is absorbed through the skin but vapors are not. 56 to 64% of inhaled ethylbenzene is retained and metabolized. Urinary metabolites following exposure to 23 to 85 ppm for 8 hr are mandelic acid (64%), phenylglyoxylic acid (25%), and methylphenylcarbinol/1-phenyl ethanol (5%). Concurrent exposure to xylene and ethylbenzene causes slower excretion of EB metabolites. Based on the rat LD_{50} , one manufacturer gives 3 to 4 oz. as the lethal dose for a 100 lb person.

Continue on next page

Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Skin and CNS diseases and impaired pulmonary function (especially obstructive airway disease). **Target Organs:** Eyes, respiratory system, skin, CNS, blood. **Primary Entry Routes:** Inhalation, skin and eye contact. **Acute Effects:** Vapor inhalation of 200 ppm caused transient eye irritation; 1000 ppm caused eye irritation with profuse watering (tolerance developed rapidly); 2000 ppm caused severe and immediate eye irritation and watering, nasal irritation, chest constriction, and vertigo; 5000 ppm was intolerable and caused eye and nose irritation. Inhalation of high concentrations may cause narcosis, cramps, and death due to respiratory paralysis. Skin exposed to pure ethylbenzene for 10 to 15 min absorbed 22 to 33 mg/cm²/hr. Immersion of hand in solutions of 112 & 156 mg/L for 1 hr absorbed 118 & 215.7 µg/cm²/hr, respectively. **Chronic Effects:** Repeated skin contact may cause dryness, scaling, and fissuring. Workers chronically exposed to > 100 ppm complained of fatigue, sleepiness, headache, and mild irritation of the eyes and respiratory tract. Repeated vapor inhalation may result in blood disorders, particularly leukopenia (abnormally low level of white blood cells) and lymphocytosis.

FIRST AID

Eyes: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that conscious and alert person drink 1 to 2 glasses of water to dilute. Do not induce vomiting! Aspiration of even a small amount of EB in vomitus can cause severe damage since its low viscosity and surface tension will cause it to spread over a large area of the lung tissue.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: BEI = mandelic acid in urine (1.5 g/g of creatinine), sample at end of shift at workweeks end. Since this test is not specific, test for EB in expired air for confirmation.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate and ventilate area, deny entry and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against vapor inhalation and skin/eye contact. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container. Dike far ahead of large spill for later reclamation or disposal. Report any release >1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** If released to soil, EB partially evaporates into the atmosphere, with a half-life of hrs to wks, and some leaches into groundwater, especially in soil with low organic carbon content. Biodegradation occurs with a half-life of 2 days. Some EB may absorb to sediment or bioconcentrate in fish. Evidence points to slow biodegradation in groundwater. In air, it reacts with photochemically produced hydroxyl radicals with a half-life of hrs to 2 days. Additional amounts may be removed by rain. **Ecotoxicity Values:** Shrimp (*Mysidopsis bahia*), LC₅₀ = 87.6 mg/L/96 hr; sheepshead minnow (*Cyprinodon variegatus*) LC₅₀ = 275 mg/L/96 hr; fathead minnow (*Pimephales promelas*) LC₅₀ = 42.3 mg/L/96 hr in hard water & 48.5 mg/L/96 hr in softwater. **Disposal:** A candidate for rotary kiln incineration at 1508 to 2912°F (820 to 1600°C), liquid injection incineration at 1202 to 2912°F (650 to 1600°C), and fluidized bed incineration at 842 to 1796°F (450 to 980°C). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.21): No. D001

Listed as a SARA Toxic Chemical (40 CFR 372.65)

SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311 (b)(4) & CWA, Sec. 307 (a)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use a powered air-purifying respirator with an appropriate organic vapor cartridge, a supplied-air respirator (SAR), SCBA, or chemical cartridge respirator with appropriate organic vapor cartridge. For < 2000 ppm, use a SAR or SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made of Viton or polyvinylchloride to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾ **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in a cool, dry, well-ventilated area away from ignition sources and oxidizers. Outside or detached storage is preferred. If inside, store in a standard flammable liquids cabinet. Containers should have flame-arrestor or pressure-vacuum venting. To prevent static sparks, electrically ground and bond all equipment used with ethylbenzene. Install Class 1, Group D electrical equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain levels as low as possible. Purge and ventilate reaction vessels before workers are allowed to enter for maintenance or cleanup. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, skin, blood, and respiratory system.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Ethylbenzene

DOT Hazard Class: 3

ID No.: UN1175

DOT Packing Group: II

DOT Label: Flammable liquid

Special Provisions (172.102): T1

Packaging Authorizations

a) Exceptions: 173.150

b) Non-bulk Packaging: 173.202

c) Bulk Packaging: 173.242

Quantity Limitations

a) Passenger Aircraft or Railcar: 5L

b) Cargo Aircraft Only: 60 L

Vessel Stowage Requirements

a) Vessel Stowage: B

b) Other: —

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 153, 159, 162, 163, 164, 167, 168, 171, 176, 179

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** W Silverman, MD



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Material Safety Data Sheets Collection:

Sheet No. 318
Xylene (Mixed Isomers)

Issued: 11/80 Revision: E, 9/92 Errata: 12/94

Section 1. Material Identification

Xylene (Mixed Isomers) (C_8H_{10}) Description: The commercial product is a blend of the three isomers [ortho-(*o*-), meta-(*m*-), para-(*p*-)] with the largest proportion being *m*-xylene. Xylene is obtained from coal tar, toluene by transalkylation, and pseudocumene. Used in the manufacture of dyes, resins, paints, varnishes, and other organics; as a general solvent for adhesives, a cleaning agent in microscope technique; as a solvent for Canada balsam microscopy; as a fuel component; in aviation gasoline, protective coatings, sterilizing catgut, hydrogen peroxide, perfumes, insect repellants, pharmaceuticals, and the leather industry; in the production of phthalic anhydride, isophthalic, and terephthalic acids and their dimethyl esters which are used in the manufacture of polyester fibers; and as an indirect food additive as a component of adhesives. Around the home, xylene is found as vehicles in paints, paint removers, degreasing cleaners, lacquers, glues and cements and as solvent/vehicles for pesticides.

Other Designations: CAS No. 1330-20-7 [95-47-6; 108-38-3; 106-42-3 (*o*-, *m*-, *p*-isomers)], dimethylbenzene, methyltoluene, NCI-C55232, Violet 3, xylol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

Cautions: Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

R 1
I 2
S 2
K 3

NFPA



HMIS

H 2+

F 3

R 0

PPE ‡

‡ Chronic Effects

‡ Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Xylene (mixed isomers): the commercial product generally contains ~ 40% *m*-xylene; 20% each of *o*-xylene, *p*-xylene, and ethylbenzene; and small quantities of toluene. Unpurified xylene may contain pseudocumene.

1991 OSHA PELs

8-hr TWA: 100 ppm (435 mg/m³)

15-min STEL: 150 ppm (655 mg/m³)

1990 IDLH Level

1000 ppm

1990 NIOSH RELs

TWA: 100 ppm (435 mg/m³)

STEL: 150 ppm (655 mg/m³)

1992-93 ACGIH TLVs

TWA: 100 ppm (434 mg/m³)

STEL: 150 ppm (651 mg/m³)

BEI (Biological Exposure Index): Methylhippuric acids in urine at end of shift: 1.5 g/g creatinine

1990 DFG (Germany) MAK

TWA: 100 ppm (440 mg/m³)

Category II: Substances with systemic effects

Half-life: < 2 hr

Peak Exposure: 200 ppm, 30 min, average value, 4 peaks per shift

1985-86 Toxicity Data*

Human, inhalation, TC₅₀: 200 ppm produced olfaction effects, conjunctiva irritation, and other changes involving the lungs, thorax, or respiration.

Man, inhalation, LC₅₀: 10000 ppm/6 hr; toxic effects not yet reviewed.

Human, oral, LD₅₀: 50 mg/kg; no toxic effect noted.

Rat, oral, LD₅₀: 4300 mg/kg; toxic effect not yet reviewed.

Rat, inhalation, LC₅₀: 5000 ppm/4 hr; toxic effects not yet reviewed.

* See NIOSH, RTECS (XE2100000), for additional toxicity data.

Section 3. Physical Data

Boiling Point Range: 279 to 284 °F (137 to 140 °C)*

Boiling Point: ortho: 291 °F (144 °C); meta: 281.8 °F (138.8 °C);

para: 281.3 °F (138.5 °C)

Freezing Point/Melting Point: ortho: -13 °F (-25 °C);

meta: -53.3 °F (-47.4 °C); para: 55 to 57 °F (13 to 14 °C)

Vapor Pressure: 6.72 mm Hg at 70 °F (21 °C)

Saturated Vapor Density (Air = 1.2 kg/m³): 1.23 kg/m³, 0.077 lbs/ft³

Appearance and Odor: Clear, sweet-smelling liquid.

* Materials with wider and narrower boiling ranges are commercially available.

Molecular Weight: 106.16

Specific Gravity: 0.864 at 20 °C/4 °C

Water Solubility: Practically insoluble

Other Solubilities: Miscible with absolute alcohol, ether, and many other organic liquids.

Octanol/Water Partition Coefficient: logKow = 3.12-3.20

Odor Threshold: 1 ppm

Viscosity: <32.6 SUS

Section 4. Fire and Explosion Data

Flash Point: 63 to 77 °F (17 to 25 °C) CC **Autoignition Temperature:** 982 °F (527 °C) (*m*-) **LEL:** 1.1 (*m*-, *p*-); 0.9 (*o*-) **UEL:** 7.0 (*m*-, *p*-); 6.7 (*o*-)

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO₂), water spray or regular foam. For large fires, use water spray, fog or regular foam. Water may be ineffective. Use water spray to cool fire-exposed containers. **Unusual Fire or Explosion Hazards:** Xylene vapors or liquid (which floats on water) may travel to an ignition source and flash back. The heat of fire may cause containers to explode and/or produce irritating or poisonous decomposition products. Xylene may present a vapor explosion hazard indoors, outdoors, or in sewers. Accumulated static electricity may occur from vapor or liquid flow sufficient to cause ignition. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing will provide limited protection. If feasible and without risk, move containers from fire area. Otherwise, cool fire-exposed containers until well after fire is extinguished. Stay clear of tank ends. Use unmanned hose holder or monitor nozzles for passive cargo fires. If impossible, withdraw from area and let fire burn. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Xylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Xylene is easily chlorinated, sulfonated, or nitrated. **Chemical Incompatibilities:** Incompatibilities include strong acids and oxidizers and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin). Xylene attacks some forms of plastics, rubber, and coatings. **Conditions to Avoid:** Avoid heat and ignition sources and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of xylene can produce carbon dioxide, carbon monoxide, and various hydrocarbon products.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,⁽¹⁶⁴⁾ NTP,⁽¹⁶⁹⁾ and OSHA⁽¹⁶⁴⁾ do not list xylene as a carcinogen. **Summary of Risks:** Xylene is an eye, mucous membrane, and respiratory tract irritant. Irritation starts at 200 ppm; severe breathing difficulties which may be delayed in onset can occur at high concentrations. It is a central nervous system (CNS) depressant and at high concentrations can cause coma. Kidney and liver damage can occur with xylene exposure. With prolonged or repeated cutaneous exposure, xylene produces a defatting dermatitis. Chronic toxicity is not well defined, but it is less toxic than benzene. Prior to the 1950s, benzene was often found as a contaminant of xylene and the effects attributed to xylene such as blood dyscrasias are questionable. Since the late 1950s, xylenes have been virtually benzene-free and blood dyscrasias have not been associated with xylenes. Chronic exposure to high concentrations of xylene in animal studies have demonstrated mild reversible decrease in red and white cell counts as well as increases in platelet counts.

Continue on next page

Section 6. Health Hazard Data, continued

Menstrual irregularity was reported in association with workplace exposure to xylene perhaps due to effects on liver metabolism. Xylene crosses the human placenta, but does not appear to be teratogenic under conditions tested to date. **Medical Conditions Aggravated by Long-Term Exposure:** CNS, respiratory, eye, skin, gastrointestinal (GI), liver and kidney disorders. **Target Organs:** CNS, eyes, GI tract, liver, kidneys, and skin. **Primary Entry Routes:** Inhalation, skin absorption (slight), eye contact, ingestion. **Acute Effects:** Inhalation of high xylene concentrations may cause dizziness; nausea, vomiting, and abdominal pain; eye, nose, and throat irritation; respiratory tract irritation leading to pulmonary edema (fluid in lung); drowsiness; and unconsciousness. Direct eye contact can result in conjunctivitis and corneal burns. Ingestion may cause a burning sensation in the oropharynx and stomach and transient CNS depression. **Chronic Effects:** Repeated or prolonged skin contact may cause drying and defatting of the skin leading to dermatitis. Repeated eye exposure to high vapor concentrations may cause reversible eye damage, peripheral and central neuropathy, and liver damage. Other symptoms of chronic exposure include headache, fatigue, irritability, chronic bronchitis, and GI disturbances such as nausea, loss of appetite, and gas.

FIRST AID Emergency personnel should protect against exposure. **Eyes:** Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Carefully dispose of contaminated clothing as it may pose a fire hazard. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. Monitor exposed person for respiratory distress. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, *do not induce vomiting!* If spontaneous vomiting should occur, keep exposed person's head below the hips to prevent aspiration (breathing liquid xylene into the lungs). *Aspiration of a few millimeters of xylene can cause chemical pneumonitis, pulmonary edema, and hemorrhage.* **Note to Physicians:** Hippuric acid or the ether glucuronide of ortho-toluic acid may be useful in diagnosis of meta-, para- and ortho-xylene exposure, respectively. Consider gastric lavage if a large quantity of xylene was ingested. Proceed gastric lavage with protection of the airway from aspiration; consider endotracheal intubation with inflated cuff.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and ventilate spill area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If feasible and without undue risk, stop leak. Use appropriate foam to blanket release and suppress vapors. Water spray may reduce vapor, but does not prevent ignition in closed spaces. For small spills, absorb on paper and evaporate in appropriate exhaust hood or absorb with sand or some non-combustible absorbent and place in containers for later disposal. For large spills dike far ahead of liquid to contain. Do not allow xylene to enter a confined space such as sewers or drains. On land, dike to contain or divert to impermeable holding area. Apply water spray to control flammable vapor and remove material with pumps or vacuum equipment. On water, contain material with natural barriers, booms, or weirs; apply universal gelling agent; and use suction hoses to remove spilled material. Report any release in excess of 1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** Little bioconcentration is expected. Biological oxygen demand 5 (after 5 days at 20 °C): 0.64 (no stated isomer). Ecotoxicity values: LD₅₀, Goldfish, 13 mg/L/24 hr, conditions of bioassay not specified, no specific isomer. **Environmental Degradation:** In the atmosphere, xylenes degrade by reacting with photochemically produced hydroxyl radicals with a half-life ranging from 1-1.7 hr. in the summer to 10-18 hr in winter or a typical loss of 67-86% per day. Xylenes are resistant to hydrolysis. **Soil Absorption/Mobility:** Xylenes have low to moderate adsorption to soil and when spilled on land, will volatilize and leach into groundwater. **Disposal:** As a hydrocarbon, xylene is a good candidate for controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U239, F003 (spent solvent)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4); per RCRA, Sec. 3001]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations >1000 ppm, use any chemical cartridge respirator with organic vapor cartridges; any powered, air-purifying respirator with organic vapor cartridges; any supplied-air respirator; or any self-contained breathing apparatus. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. With breakthrough times > 8 hr, consider polyvinyl alcohol and fluorocarbon rubber (Viton) as materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾ **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in clearly labelled, tightly closed, containers in a cool, well-ventilated place, away from strong oxidizing materials and heat and ignition sources. During transferring operations, electrically ground and bond metal containers. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Use hermetically sealed equipment, transfer xylene in enclosed systems, avoid processes associated with open evaporating surfaces, and provide sources of gas release with enclosures and local exhaust ventilation. Use Class I, Group D electrical equipment. **Administrative Controls:** Establish air and biological monitoring programs and evaluate regularly. Consider preplacement and periodic medical examinations including a complete blood count, a routine urinalysis, and liver function tests. Consider hematologic studies if there is any significant contamination of the solvent with benzene. If feasible, consider the replacement of xylene by less toxic solvents such as petrol (motor fuel) or white spirit. Before carrying out maintenance and repair work, steam and flush all equipment to remove any xylene residues.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Xylenes

DOT Hazard Class: 3

ID No.: UN1307

DOT Packing Group: II

DOT Label: Flammable Liquid

Special Provisions (172.102): T1

Packaging Authorizations

a) Exceptions: 173.150

b) Nonbulk Packaging: 173.202

c) Bulk Packaging: 173.242

Quantity Limitations

a) Passenger, Aircraft, or Railcar: 5L

b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements

a) Vessel Stowage: B

b) Other: -

MSDS Collection References: 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 176, 180.

Prepared by: MJ Wurth, BS: Industrial Hygiene Review: PA Roy, MPH. CIH: Medical Review: W Silverman, MD



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Material Safety Data Sheet Collection

Acenaphthene

MSDS No. 975

Date of Preparation: 10/95

Section 1 - Chemical Product and Company Identification

47

Product/Chemical Name: Acenaphthene

Chemical Formula: $C_{10}H_6(CH_2)_2$

CAS Number: 83-32-9

Synonyms: 1,2-dihydroacenaphthylene; 1,8-dihydroacenaphthalene; 1,8-ethylenenaphthalene; ethylenenaphthalene; naphthyleneethylene; periethylenenaphthalene

Derivation: By passing ethylene and benzene or naphthalene through a red hot tube; by heating tetrahydroacenaphthene with sulfur to 356 °F (180 °C); or by reacting acenaphthenone or acenaphthenequinone by high-pressure hydrogenation in decalin with nickel at 356 to 464 °F (180 to 240 °C). Occurs as a by-product in coal tar production during the high-temperature carbonization or coking of coal.

General Use: Used as an intermediate for dyes, pharmaceuticals, insecticides, fungicides, and plastics.

Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Acenaphthene, ca 98 %wt

OSHA PEL

Nuisance Particulates

8-hr TWA: 15 mg/m³ (total dust), 5 mg/m³ (respirable fraction)

ACGIH TLV*

Nuisance Particulates

TWA: 10 mg/m³

NIOSH REL

None established

DFG (Germany) MAK

None established

* Notice of intended change to 10 mg/m³ (inhalable), 3 mg/m³ (respirable).

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Acenaphthene exists as white, needle-like crystals. There is very limited information on the toxicity of acenaphthene. It is irritating to the skin, eyes, and mucous membranes and may cause vomiting if large amounts are ingested. Animal studies indicate possible mutagenic activity. It is combustible.

Potential Health Effects

Primary Entry Routes: Inhalation, skin and eye contact.

Target Organs: Eyes, skin, respiratory tract.

Acute Effects

Inhalation: Irritation of the respiratory tract may occur.

Eye: Irritation may occur.

Skin: Irritation may occur.

Ingestion: Ingestion of large amounts may cause vomiting. Irritation of the gastrointestinal tract may occur.

Carcinogenicity: IARC, NTP, and OSHA do not list acenaphthene as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Pre-existing skin disorders.

Chronic Effects: None reported.

Wilson

Risk
Scale

R 1

I 2

S 2

K 1

HMIS

H 1

F 1

R 0

PPE*

* Sec. 8

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water followed by a thorough soap and water wash.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water to dilute. Vomiting may be spontaneous if large amounts are ingested.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

Flash Point: Combustible

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

Flammability Classification: Combustible Solid

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, fog, or foam.

Unusual Fire or Explosion Hazards: None reported.

Hazardous Combustion Products: Carbon oxide(s).

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

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Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate and ventilate area.

Small Spills: *Do not sweep!* Carefully scoop up or vacuum (with appropriate filter) and place in suitable containers.

Large Spills

Containment: Flush spills with water to containment area for later disposal. *Do not* release into sewers or waterways.

Cleanup: Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use only with ventilation adequate to prevent airborne hazards. *Do not* use near heat and ignition sources.

Storage Requirements: Store in a cool, dry, well-ventilated area away from heat, ignition sources and incompatibles (Sec. 10).

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where possible, enclose all processes to prevent dust dispersion into work area. To prevent static sparks, electrically ground and bond all equipment used with and around acenaphthene.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations at least as low as those given for *nuisance dusts* (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾

Administrative Controls: Consider periodic medical exams to determine if any irritation upon exposure to acenaphthene has occurred.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** *Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove acenaphthene from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using acenaphthene, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: White, needle-like crystals

Odor Threshold: 0.5048 mg/m³

Vapor Pressure: < 0.02 mm Hg at 68 °F (20 °C);

10 mm Hg at 268 °F (131 °C)

Formula Weight: 154.21

Specific Gravity (H₂O=1, at 4 °C): 1.0242 at (194 °F) 90 °C.

Water Solubility: 100 mg/L

Other Solubilities: Soluble as 1 g/ 31 mL (ethanol), 56 mL (methanol), 25 mL (propanol), 2.5 mL (chloroform), 5 mL (benzene & toluene); 3.2 g/100 mL glacial acetic acid.

Boiling Point: 531.5 °F (277.5 °C)

Melting Point: 200.5 °F (93.6 °C)

Refractive Index: 1.6048 at 212 °F (100 °C)

Octanol/Water Partition Coefficient: log K_{ow} = 3.92

Henry's Law Constant: 1.55 x 10⁻⁴ atm/m³/mole at 77 °F (25 °C):

Section 10 - Stability and Reactivity

Stability: Acenaphthene is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Acenaphthene reacts with molecular oxygen in the presence of alkali-earth metal bromides to form acenaphthequinone; reacts with ozone in the presence of alkali-earth metal hydroxides to form 1,8-naphthaldehyde carboxylic acid; and is oxidized to aromatic alcohols and ketones by reaction with transition metal catalysts.

Conditions to Avoid: Exposure to heat, ignition sources, and incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of acenaphthene can produce carbon oxide(s) and thick, acrid smoke.

Section 11 - Toxicological Information**Toxicity Data:*****Acute Effects:**

Rat, intraperitoneal, LD₅₀: 600 mg/kg

Mutagenicity:

Microorganisms (species unspecified): 3 mg (-S9) caused mutation.

* See NIOSH, *RTECS* (AB1000000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: *Pimephales promelas* (fathead minnow), LC₅₀ = 1700 µg/L/72 hr, 1600 µg/L/96 hr; *Salmo gairdneri* (rainbow trout), LC₅₀ = 1570 µg/L/24 hr, 1130 µg/L/48 hr, 800 µg/L/72 hr, 670 µg/L/96 hr.

Environmental Fate: In soil, acenaphthene will biodegrade under aerobic conditions with a half-life of 10 to 60 days. A soil absorption coefficient of 2065 to 3230 indicates slight mobility. In water, biodegradation will occur under aerobic conditions with a half-life of 1 to 25 days, as well as photolysis in direct sunlight. Volatilization is another means of removal with half-lives of 11 hr from a model river and 39 days from a model pond which considers the effect of adsorption. In air, acenaphthene reacts with photochemically-produced hydroxyl radicals with a half-life of 7.2 hr.

Section 13 - Disposal Considerations

Disposal: Acenaphthene is a good candidate for rotary-kiln incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Transportation Data (49 CFR 172.101):****Shipping Name:**

Environmentally Hazardous
Substances, solid, n.o.s.

Shipping Symbols: -

Hazard Class: 9

ID No.: UN3077

Packing Group: III

Label: Class 9

Special Provisions (172.102): 8,

B54, N50

Packaging Authorizations

- a) Exceptions: 173.155
- b) Non-bulk Packaging: 173.213
- c) Bulk Packaging: 173.240

Quantity Limitations

- a) Passenger, Aircraft, or Railcar: None
- b) Cargo Aircraft Only: None

Vessel Stowage Requirements

- a) Vessel Stowage: A
- b) Other: -

Section 15 - Regulatory Information**EPA Regulations:**

RCRA Hazardous Waste (40 CFR 261.33): Not listed

CERCLA Hazardous Substance (40 CFR 302.4) listed per CWA, Sec. 307(a)

CERCLA Reportable Quantity (RQ), 100 lb (45.4 kg)

SARA Toxic Chemical (40 CFR 372.65): Not listed

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): Not listed*

*Not listed as acenaphthene but does fall under the category *Nuisance Particulates, not otherwise specified*.



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Material Safety Data Sheets Collection

Benzo(a)pyrene

MSDS No. 164

Date of Preparation: 2/94

Section 1 - Chemical Product and Company Identification

4

Product/Chemical Name: Benzo(a)pyrene

Chemical Formula: $C_{20}H_{12}$; a polynuclear aromatic hydrocarbon

CAS No.: 50-32-8

Synonyms: BaP; 3,4-benz(a)pyrene; BP; 3,4-benzopyrene; 3,4-benzpyrene. Formerly called 1,2-benzpyrene.

Derivation: Synthesized from pyrene and succinic anhydride.

General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires. **Vendors:** Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Benzo(a)pyrene, ca 100 %wt; except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PELs

Coal tar pitch volatiles

8-hr TWA: 0.2 mg/m³

ACGIH TLVs

A2: Suspected Human Carcinogen

NIOSH REL

10-hr TWA: 0.1 mg/m³

Carcinogen; coal tar pitch volatile,
cyclohexane extractable fraction.

DFG (Germany) MAK

None established

IDLH Level

700 mg/m³

Coal tar pitch volatiles (benzene soluble
fraction)

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Benzo(a)pyrene is a pale yellow, crystalline solid or powder that is irritating to the skin, eyes, and respiratory tract. It is a carcinogen and mutagen. Handle with extreme caution!

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion. **Target Organs:** Respiratory system, bladder, kidneys, skin.

Acute Effects: Inhalation: Respiratory tract irritation. Eye: Irritation and/or burns on contact. Skin: Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization). Ingestion: None reported.

Carcinogenicity: IARC, NTP, NIOSH, ACGIH, EPA, and MAK list benzo(a)pyrene as: an IARC 2A (probably carcinogenic to humans: limited human evidence, sufficient evidence in experimental animals), an NTP-2 (reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals), a NIOSH-X (carcinogen defined with no further categorization); an ACGIH TLV-A2 (suspected human carcinogen: carcinogenic in experimental animals, but available epidemiological studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans); an EPA-B2 (sufficient evidence from animal studies, inadequate evidence or no data from epidemiological studies); and an MAK-A1 (capable of inducing malignant tumors as shown by experience with humans) carcinogen, respectively.

Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.

Chronic Effects: Inhalation: Cough and bronchitis. Eye: Photosensitivity and irritation. Skin: Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization).

Other: Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.

Comments: Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).

Wilson
Risk
Scale
R 1
I 4
S 4
K 1

HMIS
H 2*
F 1
R 0
* Chronic
Effects
PPE†
†Sec. 8

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persists.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.

Special Precautions/Procedures: Emergency personnel should protect against exposure.

Section 5 - Fire-Fighting Measures

Flash Point: None reported. Benzo(a)pyrene may burn, but does not readily ignite.

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.

Unusual Fire or Explosion Hazards: None reported.

Hazardous Combustion Products: Carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

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Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.

Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.

Large Spills

Containment: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways.

Cleanup: Do not dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. Do not reuse contaminated cleaning materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.

Storage Requirements: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory.

Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)

Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV₁, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semi-

annual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure-demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: Pale yellow monoclinic needles with a faint, aromatic odor.

Vapor Pressure: >1 mm Hg at 68 °F (20 °C)

Formula Weight: 252.30

Specific Gravity (H₂O=1, at 4 °C): 1.351

Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)

Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Boiling Point: >680 °F (>360 °C); 540 °F (310 °C) at 10 mm Hg

Melting Point: 354 °F (179 °C)

Octanol/Water Partition Coefficient: log K_{ow} = 6.04

Section 10 - Stability and Reactivity

Stability: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Conditions to Avoid: Avoid heat and ignition sources and incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11- Toxicological Information

Toxicity Data: *

Tumorigenic Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Mouse, inhalation: 200 ng/m³/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

Teratogenicity:

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Mouse, oral: 75 mg/kg administered to the female during the 12-14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Skin Effects:

Mouse: 14 µg caused mild irritation.

Mutagenicity:

Human, liver cell: 100 nmol/L caused DNA damage.

Human, lung cell: 1 µmol/L caused DNA damage.

Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

* See NIOSH, RTECS (DJ3675000), for additional toxicity data.

Section 12 - Ecological Information**Ecotoxicity:** Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.**Environmental Transport:** Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp.*), snails (*Littornia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.**Environmental Degradation:** If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr).**Soil Absorption/Mobility:** It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.**Section 13 - Disposal Considerations****Disposal:** Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.**Section 14 - Transport Information****DOT Transportation Data (49 CFR 172.101):****Shipping Name:** Environmentally hazardous substances, solid, n.o.s.***Shipping Symbols:** —**Hazard Class:** 9**ID No.:** UN3077**Packing Group:** III**Label:** Class 9**Special Provisions (172.102):** 8, B54**Packaging Authorizations**

a) Exceptions: 173.155

b) Non-bulk Packaging:
173.213

c) Bulk Packaging: 173.240

Quantity Limitations

a) Passenger, Aircraft, or Railcar: None

b) Cargo Aircraft Only: None

Vessel Stowage Requirements

a) Vessel Stowage: A

b) Other: —

* If it is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) of 1 lb (0.454 kg)

Section 15 - Regulatory Information**EPA Regulations:**

Listed as a RCRA Hazardous Waste (40 CFR 261.33)

RCRA Hazardous Waste Number: U022

Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA and CWA, Sec. 307(a)

CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)

SARA 311/312 Codes: 1,2

SARA Toxic Chemical (40 CFR 372.65): Not listed

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

Listed as an OSHA Specifically Regulated Substance, Coal Tar Pitch Volatiles, (29CFR 1910.1002)

Section 16 - Other Information**References:** 73, 103, 124, 127, 132, 133, 136, 139, 148, 164, 169, 174, 175, 184, 187, 189, 190**Prepared By:** MJ Wurth, BS **Industrial Hygiene Review:** PA Roy, MPH **Medical Review:** T Thoburn, MD, MPH**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.



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Material Safety Data Sheet Collection

Bromodichloromethane MSDS No. 973

Date of Preparation: 10/95

Section 1 - Chemical Product and Company Identification

47

Product/Chemical Name: Bromodichloromethane

Chemical Formula: CHBrCl₂

CAS Number: 75-27-4

Synonyms: BDCM; dichlorobromomethane; methane, bromodichloro-; monobromodichloromethane

Derivation: Produced by treating the chlorine analog with hydrogen bromide in the presence of an aluminum halide catalyst.

Bromodichloromethane is found in treated (chlorinated) water at levels significantly higher than untreated water.

General Use: Used in research as a laboratory reagent or for chemical synthesis. Formerly used as a flame retardant, in fire extinguishers, as a solvent for waxes, fats, and resins, and to separate minerals from salts.

Vendors: No longer produced or used commercially in the US.

Section 2 - Composition / Information on Ingredients

Bromodichloromethane, ca 98+ % vol

OSHA PEL

None established

ACGIH TLV

None established

NIOSH REL

None established

DFG (Germany) MAK

None established

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Bromodichloromethane exists as a colorless, volatile liquid. It is toxic to the central nervous system, resulting in sleep disturbances and fatigue. Liver and kidney damage may also occur. Bromodichloromethane is considered to be a potential human carcinogen based on animal studies. It is nonflammable as indicated by its former use as a flame retardant.

Potential Health Effects

Primary Entry Routes: Inhalation

Target Organs: Central nervous system (CNS), blood, liver, kidneys.

Acute Effects

Inhalation: CNS effects including fatigue, sleep disturbances, and incoordination. Methemoglobinemia (lack of oxygenated blood in body tissues), evident by a bluish tint to skin, lips, and fingernails, is also likely.

Eye: No effects reported.

Skin: No effects reported.

Ingestion: CNS effect may occur as via inhalation.

Carcinogenicity: IARC (Group 2B, possible human carcinogen with limited human evidence in the absence of animal evidence) and NTP (Group 2, probable human carcinogen with sufficient animal evidence and insufficient human evidence).

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Repeated exposure to bromodichloromethane has resulted in liver and kidney carcinogenicity in animals. It is not known whether or not chronic exposure will produce cancer in humans. Human mutation data has been reported (Sec. 11).

Other: Bromodichloromethane is metabolized to carbon monoxide in the liver. Therefore, toxic effects to the nervous system are due to carbon monoxide formation. This also explains why the liver can be adversely affected. Exposure to acetone and chlordecone potentiates liver toxicity.

Wilson
Risk
Scale
R 1
I 3
S 1
K 1

HMIS
H 2*
F 0
R 0

*Chronic
Effects
PPE†
†Sec. 8

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min.

Skin Contact: Quickly remove contaminated clothing. Rinse with plenty of water followed by a thorough soap and water wash.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water to dilute. Inducement of vomiting should not be necessary except in cases of large ingestions.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable

Autoignition Temperature: Nonflammable

LEL: Nonflammable

UEL: Nonflammable

Flammability Classification: Nonflammable

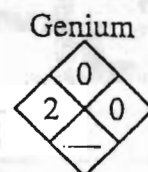
Extinguishing Media: Use agents suitable for surrounding fire.

Unusual Fire or Explosion Hazards: None reported.

Hazardous Combustion Products: Thermal decomposition can result in chlorine, phosgene, bromine and carbon oxide(s) gases.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel and ventilate area. Cleanup personnel should protect against inhalation.

Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers.

Large Spills

Containment: Dike far ahead of spill for later disposal. Do not release into sewers or waterways.

Cleanup: Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use only with ventilation sufficient to maintain airborne concentrations at nonhazardous levels.

Storage Requirements: Store in a cool, dry, well-ventilated area away from sources of elevated temperatures.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: No additional controls are necessary.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾

Administrative Controls: Employees should be informed of the potential carcinogenicity of bromodichloromethane and periodic medical exams should be used to detect any abnormal kidney or liver activity.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove bromodichloromethane from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using bromodichloromethane, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance and Odor: Colorless

Odor Threshold: 1680 mg/m³

Vapor Pressure: 50 mm Hg at 68 °F (20 °C)

Saturated Vapor Density (Air = 1.2 kg/m³, 0.075 lb/ft³):
1.57 kg/m³ or 0.098 lb/ft³

Formula Weight: 163.83

Refractive Index: 1.4964 at 68 °F (20 °C)

Specific Gravity (H₂O=1, at 4 °C): 1.980 at 68 °F (20 °C)

Water Solubility: 4,500 mg/L

Other Solubilities: Soluble in alcohol, acetone, benzene, chloroform, and ethyl ether.

Boiling Point: 195 °F (90.6 °C)

Freezing Point: -70.8 °F (-57.1 °C)

Octanol/Water Partition Coefficient: log K_{ow} = 1.88 (calc)

Henry's Law Constant: 1.6 x 10⁻³ atm/m³/mole at 68 °F (20 °C)

Section 10 - Stability and Reactivity

Stability: Bromodichloromethane is stable at room temp. in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: None reported.

Conditions to Avoid: Exposure to elevated temperatures.

Hazardous Decomposition Products: Thermal oxidative decomposition of bromodichloromethane can produce chlorine, bromine, phosgene, and carbon oxide(s) gases.

Section 11 - Toxicological Information**Toxicity Data:*****Acute Oral Effects:**

Rat, oral, LD₅₀: 430 mg/kg caused somnolence, tremor, and liver changes.

Mouse, oral, LD₅₀: 450 mg/kg caused changes in circulation, fatty liver degeneration, and hemorrhage.

Mutagenicity:

Human, lymphocyte: 400 µmol/L caused sister chromatid exchange.

Mouse, lymphocyte: 180 mg/L (+S9) caused mutation.

Multiple Dose Toxicity Data:

Rat, oral: 5670 mg/kg administered continuously for 4 weeks resulted in changes in liver weight and serum composition, and weight loss or decreased weight gain.

Tumorigenicity:

Rat, oral: 25.5 g/kg administered continuously for 2 years produced gastrointestinal and kidney tumors.

Mouse, oral: 38.25 g/kg administered continuously for 2 years produced liver tumors.

* See NIOSH, RTECS (PA5310000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Data not found.

Environmental Fate: If released to soil, bromodichloromethane is expected to volatilize due to its high vapor pressure. Because it is highly mobile in soil, leaching will occur and biodegradation will occur under anaerobic conditions. In water, volatilization is expected to be relatively rapid with a typical half-life from streams and rivers of 35 hr. Bioconcentration is not expected to be significant (BCF = 0.72 to 1.37). In air, bromodichloromethane is expected to exist almost entirely in the vapor phase and react with hydroxyl radicals in the troposphere (half-life = 6.65 months). This persistent half-life indicates that long-range global transport is possible. Any bromodichloromethane that does not undergo reaction with hydroxyl radicals can reach the stratosphere, where it will be destroyed via photolysis.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Transportation Data (49 CFR 172.101):**

Shipping Name: Environmentally Hazardous Substance, liquid, n.o.s.

Shipping Symbols: -

Hazard Class: 9

ID No.: UN3082

Packing Group: III

Label: Class 9

Special Provisions (172.102): 8, N50, T1

Packaging Authorizations

a) Exceptions: 173.155

b) Non-bulk Packaging: 173.203

c) Bulk Packaging: 173.241

Quantity Limitations

a) Passenger, Aircraft, or Railcar: None

b) Cargo Aircraft Only: None

Vessel Stowage Requirements

a) Vessel Stowage: A

b) Other: -

Section 15 - Regulatory Information**EPA Regulations:**

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per CWA, Sec. 307(a)

CERCLA Reportable Quantity (RQ), 5000 lb (2270 kg)

Listed as a SARA Toxic Chemical (40 CFR 372.65)

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): Not listed

Section 16 - Other Information

References: 73, 103, 136, 189, 198

Prepared By M Gannon, BA
Industrial Hygiene Review PA Roy, MPH, CIH
Medical Review W Boucher, MD

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**Section 1. Material Identification**

41

Methyl Ethyl Ketone (CH₃CH₂COCH₃) Description: Derived by dehydrogenation or selective oxidation of *sec*-butyl alcohol; from mixed *n*-butylenes and sulfuric acid, followed by distillation to separate *sec*-butyl alcohol and then dehydrogenation; or by controlled oxidation of butane. Used as a solvent for printing inks and cellulose compounds (nitrocellulose particular), constituent of dewaxing compositions; in the manufacture of acrylic and vinyl surface coatings, paint removers, cements and adhesives, artificial leather, cosmetics, lubricating oils, pharmaceuticals, smokeless powder and explosives, and cleaning fluids.

Other Designations: CAS No. 78-93-3, 2-butanone, ethyl methyl ketone, methylacetone, 2-oxobutane.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

Warnings: Methyl ethyl ketone is a flammable liquid. Vapors are irritating to the eyes and respiratory tract. It potentiates the neurotoxic potential of other chemicals and some findings suggest it may be neurotoxic itself.

R	1 -	NFPA
I	2 -	
S	2*	
K	4	
* Skin absorption		
HMIS		
H	2	
F	3	
R	0	
PPE†		
† Sec. 8		

Section 2. Ingredients and Occupational Exposure Limits

Methyl ethyl ketone, ca 100%

1992 OSHA PELs**Transitional Limit**

8-hr TWA: 200 ppm (590 mg/m³)

Final Rule Limits

8-hr TWA: 200 ppm (590 mg/m³)

15-min STEL: 300 ppm (885 mg/m³)

1992 NIOSH RELs

8-hr TWA: 200 ppm (590 mg/m³)

STEL: 300 ppm (885 mg/m³)

1993-94 ACGIH TLVs

TWA: 200 ppm (590 mg/m³)

STEL: 300 ppm (885 mg/m³)

1991 DFG (Germany) MAK

TWA: 200 ppm (590 mg/m³)

Half-Life: < 2 hr

Category II: Substances with systemic effects

Peak Exposure Limit: 400 ppm, 30 min.

average value, 4/shift

1992 Toxicity Data*

Rabbit, skin: 500 mg/24 hr caused severe irritation.

Rat, oral, LD₅₀: 2737 mg/kg

Rat, inhalation, TC_{Lo}: 3000 ppm/7 hr from 6 to 15 days of pregnancy caused craniofacial abnormalities (including nose and tongue) as well as developmental abnormalities of the urogenital system and homeostasis.

Human, inhalation, TC_{Lo}: 100 ppm/5 min caused eye irritation and respiratory changes.

1990 IDLH Level

3000 ppm

* See NIOSH, RTECS (EL6475000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 176 °F (80 °C)

Melting Point: -122.6 °F (-85.9 °C)

Vapor Pressure: 71.2 mm Hg at 68 °F (20 °C)

Saturated Vapor Density (Air = 0.075 lb/ft³ or

2 kg/m³): 0.085 lb/ft³ or 1.368 kg/m³

Bulk Density: 6.71 lb/gal

Refractive Index: 1.379 at 68 °F (20 °C)

Optical Temperature: 504 °F (262 °C)

Optical Pressure: 41 atm

Molecular Weight: 72.1

Density: 0.8045 g/mL at 68 °F (20 °C)

Water Solubility: MEK in water = 28%; water in MEK = 12.5%

Other Solubilities: Soluble in alcohol, benzene, ether, and fixed oils.

Surface Tension: 24.6 dyne/cm at 68 °F (20 °C)

Ionization Potential: 9.54 eV

Viscosity: 0.4 cP at 77 °F (25 °C)

Relative Evaporation Rate (ether = 1): 2.7

Octanol/Water Partition Coefficient: log Kow = 0.26 to 0.29

Appearance and Odor: Colorless, volatile, liquid with a sweet mint or acetone-like odor. The odor threshold is 25 ppm.

Section 4. Fire and Explosion Data

Flash Point: 16 °F (-9 °C)

Autoignition Temperature: 759 °F (404 °C)

LEL: 1.4% at 200 °F (93 °C)

UEL: 11.4% at 200 °F (93 °C)

Extinguishing Media: A Class 1B flammable liquid. For small fires, use dry chemical, carbon dioxide, water spray, or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam.

Usual Fire/Explosion Hazards: Vapors may travel to ignition source and flash back. Container may explode in fire. Burning rate = 4.1 mm/min.

Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus

(SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides only

limited protection. If possible without risk, move container from fire area. Apply cooling water to container sides until well after fire is out. Stay

away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw and let fire burn.

Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from

fire control methods to sewers or waterways; dike for proper disposal.

Section 5. Reactivity Data

Stability/Polymerization: Methyl ethyl ketone is stable at room temperature in closed containers under normal storage and handling conditions.

Hazardous polymerization: cannot occur.

Chemical Incompatibilities: Include chlorosulfonic acid, oleum (fuming sulfuric acid), potassium-*t*-butoxide, hydrogen peroxide + nitric acid, 2-

-propanol (forms explosive peroxides), chloroform + alkali, amines, ammonia, inorganic acids, caustics, copper, isocyanates, pyridines, and strong

oxidizers. MEK will soften or dissolve some plastics.

Additions to Avoid: Exposure to heat, ignition sources, and incompatibles.

Hazardous Products of Decomposition: Thermal oxidative decomposition of MEK can produce carbon dioxide gas and acrid smoke.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,⁽¹⁸³⁾ NTP,⁽¹⁶⁹⁾ and OSHA⁽¹⁸³⁾ do not list methyl ethyl ketone as a carcinogen.

Summary of Risks: MEK vapors are irritating to the eyes and respiratory tract. Inhalation causes varying degrees of central nervous system

depression. Approximately 75% of inhaled MEK is absorbed in humans. It is absorbed readily through the skin...

Continue on next page

Section 6. Health Hazard Data, continued

and prolonged contact may cause dermatitis. Because of its low odor threshold, MEK's irritating properties should be sufficient to prevent overexposure. MEK appears to potentiate the neurotoxic effects of some chemicals including *n*-butyl ketone and *n*-hexane, and some studies suggest that MEK may even produce neurotoxicity itself (possibly because it is partially metabolized to methanol⁽¹³⁹⁾). Medical Conditions Aggravated by Long-Term Exposure: Dermatitis. Target Organs: Respiratory tract, central nervous system, skin, and eyes. Primary Entry Routes: Inhalation, eyes, and skin contact/absorption. Acute Effects: Inhalation may cause headache, dizziness, nausea, vomiting, weakness, and unconsciousness. High concentration can cause smarting in addition to irritation of the eyes and respiratory tract. In one study, exposure to 100 ppm caused slight nose and throat irritation, 200 ppm caused mild eye irritation, and 300 ppm was "objectionable" with headache and throat irritation. In another study, short exposure to 500 ppm caused nausea and vomiting. Also, workers exposed to 300 to 600 ppm for an unspecified time period experienced numbness of the fingers and arms; one worker experienced leg numbness with a tendency to "give way under him". Direct eye contact can cause painful irritation and corneal injury. Chronic Effects: Repeated skin contact can cause defatting and dermatitis, apparently without irritation.

FIRST AID Eyes: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water.

Inhalation: Remove exposed person to fresh air, administer 100% humidified supplemental oxygen and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless otherwise advised, have that conscious and alert person drink 1 to 2 glasses of water to dilute. Do not induce vomiting because of possible aspiration into the lungs.

Note to Physicians: MEK is detectable in expired air and urine. There is good correlation between urinary MEK and workplace air concentration.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against exposure. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers. Dike far ahead of large spill for reclamation or disposal. For spills in water, use natural barriers or spill control booms to limit spill travel. Prevent entry into sewers, drains, and waterways. Follow applicable OSHA regulations (29 CFR 1910.120). Ecotoxicity Values: *Pimephales promelas* (fathead minnow) LC₅₀ = 3,220 mg/L/96 hr; *Lepomis macrochirus* (bluegill), TL_m = 5,640 to 1,690 mg/L/24 to 96 hr. Environmental Degradation: In water MEK will evaporate with an expected half-life of 3 to 12 days in rivers and lakes, respectively. It slowly biodegrades in both fresh and salt water. It may degrade in ground water after a long acclimation period. It is not expected to bioconcentrate in aquatic organisms. On land, MEK will either evaporate or leach into the ground. In air, MEK will degrade by photochemical reaction with hydroxyl radicals (half-life = 2.3 days). Under smog conditions, degradation may be slightly faster. Disposal: Incineration is possible in permit-approved facilities. Steam stripping can be used to remove MEK from aqueous waste. Concentrations up to several wt % solvent in water can be handled with better than 99% removal expected. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): U159
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 5000 lb (2270 kg) [* per RCRA, Sec. 3001]

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use any powdered air-purifying respirator with organic vapor cartridges (OVCs) or any chemical cartridge respirator with a full facepiece and OVCs. For < 3000 ppm, use any air-purifying, full facepiece respirator (gas mask) with a chin-style, front-or-back mounted organic vapor canister. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Butyl rubber and Teflon with breakthrough times (BT) of > 8 hr and polyethylene/ethylene vinyl alcohol with a BT of > 4 hr are suitable PPE materials. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103) **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work and street clothes and launder before reuse. Remove MEK from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using MEK, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage/Handling Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, incompatibles (Sec. 5). Periodically check containers for leaks.

Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. To prevent static sparks, electrically ground and bond all equipment used with MEK.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin and respiratory system. Inform workers that MEK is absorbed through the skin and stress the importance of wearing appropriate gloves.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Methyl ethyl ketone
DOT Hazard Class: 3
ID No.: UN1193
DOT Packing Group: II
DOT Label: Flammable liquid
Special Provisions (172.102): T8

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60L
Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: —

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 148, 149, 153, 159, 168, 171, 183, 186
Prepared by: M Gannon, BA; Industrial Hygiene Review: RE Langford, Ph.D, CIH; Medical Review: T Thoburn, MD, MPH



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Material Safety Data Sheets Collection:

Sheet No. 308
Dichlorodifluoromethane

Issued: 11/77

Revision: D, 9/92

Section 1. Material Identification

Dichlorodifluoromethane (CCl₂F₂) Description: Derived by reacting carbon tetrachloride and hydrogen fluoride in the presence of an antimony halide catalyst, or by high temperature chlorination of vinylidene fluoride. Formerly used as an aerosol propellant but due to its role in ozone depletion, this use was banned by the USEPA on 12/15/78. Still used as a refrigerant, leak detection agent, blowing agent for polymeric foams, a foaming agent in fire extinguishers, a solvent or diluent in fumigants for food and medical equipment sterilization; in the manufacture of glass bottles, preparing frozen tissue sections, in paint and varnish removers, water purification, and in thermal expansion valves.

Other Designations: CAS No. 75-71-8, Algofrene type 2, Arcton, difluorodichloromethane, Eskimon-12, FC-12, fluorocarbon-12, Freon-12, Genetron-12, Halon, Isotron-12, propellant-12, refrigerant-12, Ucon-12.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

Cautions: Dichlorodifluoromethane is considered low in toxicity but is a simple asphyxiant and produces weak irritative and narcotic effects in high concentrations. It may also induce serious cardiac arrhythmias at high concentrations and in susceptible individuals. Contact with the liquid can cause frostbite.

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HMIS

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PPE*

* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Dichlorodifluoromethane, ca 99.9%

1991 OSHA PEL

8-hr TWA: 1000 ppm (4950 mg/m³)

1990 IDLH Level

50,000 ppm

1990 NIOSH REL

10-hr TWA: 1000 ppm (4950 mg/m³)

1992-93 ACGIH TLV

TWA: 1000 ppm (4950 mg/m³)

1990 DFG (Germany) MAK

TWA: 1000 ppm (5000 mg/m³)

Category IV: Substances eliciting very weak effects.

Peak Exposure Limit: 2000 ppm.

60 min momentary value,* 3/shift

1985-86 Toxicity Data†

Human, inhalation, TC_{Lo}: 200,000 ppm/30 min caused conjunctival irritation, fibrosing aveolitis, and changes in the liver.

Rat, inhalation, LC₅₀: 80 pph/30 min; toxic effects not yet reviewed

Rabbit, inhalation, LC_{Lo}: 80 pph/30 min; toxic effects not yet reviewed

* The momentary value is the level which should never be exceeded.

† See NIOSH, *RTECS* (PA8200000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: -22 °F (-29.8 °C)

Freezing Point: -252 °F (-158 °C)

Vapor Pressure: 5.7 atm at 68 °F (20 °C)

Vapor Density (Air = 1): 4.16

Surface Tension: 9 dyne/cm

Viscosity: 0.262 cP at 70 °F (21 °C)

Ionization Potential: 11.75 eV

Molecular Weight: 120.9

Density (liquid): 1.486 at -22 °F (-29.8 °C)

Water Solubility: Nearly insoluble, 0.03% at 77 °F (25 °C)

Other Solubilities: Soluble in most organic solvents, such as alcohol, ether, benzene, amyl chloride, bromobenzene, bromoform, n-butyl alcohol, butyl butyrate, carbon tetrachloride, and chloroform.

Critical Temperature: 232.7 °F (111.5 °C)

Critical Pressure: 43.2 atm

Appearance and Odor: Colorless, practically odorless (smells like ether at 20% in air) gas.

Section 4. Fire and Explosion Data

Flash Point: Nonflammable

Autoignition Temperature: Nonflammable

LEL: None reported

UEL: None reported

Extinguishing Media: Use extinguishing media suitable for surrounding fire.

Unusual Fire or Explosion Hazards: Cylinder may explode in heat of fire.

Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing provides only limited protection. If possible without risk, move container from fire area. Apply cooling water to sides of containers until well after fire is out. Stay away from ends of tanks. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Dichlorodifluoromethane is stable until 1022 °F (550 °C) above which it begins to decompose. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Chemically active metals such as sodium, potassium, calcium and powdered aluminum, zinc, or magnesium.

Conditions to Avoid: Exposure to excessive heat and contact with incompatibles.

Hazardous Products of Decomposition: Thermal oxidative decomposition of dichlorodifluoromethane can produce carbon dioxide (CO₂), and toxic phosgene, chlorine, hydrogen chloride, hydrogen fluoride, and fluorine gases.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,⁽¹⁶⁴⁾ NTP,⁽¹⁶⁹⁾ and OSHA⁽¹⁶⁴⁾ do not list dichlorodifluoromethane as a carcinogen.

Summary of Risks: Dichlorodifluoromethane is relatively low in toxicity but is a simple asphyxiant when oxygen levels decline to 15 to 16%, and produces unconsciousness at 6 to 8% oxygen. It also produces weak narcotic-like effects (when 10% mixture is inhaled) and eye irritation at high concentrations. Bursts of compressed gas or liquid can cause frostbite.

Medical Conditions Aggravated by Long-Term Exposure: Pre-existing ventricular ectopy.

Target Organs: Cardiovascular system and the central and peripheral nervous systems.

Continue on next page

Section 6. Health Hazard Data, continued

Primary Entry Routes: Inhalation. **Acute Effects:** Signs of asphyxia include 'air hunger', rapid-irregular breathing, headache, fatigue, mental confusion, nausea & vomiting, giddiness & poor judgement, exhaustion, numbness of extremities, unconsciousness, convulsions, and death. Human volunteers exposed to varying concentrations experienced the following symptoms: 10,000 ppm for 2.5 hours—caused a 7% reduction in standard psychometer scores; 27,000 ppm for 15 or 60 seconds—caused an increase in airway resistance and electrocardiographic changes; 40,000 ppm for 80 minutes—generalized paresthesia, ringing in ears, apprehension, and slurred speech; 110,000 ppm for 11 minutes—marked decrease in consciousness, amnesia, and cardiac arrhythmias; 200,000 ppm for a few moments—eye irritation and CNS effects. **Chronic Effects:** Possible neurotoxic effects.

FIRST AID

Eyes: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** For frostbite, rapidly rewarm in 107.6 °F (42 °C) water until a flush returns. Do not use dry heat! **Inhalation:** Remove exposed person to fresh air and support breathing as needed.

Ingestion: Unlikely! Dichlorodifluoromethane is only a liquid below -22 °F (-29.8 °C).

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor closely for ventricular ectopy and treat according to ACLS guidelines of the American Heart Association.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. If possible without risk, stop leak. Leaks may be visible as a vapor cloud. If leak cannot be repaired, empty into a combustion chamber with a combustible fuel and burn (insure complete combustion to prevent phosgene formation). Consult local/state air pollution control authority before incineration. Use an acid scrubber to remove evolved halo-acids. Do not release leaking cylinder gas to the atmosphere because of CF-12's role in ozone depletion. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Degradation:** CF-12 volatilizes rapidly and is broken down in the stratosphere by absorption of higher energy with shorter wavelength UV light. **Soil Absorption/Mobility:** CF-12 may absorb to soil particles as it has a log octanol/water partition coefficient of 2.16. **Disposal:** CF-12 is a potential candidate for rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C) & for fluidized bed incineration at 842 to 1796 °F (450 to 980 °C). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U075

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 5000 lb (2270 kg) [* per RCRA, Sec. 3001]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For <10,000 ppm, use a supplied-air respirator (SAR) or SCBA. For <25,000 ppm use a SAR operated in continuous-flow mode. For <50,000 ppm, use a SAR or SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.** If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Wear chemically protective gloves, boots, aprons, and gauntlets made from Neoprene rubber (recommended by ACGIH) to prevent skin contact.

Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool [below 125 °F (51.5 °C)], dry, well-ventilated area away from incompatibles (Sec. 5). Shipped as a liquefied compressed gas under its own vapor pressure. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Never use arc-producing, open flame, or other high-temperature equipment in halogenated hydrocarbon atmospheres. Levels well below the TLV can damage direct fired space heaters & water heaters when drawn into the combustion chamber. Heaters should have an independent air supply. Before entering a confined space that may contain CF-12, ensure that there is adequate oxygen (19%). Consult 29 CFR 1910.146 for procedures on confined space entry. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Dichlorodifluoromethane (R-12)

DOT Hazard Class: 2.2

ID No.: UN1028

DOT Packing group: -

DOT Label: Nonflammable Gas

DOT Packaging Requirements (172.102): -

Packaging Authorizations

a) Exceptions: 173.306

b) Nonbulk Packaging: 173.304

c) Bulk Packaging: 173.314 & 173.315

Quantity Limitations

a) Passenger Aircraft or Railcar: 75 kg

b) Cargo Aircraft Only: 150 kg

Vessel Stowage Requirements

a) Vessel Stowage: A

Other: -

MSDS Collection References: 73, 101, 103, 124, 126, 127, 132, 133, 136, 140, 148, 153, 159, 163, 164, 167, 168, 176, 178, 180
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** P Roy, CIH, MPH; **Medical Review:** AC Darlington, MD, MPH

Material Safety Data Sheet

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No. 359

ETHYLENE DICHLORIDE
(Formerly 1,2-Dichloroethane)
(Revision C)

Issued: November 1978

Revised: August 1987

SECTION 1. MATERIAL IDENTIFICATION

CHEMICAL NAME: ETHYLENE DICHLORIDE (Changed to reflect common industrial practice)

DESCRIPTION (Origin/Uses): Made from acetylene and HCl. Used as a degreaser, a scavenger in leaded gasoline, as an intermediate in the manufacture of vinyl chloride, in paint removers, in wetting and penetration agents, in ore flotation processes, as a fumigant, and as a solvent for fats, oils, waxes, and gums.

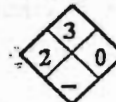
OTHER DESIGNATIONS: 1,2-Dichloroethane; sym-Dichloroethane; Dutch Liquid; Dutch Oil; EDC;

Ethane Dichloride; Ethylene Chloride; 1,2-Ethylene Dichloride; Glycol Dichloride; $C_2H_4Cl_2$;

NIOSH RTECS KI0525000; CAS #0107-06-2

MANUFACTURERS/SUPPLIERS: Available from several suppliers, including:

Dow Chemical USA, 2020 Dow Center, Midland, MI 48640; Telephone: (517) 636-1000



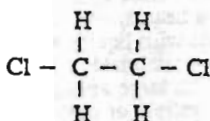
HMIS		R	1
H	1	I	4
F	3	S	2
R	0	K	4
PPE*			

* See Sect. 8

COMMENTS: Ethylene dichloride is a flammable, toxic liquid.

SECTION 2. INGREDIENTS AND HAZARDS

Ethylene Dichloride, CAS #0107-06-2; NIOSH RTECS #KI0525000



*The maximum allowable peak concentration (above the ceiling level value) of ethylene dichloride is 200 ppm for 5 minutes in any 3-hour period.

COMMENTS: Additional data concerning toxic doses and tumorigenic, reproductive, and mutagenic effects is listed (with references) in the NIOSH RTECS 1983-84 supplement, pages 865-66.

%

HAZARD DATA

100

ACGIH Values 1987-88

TLV-TWA: 10 ppm, 40 mg/m³

OSHA PEL* 1986-87

8-Hr TWA: 50 ppm;

Ceiling: 100 ppm (15 Min.)

NIOSH REL 1986-87

10-Hr TWA: 1 ppm

Ceiling: 2 ppm (15 Min.)

Toxicity Data

Man, Inhalation, TC_{Lo} : 4000 ppm/1 Hr

Human, Oral, TD_{Lo} : 428 mg/kg

Man, Oral, TD_{Lo} : 892 mg/kg

Man, Oral, LD_{Lo} : 714 mg/kg

Rat, Oral, LD_{50} : 670 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point ... 182.3°F (83.5°C)

Vapor Pressure ... 87 Torr at 77°F (25°C)

Water Solubility ... Soluble in about 120 Parts Water

Vapor Density (Air = 1) ... 3.4

Appearance and odor: Colorless, clear liquid. Sweet, chloroformlike odor is typical of chlorinated hydrocarbons. The recognition threshold (100% of test panel) for ethylene dichloride is 40 ppm. Odor detection probably indicates an excessive exposure to vapor. High volatility and flammability, coupled with its toxicity and carcinogenic potential, make this material a major health hazard.

COMMENTS: Ethylene dichloride is miscible with alcohol, chloroform, and ether.

Evaporation Rate (n-BuAc = 1) ... Not Listed

Specific Gravity ... 1.2569 at 69°F (20°C)

Freezing Point ... -31.9°F (-35.5°C)

Molecular Weight ... 98.96 Grams/Mole

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

See Below

775°F (413°C)

% by Volume

6.2

15.9

EXTINGUISHING MEDIA: Use chemical, carbon dioxide, alcohol foam, water spray/fog, or dry sand to fight fires involving ethylene dichloride. Direct water sprays may be ineffective extinguishing agents, but they may be successfully used to cool fire-exposed containers. Use a smothering effect to extinguish fires involving this material. **UNUSUAL FIRE/EXPLOSION**

HAZARDS: Ethylene dichloride is a dangerous fire and explosion hazard when exposed to sources of ignition such as heat, open flames, sparks, etc. Its vapors are heavier than air and can flow along surfaces to distant, low-lying sources of ignition and flash back. If it is safe to do so, remove this material from the fire area. Ethylene dichloride burns with a smoky flame.

SPECIAL FIRE-FIGHTING PROCEDURES: Wear a self-contained breathing apparatus with a full facepiece operated in a pressure-demand or another positive-pressure mode.

COMMENTS: Flash Point and Method: 56°F (13°C) CC; 65°F (18°C) OC.

OSHA Flammability Class (29 CFR 1910.106): IB. DOT Flammability Class (49 CFR 173.115): Flammable Liquid

SECTION 5. REACTIVITY DATA

Ethylene dichloride is stable. Hazardous polymerization cannot occur.

CHEMICAL INCOMPATIBILITIES include strong oxidizing agents. Explosions have occurred with mixtures of this material and liquid ammonia or dimethylaminopropylamine. Finely divided aluminum or magnesium metal may be hazardous in contact with ethylene dichloride.

CONDITIONS TO AVOID: Eliminate sources of ignition such as excessive heat, open flames, or electrical sparks, particularly in low-lying areas, because the explosive, heavier-than-air vapors will concentrate there.

PRODUCTS OF HAZARDOUS DECOMPOSITION can include vinyl chloride, chloride fumes, and phosgene. Phosgene is an extremely poisonous gas. Products of thermal-oxidative degradation (i.e., fire conditions) must be treated with appropriate caution.

SECTION 6. HEALTH HAZARD INFORMATION

Ethylene dichloride is listed as an anticipated human carcinogen by the NTP and as a probable human carcinogen (Group 2B), by the IARC. It was found to be an animal-positive carcinogen by the IARC. NCI reported positive results (mouse, rat) from its carcinogenesis bioassay. **SUMMARY OF RISKS:** Ethylene dichloride is considered to be one of the more toxic of the common chlorinated hydrocarbons. Deaths from accidental ingestion of this material have been reported. Inhalation of vapors reportedly caused three fatalities. Excessive inhalation of ethylene dichloride vapors can cause respiratory irritation, intoxication, narcotic and anesthetic effects, vomiting, dizziness, depression, and diarrhea. The hepatotoxic (injurious to liver) effects of this material are significant. The systemic effects from overexposure can appear in the liver, kidneys, digestive tract, blood, lungs, adrenal glands, and the central nervous system. Tests on animals have revealed reproductive failure and fetal resorption. There may be increased risk to nursing infants of exposed mothers. **TARGET ORGANS:** Central nervous system, eyes, kidneys, liver, heart, adrenal glands, and skin. **PRIMARY ENTRY:** Inhalation, absorption through skin, oral, or eye contact. **ACUTE EFFECTS:** Skin contact causes irritation, defatting, and, if repeated or prolonged, burning. Eye contact causes irritation and serious injury (clouding of the cornea) if it is not removed promptly. **CHRONIC EFFECTS:** Injuries to the liver (hepatotoxicity) and kidneys, weight loss, low blood pressure, jaundice, oliguria (reduced excretion of urine), or anemia. **MEDICAL CONDITIONS AGGRAVATED BY LONG-TERM EXPOSURE:** Persons taking anticoagulants could experience an increase in tendency to bleed. Persons taking insulin face an increased risk of lowered blood sugar. **FIRST AID:** Be prepared to restrain a hyperactive victim. **EYE CONTACT:** Flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Get medical help.* **SKIN CONTACT:** Immediately flush the affected area with water. Wash thoroughly with soap and water. Remove and launder contaminated clothing before wearing it again; clean material from shoes and equipment. Get medical help.* **INHALATION:** Remove victim to fresh air; restore and/or support his breathing as needed. Get medical help.* **INGESTION:** Never give anything by mouth to someone who is unconscious or convulsing. Rinse victim's mouth with water. Oxygen and artificial respiration may be needed. Get medical help.* **GET MEDICAL ASSISTANCE = IN PLANT, PARAMEDIC, COMMUNITY.** Get prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Before using ethylene dichloride, it is essential that proper emergency procedures be established and made known to all personnel involved in handling it. Notify safety personnel of ethylene dichloride spills or leaks and implement containment procedures. Remove and eliminate all possible sources of ignition such as heat, sparks, and open flames from the area. Cleanup personnel should use protection against inhalation of vapors and contact with liquid. Contain spills by using an absorbent material such as dry sand or vermiculite. Use nonsparking tools to mix waste material thoroughly with absorbent and place it in an appropriate container for disposal. Flush trace residues with large amounts of water. Do not flush waste to sewers or open waterways. **WASTE DISPOSAL:** Consider reclamation, recycling, or destruction rather than disposal in a landfill. Waste may be burned in an approved incinerator equipped with an afterburner and a scrubber. Follow Federal, state, and local regulations. Ethylene dichloride is designated as a hazardous substance by the EPA (40 CFR 116.4). Ethylene dichloride is reported in the 1983 EPA TSCA Inventory. EPA Hazardous Waste Number (40 CFR 261.33): U077 EPA Reportable Quantity (40 CFR 117.3): 5000 lbs (2270 kgs) Aquatic Toxicity Rating, TLM 96: 1000 - 100 ppm

SECTION 8. SPECIAL PROTECTION INFORMATION

GOGGLES: Always wear protective eyeglasses or chemical safety goggles. Ethylene dichloride is particularly harmful to the eyes, and direct contact results in corneal opacity (permanent clouding of the eye). **GLOVES:** Wear impervious rubber gloves to prevent skin contact. **RESPIRATOR:** Use a NIOSH-approved respirator per the NIOSH *Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. Any detectable concentration of ethylene dichloride requires an SCBA, full facepiece, and pressure-demand/positive-pressure modes. Warning: Air-purifying respirators will not protect workers from oxygen-deficient atmospheres. **OTHER:** Wear rubber boots, aprons, and other protective clothing suitable for use conditions to prevent skin contact. Remove contaminated clothing and launder it before wearing it again. Discard contaminated shoes. **VENTILATION:** Provide maximum explosion-proof local fume exhaust ventilation systems to maintain the airborne concentrations of ethylene dichloride vapors below the exposure limits cited in section 2. Install properly designed hoods that maintain a minimum face velocity of 100 fpm (linear feet per minute). **SAFETY STATIONS:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **SPECIAL CONSIDERATIONS:** Vapors are heavier than air and will collect in low-lying areas. Eliminate sources of ignition in these areas and again provide good ventilation there. **COMMENTS:** Practice good personal hygiene. Keep materials off of your clothes and equipment. Avoid transferring this material from hands to mouth while eating, drinking, or smoking. Immediately remove ethylene dichloride-saturated clothing to avoid flammability and health hazards. Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store ethylene dichloride in tightly closed containers in a cool, dry, well-ventilated area away from sources of ignition. Protect containers from physical damage and from exposure to excessive heat. Avoid direct physical contact with strong acids, bases, oxidizing agents, and reducing agents. **SPECIAL HANDLING/STORAGE:** Use nonsparking tools. Outside or detached storage is preferred. Store and handle ethylene dichloride in accordance with the regulations concerning OSHA class IB flammable liquids. **ENGINEERING CONTROLS:** During transfer operations involving ethylene dichloride, the liquid and its vapors must not be exposed to nearby sources of ignition from engineering systems that are not explosion proof. Preplan emergency response procedures.

TRANSPORTATION DATA (per 49 CFR 172.101-2):

DOT Hazard Class: Flammable Liquid

DOT Label: Flammable Liquid

IMO Class: 3.2

DOT Shipping Name: Ethylene Dichloride

DOT ID No. UN 1184

IMO Label: Flammable Liquid, Poison

References: 1-9, 12, 19, 21, 26, 43, 47, 73, 87-102. CK

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Approvals *J.O. Accorcello*

Indust. Hygiene/Safety *J.W. 11-18-87*

Medical Review *Genium Publishing 11-30-87*

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Material Safety Data Sheets Collection:

Sheet No. 703
1,2-Dichloroethylene

Issued: 4/90

Section 1. Material Identification**31**

1,2-Dichloroethylene Description: An industrial solvent composed of 60% cis- and 40% trans-isomers. Both isomers, cis and trans, are made by partial chlorination of acetylene. Used as a general solvent for organic materials, lacquers, dye extraction, thermoplastics, organic synthesis, and perfumes. The trans-isomer is more widely used in industry than either the cis-isomer or the mixture. Toxicity also varies between the two isomers.

Other Designations: CAS No. 0540-59-0; $C_2H_2Cl_2$; acetylene dichloride; cis-1,2-dichloroethylene; sym-dichloroethylene; trans-1,2-dichloroethylene, dioform.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*^(TM) for a suppliers list.

R 1
I 2
S 2
K 1



HMIS
H 2
F 3
R 1
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

1,2-Dichloroethylene, ca 100%

OSHA PEL

8-hr TWA: 790 mg/m³, 200 ppm

ACGIH TLV, 1989-90

TLV-TWA: 790 mg/m³, 200 ppm

NIOSH REL, 1987

790 mg/m³, 200 ppm

Toxicity Data*

Rat, oral, LD₅₀: 770 mg/kg; toxic effects not yet reviewed
Frog, inhalation, TC₅₀: 117 mg/m³ inhaled for 1 hr affects the peripheral nerve and sensation (flaccid paralysis without anesthesia); behavior (excitement); lungs, thorax, or respiration (respiratory depression)

* See NIOSH, RTECS (KV9360000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: 119 °F/48 °C

Melting Point: -56 to -115 °F/-49 to -82 °C/

Vapor Pressure: 180 to 264 torr at 68 °F/20 °C

Vapor Density (Air = 1): 3.4

Molecular Weight: 96.95 g/mol

Specific Gravity (H₂O = 1 at 39 °F/4 °C): 1.27 at 77 °F/25 °C

Water Solubility: Insoluble

Appearance and Odor: A colorless, low-boiling liquid with a pleasant odor.

Section 4. Fire and Explosion Data

Flash Point: 37 °F/2.8 °C, CC

Autoignition Temperature: 860 °F/460 °C

LEL: 5.6% v/v

UEL: 12.8% v/v

Extinguishing Media: Use dry chemical, CO₂, halon, water spray, or standard foam. Water may be ineffective unless used to blanket the fire.

Unusual Fire or Explosion Hazards: This material's vapors are a dangerous fire hazard and moderate explosion hazard when exposed to any heat or ignition source or oxidizer.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and a fully encapsulating suit. Vapors may travel to heat or ignition sources and flash back. Stay upwind and out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: This material is stable at room temperature in closed containers under normal storage and handling conditions.

Hazardous polymerization: cannot occur.

Chemical Incompatibilities: This material is incompatible with alkalis, nitrogen tetroxide, difluoromethylene, strong oxidizers, and dihydrofluorite. When in contact with copper or copper alloys or by reaction with potassium hydroxide, explosive chloroacetylene may be released.

Conditions to Avoid: Addition of hot liquid to cold 1,2-dichloroethylene may cause sudden emission of vapor that could flash back to an ignition source.

Hazardous Products of Decomposition: Thermal oxidative decomposition of 1,2-dichloroethylene can produce highly toxic fumes of chlorine (Cl₂).

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists 1,2-dichloroethylene as a carcinogen.

Summary of Risks: 1,2-Dichloroethylene's most important effect is its irritation of the central nervous system (CNS) and narcosis. This material is toxic by inhalation, ingestion, and skin contact. It is also irritating to the eyes. The trans-isomer at 2200 ppm causes nausea, vertigo, and burning of the eyes. The trans-isomer is twice as potent as the cis-isomer. If renal effects occur, they are transient.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Central nervous system, eyes, respiratory system.

Primary Entry Routes: Inhalation, ingestion, skin and eye contact.

Acute Effects: Inhalation of 1,2-dichloroethylene causes narcosis, respiratory tract irritation, nausea, vomiting, tremor, weakness, central nervous depression, and epigastric (the abdomen's upper midregion) cramps. Contact with the liquid causes eye and skin (on prolonged contact) irritation. Ingestion causes slight depression to deep narcosis.

Chronic Effects: None reported.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: Quickly remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed. Have trained personnel administer 100% oxygen, preferably with humidification.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Intravenous injections of calcium gluconate may relieve cramps and vomiting. Treat central nervous system effects symptomatically.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Design and practice a 1,2-dichloroethylene spill control and countermeasure plan (SCCP). Notify safety personnel, remove all heat and ignition sources, evacuate hazard area, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation and skin or eye contact. Absorb small spills on paper towels. After evaporating the 1,2-dichloroethylene from these paper towels in a fume hood, burn the paper in a suitable location away from combustible material. Collect and atomize large quantities in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per RCRA, Sec. 3001, per Clean Water Act, Sec. 307(a)]†

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

† Listed as 1,2-trans-dichloroethylene.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. 1,2-dichloroethylene attacks some forms of plastics, rubber, and coatings.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and oxidizing materials. Outside or detached storage is preferred. If stored inside, place containers in a standard flammable liquids storage cabinet or room. Protect containers from physical damage.

Engineering Controls: Avoid vapor inhalation and skin and eye contact. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. 1,2-dichloroethylene is a dangerous fire hazard. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement questionnaires which emphasize detecting a history of chronic respiratory disease.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 7, 26, 38, 73, 84, 85, 87, 88, 100, 101, 103, 109, 126, 127, 136, 137

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD

F7



Genium Publishing Corporation

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Material Safety Data Sheets Collection:

Sheet No. 514
p-Dichlorobenzene

Issued: 10/83

Revision: A, 11/90

Section 1: Material Identification

33

p-Dichlorobenzene ($C_6H_4Cl_2$) Description: Derived by chlorinating monochlorobenzene. Used as a general insecticide; a moth repellent; a germicide; a chemical intermediate in the production of polyphenylene sulfide; a plastic used in the electrical and electronics industries; a space deodorant in products such as room deodorizers, urinal and toilet bowl blocks, and diaper pail deodorizers; and in producing 1,2,4 trichlorobenzene.

Other Designations: CAS No. 0106-46-7, 1,4-dichlorobenzene, dichlorocide, Evola,* NCI-c 54955, Paracide,* Paracrytals, Paradi,* paradichlorobenzol, Paramoth,* *p*-chlorophenyl chloride, PDB,* Santochlor.*

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*⁽⁷⁾ for a suppliers list.

Cautions: *p*-Dichlorobenzene vapor is an eye and upper respiratory tract irritant. It is toxic to the liver. Prolonged exposure to high concentrations may cause weakness, dizziness, and weight loss. Flammable when exposed to heat, flame, or oxidizers.



HMIS

H 2

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R 0

PPG*

* Sec. 8

Section 2: Ingredients and Occupational Exposure Limits

p-Dichlorobenzene, ca 100%

1989 OSHA PELs

8-hr TWA: 75 ppm, 450 mg/m³

15-min STEL: 110 ppm, 675 mg/m³

1990-91 ACGIH TLVs

TWA: 75 ppm, 451 mg/m³

STEL: 110 ppm, 661 mg/m³

1988 NIOSH REL

None established

1985-86 Toxicity Data*

Human, oral, TD_{01} : 300 mg/kg produced sense organs and special senses (other eye effects); lungs, thorax, or respiration (other changes); and gastrointestinal (hypermotility, diarrhea) effects

Human, eye: 80 ppm

1987 IDLH Level

1000 ppm

* See NIOSH, RTECS (CZ4550000), for additional irritative, mutative, reproductive, and toxicity data.

Section 3: Physical Data

Boiling Point: 345 °F (174 °C) at 760 mm Hg

Melting Point: 127.6 °F (53.1 °C)

Vapor Pressure: 10 mm Hg at 130.6 °F (54.8 °C)

Vapor Density (Air = 1): 5.08

Molecular Weight: 147.01

Specific Gravity: 1.248 at 131 °F (55 °C)

Water Solubility: Insoluble

Appearance and Odor: Volatile, white crystals with a distinctive mothball-like odor that becomes very strong at concentrations between 30 and 60 ppm. At concentrations of 80 to 160 ppm, vapors are painful to the eyes and nose. Odors and irritating effects are good warnings against overexposure to *p*-dichlorobenzene; however, individuals may develop tolerance to high concentrations.

Section 4: Fire and Explosion Data

Flash Point: 150 °F (66 °C), CC

Autoignition Temperature: None reported

LEL: 1.7% v/v

UEL: None reported

Extinguishing Media: Use dry chemical, carbon dioxide, alcohol foam, or water spray. Use water spray to cool fire-exposed container, to disperse vapors, or to blanket a pool fire.

Unusual Fire or Explosion Hazards: Explosive and toxic mixtures may form in air when this material is heated, such as in a fire.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. Thoroughly decontaminate firefighting equipment after use. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5: Reactivity Data

Stability/Polymerization: *p*-Dichlorobenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: *p*-Dichlorobenzene is incompatible with strong oxidizers and oxidizing agents.

Conditions to Avoid: Avoid incompatibilities and heat or ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of *p*-dichlorobenzene includes carbon monoxide, chlorides, and chlorine.

Section 6. Health Hazard Data

Carcinogenicity: *p*-Dichlorobenzene is an NTP anticipated human carcinogen and an IARC possible human carcinogen (Group 2B) with inadequate human evidence and sufficient animal evidence.

Summary of Risks: This material has a relatively low level of acute or chronic toxicity. It may be irritating to eyes, nose, upper airways, and intestinal tract upon inhalation or ingestion. Limited case reports link acute exposure to hemolytic anemia, jaundice, methemoglobinemia, granulomas of the lung, liver atrophy, toxic hepatitis, kidney injury, and allergic pigmentation and purpura (tiny hemorrhages) of the skin. Occupational studies of PDB-exposed workers reveal none of the blood abnormalities noted with similar substances. Vapors may produce painful irritation of the eyes at 50 to 80 ppm and severe discomfort at 160 ppm.

Medical Conditions Aggravated by Long-Term Exposure: Individuals with liver disease should not be exposed to *p*-dichlorobenzene.

Target Organs: Liver, respiratory system, eyes, kidneys, and skin.

Primary Entry Routes: Inhalation and dermal contact.

Acute Effects: Acute exposures to PDB vapor may be irritating to mucous membranes of the eyes and upper respiratory tract. Ingestion of the solid resulted in toxicity to a 3-year old child, with hemolytic anemia, jaundice, and methemoglobinemia. Nausea, vomiting, and diarrhea are seen in other cases. Prolonged skin exposure may cause skin irritation.

Chronic Effects: Limited case studies show chronic toxicity with exposure to PDB. Chronic ingestion is linked to anemia, leukemia, and kidney damage. In one case, chemical dependence was noted with signs of withdrawal when ingestion stopped. Chronic vapor exposure is suggested in cases of lung granulomatosis, liver abnormalities, kidney damage, anemia, other blood cell abnormalities, and cataract formation.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of water, then induce vomiting. Consult a physician.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Urinary excretion of 2,5-dichlorophenol, a metabolite of *p*-dichlorobenzene, may be useful as an index of exposure.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, and remove or extinguish all heat and ignition sources. Cleanup personnel should protect against vapor inhalation and skin or eye contact. For liquid spills, take up spilled material with noncombustible absorbent material and place into clean metal containers for disposal. For large liquid spills, dike far ahead of spill to contain liquid. For dry spills, shovel spilled material into clean metal containers for disposal. Runoff to sewers or waterways may create health and explosion hazards. (96-hr LC₅₀ fathead minnow: 4.2 to 30 mg/l, moderately toxic.) Pesticide wastes are toxic. Follow applicable EPA and OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U072

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per Clean Water Act, Sec. 311(b)(4), Sec. 307(a), and per RCRA, Sec. 3001]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. A gas mask with organic vapor canister and dust filter is suitable to 1000 ppm. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Neoprene gloves are recommended.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below OSHA PELs and ACGIH TLVs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and oxidizing agents. *p*-Dichlorobenzene melts at 127 °F (53 °C). Protect containers against physical damage.

Engineering Controls: Avoid dust or vapor inhalation and eye and skin contact (especially when heated). Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures.

Other Precautions: Provide preplacement and annual physical examinations that emphasize the liver (liver function tests), upper respiratory tract, and eyes.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Dichlorobenzene, para, solid

DOT Hazard Class: ORM-A

ID No.: UN1592

DOT Label: None

DOT Packaging Exceptions: 173.505

DOT Packaging Requirements: 173.510

IMO Shipping Name: *p*-Dichlorobenzene

IMO Hazard Class: 6.1

ID No.: UN1592

IMO Label: St. Andrews Cross

IMDG Packaging Group: III

MSDS Collection References: 1-7, 9, 10, 12, 14, 16, 23, 26, 31, 34, 38, 43, 48, 73, 84, 85, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 140, 142, 143, 146, 148

Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: W Silverman, MD; Edited by: JR Stuart, MS

106

Material Safety Data Sheet

From Genium's Reference Collection
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No. 624

NAPHTHALENE

Issued: November 1987

SECTION 1. MATERIAL IDENTIFICATION

24

Material Name: NAPHTHALENE

Description (Origin/Uses): Used as a moth repellent and in many industrial processes.

Other Designations: Naphthalin; Naphthene; Tar Camphor; $C_{10}H_8$;
NIOSH RTECS No. QJ0525000; CAS No. 0091-20-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the
Chemicalweek Buyer's Guide (Genium ref. 73) for a list of suppliers.

HMIS

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F	2	R	1
R	0	I	4
PPG*		S	1
		K	2

*See sect. 8



SECTION 2. INGREDIENTS AND HAZARDS

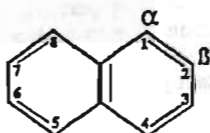
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EXPOSURE LIMITS

Naphthalene, CAS No. 0091-20-3

ca 100

IDLH* Level: 500 ppm



ACGIH TLVs, 1987-88

TLV-TWA: 10 ppm, 50 mg/m³

OSHA PEL

8-Hr TWA: 10 ppm, 50 mg/m³

Toxicity Data**

Child, Oral, LD₅₀: 100 mg/kg

Man, Unknown, LD₅₀: 74 mg/kg

Rat, Oral, LD₅₀: 1250 mg/kg

*Immediately dangerous to life and health

**See NIOSH RTECS for additional data with references to irritative, mutagenic, reproductive, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 424°F (218°C)

Vapor Density (Air = 1): 4.4

Vapor Pressure: 0.087 Torr at 77°F (25°C)

Water Solubility: Insoluble

Specific Gravity ($H_2O = 1$): 1.162 at 68°F (20°C)

Melting Point: 176°F (80°C)

Molecular Weight: 128 Grams/Mole

% Volatile by Volume: ca 100

Appearance and Odor: White crystalline flakes; strong coal tar odor.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER

UPPER

Flash Point and Method

Autoignition Temperature

Flammability Limits in Air

174°F (79°C) OC; 190°F (88°C) CC

979°F (526°C)

% by Volume

0.9

5.9

Extinguishing Media: Use water spray, dry chemical, or carbon dioxide to fight fires involving naphthalene. Caution: Foam or direct water spray applied to molten naphthalene may cause extensive foaming.

Unusual Fire or Explosion Hazards: Naphthalene is a volatile solid that gives off flammable vapor when heated (as in fire situations). This vapor is much denser than air and will collect in enclosed or low-lying areas like sumps. In these areas an explosive air-vapor mixture may form, and extra caution is required to prevent any ignition sources from starting an explosion or fire.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Naphthalene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Naphthalene is incompatible with strong oxidizing agents, chromic anhydride, and mixtures of aluminum trichloride and benzoyl chloride.

Conditions to Avoid: Ignition sources like open flame, unprotected heaters, excessive heat, lighted tobacco products, and electric sparks must not occur in work areas where naphthalene vapor may become concentrated.

Hazardous Products of Decomposition: Toxic gases like carbon monoxide are produced during fire conditions. Irritating, flammable vapor forms below the melting point because even solid naphthalene has a significant vapor pressure.

SECTION 6. HEALTH HAZARD INFORMATION

Naphthalene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Renal shutdown (kidney failure), hemolytic effects (breakdown of red blood cells), hematuria (blood in the urine), oliguria (low volume of urine), jaundice, eye damage, and depression of the central nervous system (CNS) are the primary health concerns associated with exposure to naphthalene. The ACGIH TLVs in section 2 are set to prevent eye damage. These recommended exposure limits may not be low enough to prevent blood changes in genetically hypersensitive individuals.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver, and kidneys. Administer medical exams emphasizing these organs. **Target Organs:** Eyes, skin, kidneys, liver, blood (red blood cell effects), and CNS.

Primary Entry: Inhalation, skin contact. **Acute Effects:** Inhalation of naphthalene vapor causes excitement, confusion, headache, nausea, and loss of appetite. **Chronic Effects:** Increased incidence of cataracts.

FIRST AID

Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes to remove particles.

Skin Contact: Immediately wash the affected area with soap and water.

Inhalation: Remove victim to fresh air; restore and/or support his breathing as needed.

Ingestion: Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Administer a gastric lavage followed by saline catharsis. Monitor blood and electrolytic balance. Other sources recommend giving the victim several glasses of water to drink.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all ignition sources immediately. Cleanup personnel need protection against contact and inhalation of vapor (see sect. 8). Contain large spills and collect waste. Use nonsparking tools to place naphthalene into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U165

CERCLA Hazardous Substance, Reportable Quantity: 100 lbs (45.4 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Respirator usage must be in accordance with the OSHA regulations of 29 CFR 1910.134. IDLH or unknown concentrations require an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.

Other Equipment: Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment to prevent skin contact. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems of sufficient power to maintain airborne levels of naphthalene below the OSHA PEL standard cited in section 2. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove and launder contaminated clothing before wearing it again; clean this material from shoes and equipment.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep this material off of your clothing and equipment. Avoid transferring this material from hands to mouth while eating, drinking, or smoking. Do *not* smoke, eat, or drink in any immediate work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store naphthalene in a cool, dry, well-ventilated area away from chemical incompatibles (see sect. 5).

Special Handling/Storage: Protect containers from physical damage. All bulk storage facilities must be built with an explosion-proof design. All containers used in shipping/transferring operations must be electrically grounded to prevent static sparks. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Comments: All operations with naphthalene must be done carefully to prevent accidental ignition of its flammable/explosive vapor. If the weather is warm, more naphthalene vapor forms and the potential for explosion increases. Do *not* smoke in any use or storage area!

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Naphthalene

DOT Hazard Class: ORM-A

IMO Class: 4.1

DOT ID No. UN1334

IMO Label: Flammable Solid

DOT Label: None

References: 1, 2, 12, 73, 84-94, 103. PJI

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Approvals *[Signature]*

Indust. Hygiene/Safety *[Signature]*

Medical Review *[Signature]*



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Material Safety Data Sheet Collection

Phenanthrene

MSDS No. 905

Date of Preparation: 6/94

Section 1 - Chemical Product and Company Identification

44

Product/Chemical Name: Phenanthrene

Chemical Formula: (C₆H₄CH)₂

CAS No.: 85-01-8

Synonyms: Phenantrin

Derivation: A polynuclear aromatic hydrocarbon found as a component of coal tar pitch volatiles (products of bituminous coal distillation). Produced from toluene, bibenzil, 9-methyl fluorene or stilbene by passage through red hot tubes or by diene synthesis of 1-vinyl naphthalene and maleic anhydride.

General Use: Used in the manufacture of dyestuffs and explosives; in biological research or drug synthesis.

Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Phenanthrene, ca 100 % wt

OSHA PEL*

8-hr TWA: 0.2 mg/m³

ACGIH TLV*

TWA: 0.2 mg/m³

NIOSH REL*

10-hr TWA: 0.1 mg/m³, cyclohexane
extractable fraction

DFG (Germany) MAK

None established

*Coal tar pitch volatiles (benzene soluble)

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Phenanthrene exists as shiny crystals with a faint, aromatic odor. It can cause photosensitization of the skin.

Phenanthrene is combustible and reacts dangerously with oxidizers.

Potential Health Effects

Primary Entry Routes: Skin contact.

Target Organs: Skin.

Acute Effects

Inhalation: Effects not reported.

Eye: Effects not reported.

Skin: Can cause photosensitization of the skin.

Ingestion: Effects not reported.

Carcinogenicity: Although it has produced skin cancer in experimental animals, the results were not statistically significant and IARC has assigned phenanthrene a Class 3 (unclassifiable as to carcinogenicity) designation. The NTP and OSHA do not list phenanthrene as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Skin disorders.

Chronic Effects: None reported.

**Wilson
Risk
Scale**

R 1
I 3
S 3
K 1

HMIS

H 1
F 1
R 0

PPE*

*Sec. 8

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin Contact: Quickly remove contaminated clothing. Rinse exposed area with flooding amounts of water to remove loose material and then move quickly to a soap and water wash. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

Flash Point: 340 °F (171 °C)

Flash Point Method: OC

LEL: Not reported.

UEL: Not reported.

Flammability Classification: Class IIIB Combustible liquid

Extinguishing Media: Use dry chemical or carbon dioxide; water spray or foam may cause frothing.

Unusual Fire or Explosion Hazards: None reported

Hazardous Combustion Products: Carbon oxides (CO_x) and acrid smoke

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against skin contact.

Small Spills: To avoid dust generation, *do not sweep!* Carefully scoop up or vacuum (with appropriate filter). Damp mop residue.

Large Spills

Containment: Flush large spill to containment area for later disposal. Do not release into sewers or waterways.

Cleanup: Mop up any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use nonsparking tools to open containers.

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, ignition sources, and strong oxidizers.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around phenanthrene.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendation is for *coal-tar pitch volatiles*: For any detectable concentration, use a SCBA or supplied-air respirator (with auxiliary SCBA) with a full facepiece and operated in pressure-demand or other positive pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.** If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: Colorless, shiny crystals with a faint, aromatic odor.

Vapor Pressure: 1 mm Hg at 244.76 °F (118.2 °C);

399 mm Hg at 536.2 °F (278 °C)

Formula Weight: 178.22

Density (H₂O=1, at 4 °C): 1.179 g/L at 77 °F (25 °C)

Water Solubility: 1.6 mg/L at 59 °F (15 °C)

Other Solubilities: 1 g in: 2.4 mL toluene, 2.4 mL carbon tetrachloride, 2 mL benzene, 1 mL carbon disulfide, 25 mL absolute alcohol, 60 mL cold 95% alcohol, 10 mL boiling 95% alcohol and 3.3 mL anhydrous ether. Also soluble in glacial acetic acid, chloroform, and hot pyridine.

Boiling Point: 644 °F (340 °C)

Melting Point: 213 °F (101 °C)

Refraction Index: 1.59427

Octanol/Water Partition Coefficient: log K_{ow} = 4.57

Section 10 - Stability and Reactivity

Stability: Phenanthrene is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Strong oxidizers.

Conditions to Avoid: Phenanthrene dust generation and exposure to heat ignition sources, or oxidizers.

Hazardous Decomposition Products: Thermal oxidative decomposition of phenanthrene can produce carbon oxide(s).

Section 11- Toxicological Information**Toxicity Data: *****Acute Oral Effects:**

Mouse, oral, LD₅₀: 700 mg/kg

Mutagenicity:

Rat, liver cell: 3 mmol/L caused DNA damage

Human, lymphocyte: 100 µmol/L caused mutation

Carcinogenicity:

Mouse, skin: 71 mg/kg produced tumors at site of application.

* See NIOSH, RTECS (SF7175000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: *Neanthes arenaceodentata*, TL_m = 0.6 ppm/96 hr, sea water at 71.6 °F (22 °C)

Environmental Degradation: If released to soil, some phenanthrene may biodegrade but the majority will bind to the soil without much leaching to groundwater. Volatilization is not expected to be significant. In water, it will adhere to particulates and sediment. Photolysis may occur near the surface producing toxic substances. Photolysis/photooxidation half-life = 8.4 hr. In the air, it will react with photochemically generated hydroxyl radicals (half-life = 1.67 days).

Soil Absorption/Mobility: Phenanthrene absorbs strongly to soil and sediment in water.

Section 13 - Disposal Considerations

Disposal: For treatment of phenanthrene contaminated water, the particulate bound portion can be removed by sedimentation, flocculation, and filtration. Chlorination is not recommended as it has been shown to produce mutagenic substances. The dissolved portion requires oxidation for partial removal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Transportation Data (49 CFR 172.101):****Shipping Name:**

Environmentally hazardous substances, solid, n.o.s.*

Shipping Symbols: —

Hazard Class: 9

ID No.: UN3077

Packing Group: III

Label: Class 9

Special Provisions (172.102): 8, B54, N50

Packaging Authorizations

a) Exceptions: 173.155

b) Non-bulk Packaging: 173.213

c) Bulk Packaging: 173.240

Quantity Limitations

a) Passenger, Aircraft, or Railcar: None

b) Cargo Aircraft Only: None

Vessel Stowage Requirements

a) Vessel Stowage: A

b) Other: —

* Classified as a hazardous substance when phenanthrene is in a quantity, in one package, which equals or exceeds the RQ of 5000 lb (2270 kg)

Section 15 - Regulatory Information**EPA Regulations:**

RCRA Hazardous Waste Number: Not listed

Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per CWA, Sec. 307(a)

CERCLA Reportable Quantity (RQ), 5000 lb (2270 kg)

SARA 311/312 Codes: 1

SARA Toxic Chemical (40 CFR 372.65): Not listed

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed (coal tar pitch volatiles) as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 23, 73, 103, 124, 132, 133, 136, 139, 159, 164, 187, 190

Prepared ByM Gannon, BA

Industrial Hygiene ReviewPA Roy, MPH, CIH

Medical Review W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 711
Pyrene

Issued: 4/90

Section 1. Material Identification

31

Pyrene Description: A condensed ring, polyaromatic hydrocarbon compound derived from coal tar. Also synthesized from o,o'-ditolyl. Used in biochemical research and as starting material for synthesizing benzo(a)pyrene. An ingredient of smoked and broiled meat, tobacco smoke, and air pollution.

Other Designations: CAS No. 0129-00-0; $C_{16}H_{10}$; beta-pyrene; benzo(d,e,f)phenanthrene; benzo(d,e,f)phenathrene.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*⁽⁷⁾ for a suppliers list.

R 1
I 3
S 2*
K -
* Skin
absorption

Genlum



HMIS
H 2
F 1
R 0
PPG†
† Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Pyrene, ca 100%

OSHA PEL

ACGIH TLV, 1989-90

NIOSH REL, 1987

Toxicity Data*

8-hr TWA: 0.2 mg/m³

None established

None established

Rat, oral, LD₅₀: 2700 mg/kg ingested produces conjunctiva irritation, excitement, and muscle contraction

Rat, inhalation, LC₅₀: 170 mg/m³ inhaled produces conjunctiva irritation, excitement, and muscle contraction

Gene mutation in mammalian cells; human cell types: 12 µmol/l

* See NIOSH, RTECS (UR2450000), for additional mutative, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 759 °F/404 °C

Molecular Weight: 202.26 g/mol

Melting Point: 313 °F/156 °C

Specific Gravity ($H_2O = 1$ at 39 °F/4 °C): 1.271 at 73 °F/23 °C

Vapor Pressure: 6.85×10^{-7} torr at 68 °F/20 °C

Water Solubility: Insoluble (0.135 mg/l)

Appearance and Odor: Colorless solid or a slight blue florescent solution. Tetracene impurities give pyrene a yellow color.

Section 4. Fire and Explosion Data

Flash Point: None reported

Autoignition Temperature: None reported

LEL: None reported

UEL: None reported

Extinguishing Media: Use foam, dry chemical, and CO₂ to extinguish fire.

Unusual Fire or Explosion Hazards: Pyrene is a flammable and combustible material that heat and ignition sources may ignite. It burns rapidly with a flare-like effect.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Avoid skin contact. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Pyrene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Hazardous Products of Decomposition: Thermal oxidative decomposition of pyrene can emit irritating fumes and acrid smoke.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists pyrene as a carcinogen.

Summary of Risks: Pyrene is irritating to exposed skin and eyes, moderately toxic by ingestion and intraperitoneal routes, and a poison by inhalation. Experimental studies show pyrene is a tumorigen in animals and a mutagen in humans. Workers exposed to concentrations between 3 and 5 mg/m³ showed some unspecified teratogenic effects. In general, human exposure occurs mainly through inhalation of tobacco smoke and polluted air. Although ingesting smoked and broiled meats may expose humans to pyrene, there is little indication of serious health effects.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Skin, eyes, respiratory tract.

Primary Entry Routes: Inhalation, ingestion, skin contact.

Acute Effects: Vapor inhalation may irritate the nose mucosa and respiratory tract. Vapors may also cause conjunctival irritation. Pyrene is absorbed through intact skin and causes dermal irritation. Ingestion may irritate and burn the esophagus and gastrointestinal tract.

Chronic Effects: None reported.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: Quickly remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a *conscious* person drink 1 to 2 glasses of milk or water. Do not induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Observe patients with dermal exposure for systemic poisoning since pyrene is absorbed through intact skin.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, and remove all heat and ignition sources. Cleanup personnel should protect against vapor inhalation and skin and eye contact. Scoop spilled material into appropriate disposal containers. Absorb liquid with inert, noncombustible material and place waste in appropriate disposal containers. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, Sec. 307(a)]
Listed as SARA Extremely Hazardous Substance (40 CFR 355), Reportable Quantity: 5000 lb, Threshold Planning Quantity (TPQ): 1000/10,000 lb

SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰²⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, well-ventilated area. Protect containers from physical damage.

Engineering Controls: Avoid vapor inhalation and skin contact. Practice good personal hygiene and housekeeping procedures. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Provide preplacement and periodic medical examinations, including comprehensive medical histories with emphasis on the oral cavity, respiratory tract, bladder, and kidneys. Examine the skin for premalignant and malignant lesions.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 7, 73, 87, 103, 123, 124, 126, 127, 136

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD

F8

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN

The soil and groundwater, surface water and sediment sampling techniques to be employed at the Provan facility in Newburgh, New York, are detailed below. All efforts will be made to eliminate sample contamination and maximize the reliability to the analytical results. These efforts include proper use and cleaning of sampling equipment and sample containers to eliminate sample contamination, use of a quality assurance program to maximize accuracy and precision of the analytical results, proper installation of groundwater monitoring wells and the use of chain-of-custody procedures to track the samples from source to analysis and minimize the opportunity for tampering.

SAMPLING EQUIPMENT AND PROCEDURES

SAMPLING EQUIPMENT AND CLEANING PROCEDURES

The sample containers, glass jars with Teflon™ lined-plastic screw-on lids, will be provided by the contracted New York State Department of Health ELAP Certified Laboratory. Containers used to collect soil and water samples will be specifically designed for that purpose. The containers will be cleaned prior to shipment by the laboratory, using standard, in-house procedures.

Soil samples will be collected with either a hand auger, split-spoon sampler or Geoprobe Macrocore device. If a split-spoon sampler or Macrocore device is used, a drill rig will be used to drive the sampler to the required depth and obtain soil samples. The split-spoon sampler will be 24 inches in length and in accordance with ASTM D1586-67. The Macrocore will be 48 inches in length. The Macrocore sampler will be equipped with a sample retention device and acetate liner to ensure sample quality.

All soil sampling equipment will be cleaned with a wire or bristle brush to remove any clinging soils or materials. This will be followed by a washing with a phosphate-free detergent and water. The equipment will then be rinsed with clean water, distilled water, methanol (used to avoid contaminating soils with acetone), and finally, distilled water. The drilling tools will be cleaned with a steam cleaner prior to use and between work on individual boreholes.

Prior to sampling groundwater, wells will be purged by bailing or pumping, depending on well productivity. If bailing is used, one PVC bailer will be dedicated to each well for use in purging and one stainless steel, Polyethylene, or Teflon™ bailer will be dedicated to each well for use in sampling.

All purge/sampling equipment will be cleaned before transporting to the field. Bailers will be cleaned by the certified laboratory using standard in-house procedures. After drying, the bailers will be wrapped in aluminum foil for transportation to the field. Pumps used to purge wells prior to sampling will be cleaned by rinsing with detergent, potable water, distilled water, methanol and distilled water.

USE OF QUALITY ASSURANCE SAMPLES (BLANKS, DUPLICATES)

Travel blank samples, duplicates and blank samples generated in the field will serve as an independent check on the laboratory and field sampling techniques. These samples will be coded to minimize the chance of laboratory identification.

The following QA/QC samples will be collected:

- One travel/trip blank, consisting of distilled water prepared by the laboratory and analyzed for VOC analysis, will be collected for each two days of sampling.

- One field blank for each media sampled that day will be submitted for analysis for volatile organics.

SAMPLING METHODOLOGY

All subsurface work will be conducted in a manner that produces reliable information of subsurface conditions and representative soil, sediment, surface water and groundwater samples for analysis. A First Environment degreed hydrogeologist, geologist, engineer or equivalent will supervise all drilling and sampling procedures.

Soil Sample Collection Methodology

Soil Samples.

The location of each borehole will be referenced by a grid system or some other survey control. A drill rig/Geoprobe or hand auger will be used to produce boreholes at the proper depths at each predetermined sampling location. Sample depths will be measured to ensure they are correct. Samples will be taken by driving a split-spoon sampler, Macrocore or hand auger into the undisturbed material below the bottom of the borehole. The sampler will be equipped with a sample retention device.

Prior to sample collection, sample depths will be screened with Photoionization Detector (PID) to insure that collected samples are representative of actual soil conditions. This will be accomplished through head space analysis. The PID is calibrated to 100 ppm isobutylene prior to each day's activities.

A soil sample will be collected from the appropriate sampler or hand auger. To prevent contamination of sample bottle by windblown soils, each bottle will remain sealed until sample collection. Upon soil collection, the sample will be split in two bottles for headspace analysis and laboratory analysis. The sample containing the highest

headspace PID reading at each boring will submit the split sample to the laboratory. This sample will bottle have the following information recorded on it:

- Job Name and Location
- Sample Location
- Time and Date of Sampling
- Depth of Sampling
- Analysis
- Boring Number

The jar will then be placed in a cooler and kept at 4°C until transported to the laboratory. This procedure will be repeated at each sample location and for successive samples at the same location.

Each sample device will be examined in the field to aid in evaluation of site stratigraphy. If boreholes are located at or near the water table, they will be sealed with a cement bentonite grout acceptable for use in monitoring wells.

Monitoring Well Installation Technique and Design

To ensure that representative samples of the groundwater are obtained, monitoring wells will be installed in accordance with NYSDEC monitoring well installation and design specifications for unconsolidated material as presented in Section 5.5.3.2 of the NYSDEC Sampling Guidelines and Protocols. All wells will be constructed of threaded, flush joint, schedule 40 PVC wells materials, supplied by the drilling contractor and will be installed using auger drilling techniques.

Upon completion of the borings, an appropriate length of 2-inch PVC, 0.010-inch slotted well screen will be installed through the hollow stem augers from approximately 10 feet below to 5 feet above the water table. Should the water table be encountered within 7

feet or less of the ground surface, the well screen will extend to within 2 feet of the ground surface. The remainder of the well will consist of 2-inch PVC casing which will extend over the ground surface. Filter sand will be placed in the annulus between the screen and the borehole to a level of at least 6 inches above the top of the screen. A bentonite pellet seal will be placed on top of the filter sand. The remainder of the annulus will be grouted with a cement bentonite grout acceptable for use in monitoring wells. The surface protection will consist of a lockable steel casing, extending approximately 2 feet above the ground surface and anchored in cement. In areas accessible to vehicular traffic, road boxes may be installed.

For the deep monitoring wells an isolation casing will be installed and grouted to the top of the clay confining layer. Drilling will be resumed through the grout, clay later and into the lower waterbearing zone (see Figure 4-7 for example of monitoring well installation using an isolation casing). If no competent clay later is encountered the wells will be installed with a single casing to a maximum depth of 35 feet.

To complete the monitoring well installation, each well will be developed by pumping, bailing or an equivalent method. This will remove fines generated during the installation and ensure that hydraulic continuity is established between the well and the aquifer.

Groundwater Flow Direction

A New York registered land surveyor will survey the reference elevation of the top of the PVC monitoring well casings. Water level measurements will be recorded to within 0.01 feet, using an electric water-level indicator. This information will be used to determine groundwater flow direction and construct groundwater contour maps.

Groundwater Sample Collection Methodology

Water samples will be collected no sooner than two weeks after development of the monitoring wells. Prior to sample collection, a minimum of three well volumes will be

evacuated using a pump of dedicated bailer depending on well production. After purging, a bailer will be submerged beneath the water column in the well, filled and raised to the surface. The sample collection jar will be filled directly from the bailer. Bailing will continue until each sample jar is filled and closed. Care will be taken to ensure that samples tested for volatile organics have no air space. Sample jars will be kept closed until the time of collection, to prevent airborne contamination of the sample container. Specific conductance and pH will be measured in the field.

After closing the sample jar, the following information will be recorded on the sample container:

- Job Name
- Sample Media
- Sample Location
- Time and Date of Sampling
- Analysis

The sample will then be placed in a cooler and kept at 4°C until transported to the laboratory for analysis. This process will be repeated for each well.

A field log will also be kept and the following information recorded for each sample:

- Time and Date of Sampling
- Weather
- Name of Sampler
- Water Level Prior to Purge
- Total Well Depth
- Volume Purged
- Purging Method
- Sampler Type
- Presence and Description of any Free Product
- pH, Specific Conductance and Turbidity
- Other Characteristics (odor, color, etc.)

CHAIN-OF-CUSTODY PROCEDURES

Each sample will be recorded separately on the chain-of-custody manifest as part of the sampling procedure. The information obtained for each sample will include the following:

- Sample Identification
- Sampler's Name
- Time and Date of Sampling
- Sample Laboratory Number
- Analysis to be Performed
- Laboratory Name

Chain-of-Custody procedures will include the following:

- All samples will be listed on a chain-of-custody manifest.
- All personnel responsible for sampling, transporting and receiving samples will sign the chain-of-custody manifest.
- Analyst's name and laboratory will be recorded on the chain-of-custody manifest.
- Samples will be transported in a secured container with the chain-of-custody manifest attached.
- Samples will be kept in a locked vehicle or within sight of a custodian until received by the laboratory.

PROVISIONS FOR SPLIT SAMPLES

Approximately one week prior to soil and groundwater sampling, the department will be notified of the sampling times and dates. It will then have the option of observing or obtaining split samples.

ANALYTICAL LABORATORY AND METHODS

ANALYTICAL LABORATORY

INTEGRATED ANALYTICAL LABORATORIES (IAL)

Randolph, New Jersey 07869

ANALYTICAL METHODS

Analytical methods and detection limits are attached.

VOLATILE COMPOUNDS

	TCL	Instrument Average MDL Aqueous (ppb)	Reported MDL, Soil (ppb)	Reported MDL, Methanol Soil (ppb)
Acetone	x	1.640	20	2500
Benzene	x	0.450	5	625
Bromochloromethane	x	0.540	5	625
Bromodichloromethane	x	0.370	5	625
Bromoform	x	0.310	5	625
Bromomethane	x	0.560	5	625
2-Butanone (MEK)	x	0.730	20	2500
Carbon disulfide	x	0.230	5	625
Carbon tetrachloride	x	0.540	5	625
Chlorobenzene	x	0.200	5	625
Chloroethane	x	0.370	5	625
Chloroform	x	0.390	5	625
Chloromethane	x	0.730	5	625
cis-1,2-Dichloroethene	x	0.390	5	625
cis-1,3-Dichloropropene	x	0.370	5	625
Cyclohexane	x			
1,2-Dibromo-3-chloropropane	x	0.650	5	625
Dibromochloromethane	x	0.230	5	625
1,2-Dibromochloroethane/Ethylene dibromide (EDB)	x	0.230	5	625
1,2-Dichlorobenzene	x	0.480	5	625
1,3-Dichlorobenzene	x	0.510	5	625
1,4-Dichlorobenzene	x	0.370	5	625
Dichlorodifluoromethane	x	0.620	5	625
1,1-Dichloroethane	x	0.450	5	625
1,2-Dichloroethane (EDC)	x	0.420	5	625
1,1-Dichloroethene	x	0.280	5	625
1,2-Dichloropropane	x	0.680	5	625
Ethylbenzene	x	0.370	5	625
2-Hexanone	x	0.620	20	2500
Isopropylbenzene ** (see note)	x	0.370	5	625
Methyl acetate	x			
Methylcyclohexane	x			
Methyl-2-pentanone/Methyl Isobutyl Ketone (MIB)	x	0.420	20	2500
Methylene Chloride	x	0.420	5	625
Methyl-tertiary-butyl ether (MTBE)	x	1.270	5	625
Styrene	x	0.200	5	625
1,1,2,2-Tetrachloroethane	x	0.390	5	625
Tetrachloroethene (PERC)	x	0.310	5	625
Toluene	x	0.510	5	625
Total Xylenes	x	1.160	5	625
trans-1,2-Dichloroethene	x	0.540	5	625
trans-1,3-Dichloropropene	x	0.310	5	625
2,4-Trichlorobenzene	x	0.390	5	625
1,1,1-Trichloroethane	x	0.730	5	625
1,2-Trichloroethane	x	0.450	5	625
Trichloroethene	x	0.340	5	625
Trichlorofluoromethane	x	0.480	5	625
1,1,2-Trichloro-1,2,2-trifluoroethane	x			
Vinyl Chloride	x	0.420	5	625

x MDL not available

x MDL not available

x MDL not available

x MDL not available

TCL from EPA Internet site 6/8/99. TCL changed 1/1/00, RR confirmed.

Printed 6/23/009:42 AM

SEMIVOLATILE COMPOUNDS

	TCL	Instrument MDL, C (Aqueous)	Reported MDL's, Soil (ppb)
Acenaphthene	x	0.111	33.3
Acenaphthylene	x	0.176	33.3
Acetophenone	x		X - MDL Not Available
Anthracene	x	0.182	33.3
Atrazine	x		X - MDL Not Available
Benzaldehyde	x		X - MDL Not Available
Benzo[a]anthracene	x	0.249	33.3
Benzo[a]pyrene	x	0.335	33.3
Benzo[b]fluoranthene	x	0.545	33.3
Benzo[g,h,i]perylene	x	0.546	33.3
Benzo[k]fluoranthene	x	0.690	33.3
1,1-Biphenyl	x		X - MDL Not Available
Bis(2-chloroethoxy)methane	x	0.161	33.3
Bis(2-chloroethyl)ether	x	0.167	33.3
Bis(2-chloroisopropyl)ether **	x	0.548	33.3
Bis(2-ethylhexyl)phthalate	x	0.732	33.3
4-Bromophenyl-phenylether	x	0.447	33.3
Butylbenzylphthalate	x	0.570	33.3
Caprolactam	x		X - MDL Not Available
Carbazole	x	0.289	33.3
4-Chloro-3-methylphenol	x	0.432	33.3
4-Chloroaniline	x	0.563	33.3
2-Chloronaphthalene	x	0.295	33.3
2-Chlorophenol	x	0.167	33.3
4-Chlorophenyl-phenylether	x	0.442	33.3
Chrysene	x	0.402	33.3
Dibenz[a,h]anthracene	x	0.421	33.3
Dibenzofuran	x	0.168	33.3
3,3'-Dichlorobenzidine	x	0.337	33.3
2,4-Dichlorophenol	x	0.516	33.3
Diethylphthalate	x	0.297	33.3
Dimethylphthalate	x	0.248	33.3
2,4-Dimethylphenol	x	0.260	33.3
Di-n-butylphthalate	x	0.478	33.3
4,6-Dinitro-2-methylphenol	x	0.887	33.3
2,4-Dinitrophenol	x	0.405	33.3
2,4-Dinitrotoluene	x	0.864	33.3
2,6-Dinitrotoluene	x	0.444	33.3
Di-n-octylphthalate	x	0.629	33.3
Fluoranthene	x	0.409	33.3
Fluorene	x	0.372	33.3
Hexachlorobenzene	x	0.502	33.3
Hexachlorobutadiene	x	0.418	33.3
Hexachlorocyclopentadiene	x	0.332	33.3
Hexachloroethane	x	0.415	33.3
Indeno[1,2,3-cd]pyrene	x	0.623	33.3
sophorone	x	0.259	33.3
2-Methylnaphthalene	x	0.184	33.3

** Compound also known as 2,2-oxybis (1-Chloropropane)

SEMIVOLATILE COMPOUNDS

	TCL	Instrument MDL, C (Aqueous)	Reported MDL's, Soil (ppb)
2-Methylphenol (o-Cresol)	x	0.252	33.3
4-Methylphenol (p-Cresol)	x	0.285	33.3
Naphthalene	x	0.132	33.3
2-Nitroaniline	x	0.510	33.3
3-Nitroaniline	x	0.696	33.3
4-Nitroaniline	x	0.929	33.3
Nitrobenzene	x	0.414	33.3
2-Nitrophenol	x	0.819	33.3
4-Nitrophenol	x	0.687	33.3
Nitroso-di-n-propylamine	x	0.245	33.3
Nitrosodiphenylamine	x	0.338	33.3
Pentachlorophenol	x	0.751	33.3
Benanthrene	x	0.146	33.3
Phenol	x	0.269	33.3
Pyrene	x	0.262	33.3
4,5-Trichlorophenol	x	0.445	33.3
4,6-Trichlorophenol	x	0.583	33.3

PCB'S

COMPOUNDS	TCL 8082	Reported Aq (ppb) MDL's	Reported Soil (ppb) MDL's
Aroclor 1016	X	0.2	6.68
Aroclor 1221	X	0.2	6.68
Aroclor 1232	X	0.2	6.68
Aroclor 1242	X	0.2	6.68
Aroclor 1248	X	0.2	6.68
Aroclor 1254	X	0.2	6.68
Aroclor 1260	X	0.2	6.68

PESTICIDES

COMPOUNDS	TCL 8081A	Reported Aq (ppb) MDL's	Reported Soil (ppb) MDL's
4,4'-DDD	X	0.005	0.167
4,4'-DDE	X	0.005	0.167
4,4'-DDT	X	0.005	0.167
Aldrin	X	0.005	0.167
alpha-BHC	X	0.005	0.167
alpha-Chlordane	X	0.005	0.167
beta-BHC	X	0.005	0.167
delta-BHC	X	0.005	0.167
Dieldrin	X	0.005	0.167
Endosulfan I	X	0.005	0.167
Endosulfan II	X	0.005	0.167
Endosulfan sulfate	X	0.005	0.167
Endrin	X	0.005	0.167
Endrin aldehyde	X	0.005	0.167
Endrin Ketone	X	0.005	0.167
gamma-BHC (Lindane)	X	0.005	0.167
gamma-Chlordane	X	0.005	0.167
Heptachlor	X	0.005	0.167
Heptachlor Epoxide	X	0.005	0.167
Methoxychlor	X	0.005	0.167
Toxaphene	X	0.025	0.835

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COMPOUNDS	Aqueous - MDL (ppm) - ICP 6010	Monitoring Well - MDL (ppm) - ICP/MS 200.8	Soil MDL (ppm) - ICP/MS 6020
Aluminum	0.1	0.1	2.0
Antimony	0.1	0.008	2.0
Arsenic	0.1	0.004	0.2
Barium	0.01	0.02	5.0
Beryllium	0.02	0.004	0.2
Cadmium	0.005	0.0006	0.2
Calcium	0.4	0.8	20.0
Chromium	0.01	0.02	0.6
Cobalt	0.02	0.04	0.4
Copper	0.02	0.04	0.4
Iron	0.05	0.10	3.0
Lead	0.004/0.029	0.004/0.029	2.0
Magnesium	0.10		20.0
Manganese	0.005	0.01	0.4
Mercury	☒	☒	☒
Nickel	0.01	0.02	0.6
Potassium	0.1		20.0
Selenium	0.1	0.008	2.0
Silver	0.02	0.0004	
Sodium	0.1		20.0
Thallium	0.004	0.008	0.08
Vanadium	0.015	0.03	0.3
Zinc	0.01	0.02	1.0

☒ = MDL for TCLP, Wastewater & Monitoring Well is 0.0005
by ColdVapor and 0.0125 for Soil by Cold Vapor.

Wet Chemistry

COMPOUNDS	SOIL - Reported MDL	AQUEOUS - Reported MDL	Aqueous Method	Soil Method	Holding Times
Cyanide, Total (ppm)	1.00	0.05	335.2	9010	14 days

**Citizen Participation Plan
for the
Site Investigation/Remedial
Alternative Workplan
Former Jonas Automotive Facility
Environmental Restoration Project No. B00136-3**

Prepared for
City of Newburgh
83 Broadway
Newburgh, NY 12550

September 2000

Project No. JONAS001

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
BASIC SITE INFORMATION	1
SITE DESCRIPTION/LOCATION/BRIEF HISTORY	1
STATUS OF PROPOSED SITE INVESTIGATION	3
CITIZEN PARTICIPATION ACTIVITIES	5
GOALS AND OBJECTIVES	5
TOOLS AND METHODS	7
CONTACT LIST	7
DOCUMENT REPOSITORY	8
PUBLIC MEETING AND COMMENT PERIOD	10
RESPONSIVENESS SUMMARY	11
AVAILABILITY SESSIONS	11
INFORMATION SHEETS	12
SUMMARY	13
FIGURES	14
APPENDICES	
A Glossary of Key Citizen Participation Terms and Major Program Elements	15
B Identification of Document Repositories and List of Available Documents	15
C Identification of Interested Parties (Contact List)	15
D Identification of Project Management Contacts and Project Spokesperson	15

INTRODUCTION

Citizen participation is an important and integral component of remedial programs in New York State. Integration of individuals and organizations into the remedial program helps ensure outcomes that account for both technical and human concerns for **protecting public health and the environment**. In order for this integration to be accomplished, a project-specific plan is needed to inform and involve community residents, public and private leaders, and other stakeholders. This Citizen Participation Plan (CPP) addresses this need by documenting the planned project-specific public outreach activities and resources organized for the remedial program associated with the Former Jonas Automotive Site in Newburgh, NY (Jonas Automotive Site).

The primary purpose of this CPP is to outline a variety of communication methods that, based on applicable New York State law and New York State Department of Environmental Conservation (NYSDEC) guidance, provide for constructive communication of program activities among the stakeholders and other interested parties. This CPP includes methods intended to inform interested parties of program developments, elicit responses and public involvement and provide a central point of contact for inquiries regarding the remedial program for the Jonas Automotive Site. Given this context, this CPP presents the planned communication and outreach activities, describes how interested individuals and groups can participate in the remedial program, and provides a variety of reference materials to facilitate gaining access to project-specific information and management personnel.

BASIC SITE INFORMATION

Site Description/Location/Brief History

The City of Newburgh took ownership of the Jonas Automotive Site after it foreclosed on this approximately 1.5 acre property.

The Jonas Automotive Site is located at 86 Wisner Avenue in Newburgh, NY. Approximately 30% of the site is covered by the old brick and steel building, the

remaining portion of the property is covered with gravel, cinders, earthen fill and vegetation. The building consists of one slab-on-grade concrete, brick and steel structure of approximately 16,000 square feet and is currently vacant. Past uses include the dismantling of automobile motors. At the back of the building to the east is a concrete pad where an overhead crane operated and where there is evidence of an old railway spur. At the back of the property, on the south side, there is a small cinder block garage type building. The location of the facility is illustrated on the Newburgh Quadrangle Map included in this Plan as Figure 1.

The surrounding area is a mixture of residential and commercial buildings. The residential area lines Wisner Avenue and the commercial area lines Broadway Avenue. Also, some commercial properties are interspersed among the residential properties on Wisner Avenue. Prime Inc., an automotive parts warehouse, is located directly next door to the south; adjacent to Prime on the South is the Nissan Used Car Dealer, Dunkin' Donuts, Planet Wings, a car wash and Newburgh Auto Parts- all of which front on Broadway Avenue (Route 17K). To the east of the property are low-lying, underdeveloped land and Gidneytown Creek. To the north and to the west of the property are residences.

The initial historic records search on this property identified two additional facility names- Poughkeepsie Iron Fabricators and Poughkeepsie Trim and Steel. Under the name of Jonas Automotive, the site is listed in the New York State Spills database. According to the Environmental Data Resources, Inc. Report, motors were being dumped in the rear of the property, and fluids were visible on the ground. The release was reported to the NYSDEC by a citizen on March 2, 1998 and given spill #9713317. Thereafter, the responsible party stockpiled the contaminated soil on the site and failed to properly dispose of it.

Another former occupant of the subject property, Poughkeepsie Iron Fabricators, is listed in the underground storage tank (UST) and aboveground storage tanks (AST) databases. According to these listings, there exists one UST and four ASTs on the

property. The UST is a 1000-gallon steel vessel used to store gasoline. This tank was installed in August 1962, and remains in service. In addition, there are two 1000-gallon diesel, one 500-gallon (gasoline) and one 275-gallon (fuel oil) ASTs on-site. All tanks are steel and are reported to be still in service. It should be noted that during the February 8th, 2000 site visit only one AST was identified on this site.

Poughkeepsie Trim & Steel (PTS), also identified as Jonas Auto Rebuilders, is also listed in the NY Spills database. The PTS listing is similar to the spill case described above in that motor blocks were reportedly being dumped on an on-site concrete pad and surrounding soil, while the Gidneytown Creek was located 1,500 feet away. On July 6, 1994, the spill was called into the NYSDEC by the Newburgh Building Inspector, and assigned spill #9404697. According to the report, a willing responsible party existed and corrective action was taken. The spill case was subsequently closed on July 11, 1994.

Although there are other environmental issues in the immediate vicinity of the Jonas property (e.g. leaking underground storage tanks), there were no more listings regarding the site itself in the initial historic report on the site.

Status of Proposed Site Investigation

The Jonas Automotive Site Investigation is at its initial stage. First Environment, Inc., an environmental engineering firm, was retained by the City of Newburgh to conduct a Site Investigation and remediation activities at the Jonas Automotive site in April 1999. Waste characterization of soil stockpiled on the site was performed and the soil was properly disposed of off-site in December of 1999 at the request of NYSDEC.

Areas of environmental concern for this property were identified at the February 8th, 2000 site inspection. Personnel conducting that site inspection included NYSDEC personnel, Mr. William Hauser, the City of Newburgh's Engineer of McGoey, Hauser and Edsall, and Thomas Bambrick, Geologist and Scott Green, Hydrogeologist of First Environment, Inc.

Based on the findings of the February 8, 2000 site inspection, nine (9) areas of potential environmental concern were preliminarily identified. These areas include:

- Area 1- Drum Storage Area- (16 drums)
- Area 2- Overhead Crane Area- a concrete pad area at back of building
- Area 3- Low-lying Ground
- Area 4- Drywell and Leachfield
- Area 5- Catch Basin
- Area 6- Underground Storage Tank
- Area 7- Aboveground Storage Tank- 1,000-gallon tank used to store waste engine fluids
- Area 8- Drains and Sumps
- Area 9- Groundwater

The areas of potential environmental concern, and the proposed investigation activities are discussed in detail in the Site Investigation WorkPlan. Figure 2- Jonas Automotive-Sampling Locations shows all of the Areas of Potential Environmental Concern.

As part of this Site Investigation several remediation activities will be performed including the removal of the underground storage tank and the above ground storage tank and their proper disposal off-site. In addition, limited soil removal will take place based on visual inspection of soils, as well as the sampling of soils following the removal of these two tanks.

Soil sampling will be completed at all areas of concern; tests will be performed for both volatile organic and base neutral compounds. In addition to the soil sampling, four monitoring wells will be installed to evaluate the impact of past operations on the groundwater. One well will be installed at the location of the underground storage tank. The three remaining wells will be installed adjacent to the catch basin and dry well. All groundwater samples will be analyzed for volatile organic compounds, base neutral compounds and priority pollutant metals.

When the tank removals and sampling have been completed, it is probable that the Site Investigation and Remedial Alternatives Workplan will be amended to reflect the results

of the sampling and that more sampling may be required before any additional remedial measures are proposed for this site.

When the initial sampling is complete information sheets on the results will be distributed to the contact list for all interested parties. All sampling reports and amendments to the Site Investigation and Remediation Alternatives Plan will also be available to the public at the document repositories for this project. See Appendix B.

CITIZEN PARTICIPATION ACTIVITIES

This section presents the specific citizen participation and outreach activities planned for implementation during the Jonas Automotive remedial program. Operating under overarching project-specific citizen participation goals, clearly defined objectives will be achieved by implementing a range of communication tools and methods. The planned activities are geared toward making project-specific information (e.g., work plans, technical reports, data, information sheet summaries) available to the public; facilitating communication among stakeholders (e.g., contact list, public meetings, comment periods); and notifying the public of document availability, public meetings, comment periods, and major program milestones.

Areas where project-related documents will be available are provided in Appendix B. The community contact list is provided in Appendix C, while the Jonas Automotive Project management contacts (NYSDEC, New York State Department of Health [NYSDOH], and City of Newburgh representatives and Project Spokesperson are provided in Appendix D.

Goals and Objectives

The central goal of this CPP is to achieve effective, open communication between the City of Newburgh (owner of the former Jonas Automotive site), the citizens of Newburgh, the NYSDEC, and other stakeholders and interested parties. Corollary goals include:

- Communicate program goals and major milestones, actions, and outcomes;
- Inform citizens and others of on-going project activities, status, and progress,
- Provide citizens (and all stakeholders) a forum for input and comment;
- Engender a public understanding of the constituents of interest (chemicals observed in the project area), their potential risks to human health and the environment, and appropriate responses to mitigate those risks; and
- Inform the community about the duration and complexity of the remedial program.

In order to accomplish these goals, the following specific objectives will be pursued through the implementation of this CPP:

- Consistently communicate goals, accomplishments, and status of the project to the contact list (including community leaders, public officials, and the wider community, as necessary) through appropriate means;
- Maintain, update, and utilize the contact list,
- Educate the community, in lay terms, about the nature and magnitude of potential project area risks, including instructions for mitigating risk (if appropriate) and assurances that the environment and worker/public health and safety are protected;
- Provide interested parties the opportunity to review and comment on technical reports generated through the remedial program (e.g., public comment periods and document repository as required);
- Provide interested parties the opportunity to present opinions and ideas during the remedial program (e.g., conduct a public meeting/comment period and availability session as required);
- Provide response to public review and comment (e.g., prepare a responsiveness summary as required);
- Provide the news media with interviews or press releases, as available, to ensure accurate coverage of remedial program activities; and

- Periodically review the effectiveness of the citizen participation and outreach activities during the remedial program and make adjustments in this CPP's methods and/or activities, if necessary.

Tools and Methods

There are many ways to reach and communicate with the community of Newburgh as this CPP is implemented over the course of the remedial program. A variety of outreach tools and methods will be used because "The Community" is not a single entity, but comprised of various organizations, public, and business leaders, and a diverse assemblage of individuals of all ages, education backgrounds, and cultures.

Interested parties will be informed and invited to participate in the planned citizen participation activities through appropriate means such as mailings to the contact list, press releases, or information sheets and other documents made available in the document repository.

The following specific public participation activities will be implemented to facilitate public involvement in the Jonas Automotive Project. Depending upon the nature of work ongoing at the site, the NYSDEC and City of Newburgh may decide to use any or all of the following citizen participation tools and methods.

Contact List

The contact list includes the names, addresses, and/or telephone numbers of individuals, groups, organizations, and/or media interested in or affected by the Jonas Automotive Project. The contact list is periodically updated with the contact information of any individual, group, organization, or business that has an interest in the project and wishes to receive public mailings or announcements published regarding project activities. Names are added to the contact list as they are received from public meeting sign-in sheets or from any public inquiry requesting to be included on the list. When

specific citizen participation activities are scheduled, the contact list is used to notify interested parties as to how and where they can participate in project decision-making. For example, when and if, the NYSDEC prepares its PRAP (Proposed Remedial Action Work Plan), for this project, the contact list will be used to inform interested parties of the availability of the PRAP for public review and comment, and of the date, time, and location of the PRAP public meeting and public comment period.

The first activity proposed for the Jonas Automotive Project will be to mail an announcement concerning the availability of the Site Investigation/Remedial Alternative Workplan to the contact list. The next activity will be to prepare the information sheet on the results of the tank removals and all soil and groundwater sampling proposed in the initial investigation period. The remainder of the CPP activities will occur after the amendments to the initial Site Investigation/Remedial Action Work Plan. Because it is at this stage of the remedial program that more specific information will be available to define the site's environmental problems and the proposed remedies.

The contact list is provided as Appendix C of this CPP.

Document Repository

Document repositories will be established in publicly accessible locations that have the accommodations necessary to house and make project related documents available for community reference and review. The use of document repositories is intended to maximize public access to site information while minimizing abuse, destruction, of project documentation. The document repositories for the Jonas Automotive Project are:

NYSDEC Region 3 Office

21 South Putt Comers Road
New Paltz, NY 12561-1696
Phone: (914) 256-3154
Hours: 9:00 a.m. to 4:30 p.m.
Monday through Friday

Newburgh Free Library

Head of Reference Department
124 Grand Street
Newburgh, NY 12550
Phone: (914) 561-1985
Hours: Mon - Thu 9:00 am - 9:00 pm
Fri, Sat 9:00 am - 5:00 pm
Sun 1:00 pm - 5:00 pm

The following documents, as they become available, will be placed in the repositories and made available for public reference and use:

- Site Investigation/Remedial Alternative Workplan; (Available)
- Quality Assurance/Quality Control Plan; (Available)
- Health and Safety Plan (HASP); (Available)
- Citizen Participation Plan (CPP); (Available)
- SI/RAR- Site Investigation/Remedial Action Report (SI/RAR);
- Proposed Remedial Action Plan (PRAP);
- Record of Decision and Responsiveness Summary; Remedial Design Documents (including design Plans and Specifications), and
- Other Materials (e.g., Information Sheets, Notices, etc.).

Public Meeting and Comment Period

After completion of the SI/RAR, the preferred remedy for the site will be presented in a PRAP and subject to public review and comment. If, after the initial investigation, no significant environmental concerns are found at this site, there is the possibility that the only additional Citizen Participation Activity would be a public meeting to explain all the results and findings of the initial investigation.

If any contamination is found on site that exceed NYSDEC or Federal limits, a PRAP will be developed. A public meeting and comment period will be held at a convenient time and location to gather public comments on the PRAP. A 45-day comment period will also be established to gather additional comments and questions from interested parties. During the public meeting, NYSDEC, NYSDOH and City of Newburgh project managers will be on hand to summarize the findings of the SI/RAR and answer questions regarding project area characterization, data, activities, remedial alternatives, the preferred remedy presented in the PRAP, costs, implementation schedules, and criteria used in evaluating the preferred remedy.

Following discussion of the project's status, citizens and others have the opportunity to ask questions and provide comment on the SI/RAR findings and the PRAP. After the public meeting and comment period end, NYSDEC will review all public comments and, where applicable, incorporate the comments into the final remedial action decisions embodied in the ROD. The ROD describes the remedial action to be taken at the project area, the rationale used to select a particular remedial alternative, and a summary of public comments with corresponding NYSDEC and/or NYSDOH responses.

Responsiveness Summary

Public questions, comments, and concerns voiced during the public meeting on the PRAP and collected during the comment period will be addressed by the NYSDEC and published in the ROD's Responsiveness Summary. Agency responses are to address both the broad general concerns and the significant specific questions communicated by the interested parties.

Availability Sessions

After the ROD is issued, implementation of the selected remedial action is planned and formally designed. Upon completion of the design documents that specify the exact details of the remedial action, a fact sheet is prepared and an availability session is typically held. Availability sessions are informal and intended to provide an opportunity for NYSDEC, City of Newburgh, citizens, and other interested parties to discuss the remedial design and its implementation. For instance, before construction begins (if some form of construction is part of the design), citizens can learn of planned health and safety measures and other site controls intended to minimize such things as noise, traffic, and potential risk to human health and the environment.

During the availability session, project officials typically do not make formal presentations similar to the project overview given at the PRAP public meeting. However, by having project managers directly accessible to the community, the public

participants have an opportunity to speak with project personnel on a near one-to-one basis. Availability sessions can be held on an as-needed basis throughout the project.

Fact Sheets

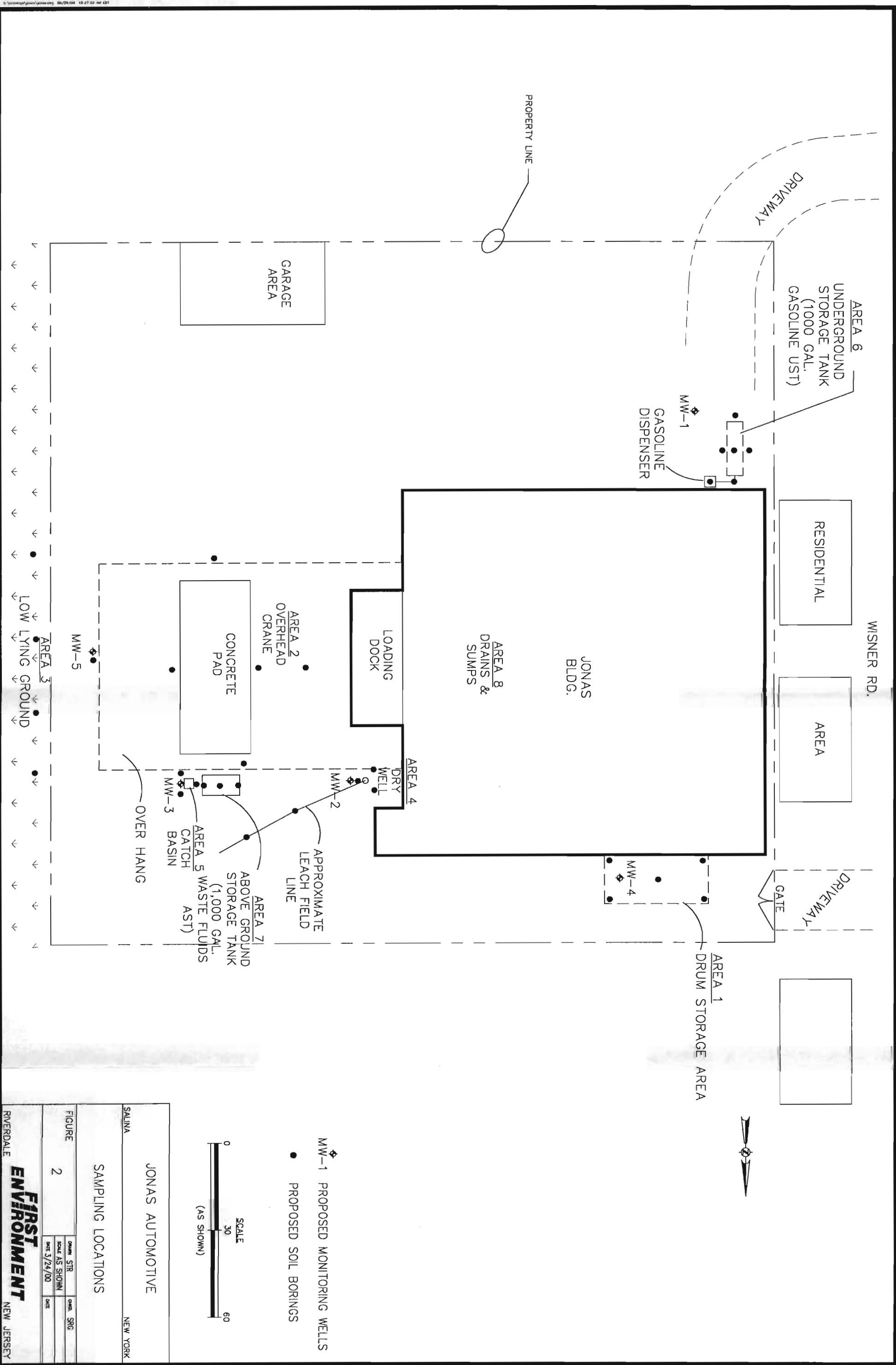
Information sheets will be prepared and distributed to the contact list in order to announce major project milestones and accomplishments throughout the remedial program (e.g., start of construction, major report completion, etc.). Written in lay terms, information sheets will describe and summarize the project area's history, review the goals of the project, update the status of project plans and/or results, list opportunities for citizen involvement, list key contacts, and list the location of the document repositories.

SUMMARY

Guided by the goals and objectives of this CPP, implementation of the planned public outreach and citizen participation activities will ensure the timely communication of important program information of interest to the stakeholders of the Jonas Automotive Project Site and the City of Newburgh. Moreover, citizen involvement and interaction in the remedial program will be facilitated through specific opportunities such as public meetings, public comment periods, availability sessions, and use of the document repositories. Throughout the remedial program, this CPP and its specific outreach tools and methods will be monitored and, as required and agreed by the NYSDEC and City of Newburgh, will be adjusted to improve its effectiveness in responding to community needs.

FIGURES

- 1 Jonas Automotive Site Location Map
- 2 Figure 2- Jonas Automotive Sampling Locations/Areas of Environmental Concern
- 3 Proposed Project Schedule for Jonas Automotive SI/RAR



APPENDICES

- A Glossary of Key Citizen Participation Terms and Major Program Elements
- B Identification of Document Repositories and List of Available Documents
- C Identification of Interested Parties (Contact List)
- D Identification of Project Management Contacts and Project Spokesperson

Appendix A
Hazardous Waste Site Program
Glossary and Acronyms

GLOSSARY

This glossary defines terms associated with New York's hazardous waste site citizen participation program, and important elements of the hazardous waste site remedial program. Words in **bold** in the definitions are defined elsewhere in the glossary. A list of acronyms often used in the remedial program begins on page D-7.

Administrative Record	Part of a site's Record of Decision which lists and defines documents used in the development of NYSDEC's decision about selection of a remedial action.
Availability Session	A scheduled gathering of program staff and members of the public in a casual setting, without a formal presentation or agenda but usually focusing on a specific aspect of a site's remedial process.
Citizen Participation	A program of planning and activities to encourage communication among people affected by or interested in hazardous waste sites and the government agencies responsible for investigating and remediating them.
Citizen Participation Plan	A document which must be developed at a site's Remedial Investigation stage. A CP plan describes the citizen participation activities that will be conducted during a site's remedial process.
Citizen Participation Record	A document prepared at a major remedial stage which describes the citizen participation activities required at that stage. A CP Record also directs a scoping process to determine if additional citizen participation activities are appropriate and feasible.
Citizen Participation Specialist	A staff member from an NYSDEC central office or regional office who has specialized training and experience to assist a project manager and to plan,

conduct and site-specific citizen participation program.

Classification

A process to place a hazardous waste site within a category which defines its hazardous waste status and its threat or potential threat to public health and the environment. Sites are listed along with their classifications in the **Registry of Inactive Hazardous Waste Disposal Sites**.

Class 1 causing or representing an imminent danger of causing irreversible or irreparable damage to public health or environment -- immediate action required.

Class 2 - significant threat to public health or environment -- action required.

Class 2a - temporary classification assigned to a site for which there is inadequate or insufficient data for inclusion in any other classification.

Class 3 - does not present a significant threat to public health or environment -- action may be deferred.

Class 4 - site properly closed -- requires continued management.

Class 5 - site properly closed -- no further action required.

Delisted - site no longer considered an inactive hazardous waste disposal site.

Comment Period

A time period for the public to review and comment about various documents and DER actions. For example, a 45-day comment period is provided when DER issues a **Proposed Remedial Action Plan (PRAP)**, and when DER proposes to Delist a site from the **Registry of Inactive Hazardous Waste Disposal Sites**.

Consent Order

A legal and enforceable agreement negotiated between NYSDEC and a **responsible party**. The order sets forth agreed upon terms by which a responsible party will undertake site investigation and/or cleanup, or pay for the costs of those activities. The order includes a description of the remedial actions to be taken by the responsible party with NYSDEC oversight, and a schedule for implementation.

Contact List

Names, addresses and/or telephone numbers of individuals, groups organizations, government officials and media affected by or interested in a particular hazardous waste site. The size of a contact list and the categories included are influenced by population density, degree of interest in a site, the stage of the remedial process and other factors. It is an important tool needed to conduct outreach activities.

Delist

Action by which DER removes a hazardous waste site from the **Registry of Inactive Hazardous Waste Disposal Sites** upon determination that the site contains inconsequential amounts of hazardous waste; or that a remediated site no longer requires **Operation and Maintenance**; or that a remediated site does not require Operation and Maintenance. A proposal to delist a site triggers a public notification and **comment period** process.

Division of Environmental Enforcement (DEE)

A unit within the New York State Department of Environmental Conservation which works with the **Division of Environmental Remediation** and others to negotiate with **responsible parties** to achieve agreements for the investigation and remediation of hazardous waste sites. A negotiated agreement is contained in a **consent order**.

Division of Environmental Remediation

Formerly the **Division of Hazardous Waste Remediation**, a major program unit within the New York State Department of Environmental Conservation created to manage the hazardous waste site remedial program from site discovery through **Operation and Maintenance** activities. Staff include: engineers, geologists, chemists, attorneys, citizen participation specialists, environmental program specialists and support staff.

Division of Hazardous Waste Remediation

(See **Division of Environmental Remediation**.)

Document Repository

A file of documents pertaining to a site's remedial and citizen participation programs which is made available for public review. The file generally is maintained in a public building near the hazardous waste site to provide access at times and a location convenient to the public.

Enforcement

NYSDEC's efforts, through legal action if necessary, to compel a **responsible party** to perform or pay for site remedial activities. NYSDEC may perform this effort by itself or in concert with other agencies.

**Environmental
Quality
Bond Act (EQBA)**

The 1986 Environmental Quality Bond Act which gives New York State bonding authority of up to \$1.2 billion to fund the State's share of the total cost of remediating hazardous waste sites in New York State.

Fact Sheet

A written discussion about part or all of a site's remedial process, prepared and provided by DER to the public. A fact sheet may focus on: a particular element of the site's remedial program; opportunities for public involvement; availability of a report or other information, or announcement of a **public meeting or comment period**.

**Interim Remedial
Measure (IRM)**

A discrete action which can be conducted at a site relatively quickly to reduce the risk to people's health and the environment from a well-defined hazardous waste problem. An IRM can involve removing contaminated soil and drums, providing alternative water supplies or securing a site to prevent access.

**National Priorities
List**

The U.S. Environmental Protection Agency's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using money from a special trust fund.

**New York State
Department of Health**

Agency within the executive branch of New York State government which: performs health-related inspections at suspected hazardous waste sites; conducts health assessments to determine potential risk from environmental exposure; reviews Risk Assessments prepared during the **Remedial Investigation and Feasibility Study**; conducts health-related community outreach around sites; and reviews remedial actions to assure that public health concerns are adequately addressed.

**New York State
Department of Law**

Agency within the executive branch of New York State government which takes the lead on hazardous waste sites requiring civil enforcement through court

action. Litigation can involve negotiations and court action with **responsible** parties to clean up sites; natural resource damage claims, and recovery of remedial costs.

**New York State
Registry of Inactive
Hazardous Waste
Disposal Sites**

The "Registry." A document which NYSDEC is directed by law to maintain and which lists and provides information about every hazardous waste site in New York State which meets criteria established through a definition of hazardous waste and a **classification** system.

Operable Unit

A discrete part of an entire site that produces a release, threat of release, or pathway of exposure. An Operable Unit can receive specific investigation, and a particular remedy may be proposed. A **Record of Decision** is prepared for each Operable Unit.

**Operation and
Maintenance**

A period in which remedial action may be conducted following construction at a site (for example, operation of a "pump and treat" system), or which is performed after a remedial action to assure its continued effectiveness and protection of people's health and the environment. Activities can include site inspections, well monitoring and other sampling.

**Preliminary Site
Assessment (PSA)**

A PSA is DER's first investigation of a site. A PSA is performed to determine if a site meets New York State's definition of an inactive hazardous waste disposal site by confirming the presence of hazardous waste and determining if the site poses a significant threat to public health or the environment.

Project Manager

An NYSDEC staff member within the **Division of Environmental Remediation** (usually an engineer, geologist or hydrogeologist) responsible for the day-to-day administration or remedial activities at, and ultimate disposition of, a hazardous waste site. The Project Manager works with legal, health, **citizen participation** and other staff to accomplish site-related goals and objectives.

**Proposed Remedial
Action Plan**

An analysis by DER of each alternative considered for the remediation of a hazardous waste site and a rationale for selection of the alternative it recommends. The PRAP is created based

on information developed during the site's **Remedial Investigation and Feasibility Study**. The PRAP is reviewed by the public and other state agencies.

Public Meeting

A scheduled gathering of **Division of Environmental Remediation** staff with the affected/interested public to give and receive information, ask questions and discuss concerns about a site's remedial program. Staff from other NYSDEC divisions, legal and health staff, and staff from consultants and a responsible party often also attend. A public meeting, unlike an **availability session**, generally features a formal presentation and a detailed agenda.

Reclassification

A process by which DER redefines the threat posed by a hazardous waste site to public health and the environment by developing and assessing site information and, based on findings and conclusions, assigning a new **classification** code.

Record of Decision

A document which provides definitive record of the (ROD) cleanup alternative that will be used to remediate a hazardous waste site. The ROD is based on information and analyses developed during the **Remedial Investigation/Feasibility Study** and public comment.

Remedial Alternatives Report (RAR)

A report that contains an evaluation of options for the remediation of any contamination in, on, or under, or emanating from, a property that includes an analysis of data and other information concerning the nature and extent of that property's contamination and is generally performed concurrently, and in an interactive fashion, with the site investigation.

Remedial Construction

The physical development, assembly and implementation of the remedial alternative selected to remediate a site. Construction follows the **Remedial Design** stage of a site's remedial program.

Remedial Design

The process following finalization of a **Record of Decision** in which plans and specifications are developed for the **Remedial Construction** of the alternative selected to remediate a site.

**Remedial
Investigation/
Feasibility Study
(RI/FS)**

RI fully defines and characterizes the type and extent of hazardous waste contamination at the site. The FS, which may be which may be conducted during or after the RI, uses information developed during the RI to develop alternative remedial actions to eliminate or reduce the threat of hazardous waste contamination to public health and the environment.

Responsible Party

An individual or business who: currently owns or operates a hazardous waste site; or historically owned or operated a site when hazardous waste was disposed; or generated hazardous waste at a site; or transported hazardous waste to a site.

Responsiveness

A written summary of major oral and written comments received by DER during a **comment period** about key elements of a site's remedial program, such as a **Proposed Remedial Action Plan**, and DER's response to those comments.

Site Investigation

A process undertaken to determine the nature and extent of contamination in, on, and under, and emanating from a property. The SI includes the gathering of sufficient information to determine the necessity for, and the selection of the appropriate method of, remediation of contamination in, on, or under, or emanating from a property.

**Site Issues and
Community Profile
Scoping Sheet**

A document prepared to support each **Citizen Participation Record**. Each Scoping Sheet identifies issues and information important to DER and the community and information that needs needs to be exchanged at a particular remedial stage. The Scoping Sheet also summarizes information about the surrounding community, including demographics, special needs, etc.

Superfund

The common name for the Federal program established by The Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended in 1986. The Superfund law authorizes the U.S. Environmental Protection Agency to investigate and cleanup sites nominated to the **National Priorities List**.

Title 3 Project

Remediation of a municipally owned site through the State Superfund Title 3 Program whereby New York State pays 75 percent of eligible costs for remediation and the municipality pays 25 percent.

Toll-Free "800" Number

An information line maintained by the **Division of Environmental Remediation** to provide convenient access for people who have questions, concerns or information about hazardous waste sites and their remedial programs.

ACRONYMS

AG	--	New York State Attorney General's Office
ARAR	--	Applicable, Relevant and Appropriate Requirement
C&D	--	Construction and Debris
CERCLA and	--	Comprehensive Environmental Response, Compensation Liability Act of 1980
CO	--	Consent Order
CP	--	Citizen Participation
CPP	--	Citizen Participation Plan
CPS	--	Citizen Participation Specialist
CQC/CQA	--	Construction Quality Control/Construction Quality Assurance
DEE	--	Division of Environmental Enforcement
DER of	--	Division of Environmental Remediation, formerly the Division Hazardous Waste Remediation
DHWR of	--	Division of Hazardous Waste Remediation, now the Division Environmental Remediation
DOD	--	Department of Defense
DOL	--	Department of Law
DOW	--	Division of Water
ENB	--	Environmental Notice Bulletin
EQBA	--	1986 Environmental Quality Bond Act
EPA	--	Environmental Protection Agency
F&W	--	Division of Fish and Wildlife
FDA	--	Food and Drug Administration
FSF	--	Federal Superfund
FOIL	--	Freedom of Information Law
FS	--	Feasibility Study
FY	--	Fiscal Year
GPM	--	Gallons Per Minute
HeLP	--	Health Liaison Program

IRM	--	Interim Remedial Measure
mg/kg	--	milligrams per kilogram
NAPL	--	Non-Aqueous Phase Liquid
NPL	--	National Priorities List
NYSDEC	--	New York State Department of Environmental Conservation
NYSDOH	--	New York State Department of Health
O&M	--	Operation and Maintenance
OSHA	--	Occupational Safety and Health Administration
OU	--	Operable Unit
PAH	--	Poly-Aromatic Hydrocarbon
PCB	--	Poly-Chlorinated Biphenyl
PM	--	Project Manager
ppm/ppb/ppt	--	parts per million/parts per billion/parts per trillion
PRAP	--	Proposed Remedial Action Plan
PRP	--	Potentially Responsible Party
PRS	--	Priority Ranking System
PSA	--	Preliminary Site Assessment
QA/QC	--	Quality Assurance/Quality Control
RA	--	Remedial Action
RCRA	--	Resource Conservation and Recovery Act
RD	--	Remedial Design
RFP	--	Request for Proposals
RHWRE	--	Regional Hazardous Waste Remediation Engineer
RI	--	Remedial Investigation
RI/FS	--	Remedial Investigation/Feasibility Study
ROD	--	Record of Decision
RP	--	Responsible Party
SSF	--	State Superfund
TAGM	--	Technical and Administrative Guidance Memorandum
TCLP	--	Toxicity Characteristic Leaching Procedure
TSDF	--	Treatment, Storage and Disposal Facility
ug/l	--	micrograms per liter
USGS	--	U.S. Geological Service
VCP	--	Voluntary Cleanup Program
VOC	--	Volatile Organic Compound

Appendix B

Document Repositories and List of Available Documents

Two document repositories have been established to provide the public with access to important project documents and other information. This information will include reports, data and other information gathered and developed during the course of the Site Investigation/Remedial Alternatives Report as well as fact sheets, public meeting announcements, the Proposed Remedial Action Plan, and Record of Decision.

NYSDEC Region 3 Office
21 South Putt Corners Road
New Paltz, New York 12561
(914) 256-3154
Hours: Mon - Fri 8:30 am - 4:45 pm
Contact: Mike Knipfing, Citizen
Participation Specialist

Newburgh Free Library
Head of Reference Department
124 Grand Street
Newburgh, NY 12550
(914) 561-1985
Hours: Mon - Thu 9:00 am - 9:00 pm
Fri, Sat 9:00 am - 5:00 pm
Sun 1:00 pm - 5:00 pm

Available Documents

At the start of the Site Investigation, copies of the following documents were placed in the repositories:

- Site Investigation/Remedial Alternative Workplan
- Quality Assurance/Quality Control Plan
- Health and Safety Plan (HASP)
- Citizen Participation Plan (CPP)

Additional documents will be developed during the Remedial Program, and will be made available in the repositories. Their availability will be announced through fact sheets, public meetings, and other means.

Appendix C

Contact List/Interested Parties

The following contact list has been developed to help NYSDEC to keep the community informed about and involved in the SI/RAR process for the Provan/Ford Site. The list includes adjacent/nearby property owners; local regional and state officials; local media; civic business and environmental organizations and others. The contact list will be reviewed periodically and updated as appropriate.

Jonas Automotive Contact List

Local Officials, Committees, and Boards

Mary L. Crabb, Mayor
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

Stephen J. Rockafellow
Councilperson
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

Nicholas Valentine
Councilperson
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

Marlene A. Koisch
Councilperson
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

Regina M. Angelo
Councilperson
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

Harold J. Porr, III
City Manager
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

Nancy D'Addio
City Clerk, Registrar
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

James Monell
Planning Board Chair
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

William F. Ketcham
Corporation Counsel
City of Newburgh
83 Broadway, City Hall
Newburgh, NY 12550

Head of Reference Dept.
Newburgh Free Library
124 Grand Street
Newburgh, NY 12550
(914) 561-1985

County/Regional Officials, Boards and Organizations

Joseph G. Rampe
Orange County Executive
255-275 Main Street
Goshen, NY 10924

Vincent Poloniak, Director
Community Development
223 Main Street
Goshen, NY 10924

Donna L. Benson
Orange County Clerk
255-275 Main Street
Goshen, NY 10924

Harvey J. Burger
Orange County Legislator
P.O. Box 208
252 Montgomery Street
Newburgh, NY 12550

Comissioner Peter Garrison
Orange County Department of Planning
124 Main Street
Goshen, NY 10924
(914) 291-2318

Patrick J. Berardinelli, Sr.
Orange County Legislator
17 Hillside Court
Newburgh, NY 10950

Commisioner Maxcy J. Smith, MD
Orange County Dept. of Health
124 Main Street
Goshen, NY 10924
(914) 291-2332

Dino J. Sciamanna
Orange County Legislator
15th District
255-275 Main Street
Goshen, NY 10924

Richard L. Hansen, Sr.
Orange County Legislator
P.O. Box 201, Rt. 284
Unionville, NY 10988

State and Federal Officials and Agencies

The Honorable William J. Larkin, Jr.
New York State Senator
1093 Little Britain Road
New Windsor, NY 12553

The Honorable Thomas J. Kirwan
New York State Assemblyman
190 South Plank Road
Newburgh, NY 12550

The Honorable Daniel P. Moynihan
United States Senator
189 Main Street
Oneonta, NY 13820

The Honorable Charles Schumer
United States Senator
26 Federal Plaza, Ste. 31-100
New York, NY 10728

The Honorable Maurice D. Hinchey
United States Congressman
291 Wall Street
Kingston, NY 12401

Mark Van Dusen
NYSDOH
547 River Street
Troy, NY 12180

Geoff Laccetti
NYSDOH
547 River Street
Troy, NY 12180

Ellen Stoutenburgh, Public Affairs
Officer
NYSDEC
21 South Putt Corners Road
New Paltz, NY 12561

Michael J. Knipfing
Citizen Participation Specialist
NYSDEC
21 South Putt Corners Road
New Paltz, NY 12561

Richard Morse
Legislative Program Council's Staff
New York State Assembly, Room 520
State Capitol
Albany, NY 12224

Marc Moran, Director
NYSDEC, Region 3
21 South Putt Corners Road
New Paltz, NY 12561

Al Klauss
NYSDEC
NYSDEC, Region 3
21 South Putt Corners Road
New Paltz, NY 12561

Cesare Manfredi
NYSDEC
200 White Plains Road, Fifth Floor
Tarrytown, NY 10591-5805

David Camp
NYSDEC
50 Wolf Road
Albany, NY 12233

Local/Regional Media:

City Editor
El Clarin
48 Broadway
Haverstraw, NY 10927

City Editor
Ellenville Press
P.O.Box 31
Ellenville, NY 12428

City Editor
Mid Hudson Times
P.O. Box 434
Walden, NY 12586

City Editor
Times Herald Record
126 Main Street
New Paltz, NY 12561

City Editor
Tri-State Gazette
84-88 Fowler Street
Port Jervis, NY 12771

City Editor, Greenwood Lake & West
Milford News
P.O.Box 1117
Greenwood Lake, NY 10925

City Editor
Hudson Valley Black Press
P.O.Box 2160
Newburgh, NY 12550

City Editor
Hudson Valley Business Journal
P.O.Box 339
Pine Island, NY 10969

City Editor

Independent Republican
P.O. Drawer A
Goshen, NY 10924-0628

City Editor
News of the Highlands
P.O.Box 278
Highland Falls, NY 10928

City Editor
Orange County Post
P.O.Box 500
Washingtonville, NY 10992

City Editor
Ottaway Newspapers, Inc.
P.O.Box 401
Campbell Hall, NY 10916

City Editor
Photo News
45 Gilbert Street
Monroe, NY 10950

City Editor
Strauss Newspapers
P.O.Box 190
Warwick, NY 10990

City Editor
The Sentinel
P.O.Box 406
Vails Gate, NY 12584

City Editor
The Cornwall Local
P.O.Box B
Cornwall, NY 12518

City Editor

The Warwick Valley Dispatch
P.O.Box 594
Warwick, NY 10990

City Editor
Times Herald Record
233 Broadway
Newburgh, NY 12550

City Editor
Times Herald Record
40 Mulberry Street
Middletown, NY 10940

City Editor
Warwick Advertiser
P.O.Box 190
Warwick, NY 10990

News Director
WALL/WKOJ
1 Broadcast Plaza
Middletown, NY 10940

News Director
WDLC/WTSX
P.O.Box 920
Port Jervis, NY 12771

News Director
WDST
118 Tinker Street
Woodstock, NY 12498

News Director
WELV/WTHN
12 Tucker Drive
Poughkeepsie, NY 12601

News Director
WGNY
P.O.Box 2307
Newburgh, NY 12550

News Director

WHUD/WLNA
Radio Terrace
Peekskill, NY 10566

News Director
WTBQ
62 N. Main Street
Florida, NY 10921

News Director
WZAD
P.O.Box 978
Wurstburo, NY 12790

News Director
Access 8 TV
P.O.Box 321
Port Jervis, NY 12780

News Director
Cable 6 TV
Industrial Drive
Middletown, NY 10940

News Director
Time Warner Cablevision
P.O.Box 887
Middletown, NY 10940

News Director
TKR Cable Co.
19 South Street
Warwick, NY 10990

News Director
WRNN TV
721 Broadway
Kingston, NY 12401

Environmental Groups

Scenic Hudson
9 Vassar Street
Poughkeepsie, NY 12601
(914) 473-440

Clearwater, Inc.
112 Market Street
Poughkeepsie, NY 12601
(914) 454-7673

Greenway Conservancy
Capitol Building
Capitol Station, Room 254
Albany, NY 12224
(518) 473-3835

The Nature Conservancy
P.O. Box 601
Pawling, NY 12564

Orange Environment
P.O. Box 25
Goshen, NY 10924
(914) 294-5852

Hudson River Pilots Assoc.
75 Alexander Street
Yonkers, NY 10701

Karl Coplan, Esq.
Pace/Riverkeeper
78 North Broadway
White Plains, NY 10603

Environmental Citizens Coalition
33 Central Ave.
Albany, NY 12210

Laura Haight
NY PIRG
107 Washington Avenue
Albany, NY 12210

Orange County Land Trust
Executive Director
John Gebhards
P.O. Box 2442
Middletown, NY 10940

Adjacent/Nearby Residents, Businesses, and Property Owners

<u>Property</u>	<u>Owner's Name & Address</u>
660-666 Broadway	Craig Stephen W. & Ann Marie St. Andrews Rd. Box 321 Walden, NY 12586
668-674 Broadway	Same as above.
676-690 Broadway	Same as above.
68 Wisner Ave.	Union Glenn Associates, Inc. 88-22 81 st Rd. Glendale, NY 11385
70 Wisner Ave.	Lasek Chet C. & Jean 14 Barbara Court Newburgh, NY 12550
72 Wisner Ave.	Tillson Corporation 313 Broadway Newburgh, NY 12550
74 Wisner Ave.	Turner Ramonita 74 Wisner Ave. Newburgh, NY 12550
76 Wisner Ave.	Alstadt Martha 76 Wisner Ave. Newburgh, NY 12550
78 Wisner Ave.	Turner Russell S. & Sandra L. 78 Wisner Ave. Newburgh, NY 12550
80 Wisner Ave.	Keefe John 80 Wisner Ave. Newburgh, NY 12550
88-90 Wisner Ave.	Foti Joseph & Mary 90 Wisner Ave. Newburgh, NY 12550

92-94 Wisner Ave.	O'Dea Catherine 94 Wisner Ave. Newburgh, NY 12550
96-98 Wisner Ave.	Craig Warren S. 16 Wintergreen Ave. Newburgh, NY 12550
100-108 Wisner Ave.	Same as above.
ES Wisner Ave.	Same as above.
Wisner Ave.	McCurdy Frederic 38 Echo Lane Newburgh, NY 12550
656-658 Broadway	Leonardo Catherine c/o Todd Baright RD 3 Box 255 Red Hook, NY 12571-1495
692-694 Broadway	Mueller Thomas & Mary 56 North St. Newburgh, NY 12550
696-700	Crawshaw Marie A. 696 Broadway Newburgh, NY 12550
63-69 Wisner Ave.	Mueller Brothers Inc. 56 North St. Newburgh, NY 12550
73 Wisner Ave.	Frost Mabel aka Mabel E Frost 73 Wisner Ave. Newburgh, NY 12550
75 Wisner Ave.	Brunet George & Luna Angelina 75 Wisner Ave. Newburgh, NY 12550

81 Wisner Ave.

Pham Trinh
81 Wisner Ave.
Newburgh, NY 12550

71 Wisner Ave.

Alfano Shirley A.
71 Wisner Ave.
Newburgh, NY 12550

Appendix D

Project Management Contacts and Project Spokesperson

For additional information about the program to investigate the Provan/Ford Site, the public is encouraged to contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

NYSDEC Inactive Hazardous Waste Site Toll-Free Information Number: **1-800-342-9296**

(Calls recorded 24 hours a day. Calls are returned during business hours)

David Camp, P.E.
Project Engineer
NYSDEC
50 Wolf Road
Albany, New York 12233-7010
(518) 457-7924

Mike Knipfing
Citizen Participation Specialist
NYSDEC Region 3
21 South Putt Corners Road
New Paltz, New York 12561
(914) 256-3154

New York State Department of Health (NYSDOH):

Mark VanDeusen
Outreach Unit
NYS Department of Health
Flanigan Square
547 River Street
Troy, New York 12180
1-800-458-1158 ext. 27880

Geoff Laccetti
NYS Department of Health
Flanigan Square
547 River Street
Troy, New York 12180
1-800-458-1158 ext. 27530

City of Newburgh/First Environment, Inc. JONAS Project Spokespersons

Scott Green, P.G.
Senior Hydrogeologist
First Environment, Inc.
90 Riverdale Road
Riverdale, NJ 07457
1-800-486-5869

Tom Bambrick
Geophysicist
First Environment, Inc.
90 Riverdale Road
Riverdale, NJ 07457
1-800-486-5869

JONAS SI/RAR COST PROJECTION

Proj. Sci./Eng.
Senior Scientist
Scientist
Technical/Drafting

Rates/Hr.
\$120.00
\$100.00
\$80.00
\$60.00

WORKPLAN/HASP/CP/PREPARATION

Site Visit with DEC
Report Writing

Total Spent
\$500.00
\$5,000.00
\$5,500.00

Subtotal:

<u>Soil Removal & Drum Overpack</u>	<u>Personnel</u>	<u>Days/or</u> <u>Units</u>	<u>Well &</u> <u>Sam. #</u>	<u>Materials</u>	<u>Cost Per</u> <u>Day</u>	<u>Sample Cost</u>	<u>Cost</u>
(work conducted to date)							
<i>Soil Sampling Stockpile (ID 27 samp)</i>							
<i>Soil Sampling Labor</i>	0	0	1	\$0	\$0	\$450	\$450
<i>Soil Disposal per ton cost</i>	1	1.5	0	\$0	\$800	\$0	\$1,200
<i>Soil Trucking day per ton</i>	0	122.5	0	\$0	\$48	\$0	\$5,880
<i>FEI Labor & Oversight</i>	0	1	0	\$0	\$1,200	\$0	\$1,200
<i>Drum Overpack Chemist</i>	1	1.5	0	\$0	\$800	\$0	\$1,200
<i>Over Pack Cost per drum</i>	0	1	0	\$0	\$850	\$0	\$850
<i>FEI Labor & Oversight</i>	0	1	0	\$0	\$100	\$0	\$100
<i>Field Equipment</i>	1	1	0	\$0	\$800	\$0	\$800
<i>Travel & Food Expenses</i>	0	1	0	\$0	\$1,000	\$0	\$1,000
	0	2	0	\$0	\$50	\$0	\$100
Subtotal:							\$12,780

Drum Characterization & Disposal

<u>Composite Samples</u>	<u>Personnel</u>	<u>Days/or</u> <u>Units</u>	<u>Well &</u> <u>Sam. #</u>	<u>Materials</u>	<u>Cost Per</u> <u>Day/Drum</u>	<u>Sample Cost</u>	<u>Cost</u>
<i>Drum Profile Cost</i>	0	5	0	\$0	\$0	\$35	\$175
<i>Lab Analyses</i>	0	2	0	\$0	\$0	\$25	\$50
<i>Transportation</i>	0	1	0	\$0	\$0	\$1,300	\$1,300
<i>Chemist Labor</i>	0	1	0	\$0	\$950	\$0	\$950
<i>Oversight Labor</i>	0	3	0	\$0	\$660	\$0	\$1,980
<i>Drum Disposal Cost (Haz)</i>	1	3	0	\$0	\$800	\$0	\$2,400
<i>Drum Disposal Cost (non-Haz)</i>	0	2	0	\$0	\$250	\$0	\$500
<i>FEI Labor & Oversight</i>	0	14	0	\$0	\$165	\$0	\$2,310
<i>Field Equipment</i>	0	2	0	\$0	\$800	\$0	\$1,600
<i>Travel & Food Expense</i>	0	1	0	\$0	\$1,000	\$0	\$1,000
	0	5	0	\$0	\$50	\$0	\$250
Subtotal:							\$12,515

Subcontractor costs in italics.

JONAS SI/RAR COST PROJECTION

Soil Boring & Sampling

(all locations)

	Personnel	Days/or Units	Well & Sam. #	Materials	Cost Per Day	Sample Cost	Cost
Geoprobe (soil borings)		2.5	100	\$5	\$900	\$0	\$2,750
Mobilization	0	1	0	\$0	\$100	\$0	\$100
Drilling Oversight	1	2.5	0	\$0	\$800	\$0	\$2,000
Sampling Oversight	1	1.5	0	\$0	\$800	\$0	\$1,200
SVOC STARS 8270	0	0	53	\$0	\$0	\$185	\$9,805
VOCs STARS 8021	0	0	6	\$0	\$0	\$75	\$450
VOCs 8260	0	0	30	\$0	\$0	\$115	\$3,450
PP Metals	0	0	50	\$0	\$0	\$125	\$6,250
PCBs	0	0	21	\$0	\$0	\$55	\$1,155
Field Equipment	0	1.5	0	\$0	\$1,000	\$0	\$1,500
Travel & Food Expense	2	1	0	\$0	\$50	\$0	\$100
						Subtotal:	\$28,760

UST Excavation, Backfill, Sampling & Soil Disposal

UST Removal/Restoration	0	1	0	\$0	\$3,390	\$0	\$3,390
Backfill, Sludge Disposal, Restorator	0	1	0	\$1,500	\$0	\$0	\$1,500
UST/Drain Characterization Labor & Oversig	1	2	0	\$0	\$800	\$0	\$1,600
Soil Disposal per ton cost	0	22.5	0	\$0	\$48	\$0	\$1,080
Soil Loading per ton	0	22.5	0	\$0	\$5	\$0	\$113
Soil Trucking day per ton	0	1	0	\$0	\$850	\$0	\$850
Soil Stockpile (ID 27 sample)	0	0	1	\$0	\$0	\$450	\$450
Soil Disposal Labor & Oversight	1	1	0	\$0	\$800	\$0	\$800
Field Equipment	1	1.5	0	\$0	\$1,000	\$0	\$1,500
Travel & Food Expense	0	2	0	\$0	\$50	\$0	\$100
						Subtotal:	\$11,383

Well Installation, Slug Tests & GW Sampling

Drilling Rig	0	2.5	0	\$0	\$1,335	\$0	\$3,338
Mobilization	0	1	0	\$0	\$200	\$0	\$200
Well Materials 5 wells	0	5	0	\$350	\$0	\$0	\$1,750
Well Survey 5 wells	0	1	0	\$0	\$750	\$0	\$2,250
Labor & Drilling Oversight	1	2.5	0	\$0	\$800	\$0	\$2,000
Slug Test Field Work	2	2	0	\$0	\$800	\$0	\$3,200
Slug Tests Interpretation	1	1.5	0	\$0	\$800	\$0	\$1,200
GW VO (method 8240)	0	0	7	\$0	\$0	\$115	\$805
GW SVOC STARS (8027)	0	0	6	\$0	\$0	\$185	\$1,110
GW SVOC STARS (6020)	0	0	6	\$0	\$0	\$125	\$750
Subcontractor cost in italics						Subtotal:	\$15,894

JONAS SI/RAR COST PROJECTION

	<u>Personnel</u>	<u>Days/for</u> <u>Units</u>	<u>Well &</u> <u>Sam. #</u>	<u>Materials</u>	<u>Cost Per</u> <u>Day</u>	<u>Sample Cost</u>	<u>Cost</u>
<u>Well Installation & Sampling (cont'd)</u>							
<i>GW Sampling Labor & Oversight</i>	2	1	0	\$0	\$800	\$0	\$1,600
Field Equipment	0	3	0	\$0	\$1,000	\$0	\$3,000
Travel & Food Expense	0	6	0	\$0	\$50	\$0	\$300
						Subtotal:	\$4,900
<u>RI/RAW Report</u>							
Labor	1	6	0	\$0	\$1,000	\$0	\$6,000
Materials	0	3	0	\$100	\$0	\$0	\$300
						Subtotal:	\$6,300
						TOTAL:	\$92,532

92,532
 x 10% = 10,285.20
 544,101,800
 76,350