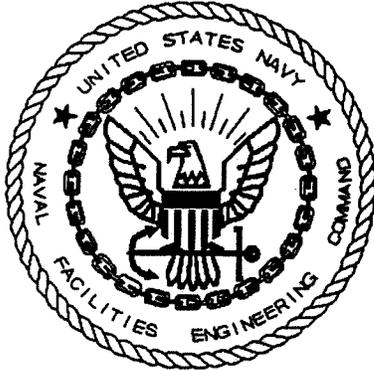


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RESOURCE CONSERVATION RECOVERY ACT FACILITY INVESTIGATION WORK PLAN  
FOR ASSEMBLY F SOLID WASTE MANAGEMENT UNITS 20, 22 AND 39 MILLINGTON  
SUPPACT TN  
3/18/1998  
ENSAFE INC



**RCRA FACILITY INVESTIGATION WORK PLAN  
ASSEMBLY F — SWMUs 20, 22 AND 39  
NAVAL SUPPORT ACTIVITY MEMPHIS  
MILLINGTON, TENNESSEE**

**Revision: 0**

**CTO-106**

**Contract Number: N627467-89-D-0318**

**Prepared for:**

**Department of the Navy  
Southern Division  
Naval Facilities Engineering Command  
North Charleston, South Carolina**

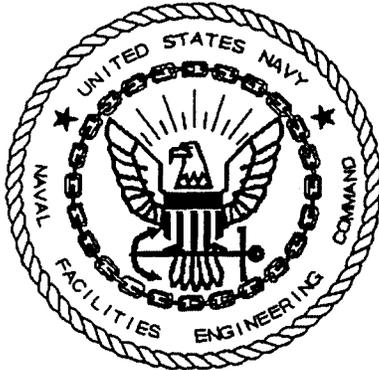


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(901)-372-7962**

**March 18, 1998**

**RCRA FACILITY INVESTIGATION WORK PLAN  
ASSEMBLY F — SWMUs 20, 22 AND 39  
NAVAL SUPPORT ACTIVITY MEMPHIS  
MILLINGTON, TENNESSEE**



**Revision: 0**

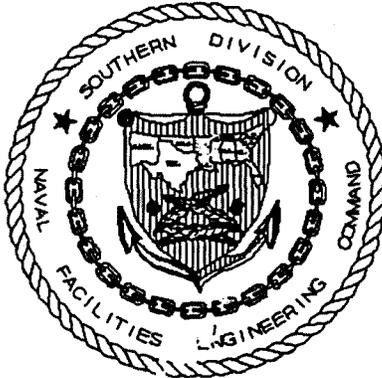
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North Charleston, South Carolina**

**Prepared by:**

**EnSafe Inc.  
5724 Summer Trees Drive  
Memphis, Tennessee 38134  
(901)-372-7962**



**The Contractor, EnSafe Inc. hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0318 is complete, accurate, and complies with all requirements of the contract.**

**Date: March 18, 1998**  
**Signature: *Robert Smith***  
**Name: Robert Smith**  
**Title: Task Order Manager**

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**List of Appendices**

Material Safety Data Sheets

## 1.0 INTRODUCTION

As part of the U.S. Navy Installation Restoration Program, the following Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan has been prepared for investigations at solid waste management units (SWMUs) 20, 22, and 39 at the Naval Support Activity (NSA) Memphis, in Millington, Tennessee (Figure 1.1). These sites were recommended for RFI characterization in the *Assembly F Confirmatory Sampling Investigation Report* (EnSafe, 1997). Because SWMUs 22 and 39 are close together, they will be investigated as one site. The primary reference for this RFI work plan is the *Comprehensive RFI Work Plan, Naval Air Station Memphis, Millington, Tennessee* (EnSafe/Allen & Hoshall, 1994).

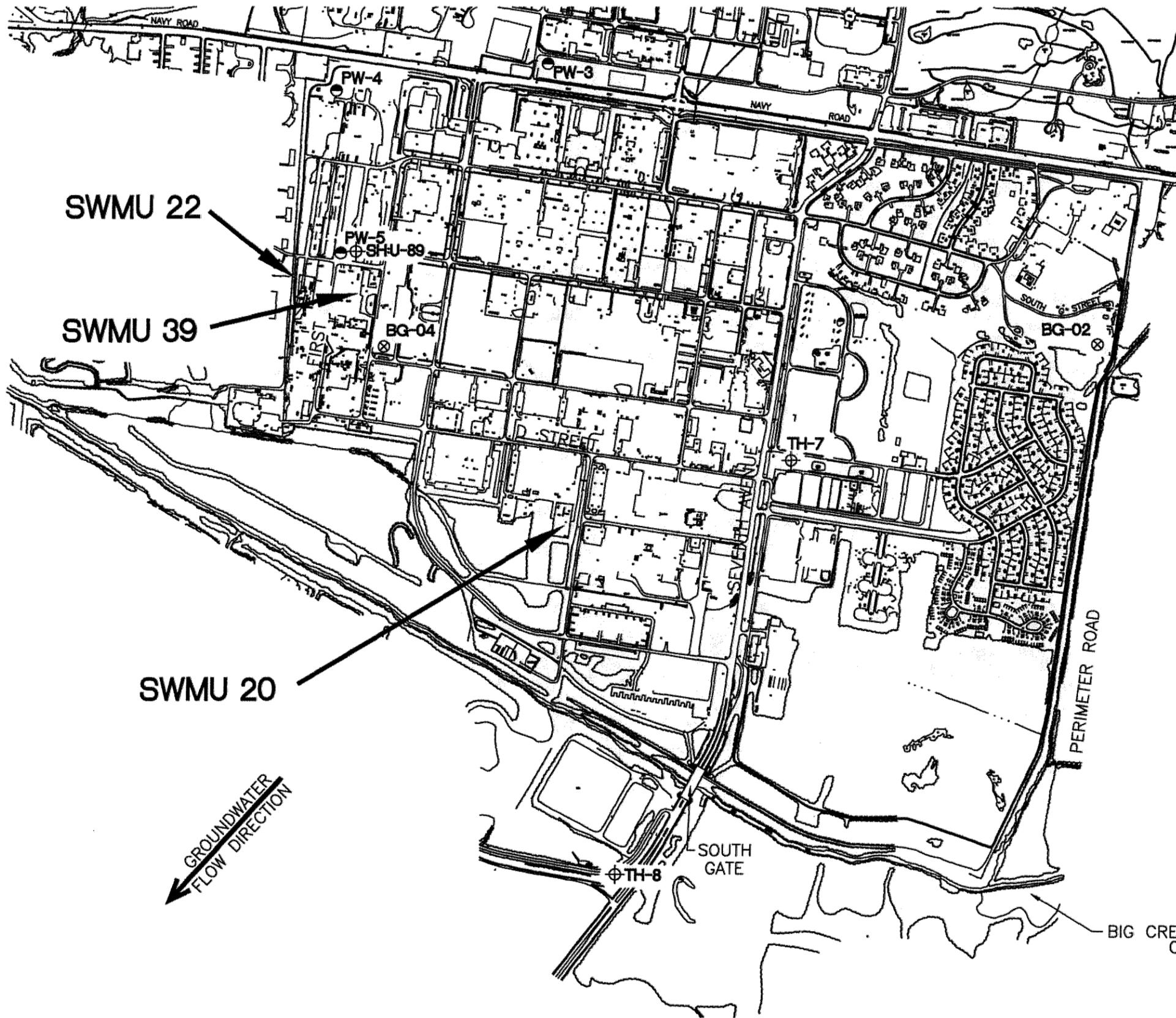
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## 2.0 ENVIRONMENTAL SETTING

SWMU 20 is approximately 200 feet west of Fifth Avenue and C Street on the NSA Memphis Southside, southeast of Building 1594 (Figure 2.1). SWMU 20 consists of the underground waste tank (UWT) 1594, which reportedly received waste oil and waste hydraulic fluid generated by the air traffic control school. The installation date of UWT 1594 is unknown; it was removed in May 1992. The information obtained on SWMU 20 during the 1990 RCRA Facility Assessment (RFA) (ERC/EDGE, 1990) is in Attachment 1 of the *Assembly F — Confirmatory Sampling Investigation (CSI) Work Plan* (EnSafe/Allen & Hoshall, 1996); the RFA listed the approximate capacity of UWT 1594 to be 100 gallons.

SWMU 22 is next to the western side of Building S-75, the boiler plant, on the NSA Memphis Southside (Figure 2.2) and approximately 200 feet west of SWMU 39. According to the NSA Memphis Public Works Office, Environmental Division, the four underground storage tanks (USTs) were installed in approximately 1944 and have since been removed. SWMU 22 consisted of three fuel oil USTs for the boiler plant and one diesel fuel UST. USTs 1245 and 1246 each held 25,000 gallons, UST 1244 held 50,000 gallons, and the diesel UST held 280 gallons. The diesel UST was removed in April 1992; the removal dates for the other three USTs are unknown. The three large USTs were constructed of concrete with steel piping, while the diesel UST was constructed of steel. The data gathered for SWMU 22 during the 1990 RFA (ERC/EDGE, 1990) is in Attachment 1 of the *Assembly F — CSI Work Plan* (EnSafe/Allen & Hoshall, 1996); along with two historical drawings of tank systems around SWMU 22.

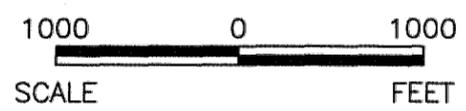
SWMU 39 is approximately 300 feet south of First Avenue and F Street, across First Avenue from Building S-75, on the NSA Memphis Southside (Figure 2.3) and approximately 200 feet east of SWMU 22. SWMU 39 is the area surrounding the concrete slab remaining from the former Building S-74. A dry cleaning facility reportedly occupied the southeast portion of Building S-74. Transformers and drums of oil were stored in the PCB storage area (an outdoor concrete slab)



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SOUTHSIDE**

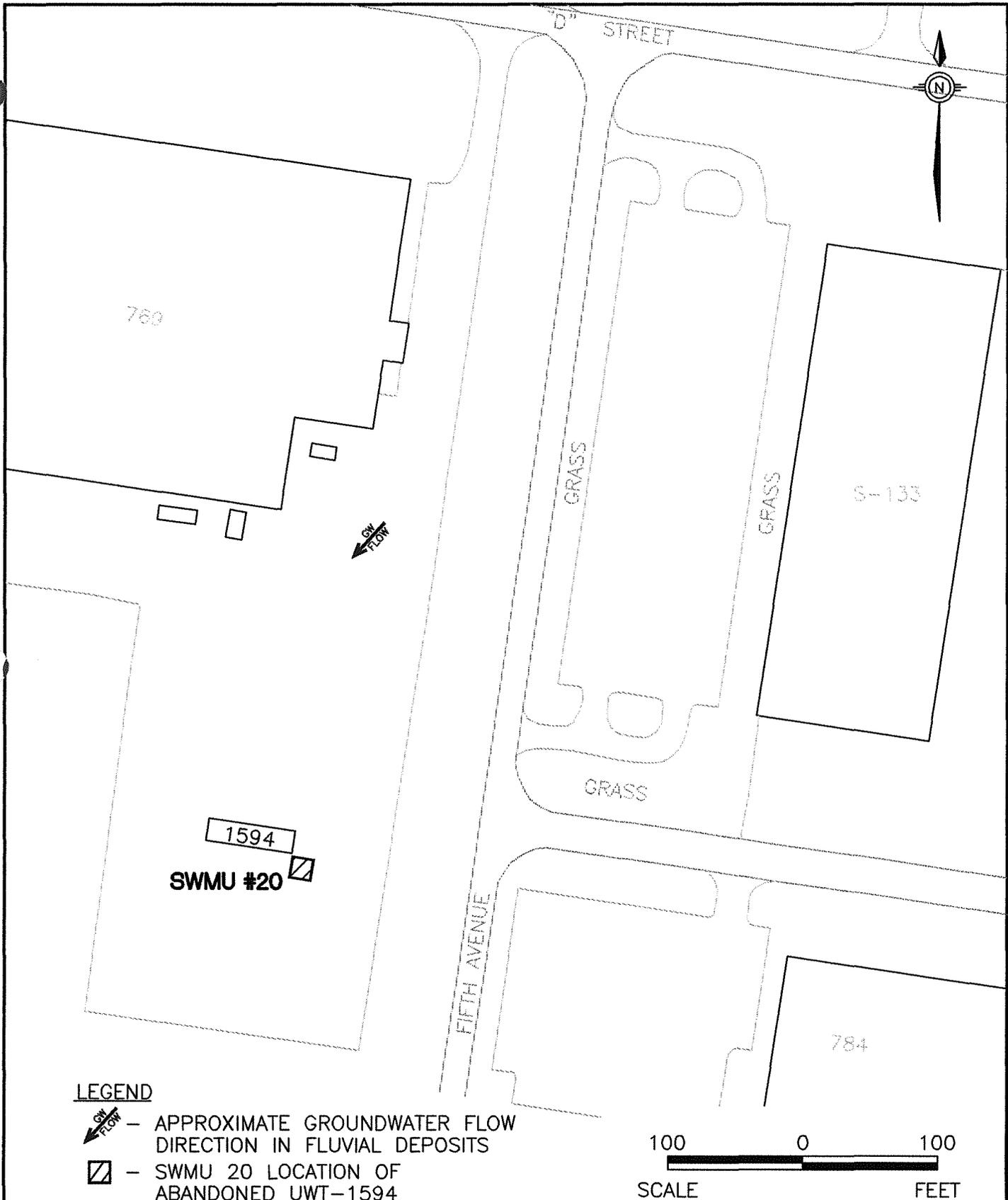
**LEGEND**

- TH-7 ⊕ STRATIGRAPHIC TEST HOLE
- PW-4 ● PRODUCTION WELL
- BG-02 ⊗ BACKGROUND WELL



ASSEMBLY F  
RFI WORK PLAN  
NSA MEMPHIS  
MILLINGTON, TENNESSEE

FIGURE 1.1  
VICINITY MAP  
ASSEMBLY F SWMUs



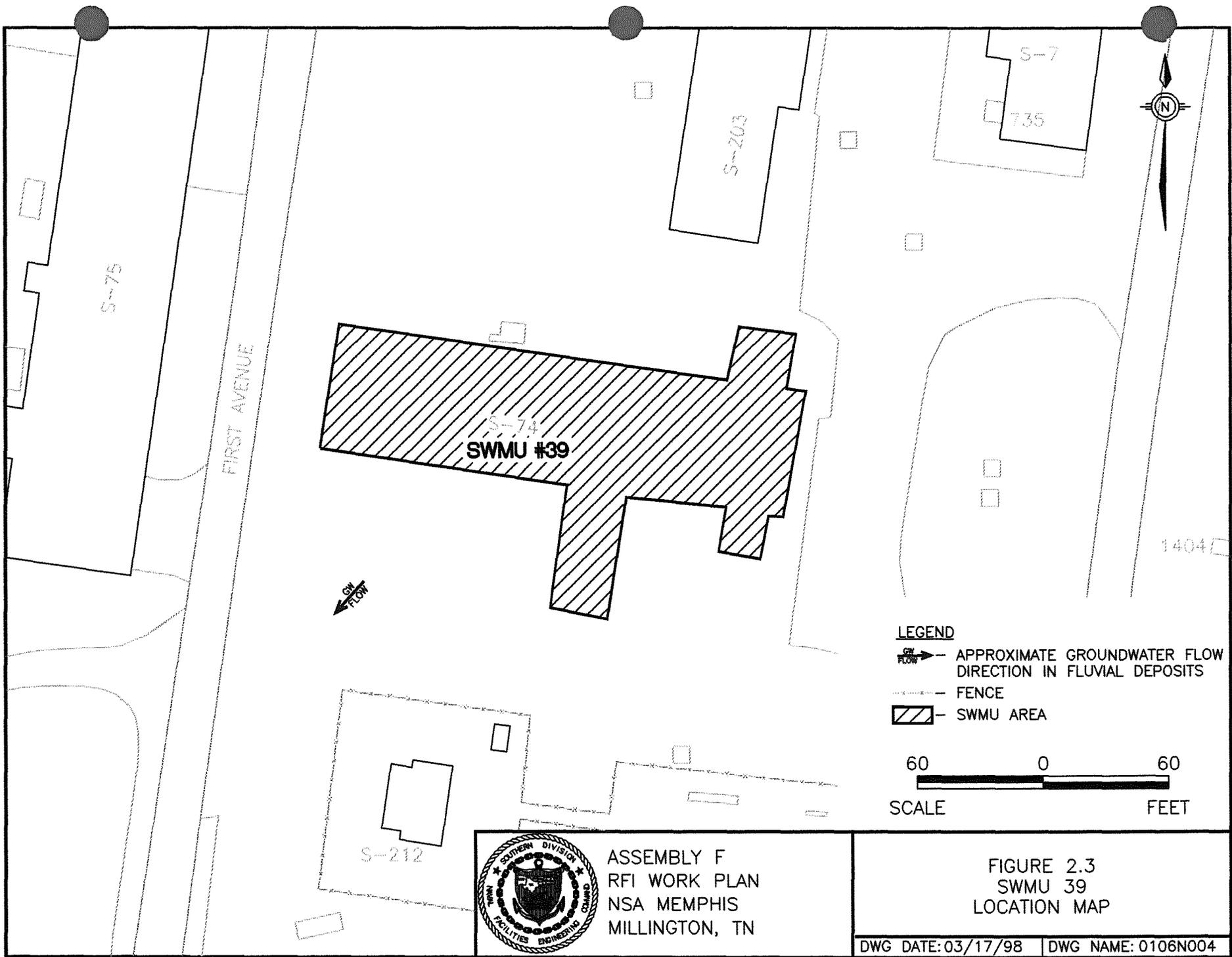
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-  - APPROXIMATE GROUNDWATER FLOW DIRECTION IN FLUVIAL DEPOSITS
-  - SWMU 20 LOCATION OF ABANDONED UWT-1594



ASSEMBLY F  
RFI WORKPLAN  
NSA MEMPHIS  
MILLINGTON, TN

FIGURE 2.1  
SWMU 20  
LOCATION MAP



until Building S-74 was demolished in 1995. The information obtained on SWMU 39 during the 1990 RFA is in Attachment 1 of the *Assembly F — CSI Work Plan* (EnSafe/Allen & Hoshall, 1996).

## 2.1 Topography

SWMUs 20, 22, and 39 are on the NSA Memphis Southside, which is characterized by relatively level, low-relief topography. Surface water at SWMU 20 drains toward the south to an east-west drainage ditch (SWMU 38) that flows into Big Creek Drainage Canal. Surface water at SWMUs 22 and 39 drains west to a north-south drainage ditch (SWMU 38) that also flows into Big Creek Drainage Canal. Both the Big Creek Drainage Canal and SWMU 38 have been subjects of an RFI (*Assembly E RFI Report* (EnSafe, 1998) and *Assembly B RFI Report* (EnSafe 1996), respectively).

The area surrounding SWMU 20 is covered by a 150- by 300-foot asphalt parking area surrounded by grass on the east, south, and west. A north-south ditch is along the east side of the parking area. The SWMU is approximately 50 feet from the parking area's eastern edge.

SWMU 22 is primarily covered by concrete and gravel; areas south and west of the SWMU are covered with grass. Areas north and east of the SWMU are gravel covered parking areas and a driveway for Building S-75.

SWMU 39's remaining building foundation is concrete. Surrounding areas are covered with grass.

## 2.2 Geologic and Hydrogeologic Information

The regional and local hydrogeology are described in Sections 2.11 and 2.12 of the *Comprehensive RFI Work Plan*. Specific geologic and hydrogeologic information for the NSA Memphis Southside has been collected from the following sources:

- Test holes completed on the NSA Memphis Southside, including two stratigraphic borings completed by the U.S. Geological Survey (USGS). 1  
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- Subsurface information obtained while installing two background well clusters, designated BG-02 and BG-04, on the NSA Memphis Southside. 4  
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The following sections describe the geologic and hydrogeologic information for the NSA Memphis Southside. 7  
8

**2.2.1 Stratigraphic Test Borings** 9  
10

Test Hole Sh:U-89 was drilled and logged in 1983 to prepare for installing Southside production well PW-5 in 1985. The USGS completed two stratigraphic borings on the Southside, designated as Test Holes 7 and 8 (Figure 1.1) in 1995. Test Hole 7 is approximately 300 feet northeast of the intersection of Seventh Avenue and D Street. Test Hole 8 is at the southeast corner of the sewage lagoons (SWMU 9) near the Big Creek Drainage Canal. Table 2.1 describes the lithology encountered in each stratigraphic test hole. As shown in Table 2.1, lithology in the upper interval of the test borings differs from north to south and west to east. Instead of loess and fluvial deposits, alluvium is present in the stratigraphic test boring nearest Big Creek Drainage Canal (Test Hole 8). In addition, the fluvial deposits are thinner and the Cockfield Formation is thicker on the eastern part of the Southside. A copy of the boring log for Sh:U-89 is included in Attachment 3 to this document. 11  
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**2.2.2 Background Well Clusters 2 and 4** 22  
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Two background well clusters, designated BG-02 and BG-04, were installed on the NSA Memphis Southside in January 1995, in conjunction with the RFIs conducted at Assembly A SWMUs. Figure 1.1 shows the background well locations. Table 2.1 describes the lithology encountered at each. The lithology at background well locations BG-02 and BG-04 was similar to that at 24  
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stratigraphic test hole Sh:U-89 and Test Hole 7, however, the fluvial deposits at BG-02 were thicker (38 feet) than at Test Hole 7 (13 feet).

No groundwater monitoring wells have been installed at any Assembly F SWMU. However, background monitoring well cluster BG-04, approximately 600 feet southeast of SWMU 39, consists of three monitoring wells, one each screened in the loess, upper fluvial deposits, and lower fluvial deposits. Static groundwater levels measured on March 30, 1995, indicated that groundwater was approximately 5 feet below land surface (bls) in the loess deposits, and 10 to 11 feet bls in the upper and lower fluvial deposits. Based on the topography and the information in the conceptual model of the NSA Memphis hydrogeology (Section 2.12 of the *Comprehensive RFI Work Plan*), groundwater is presumed to flow southwesterly in the fluvial deposits. Within the NSA Memphis Southside, groundwater in the loess/shallow alluvium most likely moves primarily downward to recharge the deeper fluvial deposits. In the immediate vicinity of SWMU 20, some water in the loess may move laterally and discharge south to the SWMU 38 drainage ditch.

### 2.3 Climatological Data

Regional climatological data are provided in Section 2.8 of the *Comprehensive RFI Work Plan*.

Table 2.1  
 Test Borings and Background Wells on the NSA Memphis Southside

Stratigraphic Unit	Sh:U-89 <sup>a,b</sup>	Test Hole 7 (Sh:V-79)	Test Hole 8 (Sh:V-80)	BG-02	BG-04
Alluvium	Not present	Not present	Clayey silt, 0-35 feet bls; sand and gravel, 35-45 feet bls (45')	Not present	Not present
Loess	Silt and clay deposits, 0-38 feet bls (38')	Silt and clayey silt, 0-34 feet bls (34')	Not present	Silt and clay deposits, 0-29 feet bls (29')	Silt and clayey silt, 0-38 feet bls (38')
Fluvial Deposits	Sand and gravel, 38-97 feet bls (59')	Sand, gravel, and silt, 34-47 feet bls (13')	Not present	Sand and gravel, 29-77 feet bls (48')	Sand, gravel, and silt, 38-71 feet bls (33')
Cockfield Formation	Sand, silt, clay, and lignite, 97-134 feet bls (37')	Sand, clay, and lignite, 47-173 feet bls (126')	Sand, silty sand, clay, and lignite, 45-153 feet bls (108')	Sand, silt, and clay, 77 feet bls to termination depth of the boring at 87 feet bls	Sand and clay, 71 feet bls to termination depth of the boring at 76 feet bls
Cook Mountain Formation	Hard clay and silt from 134-160 feet bls (26'); confining unit for the Memphis Aquifer	Hard slightly silty clay from 173 feet bls to termination depth of boring at 202 feet; confining unit for the Memphis Aquifer	Hard slightly silty clay from 153 feet bls to termination depth of boring at 182 feet bls; confining unit for the Memphis Aquifer	Not sampled	Not sampled

Notes:

- <sup>a</sup> — Sh:U-89 = USGS boring designation
- <sup>b</sup> — Lithologic description for Sh:U-89 is based on driller's log contained in Attachment 3. Lithologic descriptions for Test Holes 7 and 8 are based on oral communication with USGS representatives; geophysical logs are forthcoming in USGS publications.
- bls — below land surface
- (38') — formation thickness



**3.0 SOURCE CHARACTERIZATION**

**3.1 SWMU 20**

The former UWT-1594 at SWMU 20 reportedly received hydraulic fluid and waste oil while in operation. Soil samples collected during the tank removal and a previous investigation contained detectable levels of benzene, toluene, ethylbenzene, xylene (BTEX), total petroleum hydrocarbon (TPH), TPH-gasoline range organics (GRO), TPH-diesel range organics (DRO), and some chlorinated solvents. Groundwater samples collected from the fluvial deposits contained detectable levels of several chlorinated solvents and benzene. The results of previously collected soil and groundwater samples indicate that a release has probably occurred from UWT-1594. Additionally, the presence of chlorinated solvents in soil and groundwater indicates that the tank receive wastes other than hydraulic fluid and waste oil.

**3.2 SWMU 22**

SWMU 22 is the former site of three fuel oil tanks and one diesel tank. Soil sampled collected during a tank removal and previous investigation contained petroleum related compounds and some chlorinated compounds. Groundwater samples previously collected at this site also contained detectable levels of petroleum related compounds and chlorinated solvents, particularly ethylbenzene, m-xylene, and methylene chloride. The results of these samples indicate that a release has probably occurred from one or more of the USTs before its removal.

**3.3 SWMU 39**

SWMU 39 is the location of a former dry cleaning facility as well as a former transformer storage area. Soil and groundwater samples previously collected at SWMU 39 indicated the presence of petroleum products and chlorinated solvents, particularly ethylbenzene, m-xylene, methylene chloride and trichloroethene. Both the petroleum products and chlorinated solvents could have resulted from releases from a UST associated with the dry cleaning facility or from improper disposal practices from the dry cleaning facility.

#### 4.0 CHARACTERIZATION OF HAZARDOUS CONSTITUENT RELEASES

##### 4.1 Previous Investigations

###### SWMU 20

During the 1992 tank removal, soil samples were collected from the tank pit bottom and from the stockpiled soil. The data from the *Underground Storage Tank Closure Report, Tank No. 1594* indicate that a release probably occurred before removal of UWT 1594. No other reports of investigations or site inspections were available concerning SWMU 20.

A Confirmatory Sampling Investigation (CSI) was conducted in 1997. Analysis of soil and groundwater samples collected at SWMU 20 during the CSI 20 identified benzene, 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, and 1,1,2-trichloroethene as contaminants. These results are discussed in the *Assembly F — CSI Report (EnSafe/Allen & Hoshall, 1997)* of potential concern (COPCs) in fluvial deposits groundwater.

###### SWMU 22

The diesel tank at SWMU 22 was removed in 1992. The data from this removal, reported in the *Underground Storage Tank Closure Report, Tank No. S-75W*, indicate that a release probably occurred before the diesel UST removal. No other investigations were available concerning SWMU 22 before this removal. Prior inspection reports do not indicate any releases of hazardous constituents at SWMU 22.

A CSI was conducted at SWMU 22 in 1997. Analysis of soil and groundwater samples collected at that time identified arsenic and benzo(a)pyrene equivalents (BEQ) as COPCs in surface soil; ethylbenzene, methylene chloride, and m-xylene were identified as COPCs in fluvial deposits groundwater.

## SWMU 39

A Preliminary Groundwater Assessment was conducted at SWMU 39 in December 1995. As part of the assessment, a groundwater sample was collected from the upper fluvial deposits and submitted to an onsite laboratory to be analyzed for volatile organic compounds (VOCs). Results indicated the presence of petroleum products, presumed to be Stoddard solvent, a common dry cleaning solution.

In May 1996, a UST adjacent to the Building S-74 concrete slab was removed by a Navy subcontractor. Obvious soil contamination from the UST was visible. VOC and polychlorinated biphenyl (PCB) analyses were added to the standard petroleum-related parameters run on the soil samples ; however, analytical results were not available for inclusion in this report. Any analytical results from the UST removal will be reviewed and considered prior to implementation of this work plan.

Analysis of soil and groundwater samples collected during the SWMU 39 CSI identified ethylbenzene and m-xylene as COPCs in loess groundwater and methylene chloride and trichloroethene in fluvial deposits groundwater.

### 4.2 Data Gaps

The following data gaps will be the focus of this investigation:

- The groundwater flow direction in the fluvial deposits beneath each SWMU.
- The permeability of the sediments overlying the loess and fluvial deposits groundwater at each SWMU.
- The horizontal and vertical extent of soil contamination to the east and west of the abandoned tank pit at SWMU 20.

- The horizontal and vertical extent of *groundwater* contamination associated with each SWMU, and the horizontal and vertical extent of *soil* contamination associated with the former UWT at SWMU 20.
- Risk (both ecological and human health risk) associated with each site.

Soil and groundwater samples will be analyzed for VOCs, using SW-846 Methods 8240 and 5035 respectively. Soil samples collected with Shelby tubes will be analyzed for permeability using ASTM D-2434.

#### 4.3 Objective and Proposed Field Investigation

This RFI's objective is to define the vertical and horizontal extent of the contamination identified during the CSI and prior tank closures. The investigation will be conducted in two phases; the first phase will consist of collecting soil and groundwater samples and installing temporary piezometers using direct push technology (DPT). The second phase will involve installing and sampling monitoring wells. The well locations will be selected after reviewing the analytical data and groundwater flow direction data collected during the DPT phase of the investigation. The data collected from the first phase will be used to select the final well locations during the second phase. All sample collection and processing will be conducted in accordance with Section 4 of the *Comprehensive RFI Work Plan*.

##### 4.3.1 DPT Phase

The DPT phase of the RFI will include collecting soil and groundwater samples and installing temporary piezometers. The piezometers will be used to measure static levels to determine groundwater flow direction and for groundwater sample collection. All DPT soil and groundwater sampling will be conducted as outlined in Section 4.4.4.3 of the *Comprehensive RFI Work Plan*. Installation procedures for the temporary piezometers are discussed in section 4.4.

**4.3.1.1 SWMU 20 — Soil**

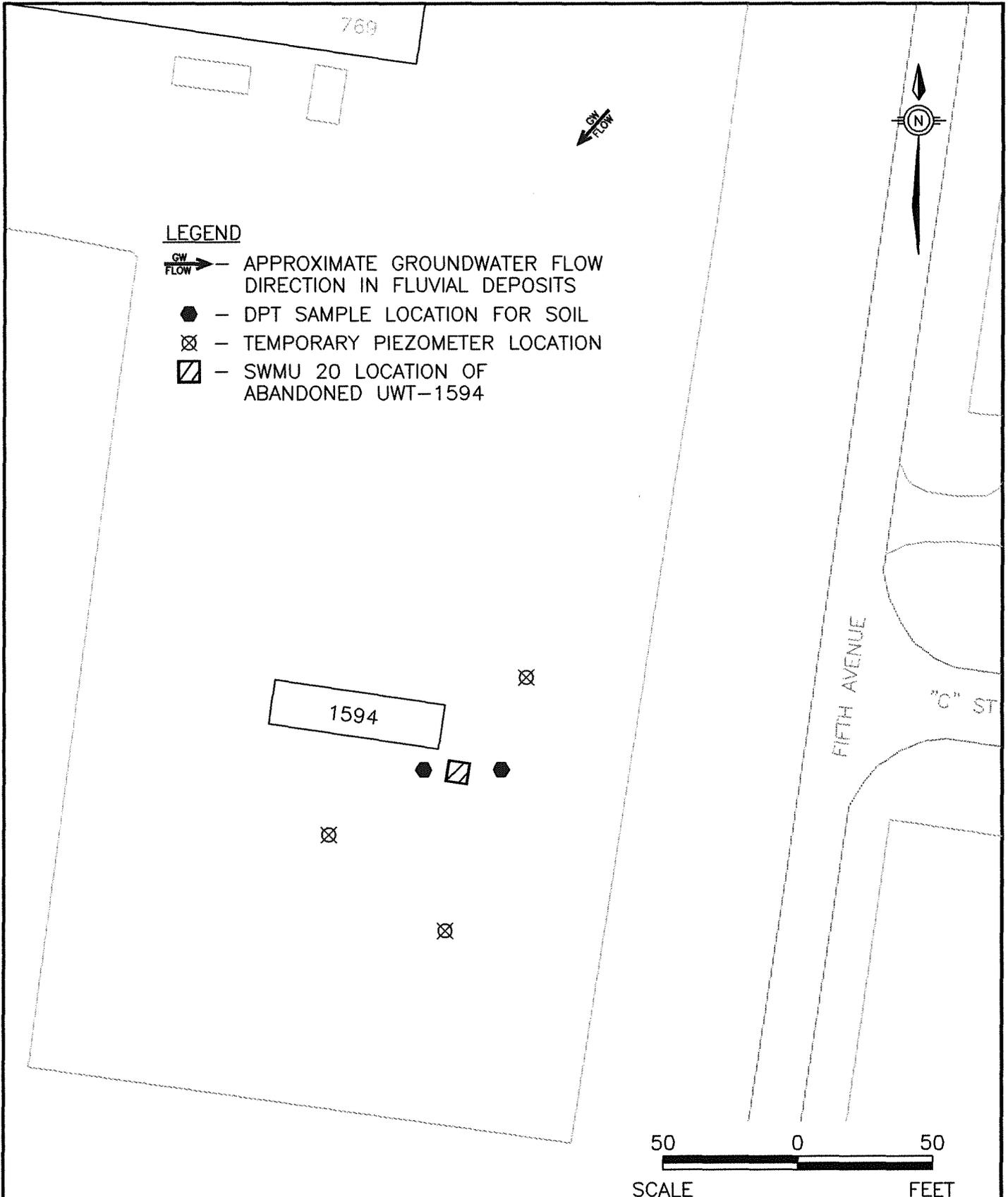
Soil contamination identified at SWMU 20 was delineated to the northwest and southeast of the abandoned UWT pit. During the first RFI phase, soil samples will be collected from two DPT locations, one northeast and the other southwest of the tank pit (Figure 4.1). Soil samples will be collected from 5 to 7 feet and from 11 to 13 feet to coincide with the CSI sample intervals where the highest concentrations of VOCs were detected. Data from these samples will be used to better define the lateral and vertical extent of soil contamination associated with UWT 1594.

**4.3.1.2 SWMU 20 — Groundwater**

The DPT phase of the SWMU 20 RFI will consist collecting a total of 12 groundwater samples from the fluvial deposits and installing four half-inch piezometers to a depth of 60 feet below ground surface (bgs) (Figure 4.1). Fluvial deposits groundwater samples will be collected from depths of 40 and 50 feet below ground surface using the DPT rig's stainless steel groundwater sampling tool. A third groundwater sample will be collected at each of the four locations from a depth of 60 feet bgs. The 60 foot samples will be collected from temporary piezometers installed to measure the static water levels and to determine the groundwater flow direction in the upper fluvial deposits. Determining the specific flow direction at SWMU 20 will improve the usefulness of the wells proposed for the second phase of the RFI. All groundwater samples will be analyzed for VOCs using SW-846 Method 8240.

**4.3.1.3 SWMUs 22 and 39 — Soil**

One DPT location will be sampled around the southwest corner of Building S-74's foundation to confirm the contamination detected during the CSI (Figure 4.2). Samples will be collected at depths of 9 to 11 feet below ground surface and 11 to 13 feet below ground surface.



**LEGEND**

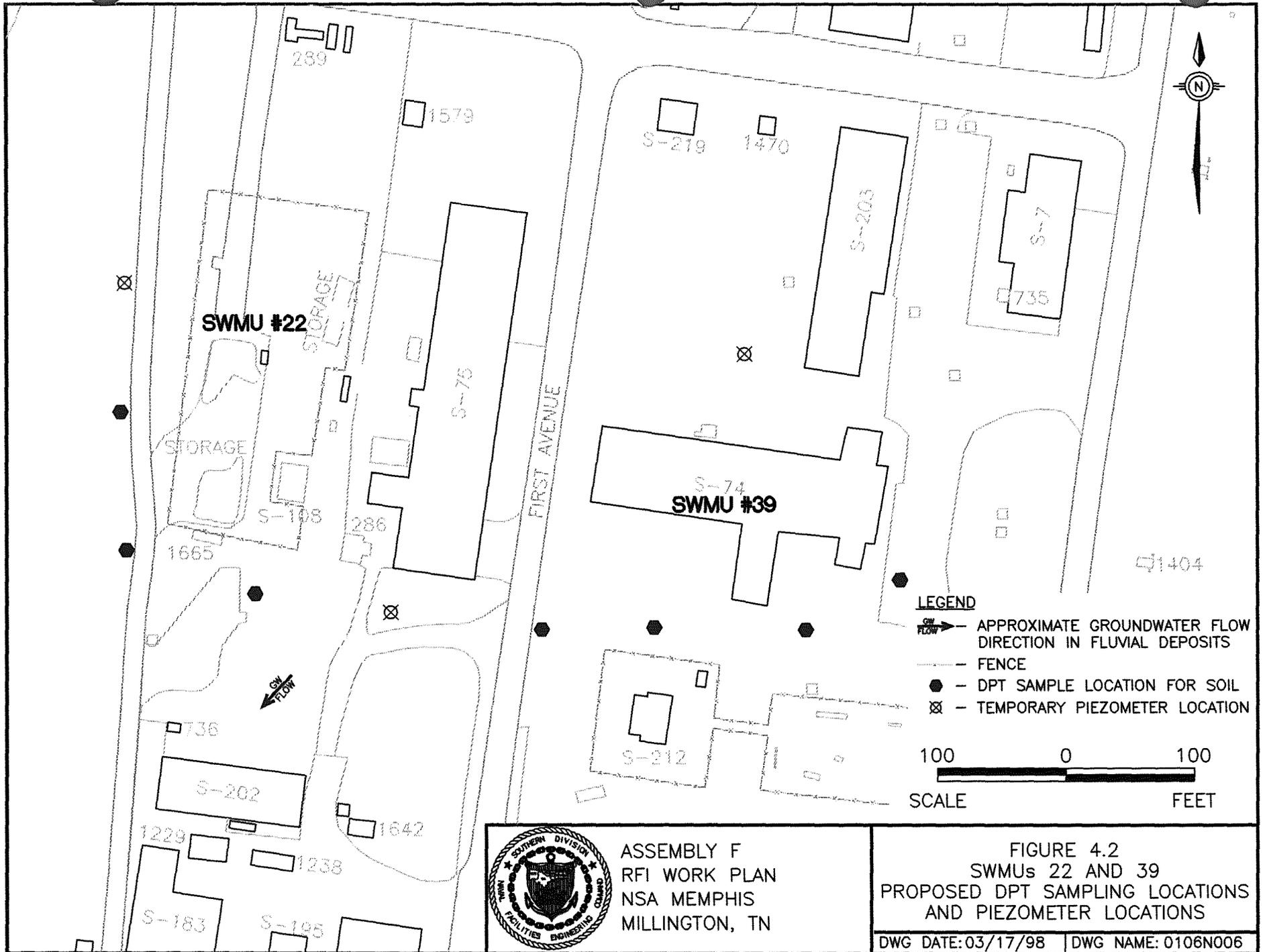
-  — APPROXIMATE GROUNDWATER FLOW DIRECTION IN FLUVIAL DEPOSITS
-  — DPT SAMPLE LOCATION FOR SOIL
-  — TEMPORARY PIEZOMETER LOCATION
-  — SWMU 20 LOCATION OF ABANDONED UWT-1594



ASSEMBLY F  
RFI WORK PLAN  
NSA MEMPHIS  
MILLINGTON, TN

FIGURE 4.1  
SWMU 20  
PROPOSED DPT SAMPLING LOCATIONS  
AND TEMPORARY PIEZOMETER LOCATIONS

DWG DATE: 03/17/98 | DWG NAME: 0106N005



#### 4.3.1.4 SWMUs 22 and 39 — Groundwater

Groundwater screening samples will be collected from a total of 10 DPT locations at SWMUs 22 and 39. The DPT rig will be used to collect groundwater (or saturated soil) samples from the loess from a depth of approximately 15 feet bgs. Groundwater samples from the fluvial deposits will be collected with the DPT rig from depths of approximately 40 feet and 60 feet bgs and analyzed for VOCs using Method 8240. Temporary piezometers will be installed at the first three of the nine locations (Figure 4.2). Three groundwater samples from the 60 foot interval will be collected from these piezometers. The groundwater flow direction will be determined before the remaining six locations are sampled.

#### 4.3.2 Monitoring Well Phase

The monitoring well phase of the RFI, which will follow the DPT phase, will consist of installing 12 groundwater monitoring wells and collecting three Shelby tube samples (one per site). Tentative well locations have been marked on the figures in this section; however, the final well locations will be selected after the DPT phase has been completed and the data have been reviewed. All groundwater monitoring wells will be installed using hollow-stem auger drilling techniques. Monitoring well installation, completion, and development will follow the procedures discussed in Section 4.5 of the *Comprehensive RFI Work Plan*. The following sections discuss well placement and rationale for each SWMU.

##### 4.3.2.1 SWMU 20

Four monitoring wells will be installed at SWMU 20. Each well will be screened in the lower fluvial deposits at a total depth of approximately 90 feet. Tentative well locations are depicted on Figure 4.3. Exact well locations will be selected after the DPT phase has been completed and the data has been reviewed. One well will be upgradient of the site, two downgradient of the site, and one near the source area. The source area well will be installed downgradient of the former tank pit, immediately outside the area of contaminated soil.

**Table 5.1**  
**Selection of Exposure Pathways for**  
**NSA Memphis Assembly F SWMUs**

Scenario Timeframe	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway		
			Resident	Adult	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.	1	
				Child	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.	2	
			Trespasser/ Visitor	Adolescent	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.	3	
			Site Worker	Adult	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.	4	
			Construction Worker	Adult	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.	5	
		Inhalation of Volatilized Contaminants	Resident	Adult	Inhalation	On-Site	Qual	VOCs identified in surface soil will be compared with soil to air screening values.	6	
				Child	Inhalation	On-Site	Qual	VOCs identified in surface soil will be compared with soil to air screening values.	7	
				Trespasser/ Visitor	Adolescent	Inhalation	On-Site	Qual	VOCs identified in surface soil will be compared with soil to air screening values.	8
				Site Worker	Adult	Inhalation	On-Site	Qual	VOCs identified in surface soil will be compared with soil to air screening values.	9
				Construction Worker	Adult	Inhalation	On-Site	Qual	VOCs identified in surface soil will be compared with soil to air screening values.	10
			Resident	Adult	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.	11	

Table 5.1  
 Selection of Exposure Pathways for  
 NSA Memphis Assembly F SWMUs

Scenario Timeframe	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
				Child	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.
			Trespasser/ Visitor	Adolescent	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.
			Site Worker	Adult	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.
			Construction Worker	Adult	Inhalation	Off-Site	None	Potential migration will be addressed in the Fate and Transport Section of the RFI; this exposure pathway will be added if a concern is identified.

**Notes:**

*Sediment and surface water do not exist onsite, so associated exposure pathways and land use scenarios were not considered. Groundwater receptors identified as a concern in future land use scenarios will be addressed in the Fate and Transport Section of the RFI to account for potential offsite migration.*

*Quant This exposure pathway will be quantified.*

*Qual This exposure pathway will not be quantified; a screening assessment will be performed.*

*None This exposure pathway will be discussed in the text, but no quantitative or qualitative assessment is anticipated.*

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**Table 5.2**  
**Summary of HHRA Exposure Pathways**  
**NSA Memphis — Assembly F RFI Work Plan**

Receptor Population	Current / Future Land Use	Medium	Age	Exposure Pathways	Offsite / Onsite	Assessment Type
Resident	F	Groundwater	Adult & Child	Dermal (while showering)	Onsite	Quantitative
				Inhalation (while showering)	Onsite	Quantitative
				Ingestion	Onsite	Quantitative
		Surface Soil	Adult & Child	Dermal	Onsite	Quantitative
				Ingestion	Onsite	Quantitative
				Inhalation of VOCs	Onsite	Screening
Trespasser / Visitor	C / F	Surface Soil	Adolescent	Dermal	Onsite	Quantitative
				Ingestion	Onsite	Quantitative
				Inhalation of VOCs	Onsite	Screening
Site Worker	F	Groundwater	Adult	Dermal (while showering)	Onsite	Quantitative
				Inhalation (while showering)	Onsite	Quantitative
				Ingestion	Onsite	Quantitative
		Surface Soil	Adult	Dermal	Onsite	Quantitative
				Ingestion	Onsite	Quantitative
				Inhalation of VOCs	Onsite	Screening
Construction Worker	F	Surface Soil	Adult	Dermal	Onsite	Screening
				Ingestion	Onsite	Screening
				Inhalation of VOCs	Onsite	Screening
		Subsurface Soil	Adult	Dermal	Onsite	Screening
				Ingestion	Onsite	Screening
		Inhalation of VOCs	Onsite	Screening		

#### 5.5.4 Identification of COPCs

The substances detected (chemicals present in site samples, or CPSSs) will be screened to develop a list or group of COPCs. COPCs are, therefore, chemicals selected by comparison to screening concentrations, intrinsic toxicological properties, persistence, fate and transport characteristics, and cross-media transport potential. The nature and general extent of CPSSs will be referenced in this section of the site-specific HHRAs. To reduce the list of CPSSs and focus the risk assessment on COPCs, the following two comparisons will be performed. This information will be summarized in accordance with RAGS Part D.

##### 5.5.4.1 Comparison of Site-Related Data to Risk-Based Screening Concentrations

The maximum concentrations of CPSSs detected during sampling will be compared to risk-based screening values. These values will be obtained from *Risk Based Screening Concentrations*, USEPA Region III, January through June, 1996 (and subsequent versions), unless other, more appropriate screening values are identified in the exposure assessment phase. As stated in the EPA Region III document, a risk goal of 1E-6 will be used to calculate screening concentrations for carcinogens. RBCs will be adjusted to reflect a target HQ of 0.1 for noncarcinogens, in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 1* (USEPA, November 1995). Groundwater results will be compared to tap water screening values, and reported soil concentrations will be compared to residential soil screening values. CPSSs with maximum detected concentrations exceeding their corresponding concentrations, goals, levels, and/or standards will be evaluated further and compared to reference background concentrations. In addition, surrogate screening values based on toxicological similarities will be used if no screening values are available in USEPA's table, and surrogate screening values will be noted where applied.

The maximum concentration reported for each carcinogenic polycyclic aromatic hydrocarbon (PAH) will be compared to its corresponding screening value. In addition, all carcinogenic PAH concentrations reported at that location will be converted to the benzo(a)pyrene equivalent

concentration (BEQ), which will be compared to the screening value for benzo(a)pyrene. PAH conversions will be performed using current Toxic Equivalency Factors (TEFs) for PAHs in accordance with USEPA Region IV *Supplemental Guidance to RAGS Bulletin 2* (USEPA, November 1995).

#### 5.5.4.2 Comparison of Site-Related Data to Background Concentrations

Background data for NSA Memphis will be referenced in this section, or background reference concentrations from E/A&H's August 27, 1996 *Reference Concentrations* technical memorandum will be used. Following comparison to risk- and hazard-based screening values, CPSSs whose maximum detected concentrations exceeded corresponding background reference concentrations will be formally assessed in the HHRA, unless otherwise noted.

The maximum reported concentration of a CPSS will be compared to its reference background concentration (when applicable). This comparison helps account for naturally occurring elements, such as beryllium, manganese, and arsenic. Thus, risk and/or hazard associated with naturally occurring elements are not addressed where their concentrations are similar to corresponding background.

In the HHRA, if the maximum concentration of a CPSS is determined to be less than either two-times mean background or the risk-based screening values, then the CPSS will not be considered further unless deemed appropriate based on chemical-specific characteristics (e.g., degradation product with greater toxicity).

#### 5.5.4.3 Elimination of Essential Elements: Calcium, Iron, Magnesium, Potassium, and Sodium

In accordance with RAGS Part A, essential elements that are potentially toxic only at extremely high concentrations may be eliminated as COPCs in a risk assessment. Specifically, an essential nutrient may be screened out if it is present at concentrations that are not associated with adverse

health effects. Based on RAGS, the lack of risk-related data, and USEPA Region IV's recommendations, the following essential nutrients will not be included in HHRAs: calcium, iron, magnesium, potassium, and sodium.

Risk information usually obtained from the Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST) is necessary to calculate risk and hazard estimates (and risk-based screening values). This information is based on toxicological and epidemiological data which are critiqued and approved by the scientific and regulatory community (i.e., listed in IRIS and/or HEAST). Risk information (or surrogate risk information) is not always available for all CPSSs, so their risk and/or hazard will not be calculated. The results of the screening process will be tabulated in the HHRA. TPH contains many chemicals, most of which are included in full-scan analysis. Risk-based screening values and toxicological data are chemical-specific, so chemical-specific data will be used in the risk assessment. TPH data will be presented, but risk estimates will not be quantified based on TPH results. The most toxic TPH constituents would generally be included in the chemical-specific analyses.

#### 5.5.4.4 Summary of COPCs

The results of the screening evaluations will be tabulated on a medium-specific basis in the site-specific HHRAs in accordance with RAGS Part D.

### 5.6 Estimation of Risk and Hazard

Risk/hazard will be subsequently calculated based on exposure estimates, then exposure scenarios (e.g., soil exposure during commercial land use) exceeding USEPA acceptable limits will be identified. An exposure scenario of concern will be identified as a scenario with incremental excess lifetime cancer risk (ILCR) estimated greater than  $1E-4$  or a hazard index (HI) estimated greater than 1. In the next step, COPCs exceeding  $1E-6$  ILCR or a HQ greater than 0.1 in a scenario of concern are retained as COCs. Section 5.7, Toxicity Assessment, discusses cancer risk thresholds and noncancer toxicity in detail.

### 5.6.1 Exposure Point Concentrations

The exposure point concentrations (EPC) is the estimated concentration of a contaminant in an exposure medium that will be contacted by a real or hypothetical receptor. Determining the exposure point concentration depends on factors such as:

- Availability of data
- Amount of data available to perform statistical analysis
- Reference concentrations not attributed to site impacts
- Location of the potential receptor

For soil, USEPA Region IV guidance calls for assuming lognormal distributions for environmental data and the calculation of 95% UCL on the mean for use in exposure quantification. Applying the UCL is generally inappropriate with less than 10 samples. Therefore, the maximum concentrations detected will be used for all datasets with less than 10 samples. In general, outliers have been included when calculating the UCL because high values seldom appear as outliers for a lognormal distribution. Including outliers increases the overall uncertainty of the calculated risks and conservatively biases exposure estimates.

For sample sets of 10 and greater, the UCL will be calculated for a lognormal distribution as  $e^x$ , where x equals:

$$\left( \bar{a} + 0.5s_a^2 + \frac{H_{0.95} x s_a}{\sqrt{n-1}} \right)$$

where:

- $\bar{a}$  =  $\Sigma a/n$  = sample arithmetic mean of the log-transformed data,  $a = \ln(x)$
- $s_a$  = sample standard deviation of the log-transformed data
- $n$  = number of samples in the data set

$H_{0.95}$  = value for computing the one-sided upper 95% confidence limit on the lognormal mean from standard statistical tables (Gilbert, 1987)

For groundwater, USEPA Region IV specifies using the average of highest concentration within a plume as the EPC. This method will be used where possible to assess groundwater. EPCs and UCLs will be summarized and tabulated when applicable in the site-specific HHRA in accordance with RAGS Part D.

### 5.6.2 Quantification of Exposure

This section describes the models, equations, and intake model variables used to quantify doses or intakes of the COPCs for the surface soil and groundwater exposure pathways. The models are designed to estimate route- and medium-specific factors, which are multiplied by the EPC to estimate chronic daily doses. The intake model variables generally reflect 50th or 95th percentile values which, when applied to the EPC, ensure that the estimated intakes represent the reasonable maximum exposure (RME, which is considered 95th percentile). Formulae are derived from RAGS, Part A unless otherwise indicated. Table 5.3 lists intake model variables used to compute chronic daily intake (CDI) for potential receptors exposed to surface soil and/or groundwater contaminants.

Because NSA Memphis is part of BRAC, future site use cannot be determined with any certainty. Therefore, the conservative assumptions will be used to account for any reasonable future use. Current reuse plans will be referenced and discussed in the site-specific HHRA. NSA Memphis media analytical results and exposure methods have been formatted to allow exposure estimates to be fine-tuned based on actual conditions as base reuse plans materialize, and this information will be used on a site-specific basis, if known.

In accordance with USEPA's recommendations, the adult and child intake variables will be combined to estimate exposure to carcinogens. This factor is referred to as the lifetime weighted

average, or LWA. The LWA considers the difference in daily ingestion rates for soil and drinking water, body weights, and exposure durations for children (ages 1 to 6) and adults (ages 7 to 31). The exposure frequency is assumed to be identical for the adult and child exposure groups, and an example is shown after the equations are presented below.

Before quantifying soil exposure, it will first be necessary to derive the appropriate fraction ingested (or contacted) (FI/FC) from contaminated area factors for each applicable COPC. These factors will be derived by evaluating the spatial distribution of COPCs. The FI/FC will be computed by estimating the maximum area affected and dividing it by the total exposure unit area. These computations will be performed conservatively to account for uncertainty associated with contaminant distributions.

The FI/FC factors modify the concentrations to more closely approximate site-wide exposure conditions for a given exposure unit area. When the UCL is used as EPC, no FI/FC adjustments will be made. In addition, CPSSs not eliminated from the HHRAs based on the screening comparisons described in Section 5.5.4.3 may be eliminated as a COPC because the UCL concentration does not exceed the corresponding background concentration or RBC. This will be discussed on a site-specific basis.

Table 5.3  
 Parameters Used to Estimate CDI

Pathway Parameters	Resident Adult	Resident Child	Adult Worker	Trespassing Child (age 7-16)	Units
<b>Surface Soil Ingestion and Dermal Contact</b>					
Ingestion Rate (soil)	100 <sup>a</sup>	200 <sup>a</sup>	50 <sup>a</sup>	100 <sup>a</sup>	mg/day
Ingestion Rate (water)	2	1	1	NA	L/day
Exposure Frequency	350 <sup>b</sup>	350 <sup>b</sup>	250 <sup>b</sup>	52 <sup>f</sup>	days/year
Exposure Duration	24 <sup>c</sup>	6 <sup>c</sup>	25 <sup>c</sup>	10 <sup>c</sup>	years
Dermal Contact Area	4,100 <sup>a</sup>	2,900 <sup>a</sup>	4,100 <sup>a</sup>	4,100 <sup>a</sup>	cm <sup>2</sup>
Skin Adherence Factor	1	1	1	1	mg/cm <sup>2</sup>
Absorption Factor	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	0.01 (organics) 0.001 (inorganics)	unitless
Oral Absorption Efficiency	0.8 (VOCs) 0.5 (other organic compounds) 0.2 (inorganics)	unitless			
Conversion Factor	1E-6	1E-6	1E-6	1E-6	kg/mg
Body Weight	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>	kg
Averaging Time, Noncancer	8,760 <sup>d</sup>	2,190 <sup>d</sup>	9,125 <sup>d</sup>	3,650 <sup>d</sup>	days
Averaging Time, Cancer	25,550 <sup>e</sup>	25,550 <sup>e</sup>	25,550 <sup>e</sup>	25,550 <sup>e</sup>	days

Notes:

- a — USEPA (1989a) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A)*.
- b — USEPA (1991b) *Risk Assessment Guidance for Superfund Vol. I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors, Interim Final*, OSWER Directive: 9285.6-03.EPA/600/8-89/043.
- c — USEPA (1991a), *Risk Assessment Guidance for Superfund: Vol. I – Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*, OSWER Directive 9285.7-01B.
- d — Calculated as the product of ED (years) x 365 days/year.
- e — Calculated as the product of 70 years (assumed lifetime) x 365 days per year.
- f — Assuming one day per week exposure.
- g — Assuming trespassing occurs during the 10-year adolescent/teenage period.
- NA — Not applicable.

5.6.2.1 Surface Soil Pathway Exposure

Ingestion of COPCs in Surface Soil

Except CDI for a site resident's exposure to carcinogens, the following equation is used to estimate the ingestion of COPCs in soil:

$$CDI_s = (EPC_s)(IR)(EF)(ED)(F)(FI)/(BW)(AT)$$

where:

- CDI<sub>s</sub> = ingested dose (mg/kg-day) 1
- EPC<sub>s</sub> = exposure point concentration of contaminant in soil (mg/kg) 2
- IR = ingestion rate (milligrams per day [mg/day]) 3
- EF = exposure frequency (days/year) 4
- ED = exposure duration (years) 5
- F = conversion factor (1E-6 kg/mg) 6
- FI = fraction ingested from contaminated source (unitless) 7
- BW = body weight (kg) 8
- AT = averaging time (days) 9

The LWA is used to calculate carcinogenic CDI for site residents. An example of the LWA calculation is shown below for the soil ingestion pathway, and LWAs are similarly calculated for subsequent equations. 10

$$LWA = [(IR_a \times ED_a)/BW_a] + [(IR_c \times ED_c)/BW_c] \quad \text{11}$$

where:

- LWA = lifetime weighted average 12
- IR = ingestion rate (milligrams per day [mg/day]) 13
- ED = exposure duration (years) 14
- BW = body weight (kg) 15
- a = adult 16
- c = child 17

Consequently, CDI for carcinogens would be calculated as follows for site residents: 18

$$CDI_s = (EPC_s)(EF)(LWA)(F)(FI)/(AT) \quad \text{19}$$

where:

- CDI<sub>s</sub> = ingested dose (mg/kg-day) 20
- EPC<sub>s</sub> = exposure point concentration of contaminant in soil (mg/kg) 21

- EF = exposure frequency (days/year) 1
- F = conversion factor (1E-6 kg/mg) 2
- FI = fraction ingested from contaminated source (unitless) 3
- AT = averaging time (days) 4
- LWA = lifetime weighted average 5

**Dermal Contact with COPCs in Surface Soil** 7

The following equation is used to estimate intake due to dermal contact with COPCs in soil: 8

$$CDI_{sd} = (EPC_s)(CF)(EF)(ED)(F)(FC)(ABS)(AF)/(BW)(AT) \quad 10$$

where: 11

- $CDI_{sd}$  = dermal dose (mg/kg-day) 12
- $EPC_s$  = exposure point concentration of contaminant in soil (mg/kg) 13
- CF = contact factor (cm<sup>2</sup>) 14
- EF = exposure frequency (days/year) 15
- ED = exposure duration (years) 16
- F = conversion factor (1E-6 kg/mg) 17
- FC = fraction contacted from contaminated source (unitless) 18
- ABS = absorption factor (unitless value, specific to organic versus inorganic compounds) 19
- AF = adherence factor (milligrams per square centimeter [mg/cm<sup>2</sup>]) 20
- BW = body weight (kg) 21
- AT = averaging time (days) 22

**5.6.2.2 Groundwater Pathway Exposure** 24

**Ingestion and Inhalation of COPCs in Groundwater** 25

The following equation is used to estimate the ingestion and/or inhalation of COPCs in groundwater: 26

$$CDI_w = (EPC_w)(IR)(EF)(ED)(FI)/(BW)(AT) \quad 28$$

where:

- CDI<sub>w</sub> = ingested/inhaled dose (mg/kg-day)
- EPC<sub>w</sub> = exposure point concentration of contaminant in water (milligrams per liter [mg/L])
- IR = ingestion rate (L/day)
- EF = exposure frequency (days/year)
- ED = exposure duration (years)
- FI = fraction ingested from contaminated source (unitless)
- BW = body weight (kg)
- AT = averaging time (days)

HHRAs are comprised of many tables, and intake tables serve only as an intermediate check when reviewing the document. The CDI equations above can be solved assuming a concentration of 1, and the result can be used as a universal multiplier. Multipliers were developed for each typical land use scenario and are shown in Table 5.4. Consequently, a significant number of the tables in HHRAs can be eliminated. An example of the abbreviated CDI method is shown below:

$$CDI=(EPC)(M)$$

where:

- CDI = chronic daily intake (mg/kg-day)
- EPC = exposure point concentration (mg/kg or mg/L)
- M = multiplier specific to the exposure scenario, land use, and potential receptor selected

Because multipliers can be reviewed separately, CDI will be incorporated into the risk and hazard equations and *will not be presented* in separate tables.

**Table 5.4**  
**Multipliers<sup>a</sup> Used to Estimate Chronic Daily Intake**

Exposure Scenario	Exposure Type	Soil		Groundwater
		Ingestion	Dermal Contact	Ingestion
		All Chemicals	Organics <sup>b</sup>	All Chemicals <sup>c</sup>
<i>Resident</i>	Noncarcinogens (adult)	1.37E-6	5.62E-7	2.74E-2
	Noncarcinogens (child)	1.28E-5	1.85E-6	6.39E-2
	Carcinogens (LWA)	1.57E-6	3.51E-7	1.49E-2
<i>Trespasser</i> (age 7-16)	Noncarcinogens	3.17E-7	1.30E-7	NA
	Carcinogens	4.52E-8	1.85E-8	NA
<i>Site Worker</i>	Noncarcinogens	4.89E-7	4.01E-7	9.78E-3
	Carcinogens	1.75E-7	1.43E-7	3.49E-3

**Notes:**

- NA — Not applicable
- LWA — Lifetime weighted average
- <sup>a</sup> — The product of the multiplier and the exposure point concentration equals the chronic daily intake for a given chemical assuming a reasonable maximal exposure scenario.
- <sup>b</sup> — The multiplier for inorganics is multiplied by a factor of 0.1 to account for the dermal absorption factor of 0.001 for inorganics; the multiplier for organic compounds includes the 0.01 factor.
- <sup>c</sup> — The ingestion intake is also used to address inhalation risk in accordance with USEPA's Supplemental Guidance To RAGS Bulletin 3; ingestion risk is approximately equal to risk posed by dermal and inhalation exposure while showering, and this is applied to volatile organic compounds only.

**5.7 Toxicity Assessment**

**5.7.1 Carcinogenicity and Noncancer Effects**

USEPA has established a classification system for rating the potential carcinogenicity of environmental contaminants based on the weight of scientific evidence. The cancer classes are described below. Cancer weight-of-evidence class "A" (human carcinogens) means that human toxicological data have shown a proven correlation between exposure and the onset of cancer (in varying forms). The "B1" classification indicates some human exposure studies have implicated

the compound as a probable carcinogen. Weight-of-evidence class "B2" indicates a possible human carcinogen based on confirmatory carcinogenic laboratory animal data. Weight-of-evidence class "C" identifies possible human carcinogens, and class "D" indicates a compound not classifiable with respect to its carcinogenic potential. A class "A" compound posing risk higher than USEPA's acceptable risk range has more weight than would a class "C" compound. There is more uncertainty in the lower classifications, so the weight-of-evidence should be used by risk managers when making risk management decisions based on cancer risk.

USEPA has established slope factors (SF) for carcinogenic compounds. The SF is defined as a "plausible upper-bound estimate of the probability of a response (cancer) per unit intake of a chemical over a lifetime" (RAGS, Part A). Upper-bound estimates are more likely to overestimate cancer potential.

In addition to potential carcinogenic effects, most substances also can produce other toxic responses at doses greater than experimentally derived threshold concentrations. USEPA has derived reference dose (RfD) values for these substances. A chronic RfD is defined as, "an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure concentration for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime." These toxicological values are used in risk formulae to assess the upper-bound level of cancer risk and noncancer hazard associated with exposure to a given chemical concentration.

For carcinogens, the potential risk posed by a chemical is computed by multiplying the CDI (as mg/kg-day) by the SF (in reciprocal mg/kg-day). The HQ (for noncarcinogens) is computed by dividing the CDI by the RfD. USEPA has set standard limits (or points of departure) for carcinogens and noncarcinogens to evaluate whether significant risk is posed by a chemical (or combination of chemicals). For carcinogens, the point-of-departure range is 1E-6, with a generally accepted range of 1E-6 to 1E-4. These risk values correlate with one in 10,000 (1E-4)

and one in 1 million (1E-6) excess cancer incidence resulting from exposure to toxic compounds from outside the body.

For noncarcinogens, other toxic effects are generally considered possible if the HQ (or sum of HQs for a pathway-hazard index) exceeds the threshold value of 1. Although both cancer risk and noncancer hazard are generally additive only if the target organ is common to multiple chemicals, a most conservative estimate of each may be obtained by summing the individual risks or hazards, regardless of target organ. Site-specific HHRAs for NSA Memphis will take the universal summation approach for each class of toxicant. Details regarding the risk formulae applied to site data are provided in Section 5.8, Risk Characterization.

Critical studies used in establishing toxicity classifications by USEPA are shown in the IRIS database, which is the primary source for information necessary to estimate risk. HEAST, Fiscal Year 1995 is the secondary source for this information. In addition, USEPA's National Center for Environmental Assessment (NCEA) will be used as a source when necessary. In accordance with RAGS Part D, a table will summarize toxicological data in the site-specific HHRAs in the form of RfDs and SFs obtained for COPCs identified in site media, as well uncertainty/modifying factors, target organs, and cancer classes (where available).

### 5.7.2 Evaluating Dermal Exposure and the Resulting Toxicity

In accordance with USEPA Region IV's *Supplemental Guidance to RAGS Bulletin 2*, dermal RfD values and SFs are derived from the corresponding oral values. As described in the supplemental guidance, the oral RfD is multiplied by an oral absorption efficiency factor (OAF), expressed as a decimal. The resulting dermal RfD is based on the absorbed dose. The RfD based on absorbed dose is the appropriate value with which to compare a dermal dose, because dermal doses are expressed as absorbed rather than administered (intake) doses. For the same reasons, a dermal SF is derived by dividing the oral SF by the OAF. The oral SF is divided rather than multiplied because SFs are expressed as reciprocal doses.

Appendix A of RAGS, Part A states that in the absence of specific data, an assumption of 5% oral absorption would be relatively conservative. *Supplemental Guidance to RAGS: Region IV Bulletin 2* indicates that in the absence of specific data, USEPA Region IV suggests an oral absorption factor of 80% for volatile organics, 50% for semivolatile organics, and 20% for inorganic chemicals. These percentages (or associated fractions) will be used in the site-specific HHRA's.

### 5.7.3 Toxicity Profiles for COPCs

In accordance with RAGS, toxicological summary paragraphs will be included in the body of the HHRA text for all COPCs. Most information for the profiles will be gleaned from IRIS and HEAST. Another source of information will be NCEA. Any additional references will be noted specifically in the text. The profiles will summarize adverse effects of COPCs and the amount associated with such effects.

## 5.8 Risk Characterization

Risk characterization combines the exposure assessment and toxicity assessment results to yield qualitative and quantitative expressions of risk and/or hazard for the exposed receptors. The quantitative component expresses the probability of developing cancer, or a threshold comparison of the estimated dose with a reference dose for noncancer effects. These quantitative estimates are developed for individual chemicals, exposure pathways, transfer media, and source media, and for each receptor for all media to which one may be exposed. The qualitative component usually involves comparing COC concentrations in media with established criteria or standards for chemicals for which there are no corresponding toxicity values. The risk characterization helps guide risk-management decisions.

Generally, the risk characterization will follow the methodology prescribed by RAGS Part A, as modified by more recent information and supplemental guidance cited in the earlier sections. *The*

USEPA methods are designed to be health-protective and tend to overestimate risk rather than underestimate it. The risk results, therefore, are generally overly conservative, because risk characterization involves summing the overestimated risk estimates.

### 5.8.1 Risk Characterization Methodology

Potential excess risks to humans following exposure to COPCs will be estimated using methods established by USEPA, when available. As discussed above, these methods are health-protective and are likely to overestimate risk. Risks from hazardous chemicals are calculated for either carcinogenic or noncarcinogenic effects. Some carcinogenic chemicals may also pose a noncarcinogenic hazard. The potential human health effects associated with chemicals that produce carcinogenic and other toxic effects will be characterized separately, as discussed below.

#### 5.8.1.1 Carcinogenic Effects of Chemicals

The risk attributed to exposure to carcinogens is estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. In the low-dose range, which would be expected for most environmental exposures, cancer risk is estimated from the following linear equation (EPA, 1989a):

$$ILCR = (CDI)(SF)$$

where:

- ILCR = incremental lifetime excess cancer risk, a unitless expression of the probability of developing cancer, adjusted for reference incidence
- CDI = chronic daily intake, averaged over 70 years (mg/kg-day)
- SF = cancer slope factor (mg/kg-day)<sup>-1</sup>

For a given pathway with simultaneous exposure of a receptor to several carcinogens, the following equation is used to sum cancer risks:

$$\text{Risk}_p = \text{ILCR}(\text{chem}_1) + \text{ILCR}(\text{chem}_2) + \dots \text{ILCR}(\text{chem}_i)$$

where:

- $\text{Risk}_p$  = total pathway risk of cancer incidence  
 $\text{ILCR}(\text{chem}_i)$  = incremental lifetime excess cancer risk for a specific chemical

Cancer risk for a given receptor across pathways and across media is summed in the same manner.

### 5.8.1.2 Noncarcinogenic Effects of Chemicals

The risks associated with the noncarcinogenic effects of chemicals are evaluated by comparing an exposure level or intake with a reference dose. The HQ, defined as the ratio of intake to RfD, is defined as (RAGS, Part A):

$$\text{HQ} = \text{CDI} / \text{RfD}$$

where:

- HQ = hazard quotient (unitless)  
CDI = intake of chemical (mg/kg-day)  
RfD = reference dose (mg/kg-day)

Chemical noncarcinogenic effects are evaluated on a chronic basis, using chronic RfD values. An HQ of 1 indicates that the estimated intake equals the RfD. If the HQ is greater than unity, there may be a concern for potential adverse health effects.

In the case of simultaneous exposure of a receptor to several chemicals, an HI will be calculated as the sum of the HQs by:

$$\text{HI} = \text{HQ}_1 + \text{HQ}_2 + \dots \text{HQ}_i$$

where:

HI = Hazard Index (unitless)  
HQ = Hazard Quotient (unitless)

Risk and hazard projections will be summarized in tabular format on a medium- and exposure pathway-specific basis in the HHRAs.

### 5.8.2 Surface Soil Pathways

Generally, the incidental ingestion and dermal contact pathways will be characterized for surface soil. Surface soil onsite will be evaluated under scenarios and exposure pathways outlined in the site-specific HHRAs.

### 5.8.3 Groundwater Pathways

Groundwater pathways will typically consist of ingestion and inhalation of volatilized chemicals in groundwater. The site-specific HHRAs will detail the pathways which will be addressed. Most groundwater pathways are not complete because municipal water supplies are used, and this will be discussed in the HHRAs.

### 5.8.4 COCs Identified

COCs will be identified based on cumulative (all pathway) risk and hazard projected for the sites. USEPA has established a generally acceptable risk range of  $1E-4$  to  $1E-6$ , and an HI threshold of 1.0. Any COC that is carried through the risk assessment process and found to contribute to a scenario with an ILCR in excess of  $1E-4$  or HI greater than 1 for any of the exposure scenarios evaluated in this risk assessment, and has an individual exposure pathway risk greater than  $1E-6$  or exposure pathway HQ greater than 0.1, will be referred to as a COC. In accordance with RAGS Part D, a table will present the COCs identified in site-specific HHRAs.

## 5.9 Risk Uncertainty

This section will discuss the uncertainty and variability inherent in the risk assessment process in addition to site-, medium-, and exposure pathway-specific influences. Overall, uncertainties associated with the initial stages of the risk assessment process become magnified when they are combined with other uncertainties. It is not possible to eliminate all uncertainties; however, recognizing the uncertainties is fundamental to understanding and subsequently using risk assessment results.

Where chronic RME estimates of risk/hazard indicated a significant threat (e.g., ILCR greater than  $1E-4$ ) would be posed to human health, central tendency (CT) analysis may be performed. RME estimates are based on the upper bound (90th or 95th percentile) exposure assumptions, while CT estimates are based on the 50th percentile (mean or median) values. CT exposure scenarios are constructed consistent with standard CT exposure assumptions provided in *Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure-Draft* (USEPA, November 1993). CT exposure assumptions will be presented in the site-specific HHRAs, when applicable.

## 5.10 Risk Summary

Risk estimates will be presented and summarized in table form in the site-specific HHRAs in accordance with RAGS Part D.

## 5.11 Remedial Goal Options

RGOs are chemical concentrations computed to equate with specific risk and/or hazard goals that may be established for a particular site. As previously discussed, COCs are identified as any COPC that significantly contributes to a scenario of concern. RGOs will be calculated for each land use scenario with cumulative risk estimates greater than  $1E-4$  or cumulative hazard indices greater than 1.0. Based on this method, COCs may be identified, requiring RGO calculation. RGO tables will be developed in accordance with RAGS Part D. Inclusion in the RGO table does

not necessarily indicate that remedial action will be required to address a specific chemical. Instead, RGOs are provided to facilitate risk-management decisions.

In accordance with USEPA Supplemental RGO Guidance, RGOs will be calculated at 1E-4, 1E-5, and 1E-6 risk levels for carcinogenic COCs and HI goals of 3, 1, and 0.1 for noncarcinogenic COCs. RGOs will be based on specific scenarios which will be identified in the site-specific HHRAs.

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## 6.0 ECOLOGICAL RISK ASSESSMENT

An ecological risk assessment (ERA) evaluates the actual or potential effects to ecological receptors due to site contamination. The terrestrial ecosystem associated with NSA Memphis Assembly F SWMUs will be the focus of this ERA. This assessment considers exposure pathways that could result in unacceptable levels of exposure to ecological receptors now or in the future. The approach to this assessment is based on USEPA's *Risk Assessment Guidance for Superfund Volume II—Environmental Evaluation Manual* (1989) and USEPA's *Framework for Ecological Risk Assessment* (USEPA/630/R-92/001), and USEPA's *Ecological Risk Guidance for Superfund: Process for Designing and Conducting Ecological Risk Interim Final* (1997).

Evaluating potential exposure pathways is one of the primary tasks of the screening-level ecological characterization of the site. For an exposure pathway to be complete, a contaminant must be able to travel from the source to the ecological receptors and to be taken up by the receptors via one or more exposure routes.

### SWMU 20

No complete exposure pathways are present due to the lack of receptors. SWMU 20 and the surrounding area consist of an asphalt parking lot and Building 1594. No quality habitat is available; therefore, no ecological risk assessment is recommended. Storm water run-off from SWMU 20 flows to the east to a drainage ditch and then south into Big Creek. The drainage ditch is associated with SWMU 38, which was included in the Assembly E investigation. Information on SWMU 38 is in the Assembly E RFI Report (E/A&H 1998). The storm water runoff impact to Big Creek has been addressed in the SWMU 2 and SWMU 9 investigations, which are also part of the Assembly E RFI.

**SWMUs 22 and 39**

No complete exposure pathways are present due to the lack of receptors. Both sites are in developed areas and consist of graveled areas surrounded by streets with no quality habitat available. Therefore no further action is recommended for ecological risk at these sites. Storm water run-off from SWMUs 22 and 39 flows to the west to a drainage ditch and then south into Big Creek. As stated in the SWMU 20 discussion, this drainage ditch and Big Creek have been addressed in previous investigations.

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**7.0 POTENTIAL RECEPTORS**

**7.1 SWMU 20**

SWMU 20 is approximately 3,000 feet southeast of the nearest offsite residence and 75 feet south of the nearest NSA Memphis office personnel at Building 1594. The storm water from SWMU 20 discharges into SWMU 38, which in turn discharges into the Big Creek Drainage Canal approximately 1,400 feet south of SWMU 20. Big Creek Drainage Canal may serve as a food and water source for various animals. SWMU 38 comprises miscellaneous industrial drainage ways throughout NSA Memphis; therefore, the potential exists for occasional contact with surface water and sediment in these ditches by NSA Memphis personnel. Offsite, the potential exists for the general public to contact surface water and sediment, due to unrestricted access to Big Creek Drainage Canal. According to NSA Memphis personnel, no fishing or swimming occurs in Big Creek Drainage Canal, but children may play near it.

Other potential receptors include two production wells shown in Figure 1.1, PW-4 and PW-5. SWMU 20 is approximately 4,400 feet southeast of PW-4 and approximately 3,000 feet southeast of PW-5. Both production wells are screened in the Fort Pillow Aquifer (PW-4 is screened at 1,450 feet bls and PW-5 is screened at 1,435 feet bls), with the Flour Island confining unit above the screened intervals.

**7.2 SWMU 22**

SWMU 22 is approximately 300 feet east of the nearest offsite residence and 20 feet west of the nearest NSA Memphis office personnel at Building S-75. Storm water from SWMU 22 discharges into SWMU 38, which in turn discharges into the Big Creek Drainage Canal approximately 2,200 feet south of SWMU 22. As stated before, this does create the potential for infrequent contact with surface water and sediment in the ditches. Production wells PW-4 and PW-5 are also potential receptors for SWMU 22.

**7.3 SWMU 39**

SWMU 39 is approximately 600 feet east of the nearest offsite residence and 200 feet east of the nearest NSA Memphis office personnel at Building S-75. The storm water from SWMU 39 discharges into SWMU 38, which in turn discharges into Big Creek Drainage Canal approximately 1,500 feet south of SWMU 39. Big Creek Drainage Canal may serve as a food and water source for various animals. SWMU 38 includes drainage ways in populated areas of NSA Memphis; NSA personnel could infrequently come into contact with surface water and sediment in these ditches. Offsite, the general public may contact surface water and sediment, due to unrestricted access to Big Creek Drainage Canal.

As with SWMUs 20 and 22, production wells PW-4 and PW-5 are also potential receptors.

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**8.0 QUALITY ASSURANCE PLAN**

The quality assurance plan presented in Section 4.14 of the *Comprehensive RFI Work Plan* will be followed throughout this investigation at SWMU 39.

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**9.0 DATA MANAGEMENT PLAN**

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The data management plan presented in Section 5 of the *Comprehensive RFI Work Plan* will be followed during this investigation at SWMU 39.

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## 10.0 HEALTH AND SAFETY PLAN

This Site-Specific Health and Safety Plan (SSHSP) is written for field operations to be conducted at the Assembly F SWMUs (Figure 1.1). This plan is to be used in conjunction with the approved NSA Memphis Comprehensive Health and Safety Plan (CHASP) (E/A&H, 1994). Copies of both this plan and the CHASP should be onsite during all field operations.

### Applicability

See CHASP Section 7.

Current Hazardous Waste Operations and Emergency Response (HAZWOPER) training certificates for EnSafe personnel and all subcontractors anticipated to be conducting fieldwork will be onsite and available for review. All EnSafe personnel, excluding interns, will have received training in first aid, and cardiopulmonary resuscitation prior to performing fieldwork.

Current Occupational Safety and Health Administration (OSHA) refresher training certificates will be available onsite for all employees involved in field activities if their refresher course requirements come up for renewal before the project begins. All subcontractors, Navy oversight personnel, and any other site visitors must provide health and safety certification with appropriate refresher course documentation prior to entering the site.

## 10.1 SITE CHARACTERIZATION

### 10.1.1 Work Areas

See Section 7.1.1 of the CHASP for a description of the following work zones:

- Exclusion Zone (EZ)
- Contaminant Reduction Zone (CRZ)
- Support Zone (SZ)

Field activities to be conducted onsite and within each work area are described in the Site Investigation Plan. Figure 10.1 shows a typical site work zone setup. There will be at least 30 feet between the boring/well location and the CRZ.

### 10.1.2 Work Area Access

Authorized personnel will be allowed access to work areas as long as they have presented documentation of 40-hour OSHA training under 29 CFR 1910.120, have signed CHASP and SSHSP plan acceptance forms, and have received a hazard communication briefing from the site health and safety officer or site manager. See also Work Area Access, Section 7.1.2 of the CHASP.

## 10.2 Site Descriptions

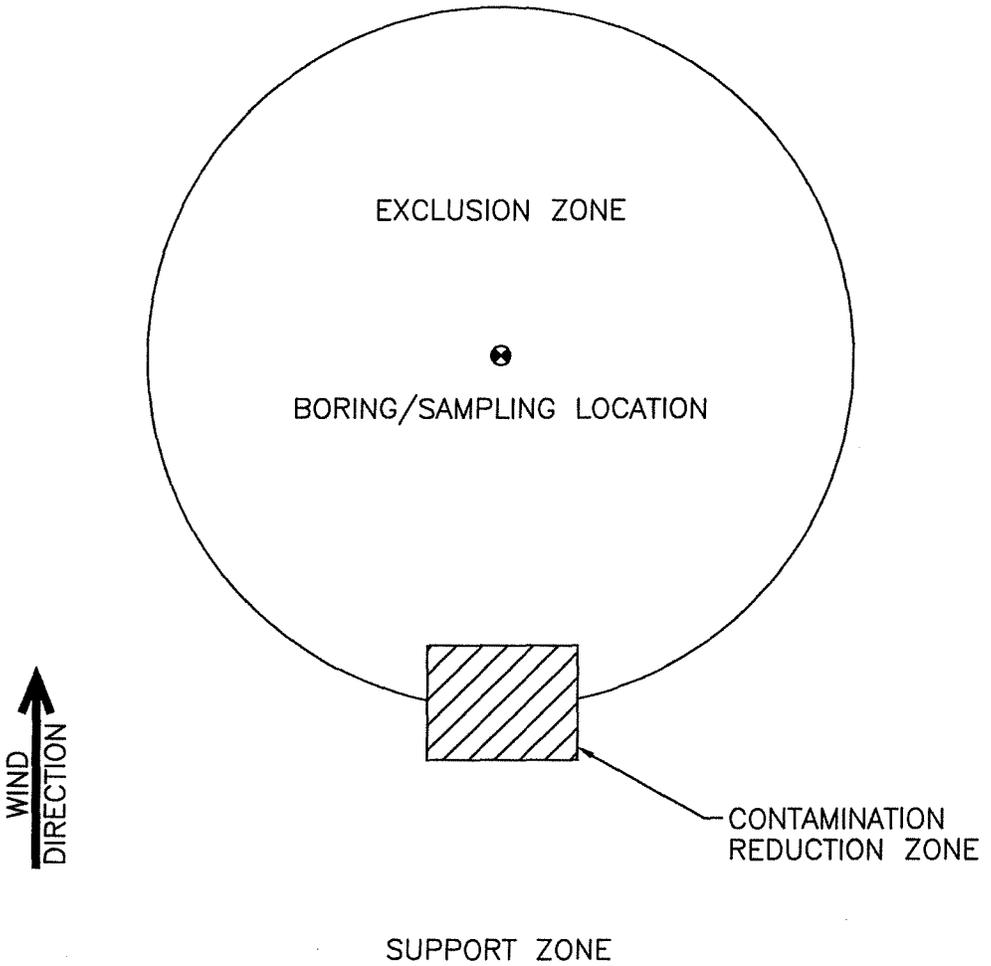
### 10.2.1 SWMU 20

#### Site Map and Work Zones

Proposed sampling locations at SWMU 20 are shown in Figures 4.1 and 4.3 . The EZ, CRZ, and SZ locations will be based on physical layout of the site, work task requirements, and current meteorological conditions. When noninvestigation personnel are in the vicinity, the EZ will be established using yellow caution tape.

#### Site Activities

Site activities will include soil and groundwater sample collection and temporary piezometer installation using DPT, and installing groundwater monitoring wells. Field methods for sample collection and well installation are described in the *Comprehensive RFI Work Plan, Naval Air Station Memphis, Millington, Tennessee* (E/A&H, 1994). Temporary piezometer installation procedures are described in Section 4.3.1 of this work plan.



SCALE: NOT TO SCALE



ASSEMBLY F  
RFI WORK PLAN  
NSA MEMPHIS  
MILLINGTON, TN

FIGURE 10.1  
SITE WORK ZONES

## Chemical Hazards

The site history for SWMU 20 suggests a potential for exposure to chemicals. Table 10-1 lists exposure guidelines for potential site chemicals. Material Safety Data Sheets (MSDSs) for those chemicals are included in Appendix A of this work plan.

### 10.2.2 SWMU 22

#### Site Map and Work Zones

Proposed sampling locations at SWMU 22 are shown in Figures 4.2 and 4.4. The EZ, CRZ, and SZ locations will be based on physical layout of the site, work task requirements, and current meteorological conditions. When noninvestigation personnel are in the vicinity, the EZ will be established using yellow caution tape.

#### Site Activities

Site activities will include soil and groundwater sample collection and temporary piezometer installation using DPT, and installing groundwater monitoring wells. Field methods for sample collection and well installation are described in the *Comprehensive RFI Work Plan, Naval Air Station Memphis, Millington, Tennessee* (E/A&H, 1994). Temporary piezometer installation procedures are described in Section 4.3.1 of this work plan.

#### Chemical Hazards

The site history for SWMU 22 suggests a potential for exposure to chemicals. Table 10-2 lists exposure guidelines for potential site chemicals. MSDSs for those chemicals are included in Appendix A of this work plan.

Table 10-1  
 SWMU 20  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)
Aldrin	0.04	Colorless to dark brown solid with mild chemical odor.	Dizziness, nausea, myoclonic jerks of the limbs, convulsions.	0.25 mg/m <sup>3</sup> Skin	0.25 mg/m <sup>3</sup> Skin	0.12 mg/m <sup>3</sup>	NA
Dieldrin	0.04	Colorless to dark brown solid with mild ammonia odor	Dizziness, nausea, myoclonic jerks of the limbs, convulsions	0.25 mg/m <sup>3</sup> Skin	0.25 mg/m <sup>3</sup> Skin	0.12 mg/m <sup>3</sup>	NA
Toluene	40	Colorless liquid with sweet, pungent, benzene-like odor	Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest	100 150 STEL	50	25	1.3 to 7.1
Hydraulic Fluid	NA	Colorless, oily liquid with odor like burned lubricating oil	Irritates eyes, skin, and respiratory system	5 mg/m <sup>3</sup>	5 mg/m <sup>3</sup> 10 mg/m <sup>3</sup> STEL	2.5 mg/m <sup>3</sup>	NA
PCBs	NA	Light yellow oily liquid or white solid powder with a weak odor	Acne from skin contact	0.5 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup> 1 mg/m <sup>3</sup> Skin	0.25 mg/m <sup>3</sup>	NA

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Table 10-1  
 SWMU 20  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)	
Cadmium	NA	Soft blue-white, malleable, lustrous metal; grayish-white powder	Pulmonary edema, dyspnea, coughing, tight chest, substernal pain; headache, chills, muscle ache; nausea, vomiting, diarrhea, anosmia, emphysema; proteinuria, mild anemia	0.05 mg/m <sup>3</sup>	0.002 mg/m <sup>3</sup> — Respirable Fraction 0.01 mg/m <sup>3</sup> — Total Dust	0.01 mg/m <sup>3</sup>	NA	
Chromium	NA	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid	Irritates eyes, skin; histologic fibrosis of lungs	1 mg/m <sup>3</sup>	1 mg/m <sup>3</sup>	0.25 mg/m <sup>3</sup>	NA	2
Lead	NA	Bluish-gray, soft metal; heavy ductile, soft, gray solid	Encephalopathy; kidney disease; irritate eyes; hypotension, weakness, facial pallor, lassitude, insomnia, PAL, eye grounds, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic; anemia, gingival lead line; tremors, paralysis of wrist, ankles. Metallic taste, increased salivation, pyorrhea	0.05 mg/m <sup>3</sup>	0.15 mg/m <sup>3</sup>	0.025 mg/m <sup>3</sup>	NA	3
Nickel	NA	Silvery solid	Dermatitis, Allergic asthma, Chemical Pneumonitis	1 mg/m <sup>3</sup>	1 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup>	NA	4

Table 10-1  
 SWMU 20  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)
Diesel Fuel	NA	Clear liquid	Produces dizziness, headache, nausea, and possibly irritation of the eyes, nose, and throat	NA	NA	NA	0.7 to 7.5
Ethylbenzene	140	Colorless liquid with a sweet gasoline-like odor	Irritation of nose, dizziness, depression. Moderate irritation of the eye with corneal injury possible. Irritates skin and may cause blisters	100 125 STEL	100 125 STEL	50	1.0 to 6.7
Benzene	4.68	Colorless to pale yellow watery liquid with a gasoline-like odor	Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possibly death	1 5 STEL	0.1 Confirmed Human Carcinogen	0.05	1.3 to 7.1
Xylene	Not Listed	Colorless liquid with aromatic odor	Dizziness, excitement, drowsiness, staggering gait, irritate eyes, nose throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis	100 150 STEL	100 150 STEL	50	1.0 to 7.0
1,1-Dichloroethane	11.06	Colorless Liquid with chloroform odor	Skin irritation, CNS depression, liver, kidney, and lung damage.	100	100	50	5.4 to 11.4

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Table 10-1  
 SWMU 20  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)
1,1-Dichloroethene	9.65	Colorless liquid with chloroform odor	Eye irritation, lung irritation, CNS depression	Not Listed	5	2.5	5.6 to 12.8
1,1,1-Trichloroethane <sup>e</sup>	100	Colorless liquid with sweet chloroform odor	Eyes and respiratory irritation, CNS depression, liver and kidney damage.	350	350	175	6.0 to 15.5

Notes:

- <sup>a</sup> — Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, 1989, Range of All Reference Values.
- <sup>b</sup> — Information referenced directly from CHEMTOX material safety data sheet (MSDS) chemical database
- <sup>c</sup> — 29 CFR 1910.1000, Table Z-1-A. Limits for Air Contaminants, as amended through 1/15/91. (PEL = Permissible Exposure Limit)
- <sup>d</sup> — 1990-1991 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference for Governmental Industrial Hygienists (ACGIH). (STEL = Short-Term Exposure Limit)
- <sup>e</sup> — Action Level is the exposure limit at which personnel will implement engineering controls or upgrade levels of personal protective equipment. The Action Level is based on 50% of the PEL or TLV, whichever is lower.
- <sup>f</sup> — Flammable range is defined as the range between the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL)
- NA — Substance information not available, or substance unlisted.
- mg/m<sup>3</sup> — milligrams per cubic meter
- ppm — parts per million

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Table 10-2  
 SWMU 22  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)
Toluene	0.021 to 69	Colorless liquid with sweet, pungent, benzene-like odor	Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest	100 150 STEL	50	25	1.3 to 7.1
Methyl Ethyl Ketone	0.25 to 85	Clear colorless liquid with a fragrant, mint-like, moderately sharp odor	Vapor irritates eyes, nose, and throat; can cause headache, dizziness, nausea, weakness, and loss of consciousness	200	200 300 STEL	100	1.4 to 11.4
Acetone	0.4 to 800	Colorless liquid with a fragrant, mint-like odor	Vapor irritating to eyes and mucous membranes; acts as an anesthetic in very high concentrations	1,000	750 1000 STEL	350	2.5 to 12.8
Lead	NA	Bluish-gray, soft metal; heavy ductile, soft, gray solid	Encephalopathy; kidney disease; irritate eyes; hypotension, weakness, facial pallor, lassitude, insomnia, PAL, eye grounds, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic; anemia, gingival lead line; tremors, paralysis of wrist, ankles. Metallic taste, increased salivation, pyorrhea	0.05 mg/m <sup>3</sup>	0.15 mg/m <sup>3</sup>	0.025 mg/m <sup>3</sup>	NA

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Table 10-2  
 SWMU 22  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)
DDT	Not Listed	Colorless to white with aromatic odor.	Eye irritation, dizziness, convulsions, vomiting, nausea, coma	1 mg/m <sup>3</sup>	1 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup>	NA
Diesel Fuel	NA	Clear liquid	Produces dizziness, headache, nausea, and possibly irritation of the eyes, nose, and throat	NA	NA	NA	0.7 to 7.5
Ethylbenzene	140	Colorless liquid with a sweet gasoline-like odor	Irritation of nose, dizziness, depression. Moderate irritation of the eye with corneal injury possible. Irritates skin and may cause blisters	100 125 STEL	100 125 STEL	50	1.0 to 6.7
Benzene	4.68	Colorless to pale yellow, watery liquid with a gasoline-like odor	Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possibly death	1 5 STEL	0.1 Confirmed Human Carcinogen	0.05	1.3 to 7.1
Xylene	Not Listed	Colorless liquid with aromatic odor	Dizziness, excitement, drowsiness, staggering gait, irritate eyes, nose throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis	100 150 STEL	100 150 STEL	50	1.0 to 7.0

**Notes:**

- <sup>a</sup> — Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, 1989, Range of All Reference Values. 2
- <sup>b</sup> — Information referenced directly from CHEMTOX material safety data sheet (MSDS) chemical database 3
- <sup>c</sup> — 29 CFR 1910.1000, Table Z-1-A. Limits for Air Contaminants, as amended through 1/15/91. (PEL = Permissible Exposure Limit) 4
- <sup>d</sup> — 1990-1991 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference for Governmental Industrial Hygienists (ACGIH). (STEL = Short-Term Exposure Limit) 5
- <sup>e</sup> — Action Level is the exposure limit at which personnel will implement engineering controls or upgrade levels of personal protective equipment. The Action Level is based on 50% of the PEL or TLV, whichever is lower. 6
- <sup>f</sup> — Flammable range is defined as the range between the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL) 7
- NA — Substance information not available, or substance unlisted. 8
- mg/m<sup>3</sup> — milligrams per cubic meter 9
- ppm — parts per million 10

### 10.2.3 SWMU 39

#### Site Map and Work Zones

Proposed sampling locations at SWMU 39 are shown in Figure 4.2 and 4.4. The EZ, CRZ, and SZ locations will be based on physical layout of the site, work task requirements, and current meteorological conditions. When noninvestigation personnel are in the vicinity, the EZ will be established using yellow caution tape.

#### Site Activities

Site activities will include soil and groundwater sample collection and temporary piezometer installation using DPT, and installing groundwater monitoring wells. Field methods for sample collection and well installation are described in the *Comprehensive RFI Work Plan, Naval Air Station Memphis, Millington, Tennessee* (E/A&H, 1994). Temporary piezometer installation procedures are described in section 4.3.1 of this work plan.

#### Chemical Hazards

The site history for SWMU 39 suggests a potential for exposure to chemicals. Table 8-3 lists exposure guidelines for potential site chemicals. MSDSs for those chemicals are included in Appendix A of this work plan.

### 10.3 Operations and Physical Hazards

Physical hazards typically encountered during environmental investigations will be present onsite. These hazards include temperature-related illnesses, uneven terrain, slippery surfaces, lifting, and use of heavy equipment. The Site Supervisor and Site Health and Safety Officer shall be aware of the potential for heat and/or cold stress and other weather-related illnesses and, as necessary, implement appropriate work regimens to minimize the likelihood of field personnel becoming ill or injured.

Heavy equipment operations will be conducted in accordance with the procedures outlined in the CHASP Appendix A, Drilling Safety Guide. When conducting operations or survey work on foot, personnel will walk at all times. Running greatly increases the probability of slipping, tripping, and falling.

#### 10.4 Employee Protection

Employee protection for this project includes standard safe work practices, NSA Memphis rules of conduct, personal protective equipment (PPE), personal decontamination procedures, and equipment for extreme weather conditions, work limitations, and exposure evaluation.

##### 10.4.1 Standard Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated.
- Hands and face must be thoroughly washed upon leaving the work area.
- No contact lenses will be worn in work areas while invasive actions are conducted.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, or discolored surfaces, or lean, sit, or place equipment on drums, containers, or soil suspected of being contaminated.

Table 10-3  
 SWMU 39  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)
Dichloroethylene	NA	Clear liquid with a sweat odor like chloroform [note: decomposes slowly, becomes acidic, and darkens in color	Inhalation of vapor cause nausea, drunkenness, depression. Contact of liquid with eyes may produce corneal injury. Prolonged contact with skin may cause a burn.	200	200	100	5.6 to 12.8
PCBs	NA	Light yellow oily liquid or white solid powder with a weak odor	Acne from skin contact	0.5 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup> 1 mg/m <sup>3</sup> Skin	0.25 mg/m <sup>3</sup>	NA
DDE	NA	Not Listed	Not Listed	Not Listed	Not Listed	NA	NA
DDT	Not Listed	Colorless to white with aromatic odor.	Eye irritation, dizziness, convulsions, vomiting, nausea, coma	1 mg/m <sup>3</sup>	1 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup>	NA
Dieldrin	0.04	Colorless to dark brown solid with mild ammonia odor	Dizziness, nausea, myoclonic jerks of the limbs, convulsions	0.25 mg/m <sup>3</sup> Skin	0.25 mg/m <sup>3</sup> Skin	0.12 mg/m <sup>3</sup>	NA
Perchloroethylene	5	Colorless liquid, chloroform-like odor	Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury.	100 200 — STEL 300 — Peak	25 100 — STEL Animal Carcinogen	12.5	NA

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Table 10-3  
 SWMU 39  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)	
Stoddard Solvent	NA	Colorless watery liquid with a gasoline-like odor	High concentration of vapors may cause intoxication. Irritation of eyes nose, throat, dizziness, dermatitis	500	100	50	0.8 >	1
Trichloroethylene	0.5 to 167	Colorless liquid with a sweet odor like chloroform	Symptom range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure.	100 200 — Ceiling	50 100 — STEL	25	8 to 10.5	2
Ethylbenzene	140	Colorless liquid with a sweet gasoline-like odor	Irritation of nose, dizziness, depression. Moderate irritation of the eye with corneal injury possible. Irritates skin and may cause blisters	100 125 STEL	100 125 STEL	50	1.0 to 6.7	3
Chlordane	NA	Amber-colored liquid with chlorine-like odor	Blurred vision, delirium, cough, abdominal pain, nausea, vomiting, diarrhea, tremors convulsions, lung, liver, kidney damage	0.5 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup> skin	0.25 mg/m <sup>3</sup>	NA	4

Table 10-3  
 SWMU 39  
 Exposure Guidelines for Expected Site Chemical Hazards

Chemical Name	Odor <sup>a</sup> Threshold (ppm)	Physical Characteristics <sup>b</sup>	Symptoms of Exposure <sup>b</sup>	OSHA PEL <sup>c</sup> (ppm)	ACGIH TLV <sup>d</sup> (ppm)	Action Level <sup>e</sup> (ppm)	Flammable range <sup>f</sup> (% by volume)
Methylene Chloride	0.4	Colorless liquid with a chloroform-like odor	Fatigue, weak, sleepiness, light-headed, limbs numb, tangle; nausea; irritated eyes, skin	25	50	12.5	13 to 25
Xylene	Not Listed	Colorless liquid with aromatic odor	Dizziness, excitement, drowsiness, staggering gait, irritate eyes, nose throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis	100 150 STEL	100 150 STEL	50	1.0 to 7.0
Vinyl Chloride	10 to 20	Colorless gas with a pleasant odor at high concentrations	High concentrations cause dizziness, anesthesia, and lung irritation.	1 5 — Ceiling Confirmed Carcinogen	5 Confirmed Carcinogen	0.5	3.6 to 33

Notes:

- <sup>a</sup> — Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, 1989, Range of All Reference Values.
- <sup>b</sup> — Information referenced directly from CHEMTOX material safety data sheet (MSDS) chemical database
- <sup>c</sup> — 29 CFR 1910.1000, Table Z-1-A. Limits for Air Contaminants, as amended through 1/15/91. (PEL = Permissible Exposure Limit)
- <sup>d</sup> — 1990-1991 Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference for Governmental Industrial Hygienists (ACGIH). (STEL = Short-Term Exposure Limit)
- <sup>e</sup> — Action Level is the exposure limit at which personnel will implement engineering controls or upgrade levels of personal protective equipment. The Action Level is based on 50% of the PEL or TLV, whichever is lower.
- <sup>f</sup> — Flammable range is defined as the range between the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL)
- NA — Substance information not available, or substance unlisted.
- mg/m<sup>3</sup> — milligrams per cubic meter

ppm — parts per million

- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. 1  
Prescribed drugs should not be taken by personnel on cleanup or response operations 2  
where the potential for absorption, inhalation, or ingestion of toxic substances exists unless 3  
specifically approved by a qualified physician. Consumption of alcoholic beverages is 4  
prohibited. 5  
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  - Due to the possible presence of overhead power lines, adequate side and overhead 7  
clearance should be maintained to ensure that the drill rig boom does not come within 15 8  
feet of any overhead lines. 9  
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  - Due to the possible presence of underground utilities (including electric, natural gas, 11  
water, sewer, telephone, etc.), NSA Memphis Personnel and local utility representatives 12  
should be contacted and requested to identify all lines at the ground surface using 13  
characteristic spray paint or labeled stakes. A 3-yard buffer zone should be maintained 14  
during all subsurface investigations. 15  
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  - Due to the flammable properties of the potential chemical hazards, all spark or ignition 17  
sources should be bonded and/or grounded or mitigated before soil boring advancement 18  
or other site activities begin. 19  
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- 10.4.2 NSA Memphis General Rules of Conduct** 21
- Liquor, firearms, narcotics, tape recorders, and other contraband items are not permitted 22  
on the premises. 23  
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  - Any violation of local, state, or federal laws, or conduct which is outside the generally 25  
accepted moral standards of the community is prohibited. 26  
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- Violation of the Espionage Act, willfully hindering or limiting production, or sabotage is not permitted. 1  
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- Willfully damaging or destroying property, or removing government records is forbidden. 4  
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- Misappropriation or unauthorized alteration of any government records is forbidden. 6  
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- Securing government tools in a personal or contractor's tool box is forbidden. 8  
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- Gambling in any form, selling tickets or articles, taking orders, soliciting subscriptions, taking up collections, etc. is forbidden. 10  
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- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long-distance telephone calls is forbidden. 13  
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- Compliance with posted signs and notices is required. 17  
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- Boisterousness and noisy or offensive work habits, abusive language, or any oral, written, symbolic, or other communicative expression which tends to disrupt the work or morale of others is forbidden. 19  
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- Fighting or threatening bodily harm to another is forbidden. 23  
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- Defacing any government property is forbidden. 25  
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- Offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes, and pants, slacks, or coverall-type garments will be worn at all times on government property. Shorts may be worn at the descretion of the Project Manager and the Project Health and Safety Officer.
- All persons operating motor vehicles will obey all NSA Memphis traffic regulations.

#### 10.4.3 Selection of Personal Protective Equipment

It is important that PPE be appropriate to protect against the potential or known hazards at each cleanup or investigation site. Protective equipment will be selected based on the types, concentrations, and routes of personal exposure that may be encountered. In situations where the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the PPE required, based on experience and sound safety practices.

The Project Health and Safety Officer will determine the appropriate level of PPE prior to the initial entry based on the chemical(s) of concern, air monitoring levels (i.e., photoionization detector [PID] readings, combustible gas indicator [CGI] readings, or colorimetric tube results), or physical site conditions (i.e., heat stress or cold exposure). PPE requirements are subject to change as site information is updated or changes. **The decision to upgrade or downgrade levels of PPE shall be made by the Project Health and Safety Officer.**

Field activities which disturb soil will be initiated in modified Level D protection except when stated otherwise in the SSHSP or when site conditions (e.g., sampling results from previous studies) indicate that modified Level D is inappropriate. Modified Level D protection consists of a hard hat, appropriate chemical-resistant gloves (vinyl or nitrile), eye protection, and chemical-resistant, steel toe and shank boots. Work coveralls (full-length sleeves and pants) will be worn

if free product or contaminants identified as skin irritants are encountered. This level of protection was selected because the contaminant concentrations detected in previous studies were low and free product was not detected.

PPE upgrades to Level C will be initiated if airborne concentrations exceed 2 parts per million (ppm) above the background concentration in the breathing zone or if the concentration of any contaminant exceeds 50% of the OSHA Permissible Exposure Limit (PEL). See Table 4-1 for the specific criteria for use and equipment for each level of protection.

#### **10.4.4 Air Monitoring**

Site history and previous site work indicate that workers may be exposed to low concentrations of numerous chemicals including VOCs, halogenated compounds, and combustible gases/vapors. Based on site history and current sampling data, "worst-case" contaminated areas will be identified before field activities begin.

**Table 10-4**  
**Level Of Protection And Criteria**

Level of Protection	Criteria for Use	Equipment
Level A	<ul style="list-style-type: none"> <li>• When atmospheres are "immediately dangerous to life and health" (IDLH in the NIOSH/OSHA Pocket Guide to Chemical Hazards or other guides).</li> <li>• When known atmospheres or situations exist that would affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes, or mucous membranes.</li> <li>• Potential situations include those where immersion may occur, vapors may be generated, or splashing may occur through site activities.</li> <li>• Where atmospheres are oxygen-deficient with the conditions above.</li> <li>• When the type(s) and or potential concentration of toxic substances are not known.</li> </ul>	<ul style="list-style-type: none"> <li>• Positive pressure-demand full facepiece, self-contained breathing apparatus (SCBA) or positive pressure-demand supplied air respirator with escape SCBA</li> <li>• Totally encapsulating chemical protective suit</li> <li>• Chemical-resistant inner and outer gloves</li> <li>• Steel toe and shank chemical-resistant boots</li> <li>• Hard hat under suit</li> <li>• Two-way radios worn inside suit</li> <li>• Coveralls, long cotton underwear, disposable protective suit, gloves and boots, worn over fully encapsulating suit</li> </ul>
Level B	<ul style="list-style-type: none"> <li>• When work areas contain less than 19.5% oxygen.</li> <li>• When vinyl chloride is detected in the breathing zone.</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical-resistant clothes, long sleeves, hooded, one or two pieces</li> <li>• Full-faced positive-pressure demand supplied air breathing apparatus or airline system with a 30-minute escape bottle</li> <li>• Hard hat</li> <li>• Inner gloves and chemical-resistant gloves</li> <li>• Steel toe and shank boots</li> <li>• Coveralls and disposable outer boots</li> </ul>
Level C	<ul style="list-style-type: none"> <li>• When airborne dust particles warrant respiratory protection.</li> <li>• When work areas contain at least 19.5% oxygen.</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical-resistant clothes, long sleeves, hood optional, one or two pieces</li> <li>• Full-face piece, air-purifying respirator equipped with cartridges suitable for the hazard</li> <li>• Hard hat</li> <li>• Inner gloves and chemical-resistant gloves</li> <li>• Steel toe and shank boots</li> <li>• Coveralls and disposable outer boots</li> </ul>

Table 10-4  
 Level Of Protection And Criteria

Level of Protection	Criteria for Use	Equipment
Level D	<ul style="list-style-type: none"> <li>• When level B or C is not indicated.</li> <li>• When airborne particles do not warrant respiratory protection.</li> <li>• When work areas contain at least 19.5% oxygen.</li> </ul>	<ul style="list-style-type: none"> <li>• Inner gloves and chemical-resistant gloves needed to handle soil or water samples</li> <li>• Steel toe and shank boots</li> <li>• Hard hat (ANSI Z891-1969 standard)</li> <li>• Eye protection (ANSI Z87.1-1968) standard</li> <li>• Sunscreen (SPF 15 or greater)</li> <li>• Coveralls and disposable outer boots</li> </ul>

**Notes:**

ANSI — American National Standards Institute.

SPF — Sun Protection Factor

Level A protection will be selected when the highest available level of respiratory, skin, and eye protection is needed. Level A protection will be required in Area A of the exclusion zone when appropriate.

**Contraindications for use of Level A:**

- Environmental measurements contiguous to the site indicate that air contaminants do not represent a serious dermal hazard.
- Reliable, accurate historical data do not indicate the presence of severe dermal hazards.
- Open, unconfined areas.
- Minimal probability of vapors or liquids (splash hazards) present which could affect or be absorbed through the skin.
- Total vapor readings indicate 500 ppm to 1,000 ppm.

Level B protection will be selected when the highest level of respiratory protection is needed, but cutaneous exposure to the small unprotected areas of the body (neck and back of head) is unlikely, or where concentrations are not known to be within acceptable standards. Additionally, the permissible limit for exposure to mixtures of all site gases will be checked using the requirements of 1910.1000(d)(2)(i) to ensure that PEL is not exceeded. If the value calculated using this method exceeds 1.0, Level B PPE is required.

Level C protection will be selected when the types and concentrations of inseparable material are known, or reasonably assumed to be no greater than the protection factors associated with air-purifying respirators, and exposure to the unprotected areas of the body is unlikely to cause harm. Dust concentrations require Level C PPE, where the respirable fractions exceed the PEL of 5 milligrams per cubic meter ( $\text{mg}/\text{m}^3$ ) or the total concentrations exceed the PEL of 15  $\text{mg}/\text{m}^3$ .

Level D protection will be chosen when measurements of atmospheric concentrations are at background levels and work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous concentrations of any chemicals.

The air in the breathing zone region will be monitored using a PID and/or other appropriate sampling equipment prior to beginning field activities at a new EZ and during ground-disturbing activities. The PID will be field calibrated to measure VOCs relative to a 100 ppm isobutylene standard. If VOCs are detected downhole, colorimetric detector tubes and/or other sampling media may be used to identify and approximate the concentrations of these compounds.

A CGI will be used during all soil boring and well installation activities. The CGI will be field calibrated to measure flammable gases relative to a 23% lower explosive limit (LEL) methane standard. Downhole CGI readings will be collected continuously whenever soil is disturbed. Field activities will immediately cease if downhole readings exceed 10% LEL. If CGI readings do not subside, the area will be carefully investigated and mapped. Operations may not proceed until readings are below 10% LEL. The area will be immediately evacuated and the situation reevaluated to determine how to proceed.

If breathing zone concentrations exceed 2 ppm above background or site conditions indicate that additional health and safety precautions are needed, field activities in the area shall stop. Field staff shall notify the Site Supervisor of the situation and he/she shall contact both the Project Manager and the Project Health and Safety Officer. The Project Health and Safety Officer will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including upgraded PPE requirements, revised work schedules, and revised decontamination procedures. (Typically, PPE will be upgraded to Level C assuming that cartridge respirators are appropriate, otherwise Level B.) See Table 4-1 for specific criteria for each protection level. Work shall not proceed until breathing zone concentrations return to background levels and it is reasonably anticipated that breathing zone samples will stay approximately at background, or the chemical constituent(s) are identified and appropriate PPE is donned.

Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

PIDs, CGIs, and other monitoring equipment shall be calibrated daily or their proper function verified before being used. Throughout the day this equipment shall be periodically checked to ensure that it is working properly. A final calibration shall be conducted at the end of the workday, at which time each instrument will be checked to ensure that it is free from surface contamination. Field staff shall note in their field notebooks that they conducted these calibrations and checks and note whether the equipment functioned properly. Malfunctioning equipment should be brought to the attention of the Site Supervisor or Site Health and Safety Officer, who will arrange to repair and/or replace that equipment as needed.

#### **10.4.5 Procedures and Equipment for Extreme Hot or Cold Weather Conditions**

See CHASP Section 7.5.5.

##### **Severe Weather Conditions**

All field work shall immediately cease at the first sign of thunder or lightning. Field personnel shall perform emergency personal and equipment decontamination (see Section 10.4.6) and seek immediate shelter.

#### **10.4.6 Personal Decontamination**

A CRZ will be established immediate to each sampling/boring site and will include a station for decontaminating equipment and personnel. The CRZ will be covered with sheets of 6-mil polyethylene (typically an area 20 feet x 20 feet is sufficient) with specific stations that will accommodate the removal and disposal of the protective clothing, boot covers, gloves, and respiratory protection, if required.

As a general rule, equipment will be decontaminated using a soap and clean water wash solution. Equipment decontamination will be completed by personnel in Level D PPE. In extreme weather (e.g., lightning) or an emergency requiring immediate evacuation, all contaminated equipment will be wrapped and taped in 6-mil polyethylene sheeting and tagged as "contaminated" for later decontamination.

Personnel working in the CRZ will be in one Level of PPE lower than personnel in the EZ. For example, if personnel in the EZ are in Level B, decontamination workers will be in Level C.

#### 10.4.6.1 Personal Decontamination Procedures

The decontamination procedures, based on Level D protection, will consist of:

- Brushing heavily soiled boots and rinsing outer gloves and boots with soap and water.
- Removing outer gloves and depositing them in a labeled plastic-lined container.
- Removing outer chemical-protective clothing.
- Washing and rinsing inner gloves.
- Thoroughly washing hard hats and eye protection at the end of each workday with a soap and water solution.
- Discarding disposable gloves and other disposable clothing in resealable bags and placing them in a labeled 55-gallon drum for proper disposal.
- All field personnel are to be instructed to shower as soon as possible after leaving the site.

Decontamination procedures will be conducted at the lunch break and at the end of each workday. If higher levels of PPE are needed, these procedures will be adjusted and this SSHSP will be amended.

All wastes (soil and water) generated during personal decontamination will be collected in 55-gallon drums, labeled, and staged for final disposal.

#### **10.4.6.2 Closure of the Personal Decontamination Station**

All disposable clothing and plastic sheeting used during site activities will be double-bagged and discarded in a refuse container. Decontamination and rinse solutions will be placed in 55-gallon drums and labeled for later analysis and disposal. All washtubs, pails, buckets, etc. will be washed, rinsed, and dried at the end of each workday.

#### **10.4.7 Work Limitations**

All site activities will be conducted during daylight only. All personnel scheduled for these activities will have completed initial health and safety training and actual field training as specified in 29 CFR 1910.120(e). All supervisors must complete an additional eight hours of training in site management. All personnel must complete an eight-hour refresher training course annually to continue working onsite.

#### **10.4.8 Exposure Evaluation**

All personnel scheduled for site activities will have had baseline physical examinations which include stressing exams of the neurologic, cardiopulmonary, musculoskeletal and dermatological systems; pulmonary function testing; multichemistry panel; and urinalysis, and have been declared fit for duty. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated annually and upon termination of employment, as required by 29 CFR 1910.120(f). The content of the annual or

termination examination will be the same as the baseline physical. A qualified physician will review the results of the annual examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, a medical examination will determine fitness for duty or whether any job restrictions are needed. The Site Health and Safety Officer will review the results with the examining physician before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job-related injury or illness requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30 years following the termination of employment.

#### 10.5 Medical Monitoring Program

See CHASP Section 7.6.

#### 10.6 Authorized Personnel

Personnel anticipated to be onsite at various times during site activities include:

- Principal-in-Charge Dr. James Speakman (EnSafe)
- Task Order Manager/Project Manager Mr. Robert Smith (EnSafe)
- Project Health and Safety Officer Mr. Doug Petty (EnSafe)
- Site Supervisor Mr. Greg Pierce (EnSafe)
- Site Health and Safety Officer Mr. Greg Pierce (EnSafe)
- Engineer-in-Charge (EIC) Mr. Mark Taylor (SOUTHDIIV)
- NSA Memphis Site Contact Mr. Rob Williamson

### 10.6.1 Responsibilities of Site Supervisor

The Site Supervisor will direct the site operations and, relative to health and safety, is responsible for ensuring that:

- Field staff follow the CHASP, SSHSP, and other safety and health standard operating procedures. Personnel who do not comply are retrained and/or instructed to leave the site and not allowed to return.
- Field staff have current HAZWOPER training.
- Field staff know who is the acting Site Health and Safety Officer.
- Field staff know the site-specific safety and health concerns.
- The onsite supply of health and safety equipment is adequate.
- Field staff participate in the EnSafe medical surveillance program (or subcontractors, an equivalent program).
- Field staff attend safety and health "kick-off" orientation and other site safety briefings.

The Site Supervisor is also responsible for ensuring that field staff who may be exposed to unique or special hazards have the training or experience necessary to safely conduct their work.

### 10.6.2 Responsibilities of Site Health and Safety Officer

The responsibilities of the Site Health and Safety Officer include:

- Providing the Site Supervisor technical input on site health and safety issues. 1
- Observing field personnel and reporting to the Site Supervisor on the effectiveness of the CHASP and SSHSP and whether field staff are using proper work practices and decontamination procedures. 2  
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- Reporting significant safety violations to the Project Manager and/or Project Health and Safety Officer. 7  
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- Conducting safety briefings during field activities. 10  
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- Ensuring that copies of the CHASP and SSHSP are maintained onsite during all field activities. 12  
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- Maintaining a file of HAZWOPER training certificates and appropriate refresher training certificates for onsite personnel. 15  
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The Site Health and Safety Officer will have the following qualifications: (1) 40 of hours OSHA training or equivalent experience, (2) 24 hours of supervisory training or equivalent experience, (3) knowledge of the health and safety concerns for the specific tasks being conducted, and (4) trained to use the air monitoring equipment; able to interpret the data collected with the instruments; familiar with symptoms of chemical exposure, heat stress, and cold exposure; and knows the location and proper use of onsite safety equipment. They will also be familiar with the CHASP and SSHSP. 18  
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The position of Site Health and Safety Officer may rotate. Often, particularly on small projects, this function is not a full-time responsibility, rather a member of the field team is selected to serve 25  
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as the alternate Site Health and Safety Officer. Then when that task is completed and/or field staff change, the alternate Site Health and Safety Officer may change as well. The alternate Health and Safety Officer must meet the criteria for the Site Health and Safety Officer listed above.

The following criteria outline when the Site Health and Safety Officer will be replaced: (1) termination of employment, (2) end of work task, (3) end of shift, (4) sickness, (5) injury, or (6) death. It should be noted that under site work schedules only one shift will be working. As a result, the Site Health and Safety Officer will be responsible for the day shift. If circumstances arise that require work during other periods, an alternate Site Health and Safety Officer will be designated.

### 10.6.3 Responsibilities of Onsite Field Staff

The health and safety responsibilities of field staff include:

- Being familiar with and complying with this CHASP and SSHSP.
- Attending site health and safety briefings and being aware of anticipated chemical, physical, and biological hazards and what to do when these hazards are encountered.
- Being properly trained on PPE to be used, safe work practices, decontamination procedures to be followed, and emergency procedures and communications.
- Using required PPE including respiratory protection.
- Having up-to-date HAZWOPER training and providing the Site Supervisor with documentation that training is current.

- Being an up-to-date participant in an acceptable medical surveillance program. 1
- Being fit-tested and physically capable of using a respirator and being in a position where 2  
using a respirator may be a requirement. Should the use of respiratory protection be 3  
required, field workers shall not have facial hair which intrudes into the respirator's 4  
sealing surface. 5
- Using the buddy system when wearing respiratory protective equipment. When working 6  
in Level C or higher, a third person shall be at the work area. This person shall be 7  
suitably equipped to provide logistical and safety support to the entry team. 8

In addition, field staff should always be alert and use their senses (sight, smell, etc.) to identify 12  
and react to potentially hazardous situations. When working in the EZ, visual contact should be 13  
maintained between personnel; field personnel should be close enough to assist each other during 14  
an emergency. Procedures for leaving a contaminated area must be planned and implemented 15  
before going onsite, in accordance with the CHASP and SSHSP. 16

The number of personnel and the amount of equipment in the contaminated area should be 18  
minimized, consistent with effective site operations. All visitors to the job site must comply with 19  
the CHASP and SSHSP procedures. PPE may be modified for visitors depending on the situation. 20  
Modifications must be approved by the Project Health and Safety Officer. 21

### 10.7 Emergency Information 23

All hazardous waste site activities present a risk to onsite personnel. During routine operations 24  
risk is minimized by establishing good work practices, staying alert, and using proper PPE. 25  
Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be 26  
anticipated. 27

If any situation or unplanned occurrence requires outside or support service, the appropriate contact from the following list will be made: 1  
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<b>Contact</b>	<b>Agency or Organization</b>	<b>Telephone</b>	5 6
Rob Williamson	NSA Memphis	(901) 874-5461/5462	7 8
Mark Taylor	SOUTHDIV EIC	(803) 743-0573	9 10
Law Enforcement	NSA Memphis Base Security	9-911	11 12
Fire Department	NSA Memphis	9-911	13 14
Ambulance Service	Naval Hospital, Millington Navy Road	(901) 874-5801/5802 or 9-911	15 16 17
Hospital	Methodist North Hospital 3960 Covington Pike	(901) 372-5211 or 9-911	18 19 20
Southern Poison Control Center	—	(901) 528-6048	21 22 23
Robert Smith	EnSafe	(901) 372-7962	24 25
Doug Petty	EnSafe	(901) 372-7962	26 27

Mark Taylor, SOUTHDIV EIC, will be contacted after appropriate emergency measures have been initiated onsite. 28  
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**10.7.1 Site Resources** 30  
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Cellular telephones or the telephone at the nearby Aircraft Fire Fighting Training Facility trailer are available for emergency use and communication/coordination with NSA Memphis. First-aid and eye wash equipment will be available at the work area. 32  
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### **10.7.2 Emergency Procedures**

Conditions that may constitute an emergency include any member of the field crew being involved in an accident or experiencing any adverse effects or symptoms of exposure while onsite, or if a condition is identified that suggests a situation is more hazardous than anticipated.

The following emergency procedures should be followed:

- Site work area entrance and exit routes will be planned and emergency escape routes delineated by the Site Health and Safety Officer. Copies of emergency contacts and routes will be posted onsite.
- If any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately stop work and act according to the instructions of the Site Health and Safety Officer.
- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the Site Health and Safety Officer to indicate possible routes for upwind escape.
- The discovery of any conditions that suggest a situation is more hazardous than anticipated will result in the suspension of work until the Site Health and Safety Officer has evaluated the situation and provides the appropriate instructions to the field team.
- If an accident occurs, the Field Project Manager is to complete an Accident Report Form (see Appendix B) for submittal to the managing principal-in-charge of the project.

- If a member of the field crew suffers a personal injury, the Site Health and Safety Officer will call (901) 372-5211 or 9-911 (serious injury) to alert appropriate emergency response agencies or administer onsite first aid (minor injury) as the situation dictates. An Accident Report Form will be completed for any such incident.

- If a member of the field crew suffers chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water, and if the situation dictates, the Site Health and Safety Officer should alert appropriate emergency response agencies, or personally ensure that the exposed individual is transported to the nearest medical treatment facility for prompt treatment see Appendix C of this work plan for directions. An Accident Report Form will be completed for any such incident.

Additional information on appropriate chemical exposure treatment methods will be provided through MSDSs in Appendix A.

## 10.8 Forms

The following forms will be used to implement this SSHSP:

- Plan Feedback Form
- Exposure History Form
- Accident Report Form

The Plan Acceptance Form will be filled out by all employees working onsite before site activities begin. The Plan Feedback Form will be filled out by the Site Health and Safety Officer and any other onsite employee who wishes to fill one out. The Exposure History Form will be completed by both the Field Project Manager and the individual(s) for whom the form is intended. Examples of each form are provided in Appendix B of this plan.

**All completed forms must be returned to the Task Order Manager at EnSafe.**

## **DIRECTIONS TO THE NEAREST MEDICAL FACILITIES**

Methodist North Hospital is the nearest hospital and the nearest facility capable of treating chemical burns. Therefore, there is only one set of directions.

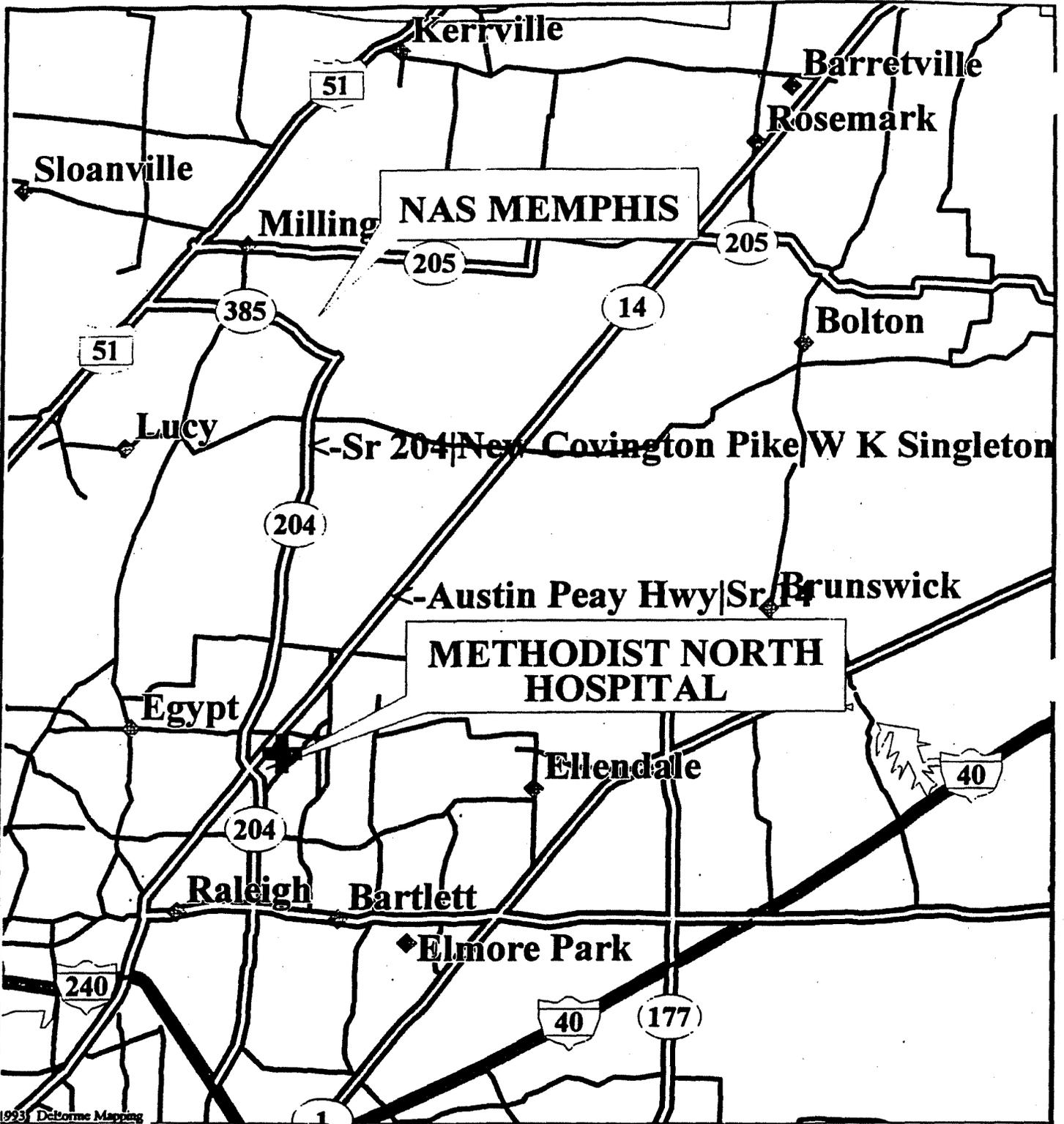
### **Nearest Hospital**

**Methodist North Hospital  
3960 Covington Pike  
Memphis, Tennessee**

**Emergency Room Telephone Number — (901) 372-5211**

### **Directions to Methodist North Hospital from NSA Memphis Main Gate:**

- 1) Exit site through South Gate (Singleton Parkway).
- 2) Continue on Singleton Parkway through the stop signs.
- 3) Singleton Parkway and Covington Pike will intersect at a red light (about 5 miles).
- 4) You will see the entrance to the emergency room 700 feet past this light on the left.



HEALTH & SAFETY PLAN  
 NAS MEMPHIS  
 MILLINGTON, TN

DIRECTIONS TO THE HOSPITAL

DWG DATE: 10/04/94 | DWG NAME: BOARD

**11.0 REFERENCES**

EnSafe/Allen & Hoshall (July, 1996). *Assembly F — Confirmatory Sampling Investigation Work Plan*. EnSafe/Allen & Hoshall: Memphis, Tennessee.

EnSafe/Allen & Hoshall (October 1994). *Comprehensive RFI Work Plan for Naval Air Station Memphis*. EnSafe/Allen & Hoshall: Memphis, Tennessee.

Investigation Derived Waste Management Plan (I'll have to send you the rest of the info).

ERC/EDGE (September 1990). *RCRA Facility Assessment (RFA), NAS Memphis*.  
ERC/EDGE: Nashville, Tennessee.

Southern Division Naval Facilities Engineering Command (May 1990). *Draft Final RCRA Facility Investigation Work Plan for Naval Air Station-Memphis*. SOUTHDIV:  
Charleston, South Carolina.

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**Appendix A**  
**Material Safety Data Sheets**

POLYSCIENCE -- ALDRIN, 510C-11  
MATERIAL SAFETY DATA SHEET  
FSC: 6810  
NIIN: 00N047402  
Manufacturer's CAGE: 58378  
Part No. Indicator: A  
Part Number/Trade Name: ALDRIN, 510C-11

=====  
General Information  
=====

Company's Name: POLYSCIENCE  
Company's Street: 7800 MERRIMAC AVE  
Company's City: NILES  
Company's State: IL  
Company's Country: US  
Company's Zip Code: 60648  
Company's Emerg Ph #: 321-965-0611  
Company's Info Ph #: 321-965-0611  
Safety Data Action Code: C  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Status: SMJ  
Date MSDS Prepared: 01MAR92  
Safety Data Review Date: 14NOV95 \*  
MSDS Serial Number: BVBVH  
Hazard Characteristic Code: T4 \*

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: 1,4:5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10-HEXACHLORO-1,4,4A,  
5,8,8A-HEXAHYDRO-, ENDO,EXO-; (ALDRIN) (SARA III)  
Ingredient Sequence Number: 01  
NIOSH (RTECS) Number: IO2100000  
CAS Number: 309-00-2  
OSHA PEL: 0.25 MG/M3, S  
ACGIH TLV: 0.25 MG/M3, S

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: SOLID.  
Solubility In Water: INSOLUBLE

=====  
Fire and Explosion Hazard Data  
=====

Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR  
APPROPRIATE FOAM.  
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT (FP N).  
Unusual Fire And Expl Hazrds: EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

=====  
Reactivity Data  
=====

Stability: YES  
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.  
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.  
Hazardous Decomp Products: HYDROGEN CHLORIDE GAS.  
Hazardous Poly Occur: NO  
Conditions To Avoid (Poly): NOT RELEVANT

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: NO

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: ACUTE:MAY BE FATAL IF INHALED, SWALLOWED, OR ABSORBED THROUGH SKIN. MAY CAUSE IRRIT. READILY ABSORBED THROUGH SKIN. MAY CAUSE VOMITING, DIARRHEA, RENAL DAMAGE, TREMORS, ATAXIA, CONVULSIONS FOLLOWED BY CNS DEPRESSION, RESP FAILURE, DEATH. CHRONIC: POSSIBLE CARCINOGEN. MAY CAUSE REPRODUCTIVE (EFTS OF OVEREXP)

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NOT RELEVANT

Signs/Symptoms Of Overexp: HLTH HAZ: DISORDERS. PROLONGED EXPOSURE CAN CAUSE: NEUROTOXIC EFFECTS. DAMAGE TO THE LIVER. IMMUNOSUPPRESSION.

Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.

Emergency/First Aid Proc: INGEST:WASH OUT MOUTH W/WATER PROVIDED PERSON IS CONSCIOUS. CALL MD. SKIN: FLUSH W/COPIOUS AMTS OF WATER FOR AT LEAST 15 MIN. REMOVE CONTAM CLTHG & SHOES. CALL MD. INHAL: REMOVE TO FRESH AIR. IF BRTHG BECOMES DFCLT, CALL MD. EYE: FLUSH W/COPIOUS AMTS OF WATER FOR @ LEAST 15 MIN. ASSURE ADEQUATE FLUSHING BY SEPARATING THE EYELIDS W/ FINGERS. CALL A PHYSICIAN.

=====  
Precautions for Safe Handling and Use  
=====

Steps If Matl Released/Spill: WEAR NIOSH/MSHA APPROVED RESP, CHEM SAFETY GOGGLES, RUBBER BOOTS AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG AND HOLD FOR WASTE DISPOSAL. AVOID RAISING DUST. VENT AREA & WASH SPILL SITE AFTER MATL PICKUP IS COMPLETE.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Method: OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.

Precautions-Handling/Storing: DANGER: POISON. MAY BE FATAL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN. POSSIBLE CARCINOGEN. MAY CAUSE REPRODUCTIVE DISORDERS.

Other Precautions: READILY ABSORBED THROUGH SKIN. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT BREATHE DUST. USE PROTECTIVE CLOTHING, GLOVES AND DUST.

=====  
Control Measures  
=====

Respiratory Protection: WEAR NIOSH/MSHA APPROVED RESPIRATOR.

Ventilation: MECHANICAL EXHAUST REQUIRED. \*

Protective Gloves: CHEMICAL-RESISTANT GLOVES.

Eye Protection: SAFETY GOGGLES.

Other Protective Equipment: OTHER PROTECTIVE CLOTHING.

Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.

Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

=====  
Transportation Data  
=====

=====  
Disposal Data  
=====

=====  
Label Data  
=====

Label Required: YES

Technical Review Date: 16FEB94

Label Date: 15FEB94

Label Status: G

Common Name: ALDRIN, 510C-11

Chronic Hazard: YES

Signal Word: DANGER!

Acute Health Hazard-Severe: X

Contact Hazard-Slight: X

Fire Hazard-None: X

Reactivity Hazard-None: X

Special Hazard Precautions: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED OR

ABSORBED THROUGH THE SKIN. MAY CAUSE CNS DEPRESSION, KIDNEY DAMAGE, LUNG FAILURE, IRRITATION. CHRONIC: NERVE & LIVER DAMAGE.

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: POLYSCIENCE

Label Street: 7800 MERRIMAC AVE

Label City: NILES

Label State: IL

Label Zip Code: 60648

Label Country: US

Label Emergency Number: 321-965-0611

=====  
URL for this msds <http://hazard.com>. If you wish to change, add to, or delete information in this archive please sent updates to [dan@hazard.com](mailto:dan@hazard.com).

POLYSCIENCE -- DIELDRIN, 510C-12  
MATERIAL SAFETY DATA SHEET  
FSC: 6810  
NIIN: 00N047403  
Manufacturer's CAGE: 58378  
Part No. Indicator: A  
Part Number/Trade Name: DIELDRIN, 510C-12

=====  
General Information  
=====

Company's Name: POLYSCIENCE  
Company's Street: 7800 MERRIMAC AVE  
Company's City: NILES  
Company's State: IL  
Company's Country: US  
Company's Zip Code: 60648  
Company's Emerg Ph #: 321-965-0611  
Company's Info Ph #: 321-965-0611  
Safety Data Action Code: C  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Status: SMJ  
Date MSDS Prepared: 01MAR92  
Safety Data Review Date: 14NOV95 \*  
MSDS Serial Number: BTYBT  
Hazard Characteristic Code: T3 \*

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: 1,4:5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10- HEXACHLORO-6,7-  
EPOXY-1,4,4A,5,6,7,8,8A-OCTAHYDRO, ENDO, EXO-; (ING 2)  
Ingredient Sequence Number: 01  
NIOSH (RTECS) Number: IO1750000  
CAS Number: 60-57-1  
OSHA PEL: 0.25 MG/M3, S  
ACGIH TLV: 0.25 MG/M3, S

Proprietary: NO  
Ingredient: ING 1: (DIELDRIN (SARA III))  
Ingredient Sequence Number: 02  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: ORANGE-TAN POWDER  
Melting Point: 289F,143C  
Vapor Density (Air=1): 13.2

=====  
Fire and Explosion Hazard Data  
=====

Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR  
APPROPRIATE FOAM.  
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT (FP N).  
Unusual Fire And Expl Hazrds: EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

=====  
Reactivity Data  
=====

Stability: YES  
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.  
Materials To Avoid: STRONG OXIDIZING AGENTS.  
Hazardous Decomp Products: TOXIC FUMES OF: CARBON MONOXIDE, CARBON

DIOXIDE, HYDROGEN CHLORIDE GAS.  
Hazardous Poly Occur: NO  
Conditions To Avoid (Poly): NOT RELEVANT

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: LD50: (ORAL, RAT) 38300 UG/KG  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: YES  
Route Of Entry - Ingestion: YES  
Health Haz Acute And Chronic: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED,  
OR ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION. CARCINOGEN. MAY ALTER  
GENETIC MATERIAL. OVEREXP MAY CAUSE REPROD DISORDER(S) BASED ON TESTS W/LAB  
ANIMALS. TARGET ORGANS: CNS, LIVER, BLOOD. OVEREXP CAN CAUSE: MALAISE,  
HEADACHE, NAUSEA, VOMITING, DIZZ, (EFTS OF OVEREXP)  
Carcinogenicity - NTP: NO  
Carcinogenicity - IARC: NO  
Carcinogenicity - OSHA: NO  
Explanation Carcinogenicity: NOT RELEVANT  
Signs/Symptoms Of Overexp: HLTH HAZ: TREMORS, CLONIC AND TONIC  
CONVULSIONS, COMA, RESPIRATORY FAILURE.  
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.  
Emergency/First Aid Proc: EYE/SKIN: FLUSH WITH COPIOUS AMOUNTS OF WATER  
REMOVE TO FRESH AIR. IF NOT BRTHG GIVE ARTF RESP. IF BRTHG IS DIFFICULT,  
GIVE OXYGEN. INGEST: WASH OUT MOUTH WITH WATER PROVIDED PERSON IS  
CONSCIOUS. CALL A PHYSICIAN. WASH CONTAMINATED CLOTHING BEFORE REUSE.

=====  
Precautions for Safe Handling and Use  
=====

Steps If Matl Released/Spill: EVACUATE AREA. WEAR NIOSH/MSHA APPROVED  
SCBA, RUBBER BOOTS AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN BAG AND HOLD  
FOR WASTE DISPOSAL. AVOID RAISING DUST. VENTILATE AREA AND WASH SPILL SITE  
AFTER MATL PICKUP IS COMPLETE.  
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.  
Waste Disposal Method: DISSOLVE OR MIX THE MATL W/A COMBUSTIBLE SOLVENT  
AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AFTERBURNER AND SCRUBBER.  
OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.  
Precautions-Handling/Storing: DO NOT BREATHE DUST. DO NOT GET IN EYES, ON  
SKIN, ON CLOTHING. AVOID PRLNGD/RPTD EXPOSURE. READILY ABSORBED THROUGH  
SKIN. HIGHTLY TOXIC. CARCINOGEN.  
Other Precautions: MUTAGEN. REPRODUCTIVE HAZARD. KEEP TIGHLY CLOSED. STORE  
IN A COOL DRY PLACE. MAY CAUSE CANCER. MAY CAUSE HERITABLE GENETIC DAMAGE.  
VERY TOXIC BY INHALATION, IN CONTACT WITH SKIN & IF SWALLOWED. IF YOU FEEL  
UNWELL, SEEK MED ADVICE.

=====  
Control Measures  
=====

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR.  
Ventilation: USE ONLY IN A CHEMICAL FUME HOOD. \*  
Protective Gloves: CHEMICAL-RESISTANT GLOVES.  
Eye Protection: ANSI APPROVED CHEM WORK GOGG (FP N).  
Other Protective Equipment: PROTECTIVE CLOTHING. ANSI APPROVED SAFETY  
SHOWER AND EYE BATH (FP N).  
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.  
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

=====  
Transportation Data  
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=====  
Disposal Data  
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=====  
Label Data  
=====

Label Required: YES

Technical Review Date: 26JAN94  
Label Date: 19JAN94  
Label Status: G  
Common Name: DIELDRIN, 510C-12  
Chronic Hazard: YES  
Signal Word: DANGER!  
Acute Health Hazard-Severe: X  
Contact Hazard-Severe: X  
Fire Hazard-None: X  
Reactivity Hazard-None: X  
Special Hazard Precautions: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED OR  
MALAISE, HEADACHE, NAUSEA, VOMITING, DIZZINESS, TREMORS, CLONIC AND TONIC  
CONVULSIONS, COMA, RESPIRATORY FAILURE. CHRONIC: CARCINOGEN. MAY ALTER  
GENETIC MATERIAL. OVEREXPOSURE MAY CAUSE REPRODUCTIVE DISORDER(S) BASED ON  
TESTS W/LAB ANIMALS. TARGET ORGANS: CNS, LIVER, BLOOD.  
Protect Eye: Y  
Protect Skin: Y  
Protect Respiratory: Y  
Label Name: POLYSCIENCE  
Label Street: 7800 MERRIMAC AVE  
Label City: NILES  
Label State: IL  
Label Zip Code: 60648  
Label Country: US  
Label Emergency Number: 321-965-0611

=====  
URL for this msds <http://hazard.com>. If you wish to change, add to, or  
delete information in this archive please sent updates to [dan@hazard.com](mailto:dan@hazard.com).

POLYSCIENCE -- DIELDRIN, 510C-12  
MATERIAL SAFETY DATA SHEET  
FSC: 6810  
NIIN: 00N047403  
Manufacturer's CAGE: 58378  
Part No. Indicator: A  
Part Number/Trade Name: DIELDRIN, 510C-12

=====  
General Information  
=====

Company's Name: POLYSCIENCE  
Company's Street: 7800 MERRIMAC AVE  
Company's City: NILES  
Company's State: IL  
Company's Country: US  
Company's Zip Code: 60648  
Company's Emerg Ph #: 321-965-0611  
Company's Info Ph #: 321-965-0611  
Safety Data Action Code: C  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Status: SMJ  
Date MSDS Prepared: 01MAR92  
Safety Data Review Date: 14NOV95 \*  
MSDS Serial Number: BTYBT  
Hazard Characteristic Code: T3 \*

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: 1,4:5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10- HEXACHLORO-6,7-  
EPOXY-1,4,4A,5,6,7,8,8A-OCTAHYDRO, ENDO, EXO-; (ING 2)  
Ingredient Sequence Number: 01  
NIOSH (RTECS) Number: IO1750000  
CAS Number: 60-57-1  
OSHA PEL: 0.25 MG/M3, S  
ACGIH TLV: 0.25 MG/M3, S

-----  
Proprietary: NO  
Ingredient: ING 1: (DIELDRIN (SARA III))  
Ingredient Sequence Number: 02  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: ORANGE-TAN POWDER  
Melting Point: 289F,143C  
Vapor Density (Air=1): 13.2

=====  
Fire and Explosion Hazard Data  
=====

Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR  
APPROPRIATE FOAM.  
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT (FP N).  
Unusual Fire And Expl Hazrds: EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

=====  
Reactivity Data  
=====

Stability: YES  
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.  
Materials To Avoid: STRONG OXIDIZING AGENTS.  
Hazardous Decomp Products: TOXIC FUMES OF: CARBON MONOXIDE, CARBON

DIOXIDE, HYDROGEN CHLORIDE GAS.  
Hazardous Poly Occur: NO  
Conditions To Avoid (Poly): NOT RELEVANT

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: LD50: (ORAL, RAT) 38300 UG/KG  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: YES  
Route Of Entry - Ingestion: YES  
Health Haz Acute And Chronic: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED,  
OR ABSORBED THROUGH SKIN. MAY CAUSE IRRITATION. CARCINOGEN. MAY ALTER  
GENETIC MATERIAL. OVEREXP MAY CAUSE REPROD DISORDER(S) BASED ON TESTS W/LAB  
ANIMALS. TARGET ORGANS: CNS, LIVER, BLOOD. OVEREXP CAN CAUSE: MALAISE,  
HEADACHE, NAUSEA, VOMITING, DIZZ, (EFTS OF OVEREXP)  
Carcinogenicity - NTP: NO  
Carcinogenicity - IARC: NO  
Carcinogenicity - OSHA: NO  
Explanation Carcinogenicity: NOT RELEVANT  
Signs/Symptoms Of Overexp: HLTH HAZ: TREMORS, CLONIC AND TONIC  
CONVULSIONS, COMA, RESPIRATORY FAILURE.  
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.  
Emergency/First Aid Proc: EYE/SKIN: FLUSH WITH COPIOUS AMOUNTS OF WATER  
REMOVE TO FRESH AIR. IF NOT BRTHG GIVE ARTF RESP. IF BRTHG IS DIFFICULT,  
GIVE OXYGEN. INGEST: WASH OUT MOUTH WITH WATER PROVIDED PERSON IS  
CONSCIOUS. CALL A PHYSICIAN. WASH CONTAMINATED CLOTHING BEFORE REUSE.

=====  
Precautions for Safe Handling and Use  
=====

Steps If Matl Released/Spill: EVACUATE AREA. WEAR NIOSH/MSHA APPROVED  
SCBA, RUBBER BOOTS AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN BAG AND HOLD  
FOR WASTE DISPOSAL. AVOID RAISING DUST. VENTILATE AREA AND WASH SPILL SITE  
AFTER MATL PICKUP IS COMPLETE.  
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.  
Waste Disposal Method: DISSOLVE OR MIX THE MATL W/A COMBUSTIBLE SOLVENT  
AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AFTERBURNER AND SCRUBBER.  
OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.  
Precautions-Handling/Storing: DO NOT BREATHE DUST. DO NOT GET IN EYES, ON  
SKIN, ON CLOTHING. AVOID PRLNGD/RPTD EXPOSURE. READILY ABSORBED THROUGH  
SKIN. HIGHTLY TOXIC. CARCINOGEN.  
Other Precautions: MUTAGEN. REPRODUCTIVE HAZARD. KEEP TIGHTLY CLOSED. STORE  
IN A COOL DRY PLACE. MAY CAUSE CANCER. MAY CAUSE HERITABLE GENETIC DAMAGE.  
VERY TOXIC BY INHALATION, IN CONTACT WITH SKIN & IF SWALLOWED. IF YOU FEEL  
UNWELL, SEEK MED ADVICE.

=====  
Control Measures  
=====

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR.  
Ventilation: USE ONLY IN A CHEMICAL FUME HOOD. \*  
Protective Gloves: CHEMICAL-RESISTANT GLOVES.  
Eye Protection: ANSI APPROVED CHEM WORK GOGG (FP N).  
Other Protective Equipment: PROTECTIVE CLOTHING. ANSI APPROVED SAFETY  
SHOWER AND EYE BATH (FP N).  
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.  
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

=====  
Transportation Data  
=====

=====  
Disposal Data  
=====

=====  
Label Data  
=====

Label Required: YES

Technical Review Date: 26JAN94

Label Date: 19JAN94

Label Status: G

Common Name: DIELDRIN, 510C-12

Chronic Hazard: YES

Signal Word: DANGER!

Acute Health Hazard-Severe: X

Contact Hazard-Severe: X

Fire Hazard-None: X

Reactivity Hazard-None: X

Special Hazard Precautions: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED OR MALAISE, HEADACHE, NAUSEA, VOMITING, DIZZINESS, TREMORS, CLONIC AND TONIC CONVULSIONS, COMA, RESPIRATORY FAILURE. CHRONIC: CARCINOGEN. MAY ALTER GENETIC MATERIAL. OVEREXPOSURE MAY CAUSE REPRODUCTIVE DISORDER(S) BASED ON TESTS W/LAB ANIMALS. TARGET ORGANS: CNS, LIVER, BLOOD.

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: POLYSCIENCE

Label Street: 7800 MERRIMAC AVE

Label City: NILES

Label State: IL

Label Zip Code: 60648

Label Country: US

Label Emergency Number: 321-965-0611

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HENKEL CORPORATION -EMERY GROUP -- EMERY 2863 MIL-H-83282 HYDRAULIC FLUID - HYDRAULI  
MATERIAL SAFETY DATA SHEET  
FSC: 9150  
NIIN: 012816191  
Manufacturer's CAGE: 0JS01  
Part No. Indicator: A  
Part Number/Trade Name: EMERY 2863 MIL-H-83282 HYDRAULIC FLUID

=====  
General Information  
=====

Item Name: HYDRAULIC FLUID, FIRE RESISTANT  
Company's Name: HENKEL CORPORATION -EMERY GROUP  
Company's Street: 4900 ESTE AVENUE  
Company's City: CINCINNATI  
Company's State: OH  
Company's Country: US  
Company's Zip Code: 45232  
Company's Emerg Ph #: 513-482-2297  
Company's Info Ph #: 513-482-2297  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 002  
Status: SE  
Date MSDS Prepared: 16JAN90  
Safety Data Review Date: 21FEB95  
Supply Item Manager: CX  
MSDS Preparer's Name: ROBERT E. BORGERDING  
MSDS Serial Number: BWMJQ  
Specification Number: MIL-H-83282  
Hazard Characteristic Code: N1

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Ingredients/Identity Information  
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=====  
Physical/Chemical Characteristics  
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Appearance And Odor: TRANSPARENT RED LIQUID, SLIGHT ESTER ODOR.  
Boiling Point: >540F, >282C  
Melting Point: -85F, -65C  
Vapor Pressure (MM Hg/70 F): <1  
Specific Gravity: 0.85 @60F  
Decomposition Temperature: UNKNOWN  
Evaporation Rate And Ref: UNKNOWN  
Solubility In Water: NEGLIGIBLE  
Corrosion Rate (IPY): UNKNOWN

=====  
Fire and Explosion Hazard Data  
=====

Flash Point: 440F, 227C  
Flash Point Method: COC  
Extinguishing Media: USE WATER SPRAY, DRY CHEMICAL, FOAM OR CARBON  
DIOXIDE. WATER MAY BE INEFFECTIVE BUT SHOULD BE USED TO KEEP DRUMS COOL.  
Special Fire Fighting Proc: FIREFIGHTERS SHOULD WEAR SELF-CONTAINED  
BREATHING APPARATUS IN THE POSITIVE PRESSURE MODE WITH A FULL FACE PIECE  
WHEN THERE IS AN EXPOSURE TO SMOKE, FUMES.  
Unusual Fire And Expl Hazrds: IF A SPILL OR LEAK HAS NOT IGNITED, USE  
WATER SPRAY TO DISPERSE THE VAPORS. WATER SPRAY MAY BE USED TO FLUSH SPILLS  
AWAY FROM FIRE.

=====  
Reactivity Data  
=====

Stability: YES  
Cond To Avoid (Stability): AVOID HEATING TO DECOMPOSITION. THE USER IS  
ADVISED TO HAVE A SAFETY EXPERT EVALUATE THE SPECIFIC CONDITIONS OF USE.  
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.  
Hazardous Decomp Products: DECOMPOSITION MAY PRODUCE CARBON MONOXIDE AND

CARBON DIOXIDE.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NONE. WILL NOT OCCUR.

=====  
Health Hazard Data  
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LD50-LC50 Mixture: TLV: NO ACGIH TLV

Route Of Entry - Inhalation: NO

Route Of Entry - Skin: NO

Route Of Entry - Ingestion: NO

Health Haz Acute And Chronic: INHALATION: UNKNOWN. INGESTION: UNKNOWN. EYE NOT CLASSIFIED AS PRIMARY IRRITANTS OR AS CORROSIVE MATERIAL.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: PRODUCT CONTAINS NO MATERIALS CURRENTLY CLASSIFIED AS CARCINOGENIC BY NTP, IARC OR OSHA.

Signs/Symptoms Of Overexp: NONE SPECIFIED BY MANUFACTURER.

Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.

Emergency/First Aid Proc: INGESTION: DO NOT INDUCE VOMITING. IF VICTIM IS CONSCIOUS AND ABLE TO SWALLOW, PROMPTLY HAVE VICTIM DRINK WATER TO DILUTE. DO NOT GIVE SODIUM BICARBONATE, FRUIT JUICES OR VINEGAR. NEVER GIVE ANYTHING BY MOUTH IF VICTIM IS UNCONSCIOUS OR HAVING CONVULSIONS. CALL A IMMEDIATELY FLUSH WITH WATER. INHALATION: REMOVE VICTIM TO FRESH AIR

=====  
Precautions for Safe Handling and Use  
=====

Steps If Matl Released/Spill: WEAR APPROPRIATE RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING. CONTAIN SPILLED MATERIAL. TRANSFER TO SECURE CONTAINERS. WHERE NECESSARY, COLLECT USING ABSORBENT MEDIA.

Waste Disposal Method: ALL RECOVERED MATERIAL SHOULD BE PACKAGED, LABELED, TRANSPORTED AND DISPOSED OR RECLAIMED IN CONFORMANCE WITH APPLICABLE LAWS AND REGULATIONS AND IN CONFORMANCE WITH GOOD ENGINEERING PRACTICES. AVOID LANDFILLING OF LIQUIDS. RECLAIM WHERE POSSIBLE.

Precautions-Handling/Storing: NO SPECIAL PRECAUTIONS NECESSARY.

Other Precautions: IN THE EVENT OF AN UNCONTROLLED RELEASE OF THIS MATERIAL, THE USER SHOULD DETERMINE IF THE RELEASE IS REPORTABLE UNDER APPLICABLE LAWS AND REGULATIONS.

=====  
Control Measures  
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Respiratory Protection: WHERE EXPOSURE IS LIKELY TO EXCEED ACCEPTABLE CRITERIA, USE NIOSH/OSHA APPROVED RESPIRATORY EQUIPMENT. RESPIRATORS SHOULD BE SELECTED BASED ON THE FORM AND CONCENTRATION OF CONTAMINANT IN AIR AND IN ACCORDANCE WITH OSHA (29 CFR 1910.134).

Ventilation: HANDLE IN THE PRESENCE OF ADEQUATE VENTILATION.

Protective Gloves: WEAR IMPERVIOUS GLOVES

Eye Protection: SAFETY GLASSES, CHEMICAL SAFETY GOGGLES

Other Protective Equipment: PROTECTIVE CLOTHING IMPERVIOUS TO THE PRODUCT FOR THE DURATION OF THE ANTICIPATED EXPOSURE.

Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.

Suppl. Safety & Health Data: AVOID UNCONTROLLED RELEASES OF THIS MATERIAL. WHERE SPILLS ARE POSSIBLE, A COMPREHENSIVE SPILL RESPONSE PLAN SHOULD BE DEVELOPED AND IMPLEMENTED.

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Transportation Data  
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Disposal Data  
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=====  
Label Data  
=====

Label Required: YES

Label Status: G

Common Name: EMERY 2863 MIL-H-83282 HYDRAULIC FLUID

Special Hazard Precautions: INHALATION: UNKNOWN. INGESTION: UNKNOWN. EYE  
NOT CLASSIFIED AS PRIMARY IRRITANTS OR AS CORROSIVE MATERIAL. NONE  
SPECIFIED BY MANUFACTURER.

Label Name: HENKEL CORPORATION -EMERY GROUP

Label Street: 4900 ESTE AVENUE

Label City: CINCINNATI

Label State: OH

Label Zip Code: 45232

Label Country: US

Label Emergency Number: 513-482-2297

=====  
URL for this msds <http://hazard.com>. If you wish to change, add to, or  
delete information in this archive please sent updates to [dan@hazard.com](mailto:dan@hazard.com).

FISHER SCIENTIFIC -- NICKEL, N40500  
MATERIAL SAFETY DATA SHEET  
NSN: 681000N027170  
Manufacturer's CAGE: 1B464  
Part No. Indicator: A  
Part Number/Trade Name: NICKEL, N40500

=====  
General Information  
=====

Company's Name: FISHER SCIENTIFIC  
Company's Street: 1 REAGENT LANE  
Company's City: FAIR LAWN  
Company's State: NJ  
Company's Country: US  
Company's Zip Code: 07410  
Company's Emerg Ph #: 201-796-7100;800-424-9300 (CHEMTREC)  
Company's Info Ph #: 201-796-7100  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Status: SMJ  
Date MSDS Prepared: 14OCT91  
Safety Data Review Date: 04MAR92  
MSDS Serial Number: BNLNM  
Hazard Characteristic Code: N1

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: NICKEL  
Ingredient Sequence Number: 01  
Percent: <100  
NIOSH (RTECS) Number: QR5950000  
CAS Number: 7440-02-0  
OSHA PEL: 1 MG/M3  
ACGIH TLV: 1 MG/M3

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Proprietary: NO  
Ingredient: WATER  
Ingredient Sequence Number: 02  
NIOSH (RTECS) Number: ZC0110000  
CAS Number: 7732-18-5  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: SUPP DATA:FUMES FROM BURNING MATERIAL.  
Ingredient Sequence Number: 03  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: EFTS OF OVEREXP:ULCERS WHICH DISCHARGE & BECOME CRUSTED.  
ERUPTION MAY SPREAD TO AREAS RELATED TO ACTIVITY OF (ING 5)  
Ingredient Sequence Number: 04  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 4:PRIMARY SITE. PIGMENTED/DEPIGMENTED PLAQUES MAY BE  
FORMED. THIS SENSIT RXN MAY BE ACCOMPANIED BY FEVER, (ING 6)  
Ingredient Sequence Number: 05  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE

ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 5:STOMATITIS, GINGIVITIS, CONJ, PAROXYSMAL ASTHMATIC  
ATTACKS & EOSINOPHILIC PNEUM. RECOVERY USUALLY OCCURS (ING 7)  
Ingredient Sequence Number: 06  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 6:W/IN 7 DAYS AFT EXPOS. NICKEL IS NOT ABSORB THRU  
UNBROKEN SKIN IN AMTS SUFFICIENT TO CAUSE INTOX. EYE:DUST (ING 8)  
Ingredient Sequence Number: 07  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 7:MAY BE IRRIT. INGEST:INSOL NICKEL CMPDS HAVE LOW LEVEL  
OF TOX DUE TO POOR ABSORP FROM GI TRACT. CHRONIC: (ING 9)  
Ingredient Sequence Number: 08  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 8:INHAL:RPTD/PRLNG INHAL MAY CAUSE MUC MEMB IRRIT & PULM  
SENSIT. WORKERS EXPOSED TO NICKEL DUST FREQUENTLY (ING 10)  
Ingredient Sequence Number: 09  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 9:DEVEL CHRONIC HYPERTROPHIC RHINITIS & NASAL SINUSITIS.  
ANOSMIA, NASAL POLYPOSIS & PERFORATION OF NASAL (ING 11)  
Ingredient Sequence Number: 10  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 10:SEPTUM MAY ALSO OCCUR. RABBITS EXPOS TO 1 MG/M3 DUST  
FOR 6 HRS PER DAY, 5 DAYS A WK FOR UP TO 6 MONTHS (ING 12)  
Ingredient Sequence Number: 11  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 11:SHOWED 2-3 FOLD INCR IN VOL DENS OF ALVEOLAR TYPE II  
CELLS. 6-MTH EXPO CAUSED FOCAL PNEUM. RATS INJECTED (ING 13)  
Ingredient Sequence Number: 12  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 12:INTRATRACHEALLY ONCE A WK W/0.9 MG FOR 10 WKS/O.3 MG  
FOR 20 WKS SHOWED ADENOCARCINOMAS, SQUAMOUS-CELL (ING 14)  
Ingredient Sequence Number: 13  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE

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Proprietary: NO  
Ingredient: ING 13:CARCINOMAS, 1 ADENOMA & 1 MIXED TUMOR. SKIN:RPTD/PRLNG  
CONT MAY CAUSE SENSIT DERM. INGEST:REPRO EFTS HAVE(ING 15)  
Ingredient Sequence Number: 14  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE  
-----

Proprietary: NO  
Ingredient: ING 14:BEEN REPORTED IN ANIMALS. FOR RESULTS OF SPECIFIC  
STUDIES ON NICKEL CARCIN STATUS, REFER TO ORIG MSDS (FP N).  
Ingredient Sequence Number: 15  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE  
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Proprietary: NO  
Ingredient: FIRST AID PROC:UPPER & LOWER LIDS, UNTIL NO EVID OF CHEM  
REMAINS (APPROX 15-20 MINS). GET MD IMMED. INGEST:TREAT(ING 17)  
Ingredient Sequence Number: 16  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE  
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Proprietary: NO  
Ingredient: ING 16:SYMPTOMATICALLY & SUPPORTIVELY. GET MD IMMED. IF VOMIT  
OCCURS, KEEP HEAD LOWER THAN HIPS TO PREVENT ASPIRATION.  
Ingredient Sequence Number: 17  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE  
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Proprietary: NO  
Ingredient: SPILL PROC:FLARES IN HAZ AREA. KEEP UNNEC PEOPLE AWAY. ISOLATE  
HAZ AREA & DENY ENTRY. RESIDUE SHOULD BE CLEANED (ING 19)  
Ingredient Sequence Number: 18  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE  
-----

Proprietary: NO  
Ingredient: ING 18:UP USING A HIGH-EFFICIENCY PARTICULATE FILTER VACUUM.  
Ingredient Sequence Number: 19  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE  
-----

Proprietary: NO  
Ingredient: OTHER PROT EQUIP:SUBSTANCE, EMPLOYER SHOULD PROVIDE EYE WASH  
FOUNTAIN W/IN IMMED WORK AREA FOR EMERGENCY USE.  
Ingredient Sequence Number: 20  
NIOSH (RTECS) Number: 9999999ZZ  
OSHA PEL: NOT APPLICABLE  
ACGIH TLV: NOT APPLICABLE  
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Physical/Chemical Characteristics

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Appearance And Odor: WHITE TO SILVER-GRAY, MALLEABLE, DUCTILE, LUSTROUS  
METAL, POWDER/CUBIC CRYSTALS  
Boiling Point: 4946F,2730C  
Melting Point: 2651F,1455C  
Vapor Pressure (MM Hg/70 F): 1 @ 1810C  
Specific Gravity: 8.90  
Solubility In Water: INSOLUBLE

=====  
Fire and Explosion Hazard Data  
=====

Flash Point: FLAMMABLE

Extinguishing Media: USE DRY SAND, DOLOMITE, GRAPHITE, SODIUM CHLORIDE, SODA ASH/APPROP METAL-EXTING PWDR. DO NOT APPLY H\*2O TO BURNING MATL.

Special Fire Fighting Proc: WEAR NIOSH/MSHA APPRVD FULL FACEPIECE PRESS DEMAND/POS PRESS SCBA & FULL PROT EQUIP (FP N). MOVE CNTNR FROM FIRE AREA, IF YOU CAN DO IT W/OUT RISK. (SUPP DATA)

Unusual Fire And Expl Hazrds: NEGLIGIBLE FIRE HAZARD IN BULK FORM; HOWEVER, DUST, POWDER, OR FUMES ARE FLAMMABLE/EXPLOSIVE WHEN EXPOSED TO HEAT OR FLAMES.

=====  
Reactivity Data  
=====

Stability: YES

Cond To Avoid (Stability): AVOID DISPER OF DUST IN AIR. FINELY DIVIDED PARTICLES, DUST/FUMES MAY BE FLAMM/EXPLO. KEEP AWAY FROM SPKS/IGNIT SOURCES.

Materials To Avoid: REFER TO ORIGINAL MSDS FOR INFO CONCERNING REACTIVITY (FP N).

Hazardous Decomp Products: MAY FORM TOXIC & HIGHLY FLAMM NICKEL CARBONYL UNDER THERMAL DECOMPOSITION.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT RELEVANT

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: LD50:(ORAL,RAT)5 GM/KG.

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: NO

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: ACUTE:INHAL:MAY CAUSE RESP IRRIT, COUGH, PNEUM & FEVER. PULM EDEMA MAY BE DELAYED SYMP. PULM SENSIT MAY OCCUR CAUSING EOSINOPHILIC PNEUM, ASTHMA & HOST REJECTION OF NICKEL CNTNG PROSTHESIS. 2 WORKERS EXPER SEV BUT TRANSIENT PNEUM AFT BEING EXPOS TO 0.26 MG/M3 FOR 6 HR. SKIN:MAY CAUSE IRRIT. SENSIT MAY (EFTS OF OVEREXP)

Carcinogenicity - NTP: YES

Carcinogenicity - IARC: YES

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NICKEL:SUFFICIENT EVIDENCE OF CARCINOGENICITY NNTP) GROUP 2B(IARC).

Signs/Symptoms Of Overexp: HLTH HAZ:OCCUR IN PREVIOUSLY EXPOS INDIVIDUALS. "NICKEL ITCH", TYPE OF DERM RESULTING FROM SENSIT TO NICKEL MAY BEGIN W/SENSATION OF BURNING & ITCH @ PLACE OF CONT & USUALLY OCCURS 7 DAYS BEFORE CHARACT ERUPTIONS APPEAR. PRIMARY ERUPTION IS ERYTHEMATOUS/FOLLICULAR; IT MAY BE FOLLOWED BY SUPERFICIAL DISCRETE (ING 4)

Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.

Emergency/First Aid Proc: INHAL:REMOVE FROM EXPOS AREA TO FRESH AIR IMMED. IF BRTHG HAS STOPPED, PERFORM ARTF RESP. KEEP PERS WARM & @ REST. TREAT SYMPTOMATICALLY & SUPPORTIVELY. GET MD IMMED. SKIN:REMOVE CONTAM CLTHG & SHOES IMMED. WASH AFFECTED AREA W/SOAP OR MILD DETERGENT & LG AMTS OF H\*2O UNTIL NO EVID OF CHEM REMAINS(APPROX 15-20 MINS). GET MD IMMED. EYE:WASH IMMED W/LG AMTS OF H\*2O/NORM SALINE, OCCAS LIFTING(ING 16)

=====  
Precautions for Safe Handling and Use  
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Steps If Matl Released/Spill: OCCUP SPILL:SHUT OFF IGNIT SOURCES. DO NOT TOUCH SPILLED MATL. FOR SM SPILLS, W/CLEAN SHOVEL, PLACE MATL INTO CLEAN, DRY CNTNR & COVER; MOVE CNTNRS FROM SPILL AREA. FOR LGR SPILLS, WET DOWN W/ H\*2O & DIKE FOR LATER DISP. NO SMOKING, FLAMES/ (ING 18)

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Method: DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N).

Precautions-Handling/Storing: STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

Other Precautions: NONE SPECIFIED BY MANUFACTURER.

=====  
Control Measures  
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Respiratory Protection: USE NIOSH/MSHA APPROVED RESPIRATOR BASED ON CONTAMINATION LEVELS FOUND IN WORKPLACE & ON SPECIFIC OPERATION. REFER TO ORIGINAL MSDS FOR SPECIFIC SELECTIONS (FP N).  
Ventilation: PROVIDE LOC EXHST VENT TO MEET PUBLISHED EXPOS LIMITS. VENT EQUIP MUST BE EXPLOSION-PROOF.  
Protective Gloves: APPROPRIATE PROTECTIVE GLOVES.  
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).  
Other Protective Equipment: APPROP PROT (IMPERVIOUS) CLTHG & EQUIP. WHERE THERE IS ANY POSSIBILITY THAT EMPLOYEE'S EYES MAY BE EXPOSED TO (ING 20)  
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.  
Suppl. Safety & Health Data: FIRE FIGHT PROC:APPLY COOLING H\*2O TO SIDES OF CNTNRS THAT ARE EXPOS TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER/MONITOR NOZZ; IF THIS IS IMPOSS, W/DRAW FROM AREA & LET FIRE BURN. EXTING USING AGENT FOR TYPE OF FIRE. AVOID BRTHG (ING 3)

=====  
Transportation Data  
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Trans Data Review Date: 92212  
DOT PSN Code: GJZ  
DOT Proper Shipping Name: FLAMMABLE SOLIDS, N.O.S.  
DOT Class: 4.1  
DOT ID Number: UN1325  
DOT Pack Group: II  
DOT Label: FLAMMABLE SOLID  
IMO PSN Code: HJB  
IMO Proper Shipping Name: FLAMMABLE SOLID, ORGANIC, N.O.S. o \*  
IMO Regulations Page Number: 4146  
IMO UN Number: 1325  
IMO UN Class: 4.1  
IMO Subsidiary Risk Label: - \*  
IATA PSN Code: MDO  
IATA UN ID Number: 1325  
IATA Proper Shipping Name: FLAMMABLE SOLID, ORGANIC, N.O.S. \*  
IATA UN Class: 4.1  
IATA Label: FLAMMABLE SOLID  
AFI PSN Code: MDO  
AFI Prop. Shipping Name: FLAMMABLE SOLIDS, ORGANIC, N.O.S.  
AFI Class: 4.1  
AFI ID Number: UN1325  
AFI Pack Group: II  
AFI Label: FLAMMABLE SOLID  
AFI Basic Pac Ref: 8-7

=====  
Disposal Data  
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=====  
Label Data  
=====

Label Required: YES  
Technical Review Date: 02MAR92  
Label Date: 27FEB92  
Label Status: G  
Common Name: NICKEL, N40500  
Chronic Hazard: YES  
Signal Word: WARNING!  
Acute Health Hazard-Slight: X  
Contact Hazard-Moderate: X  
Fire Hazard-Slight: X  
Reactivity Hazard-None: X  
Special Hazard Precautions: FLAM. STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

KEEP AWAY FROM SPARKS/IGNITION SOURCES. ACUTE:INHAL:MAY CAUSE RESP IRRIT, MAY CAUSE IRRIT, SENSIT & A TYPE OF DERM KNOWN AS "NICKEL ITCH". EYE CNTCT W/DUST MAY BE IRRIT. INGEST:LOW LEVEL OF TOXICITY. CHRONIC:CANCER HAZARD. NICKEL IS LISTED AS A CARCINOGEN. INHAL OVEREXP MAY CAUSE HYPERTROPHIC RHINITIS & NASAL SINUSITIS, ANOSMIA, NASAL POLYPOSIS & PERFORATION OF NASAL SEPTUM. PROLONGED SKIN CNTCT MAY CAUSE SENSIT DERMATITIS. INGESTION OF LARGE AMOUNTS HAVE PRODUCED REPROD EFFECTS IN LAB ANIMALS.

Protect Eye: Y

Protect Skin: Y

Protect Respiratory: Y

Label Name: FISHER SCIENTIFIC

Label Street: 1 REAGENT LANE

Label City: FAIR LAWN

Label State: NJ

Label Zip Code: 07410

Label Country: US

Label Emergency Number: 201-796-7100;800-424-9300(CHEMTREC)

=====  
URL for this msds <http://siri.org>. If you wish to change, add to, or delete information in this archive please sent updates to [dan@siri.org](mailto:dan@siri.org).

CHEM SERVICE -- F13 1,1-DICHLOROETHANE  
MATERIAL SAFETY DATA SHEET  
NSN: 655000F037545  
Manufacturer's CAGE: 8Y898  
Part No. Indicator: A  
Part Number/Trade Name: F13 1,1-DICHLOROETHANE

=====  
General Information  
=====

Company's Name: CHEM SERVICE INC  
Company's Street: 660 TOWER LN  
Company's P. O. Box: 3108  
Company's City: WEST CHESTER  
Company's State: PA  
Company's Country: US  
Company's Zip Code: 19381-3108  
Company's Emerg Ph #: 215-692-3026/800-452-9994  
Company's Info Ph #: 215-692-3026/800-452-9994  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Status: SE  
Date MSDS Prepared: 01JUN89  
Safety Data Review Date: 30DEC94  
Preparer's Company: CHEM SERVICE INC  
Preparer's St Or P. O. Box: 660 TOWER LN  
Preparer's City: WEST CHESTER  
Preparer's State: PA  
Preparer's Zip Code: 19381-3108  
MSDS Serial Number: BWJHT

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Ingredients/Identity Information  
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Proprietary: NO  
Ingredient: 1,1-DICHLOROETHANE (ETHYLIDINE CHLORIDE)  
Ingredient Sequence Number: 01  
NIOSH (RTECS) Number: KI0175000  
CAS Number: 75-34-3  
OSHA PEL: 100 PPM  
ACGIH TLV: 200 PPM  
Other Recommended Limit: 200 PPM

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.  
Boiling Point: 135.14F  
Melting Point: -142.6F  
Vapor Pressure (MM Hg/70 F): 182  
Vapor Density (Air=1): 3.4  
Solubility In Water: SLIGHT

=====  
Fire and Explosion Hazard Data  
=====

Flash Point: 23F  
Lower Explosive Limit: 6  
Upper Explosive Limit: 16  
Extinguishing Media: CO2, DRY CHEMICAL POWDER. DON'T USE WATER.  
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL.

=====  
Reactivity Data  
=====

Stability: YES  
Cond To Avoid (Stability): SENSITIVE TO HEAT.  
Materials To Avoid: STRONG OXIDIZING AGENTS/BASES, CAUSTICS.  
Hazardous Decomp Products: TOXIC FUMES.  
Hazardous Poly Occur: NO

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: ORAL LD50 (RAT/MOUSE): 725 MG/KG  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: YES  
Route Of Entry - Ingestion: YES  
Health Haz Acute And Chronic: SKIN: RAPIDLY ABSORBED/HARMFUL/IRRITATION/  
ALLERGIC REACTION/SENSITIZATION. INHALATION: HARMFUL/RESPIRATORY TRACT  
IRRITATION. EXPOSURE CAN CAUSE LIVER/KIDNEY/NERVOUS SYSTEM INJURY, DELAYED  
ADVERSE HEALTH AFFECTS. NARCOTIC AT HIGH CONCENTRATIONS.  
Carcinogenicity - NTP: NO  
Carcinogenicity - IARC: NO  
Carcinogenicity - OSHA: NO  
Explanation Carcinogenicity: NONE  
Signs/Symptoms Of Overexp: IRRITATION, DISORIENTATION.  
Emergency/First Aid Proc: EYES: FLUSH W/WATER FOR 15-20 MINS. SKIN: FLUSH  
REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET.  
INGESTION: DON'T INDUCE VOMITING/GIVE LIQUIDS IF UNCONSCIOUS/ CONVULSIVE.  
IF VOMITING, WATCH CLOSELY FOR ANY AIRWAY OBSTRUCTION. OBTAIN MEDICAL  
ATTENTION IN ALL CASES.

=====  
Precautions for Safe Handling and Use  
=====

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE OSHA  
REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR  
MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH  
CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.  
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN  
AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.  
Precautions-Handling/Storing: KEEP TIGHTLY CLOSED IN A COOL DRY PLACE.  
STORE ONLY W/COMPATIBLE CHEMICALS. FOR LABORATORY USE ONLY.  
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE  
VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS  
SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

=====  
Control Measures  
=====

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY  
EQUIPMENT.  
Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.  
Eye Protection: EYE SHIELDS  
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE  
REUSE. READILY ABSORBED & RETAINED ON CLOTHING &/SHOES.

=====  
Transportation Data  
=====

=====  
Disposal Data  
=====

=====  
Label Data  
=====

Label Required: YES  
Label Status: G  
Common Name: F13 1,1-DICHLOROETHANE  
Special Hazard Precautions: SKIN: RAPIDLY ABSORBED/HARMFUL/IRRITATION/  
ALLERGIC REACTION/SENSITIZATION. INHALATION: HARMFUL/RESPIRATORY TRACT  
IRRITATION. EXPOSURE CAN CAUSE LIVER/KIDNEY/NERVOUS SYSTEM INJURY, DELAYED  
ADVERSE HEALTH AFFECTS. NARCOTIC AT HIGH CONCENTRATIONS. IRRITATION,  
DISORIENTATION.  
Label Name: CHEM SERVICE INC  
Label Street: 660 TOWER LN  
Label P.O. Box: 3108  
Label City: WEST CHESTER

Label State: PA  
Label Zip Code: 19381-3108  
Label Country: US  
Label Emergency Number: 215-692-3026/800-452-9994

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delete information in this archive please sent updates to [dan@siri.org](mailto:dan@siri.org).

CHEM SERVICE -- F29 1,1-DICHLOROETHENE  
MATERIAL SAFETY DATA SHEET  
NSN: 655000F037520  
Manufacturer's CAGE: 8Y898  
Part No. Indicator: A  
Part Number/Trade Name: F29 1,1-DICHLOROETHENE

=====  
General Information  
=====

Company's Name: CHEM SERVICE INC  
Company's Street: 660 TOWER LN  
Company's P. O. Box: 3108  
Company's City: WEST CHESTER  
Company's State: PA  
Company's Country: US  
Company's Zip Code: 19381-3108  
Company's Emerg Ph #: 215-692-3026/800-452-9994  
Company's Info Ph #: 215-692-3026/800-452-9994  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 002  
Status: SE  
Date MSDS Prepared: 13OCT92  
Safety Data Review Date: 14DEC94  
Preparer's Company: CHEM SERVICE INC  
Preparer's St Or P. O. Box: 660 TOWER LN  
Preparer's City: WEST CHESTER  
Preparer's State: PA  
Preparer's Zip Code: 19381-3108  
MSDS Serial Number: BWJGQ

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: VINYLIDENE CHLORIDE, 1,1-DICHLOROETHENE, 1,1-DICHLOROETHYLENE,  
VDC  
Ingredient Sequence Number: 01  
NIOSH (RTECS) Number: KV9275000  
CAS Number: 75-35-4  
OSHA PEL: 1 PPM  
ACGIH TLV: 5 PPM  
Other Recommended Limit: 5 PPM

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.  
Boiling Point: 87.06F  
Melting Point: -188.5F  
Solubility In Water: INSOLUBLE

=====  
Fire and Explosion Hazard Data  
=====

Flash Point: 5F  
Extinguishing Media: CO2, DRY CHEMICAL POWDER. DON'T USE WATER.  
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL. EXPLOSIVE. TENDS TO  
DEVELOP PRESSUE ON STANDING. SENSITIVE TO HEAT & AIR. MAY POLYMERIZE UPON  
STANDING.

=====  
Reactivity Data  
=====

Stability: NO  
Cond To Avoid (Stability): HEAT, AIR, UPON STANDING.  
Hazardous Poly Occur: YES  
Conditions To Avoid (Poly): UPON STANDING.

=====  
Health Hazard Data  
=====

LD50-IC50 Mixture: ORAL LD50 (RAT/MOUSE): 200 MG/KG  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: NO  
Route Of Entry - Ingestion: YES  
IRRITATION/ALLERGIC REACTIION/SENSITIZATION. INHALATION: MUCOUS MEMBRANE IRRITATION. EXPOSURE CAN CAUSE LIVER & KIDNEY DAMAGE/NERVOUS & CARDIOVASCULAR SYSTEM INJURY/DELAYED ADVERS HEALTH EFFECTS. NARCOTIC AT HIGH CONCENTRATIONS.  
Carcinogenicity - NTP: NO  
Carcinogenicity - IARC: NO  
Carcinogenicity - OSHA: NO  
Explanation Carcinogenicity: NONE  
Signs/Symptoms Of Overexp: IRRITATION.  
Emergency/First Aid Proc: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET. INGESTION: DON'T INDUCE VOMITING/GIVE LIQUIDS IF UNCONSCIOUS/ CONVULSING. IF VOMITING OCCURS, WATCH CLOSELY FOR ANY AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.  
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.  
Precautions-Handling/Storing: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER NITROGEN & REFRIGERATION. FOR LABORATORY USE ONLY.  
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

Control Measures

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.  
Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.  
Eye Protection: EYE SHIELDS  
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

Transportation Data

Disposal Data

Label Data

Label Required: YES  
Label Status: G  
Common Name: F29 1,1-DICHLOROETHENE  
IRRITATION/ALLERGIC REACTIION/SENSITIZATION. INHALATION: MUCOUS MEMBRANE IRRITATION. EXPOSURE CAN CAUSE LIVER & KIDNEY DAMAGE/NERVOUS & CARDIOVASCULAR SYSTEM INJURY/DELAYED ADVERS HEALTH EFFECTS. NARCOTIC AT HIGH CONCENTRATIONS. IRRITATION.  
Label Name: CHEM SERVICE INC  
Label Street: 660 TOWER LN  
Label P.O. Box: 3108  
Label City: WEST CHESTER  
Label State: PA

Label Zip Code: 19381-3108

Label Country: US

Label Emergency Number: 215-692-3026/800-452-9994

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delete information in this archive please sent updates to [dan@siri.org](mailto:dan@siri.org).

J T BAKER -- 1,1,1-TRICHLOROETHANE, 9437  
MATERIAL SAFETY DATA SHEET  
NSN: 681000N049508  
Manufacturer's CAGE: 70829  
Part No. Indicator: A  
Part Number/Trade Name: 1,1,1-TRICHLOROETHANE, 9437

=====  
General Information  
=====

Company's Name: J T BAKER INC  
Company's Street: 222 RED SCHOOL LANE  
Company's City: PHILLIPSBURG  
Company's State: NJ  
Company's Country: US  
Company's Zip Code: 08865  
Company's Emerg Ph #: 908-859-2151;800-424-9300 (CHEMTREC)  
Company's Info Ph #: 800-582-2537  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 002  
Status: SMJ  
Date MSDS Prepared: 13MAY92  
Safety Data Review Date: 10MAR94  
MSDS Serial Number: BVCYQ  
Hazard Characteristic Code: NK

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: ETHANE, 1,1,1-TRICHLORO-; (1,1,1-TRICHLOROETHANE)  
Ingredient Sequence Number: 01  
Percent: 90-100  
NIOSH (RTECS) Number: KJ2975000  
CAS Number: 71-55-6  
OSHA PEL: 350 PPM;450 STEL  
ACGIH TLV: 350 PPM;450 STEL

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: COLORLESS LIQUID; FAINT ETHER-LIKE ODOR.  
Boiling Point: 165F,74C  
Melting Point: -27F,-33C  
Vapor Pressure (MM Hg/70 F): 100 @ 20C  
Vapor Density (Air=1): 4.6  
Specific Gravity: 1.32 (H\*20=1)  
Evaporation Rate And Ref: 12.8 (BUTYL ACETATE=1)  
Solubility In Water: NEGLIGIBLE (<0.1%)  
Percent Volatiles By Volume: 100  
pH: N/A

=====  
Fire and Explosion Hazard Data  
=====

Flash Point: NOT APPLICABLE  
Flash Point Method: CC  
Lower Explosive Limit: 7.5%  
Upper Explosive Limit: 15%  
Extinguishing Media: USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.  
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA & FULL PROTECTIVE EQUIPMENT (FP N).  
Unusual Fire And Expl Hazrds: THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE HCL & PHOSGENE (FP N).

=====  
Reactivity Data  
=====

Stability: YES

Cond To Avoid (Stability): MOISTURE, INSUFFICIENT INHIBITOR, HEAT, FLAME, OTHER SOURCES OF IGNITION.

Materials To Avoid: WATER, STRONG BASES, ALUMINUM, CHEMICALLY ACTIVE METALS, STRONG OXIDIZING AGENTS.

Hazardous Decomp Products: HYDROGEN CHLORIDE, PHOSGENE, CHLORINE, CARBON MONOXIDE.

Hazardous Poly Occur: NO

Conditions To Avoid (Poly): NOT RELEVANT

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: LD50: (ORAL,RAT) 10.3 G/KG.

Route Of Entry - Inhalation: YES

Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES

Health Haz Acute And Chronic: ACUTE:INHAL:MAY CAUSE PULMONARY EDEMA, HEADACHE, NAUSEA, VOMITING, DIZZINESS, DROWSINESS, IRRITATION OF UPPER RESPIRATORY TRACT, UNCONSCIOUSNESS. SKIN CONTACT:IRRITATION, PROLONGED CONTACT MAY CAUSE DERMATITIS. EYE CONTACT:IRRITATION. INGEST:NAUSEA, VOMITING. CHRONIC: KIDNEY/LIVER DAMAGE. (EFTS OF OVEREXP)

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NOT RELEVANT

Signs/Symptoms Of Overexp: HLTH HAZ:TARGET ORGANS:CNS, SKIN, EYES, CVS. CHLOROCARBON MATLS HAVE PRDCD SENSIT OF MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE SIMILAR EFT IN HUMANS. ADRENOMIMETICS (E.G., EPINEPHRINE) MAY BE CONTRAINDICATED EXCEPT FOR LIFE-SUSTAINING USES IN HUMANS ACUTELY/CHRONICALLY EXPOS TO CHLOROCARBONS (FP N).

Med Cond Aggravated By Exp: LIVER DISORDERS, HEART DISORDERS, SENSITIVE SKIN.

Emergency/First Aid Proc: INGEST:CALL MD. IF SWALLOWED, DO NOT INDUCE VOMITING. INHAL:REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. SKIN:FLUSH W/WATER. EYES:IMMEDIATELY FLUSH W/PLENTY OF WATER FOR AT LEAST 15 MINUTES.

=====  
Precautions for Safe Handling and Use  
=====

Steps If Matl Released/Spill: WEAR NIOSH/MSHA APPRVD SCBA & FULL PROT CLTHG. STOP LEAK IF YOU CAN DO SO W/OUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP W/SAND OR OTHER NON-COMBUST ABSORB MATL & PLACE INTO CNTNR FOR LATER DISPOSAL. FLUSH SPILL AREA W/WATER.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Method: DISPOSE I/A/W ALL APPLICABLE FEDERAL, STATE & LOCAL ENVIRONMENTAL REGULATIONS. EPA HAZARDOUS WASTE NUMBER: U226 (TOXIC WASTE).

Precautions-Handling/Storing: KEEP CNTNR TIGHTLY CLSD. SUITABLE FOR ANY GEN CHEM STOR AREA. HARMFUL - STOW AWAY FROM FOOD STUFFS. CAUSES IRRIT. HARMFUL IF SWALLOWED/INHALED.

Other Precautions: AVOID CONT W/EYES, SKIN, CLTHG. AVOID BRTHG VAP. USE W/ADEQ VENT. KEEP OUT OF REACH OF CHILDREN. NO SMOKING IN AREA OF USE. DO NOT USE IN GEN VICIN OF ARC WELDING, OPEN FLAMES/HOT SURFS. HEAT &/OR UV RADIA MAY CAUSE FORM OF HCL &/ (SUPDAT)

=====  
Control Measures  
=====

Respiratory Protection: NONE REQUIRED WHERE ADEQ VENT CNDTNS EXIST. IF AIRBORNE CONC IS HIGH, A NIOSH/MSHA APPRVD CHEM CARTRIDGE RESP W/ORGANIC VAP CARTIDGE IS REC. IF CONC EXCEED CAPACITY OF CARTRIDGE RESP, A NIOSH/MSHA APPRVD SCBA IS ADVISED.

Ventilation: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS. VENT HOOD.

Protective Gloves: POLYVINYL ALCOHOL GLOVES.

Eye Protection: ANSI APPVD SAFETY GOGGLES (FP N).

Other Protective Equipment: UNIFORM & APRON ARE RECOMMENDED. LAB COAT.

Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.

Suppl. Safety & Health Data: OTHER PREC:OR PHOSGENE (FP N).

=====  
Transportation Data  
=====

=====  
Disposal Data  
=====

=====  
Label Data  
=====

Label Required: YES  
Technical Review Date: 10MAR94  
Label Date: 09MAR94  
Label Status: G  
Common Name: 1,1,1-TRICHLOROETHANE, 9437  
Chronic Hazard: YES  
Signal Word: WARNING!  
Acute Health Hazard-Slight: X  
Contact Hazard-Moderate: X  
Fire Hazard-None: X  
Reactivity Hazard-None: X  
Special Hazard Precautions: ACUTE:INHALATION OF VAPORS MAY CONTRIBUTE TO THE OCCURRENCE OF IRREGULAR HEARTBEAT (FP N). INHAL:MAY CAUSE PULMONARY EDEMA, HEADACHE, NAUSEA, VOMITING, DIZZINESS, DROWSINESS, IRRITATION OF UPPER RESPIRATORY TRACT, UNCONSCIOUSNESS. SKIN CONTACT: IRRITATION, NAUSEA, VOMITING. CHRONIC:KIDNEY/LIVER DAMAGE. TARGET ORGANS:CENTRAL NERVOUS SYSTEM, SKIN, EYE, CARDIOVASCULAR SYSTEM.  
Protect Eye: Y  
Protect Skin: Y  
Protect Respiratory: Y  
Label Name: J T BAKER INC  
Label Street: 222 RED SCHOOL LANE  
Label City: PHILLIPSBURG  
Label State: NJ  
Label Zip Code: 08865  
Label Country: US  
Label Emergency Number: 908-859-2151;800-424-9300(CHEMTREC)

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=====

CHEM SERVICE -- PS-698 O,P-DDT, 98.5% PURE - REFERENCE STANDARD  
MATERIAL SAFETY DATA SHEET  
NSN: 681000F018409  
Manufacturer's CAGE: 8Y898  
Part No. Indicator: A  
Part Number/Trade Name: PS-698 O,P-DDT, 98.5% PURE

=====  
General Information  
=====

Item Name: REFERENCE STANDARD  
Company's Name: CHEM SERVICE INC  
Company's P. O. Box: 3108  
Company's City: WEST CHESTER  
Company's State: PA  
Company's Zip Code: 19381  
Company's Emerg Ph #: (215) 386-2100  
Company's Info Ph #: (215) 692-3026  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Date MSDS Prepared: 10JUL90  
Safety Data Review Date: 03SEP90  
Preparer's Company: CHEM SERVICE INC  
Preparer's City: WEST CHESTER  
Preparer's State: PA  
Preparer's Zip Code: 19381  
MSDS Serial Number: BKXWJ

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: 1,1,1-TRICHLORO-2--O-CHLOROPHENYL!-2--P-CHLOROPHENYL!ETHANE  
Ingredient Sequence Number: 01  
Percent: 98.5%  
NIOSH (RTECS) Number: KH7910000  
CAS Number: 789-02-6

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: CRYSTALLINE SOLID  
Melting Point: 163.4-167F  
Solubility In Water: INSOLUBLE

=====  
Fire and Explosion Hazard Data  
=====

Extinguishing Media: CO2, DRY CHEMICAL POWDER, SPRAY  
Unusual Fire And Expl Hazrds: NO EXPLOSIONLIMITS ARE AVAILABLE FOR THIS  
COMPOUNDS.

=====  
Reactivity Data  
=====

Stability: YES  
Materials To Avoid: STRONG BASES, STRONG OXIDIZING AGENTS, IRON, ZINC &  
OTHER LIGHT METALS. MAY BE A PEROXIDE FORMER.  
Hazardous Decomp Products: TOXIC FUMES, MAGNESIUM/ALUMINUM OR THEIR ALLOYS  
AS CONTAINERS  
Hazardous Poly Occur: NO

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: LD50 (RAT OR MOUSE): 1000 MG/KG.  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: YES  
Route Of Entry - Ingestion: YES  
Health Haz Acute And Chronic: INHALATION: DUST/VAPOR MAY CAUSE IRRITATION  
OF RESPIRATORY TRACT & MUCOUS MEMBRANES, NERVOUS SYSTEM INJURY & HARMFUL.

IRRITATION.

Carcinogenicity - NTP: NO

Carcinogenicity - IARC: NO

Carcinogenicity - OSHA: NO

Explanation Carcinogenicity: NONE

Signs/Symptoms Of Overexp: INHALATION: DUST/VAPORS CAN CAUSE IRRITATION TO RESPIRATORY TRACT & MUCOUS MEMBRANES, NERVOUS SYSTEM INJURY, & HARMFUL.

INGESTION: HARMFUL. SKIN: FATAL IF ABSORBED. EYES: IRRITATION.

Emergency/First Aid Proc: EYES/SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NO BURNS HAVE OCCURED-USE SOAP & WATER TO CLEANSE SKIN. INHALATION: REMOVE TO FRESH AIR. ADMINISTER OXYGEN IF BREATHING DIFFICULTY. ADMINISTER CPR IF CARDIAC ARREST OCCURS. INGESTION: INDUCE VOMITING. GIVE 1 TO 2 GLASSES OF WATER. DON'T ADMINISTER LIQUIDS/INDUCE VOMITING IF UNCONSCIOUS OR CONVULSING. OBTAIN MEDICAL ATTENTION IN ALL CASES. (SEE SUPP.)

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPROPRIATE EQUIPMENT. VENTILATE AREA. SWEEP UP & PLACE IN AN APPROPRIATE CONTAINER. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER. DISPOSE OF IN ACCORDANCE W/FEDERAL, STATE, & LOCAL REGULATIONS.

Precautions-Handling/Storing: KEEP CLOSED IN A COOL DRY PLACE. STORE ONLY W/COMPATIBLE CHEMICALS. FOR LABORATORY USE ONLY. DON'T WEAR CONTACT LENSES IN LAB.

Other Precautions: DON'T USE AS DRUGS, COSMETICS, AGRICULTURAL, PESTICIDAL PRODUCTS, FOOD ADDITIVES OR HOUSEHOLD CHEMICALS. AVOID PHYSICAL CONTACT. CHECK FOR PEROXIDES ON ALL OPEN SAMPLES EASILY OXIDIZED.

Control Measures

Respiratory Protection: USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.

Ventilation: HANDLE ONLY IN A HOOD

Protective Gloves: AS REQUIRED

Eye Protection: EYE SHIELDS

Work Hygienic Practices: REMOVE/WASH CONTAMINATED CLOTHING BEFORE REUSE. ONLY TRAINED PERSONNEL SHOULD HANDLE THIS CHEMICAL OR ITS CONTAINER.

Suppl. Safety & Health Data: FIRST AID: IF PATIENT EXHIBITS SHOCK, KEEP WARM & QUIET.

Transportation Data

Disposal Data

Label Data

Label Required: YES

Label Status: G

Common Name: PS-698 O,P-DDT, 98.5% PURE

Special Hazard Precautions: INHALATION: DUST/VAPOR MAY CAUSE IRRITATION OF RESPIRATORY TRACT & MUCOUS MEMBRANES, NERVOUS SYSTEM INJURY & HARMFUL.

IRRITATION. INHALATION: DUST/ VAPORS CAN CAUSE IRRITATION TO RESPIRATORY HARMFUL. SKIN: FATAL IF ABSORBED. EYES: IRRITATION.

Label Name: CHEM SERVICE INC

Label P.O. Box: 3108

Label City: WEST CHESTER

Label State: PA

Label Zip Code: 19381

Label Emergency Number: (215) 386-2100

URL for this msds <http://siri.org>. If you wish to change, add to, or

delete information in this archive please sent updates to dan@siri.org.

POLYSCIENCE -- ETHYLBENZENE, 251C-6  
MATERIAL SAFETY DATA SHEET  
NSN: 681000N047370  
Manufacturer's CAGE: 58378  
Part No. Indicator: A  
Part Number/Trade Name: ETHYLBENZENE, 251C-6

=====  
General Information  
=====

Company's Name: POLYSCIENCE  
Company's Street: 7800 MERRIMAC AVE  
Company's City: NILES  
Company's State: IL  
Company's Country: US  
Company's Zip Code: 60648  
Company's Emerg Ph #: 312-965-0611  
Company's Info Ph #: 312-956-0611  
Record No. For Safety Entry: 001  
Tot Safety Entries This Stk#: 001  
Status: SMJ  
Date MSDS Prepared: 01MAR92  
Safety Data Review Date: 13NOV95  
MSDS Serial Number: BTQWW  
Hazard Characteristic Code: F3

=====  
Ingredients/Identity Information  
=====

Proprietary: NO  
Ingredient: BENZENE, ETHYL-; (ETHYLBENZENE) (SARA III)  
Ingredient Sequence Number: 01  
NIOSH (RTECS) Number: DA0700000  
CAS Number: 100-41-4  
OSHA PEL: 100 PPM; 125 STEL  
ACGIH TLV: 100 PPM; 125 STEL

=====  
Physical/Chemical Characteristics  
=====

Appearance And Odor: COLORLESS LIQUID.  
Boiling Point: 277F, 136C  
Melting Point: -139F, -95C  
Vapor Pressure (MM Hg/70 F): SUPDAT  
Vapor Density (Air=1): 3.7  
Specific Gravity: 0.867

=====  
Fire and Explosion Hazard Data  
=====

Flash Point: 72.0F, 22.2C  
Lower Explosive Limit: 1%  
Upper Explosive Limit: 6.7%  
Extinguishing Media: CARBON DIOXIDE, DRY CHEMICAL POWDER/APPROP FOAM.  
WATER MAY BE EFFECTIVE FOR COOLING, BUT MAY NOT EFFECT EXTINGUISHMENT.  
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT (FP N). USE WATER SPRAY TO COOL FIRE-EXPOSED  
CONTAINERS. WARNING: FLAMMABLE LIQUID.  
Unusual Fire And Expl Hazrds: VAPOR MAY TRAVEL CONSIDERABLE DISTANCE TO  
SOURCE OF IGNITION & FLASH BACK. CONTAINER EXPLOSION MAY OCCUR UNDER FIRE  
CONDITIONS.

=====  
Reactivity Data  
=====

Stability: YES  
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.  
Materials To Avoid: OXIDIZING AGENTS.  
Hazardous Decomp Products: TOXIC FUMES OF: CARBON MONOXIDE, CARBON  
DIOXIDE.

Hazardous Poly Occur: NO  
Conditions To Avoid (Poly): NOT RELEVANT

=====  
Health Hazard Data  
=====

LD50-LC50 Mixture: LD50: (ORAL, RAT): 3500 MG/KG  
Route Of Entry - Inhalation: YES  
Route Of Entry - Skin: YES  
Route Of Entry - Ingestion: YES  
Health Haz Acute And Chronic: ACUTE: MAY BE HARMFUL BY INHALATION,  
INGESTION OR SKIN ABSORPTION. CAUSES SKIN IRRITATION. VAPOR OR MIST IS  
IRRITATING TO THE EYES, MUCOUS MEMBRANES & UPPER RESPIRATORY TRACT. CAN  
CAUSE CNS DEPRESSION. EXPOSURE CAN CAUSE NAUSEA, HEADACHE & VOMITING.  
TARGET ORGAN:CNS.  
Carcinogenicity - NTP: NO  
Carcinogenicity - IARC: NO  
Carcinogenicity - OSHA: NO  
Explanation Carcinogenicity: NOT RELEVANT  
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.  
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.  
Emergency/First Aid Proc: EYES: IMMEDIATELY FLUSH WITH COPIOUS AMOUNTS OF  
WATER FOR AT LEAST 15 MINUTES. SKIN: IMMEDIATELY FLUSH WITH COPIOUS AMOUNTS  
OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING &  
SHOES. INHAL: REMOVE TO FRESH AIR. INGEST: WASH OUT MOUTH WITH WATER  
PROVIDED PERSON IS CONSCIOUS. CALL MD. WASH CONTAMINATED CLOTHING BEFORE  
REUSE.

=====  
Precautions for Safe Handling and Use  
=====

Steps If Matl Released/Spill: EVACUATE AREA. SHUT OFF ALL SOURCES OF  
IGNIT. WEAR NIOSH/MSHA APPRVD SCBA, RUB BOOTS & HEAVY RUB GLOVES. USE  
NONSPK TOOLS. COVER W/ACTIVATED CARBON ABSORB, TAKE UP & PLACE IN CLSD  
CNTNRS. TRANSPORT OUTDOORS. VENT AREA & WASH SPILL SITE AFTER (SUPDAT)  
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.  
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN  
AFTERBURNER & SCRUBBER BUT EXERT EXTRA CARE IN IGNITING AS THIS MATERIAL IS  
HIGHLY FLAMMABLE. OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.  
Precautions-Handling/Storing: KEEP TIGHTLY CLOSED. KEEP AWAY FROM HEAT,  
SPARKS & OPEN FLAME. STORE IN A COOL, DRY PLACE. KEEP AWAY FROM SOURCES OF  
IGNITION. NO SMOKING.  
Other Precautions: IRRITATING TO EYES, RESPIRATORY SYSTEM & SKIN.

=====  
Control Measures  
=====

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR.  
Ventilation: MECHANICAL EXHAUST REQUIRED.  
Protective Gloves: RUBBER GLOVES.  
Eye Protection: ANSI APPRVD CHEM WORKER GOGGLES (FP N).  
Other Protective Equipment: WEAR SUITABLE PROTECTIVE CLOTHING. ANSI APPRV  
SAFETY SHOWER & EYE BATH.  
Work Hygienic Practices: DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT  
BREATHE VAPOR. WASH THOROUGHLY AFTER HANDLING.  
Suppl. Safety & Health Data: VP:10 @ 20C, 19 @ 37.7C. SPILL PROC:MATERIAL  
PICKUP IS COMPLETE.

=====  
Transportation Data  
=====

=====  
Disposal Data  
=====

=====  
Label Data  
=====

Label Required: YES  
Technical Review Date: 11JAN94

Label Date: 11JAN94  
Label Status: G  
Common Name: ETHYLBENZENE, 251C-6  
Chronic Hazard: NO  
Signal Word: DANGER!  
Acute Health Hazard-Moderate: X  
Contact Hazard-Slight: X  
Fire Hazard-Severe: X  
Reactivity Hazard-None: X  
Special Hazard Precautions: DANGER! FLAMMABLE. IRRITANT. KEEP AWAY FROM SOURCES OF IGNITION. ACUTE: CAUSES SKIN IRRITATION. VAPOR OR MIST IS IRRITATING TO THE EYES, MUCOUS MEMBRANES & UPPER RESPIRATORY TRACT. CAN CAUSE CNS DEPRESSION. EXPOSURE CAN CAUSE NAUSEA, HEADACHE & VOMITING. TARGET ORGAN:CNS. CHRONIC: NONE LISTED BY MANUFACTURER.  
Protect Eye: Y  
Protect Skin: Y  
Protect Respiratory: Y  
Label Name: POLYSCIENCE  
Label Street: 7800 MERRIMAC AVE  
Label City: NILES  
Label State: IL  
Label Zip Code: 60648  
Label Country: US  
Label Emergency Number: 312-965-0611

=====  
URL for this msds <http://siri.org>. If you wish to change, add to, or delete information in this archive please sent updates to [dan@siri.org](mailto:dan@siri.org).



100 % ODOR DETECTION: 300 ppm

----- REGULATIONS -----

DOT hazard class: 3 FLAMMABLE LIQUID  
DOT guide: 26  
Identification number: UN1090  
DOT shipping name: Acetone  
Packing group: II  
Label(s) required: FLAMMABLE LIQUID  
Special provisions: T8  
Packaging exceptions: 173.150  
Non bulk packaging: 173.202  
Bulk packaging: 173.242  
Quantity limitations-  
Passenger air/rail: 5 L  
Cargo aircraft only: 60 L  
Vessel stowage: B  
Other stowage provisions:

STCC NUMBER: 4908105

CLEAN WATER ACT Sect.307:No

CLEAN WATER ACT Sect.311:No

CLEAN AIR ACT: Not listed

EPA WASTE NUMBER: U002,D001

CERCLA REF: Y

RQ DESIGNATION: D 5000 pounds (2270 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: Irritant  
Acute toxicity: adverse effect to target organs.  
Chronic toxicity: mutagen.  
Chronic toxicity: reproductive toxin.  
Fire hazard: flammable.

UNITED STATES POSTAL SERVICE MAILABILITY:

Hazard class: Not given  
Mailability: Nonmailable  
Max per parcel: 0

NFPA CODES:

HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.  
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.  
REACTIVITY (YELLOW): (0) Stable even under fire conditions.  
SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACETONE [67-64-1]

- TLV list "Threshold Limit Values for 1992-1993"
- American Domestic Substances List
- Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
- Clean Air Act Section 111 List.
- DOT Hazardous Materials Table. 49 CFR 172.101
- EPA List of VOC chemicals from 40 CFR 60.489
- EPA TSCA Chemical Inventory List 1986
- EPA TSCA Chemical Inventory List 1989
- EPA TSCA Chemical Inventory List 1990
- EPA TSCA Chemical Inventory List 1992
- EPA TSCA Test Submission (TSCATS) Database - April 1990
- EPA TSCA Test Submission (TSCATS) Database - September 1989
- Massachusetts Substance List.
- New Jersey Right To Know Substance List. (December 1987)
- OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
- OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
- Pennsylvania Hazardous Substance List
- RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
- RCRA Hazardous Waste
- Second Third Wastes List. 40 CFR 268.11. 54 FR 26594 (June 23, 1989)
- Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
- Washington State Discarded Chemical Products List, November 17, 1989

----- TOXICITY DATA -----

**TERM TOXICITY: INHALATION:** levels of 300 ppm have caused irritation of eyes, nose and throat. levels of 500 to 1,000 ppm for 6 hours have caused, in addition, general weakness and heaviness of the eyelids. exposures of 12,000 ppm for a few minutes may cause weakness in arms and legs and fainting. 20,000 ppm may be fatal on brief exposure. **SKIN:** liquid acetone may cause drying of the skin, irritation, redness, and an increased chance of infection. **Eyes:** irritation has been reported at 500 ppm after 3-6 hours. splashes into the eye may result in swelling, irritation, damage to the cornea and blindness. **INGESTION:** 20 ml (2/3 fluid ounce) may result in excess salivation, nausea, vomiting, stomach pain and possible liver and kidney damage. 200 ml (7 fluid ounces) has resulted in these symptoms and, additionally, swelling of the throat, sores in the mouth and throat, shallow breathing and coma. although 200 ml has been survived with prompt medical attention, death may occur from as little as 100 ml (three and one half fluid ounces).(NYDH)

**LONG TERM TOXICITY:** levels of 500 to 1,000 ppm can produce eye irritation after 3 hours. daily exposures at this level have resulted in irritation of throat and lungs, dizziness, and inflammation of stomach and intestines.(NYDH)

TARGET ORGANS: respiratory system, skin, eyes, CNS

TOMS: INHALATION: vapor irritating to eyes and mucous membranes; acts as an anesthetic in very high concentrations. INGESTION: low order of toxicity but very irritating to mucous membranes. SKIN: prolonged excessive contact causes defatting of the skin, possibly leading to dermatitis. Source: CHRIS

CONC IDLH: 2500PPM

NIOSH REL: 250 ppm Time weighted averages for 8-hour exposure  
590 mg/M3 Time weighted averages for 8-hour exposure

ACGIH TLV: TLV = 750ppm(1780 mg/M3)

ACGIH STEL: STEL = 1000 ppm(2380 mg/M3)

OSHA PEL: Transitional Limits:  
PEL = 1000 ppm(2400mg/M3)  
Final Rule Limits:  
TWA = 750 ppm (1800 mg/M3)  
STEL = 1000 ppm(2400 mg/M3)  
STEL DOES NOT APPLY TO THE CELLULOSE ACETATE FIBER INDUSTRY.

MAK INFORMATION: 500 ppm  
1200 mg/M3  
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours.  
Substance with MAK value but no pregnancy classification.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed  
MAK: Not listed  
NIOSH: Not listed  
NTP: Not listed  
ACGIH: Not listed  
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

orl-man TDLo:2857 mg/kg 34ZIAG - ,64,69

BEHAVIORAL

Coma

KIDNEY, URETER, BLADDER

Other changes

orl-man TDLo:2857 mg/kg DIAEAZ 15,810,66

BEHAVIORAL

Coma

BIOCHEMICAL

Metabolism

Other

ihl-man TClO:440 ug/m<sup>3</sup>/6M GISAAA 42(8),42,77

BRAIN AND COVERINGS

Recordings from specific areas of CNS

ihl-man TClO:10 mg/m<sup>3</sup>/6H GISAAA 42(8),42,77

BIOCHEMICAL

Metabolism

Other carbohydrates

ihl-hmn TClO:500 ppm JIHTAB 25,282,43

SENSE ORGANS

Nose

Other

SENSE ORGANS

Eye

Conjunctive irritation

LUNGS, THORAX, OR RESPIRATION

Other changes

ihl-man TClO:12000 ppm/4H AOHYA3 16,73,73

GASTROINTESTINAL

Nausea or vomiting

BEHAVIORAL

Muscle weakness

J value: orl-rat LD50:5800 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:5800 mg/kg

ihl-rat LC50:50100 mg/m<sup>3</sup>/8H

ipr-rat LDLo:500 mg/kg

ivn-rat LD50:5500 mg/kg

orl-mus LD50:3 gm/kg

ihl-mus LCLo:110 gm/m<sup>3</sup>/1H

ipr-mus LD50:1297 mg/kg

ivn-mus LDLo:4 gm/kg

orl-dog LDLo:8 gm/kg

ipr-dog LDLo:8 gm/kg

scu-dog LDLo:5 gm/kg

orl-rbt LD50:5340 mg/kg

skn-rbt LD50:20 gm/kg

ivn-rbt LDLo:1576 mg/kg

skn-gpg LD50:>9400 mg/kg

scu-gpg LDLo:5 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

eye-hmn 500 ppm

skn-rbt 395 mg open MLD  
eye-rbt 3950 ug SEV

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:273 gm/kg (13W male) NTIS\*\* PB91-185975

PATERNAL EFFECTS

Spermatogenesis

California Prop 65: Not listed

----- EPA's IRIS DATA SUMMARY -----  
Acetone; CASRN 67-64-1 (04/01/92)

II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Acetone

CASRN -- 67-64-1

Last Revised -- 12/01/90

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity

Basis -- Based on lack of data concerning carcinogenicity in humans or animals.

II.A.2. HUMAN CARCINOGENICITY DATA

None.

I.A.3. ANIMAL CARCINOGENICITY DATA

None.

II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Acetone did not show mutagenic activity when tested in Salmonella typhimurium strains TA98 and TA100 or in Schizosaccharomyces pombe strain P1 either in the presence or absence of liver homogenates (McCann et al., 1975; Abbondandolo et al., 1980; Maron et al., 1981; Hallstrom et al., 1981) or in cell transformation systems (Freeman et al., 1973; Rhim et al., 1974; Quarles et al., 1979a,b). Furthermore, acetone gave negative results in assays for chromosomal aberrations and sister chromatid exchange (Norppa et al., 1981; Norppa, 1981; Tates and Kriek, 1981), DNA binding (Kubinski et al., 1981), point mutation in mouse lymphoma cells (Amacher et al., 1980), and transfection of E. coli CR63 cells (Vasavada and Padayatty, 1981). In one study, however, acetone was reported to produce chromosomal aberrations but not sister chromatid exchanges (Kawachi et al., 1980).

-----

B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

None.

-----

II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

None.

-----

II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

II.D.1. EPA DOCUMENTATION

U.S. EPA. 1988. Updated Health Effects Assessment for Acetone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency

Response, Washington, DC.

II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1988 updated Health Effects Document for Acetone has received Agency review and is approved for publication.

Agency Work Group Review: 12/06/89

Verification Date: 12/06/89

II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Charles Ris / ORD -- (202)260-5895 / FTS 260-5898

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED

FROM THE CHRIS MANUAL:

organic vapor canister or air-supplied mask; synthetic rubber gloves;  
chemical safety goggles or face splash shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

\*\* WEAR APPROPRIATE EQUIPMENT TO PREVENT:

Repeated or prolonged skin contact.

\*\* WEAR EYE PROTECTION TO PREVENT:

Reasonable probability of eye contact.

\*\* EXPOSED PERSONNEL SHOULD WASH:

Promptly when skin becomes wet.

\*\* REMOVE CLOTHING:

Immediately remove any clothing that becomes wet to avoid any flammability hazard.

\*\* REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)

NIOSH (ACETONE)

1000 ppm: Any chemical cartridge respirator with organic vapor  
cartridge(s). / Any powered air-purifying respirator with organic vapor  
cartridge(s). / Any supplied-air respirator. / Any self-contained  
breathing apparatus.

6250 ppm: Any supplied-air respirator operated in a continuous flow  
mode. \* Substance reported to cause eye irritation or damage may require  
eye protection.

12500 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator with a full facepiece. / Any self-contained breathing apparatus with a full facepiece.

20000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.

**EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.:**

Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

**ESCAPE:** Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

**FIRST AID SOURCE: NIOSH POCKET GUIDE**

**EYE:** if this chemical contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids. get medical attention immediately. contact lenses should not be worn when working with this chemical.

**SKIN:** if this chemical contacts the skin, immediately wash the contaminated skin with soap and water. if this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

**INHALATION:** if a person breathes large amounts of this chemical, move the exposed person to fresh air at once. if breathing has stopped, perform mouth-to-mouth resuscitation. keep the affected person warm and at rest. get medical attention as soon as possible.

**INGESTION:** if this chemical has been swallowed, get medical attention immediately.

**FIRST AID SOURCE: CHRIS Manual 1991**

**INHALATION:** if victim is overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped.

**INGESTION:** if victim has swallowed large amounts and is conscious and not having convulsions, induce vomiting and get medical help promptly; no specific antidote known.

**SKIN:** wash well with water.

**EYES:** flush with water immediately for at least 15 min. Consult a physician.

**FIRST AID SOURCE: DOT Emergency Response Guide 1990.**

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

**FIRE EXTINGUISHMENT:** Alcohol foam, dry chemical, carbon dioxide. Note:  
Water in straight hose stream will scatter and  
spread fire and should not be used. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport  
Information - Publication DOT 5800.5 (1990).

**DOT SHIPPING NAME:** Acetone

**DOT ID NUMBER:** UN1090

ERG93

GUIDE 26

**\*POTENTIAL HAZARDS\***

**\*FIRE OR EXPLOSION**

Flammable/combustible material; may be ignited by heat, sparks or flames.

Vapors may travel to a source of ignition and flash back.

Container may explode in heat of fire.

Vapor explosion hazard indoors, outdoors or in sewers.

Runoff to sewer may create fire or explosion hazard.

**\*HEALTH HAZARDS**

May be poisonous if inhaled or absorbed through skin.

Vapors may cause dizziness or suffocation.

Contact may irritate or burn skin and eyes.

Fire may produce irritating or poisonous gases.

Runoff from fire control or dilution water may give off poisonous gases and  
cause water pollution.

**\*EMERGENCY ACTION\***

Keep unnecessary people away; isolate hazard area and deny entry.

Stay upwind; keep out of low areas. Positive pressure self-contained

breathing apparatus (SCBA) and structural firefighters' protective

clothing will provide limited protection. \*Isolate for 1/2 mile in all

directions if tank, rail car or tank truck is involved in fire. CALL

Emergency Response Telephone Number on Shipping Paper first. If

Shipping Paper not available or no answer, CALL CHEMTREC AT

1-800-424-9300. If water pollution occurs, notify the appropriate  
authorities.

**\*FIRE**

Small Fires: Dry chemical, CO<sub>2</sub>, water spray or alcohol-resistant  
foam. Do not use dry chemical extinguishers to control fires involving

nitromethane or nitroethane. Large Fires: Water spray, fog or

alcohol-resistant foam. Move container from fire area if you can do it

without risk. Apply cooling water to sides of containers that are

exposed to flames until well after fire is out. Stay away from ends

of tanks. For massive fire in cargo area, use unmanned hose holder or

monitor nozzles; if this is impossible, withdraw from area and let

fire burn. Withdraw immediately in case of rising sound from venting

safety device or any discoloration of tank due to fire.

**\*SPILL OR LEAK**

Shut off ignition sources; no flares, smoking or flames in hazard area.

Stop leak if you can do it without risk.

Water spray may reduce vapor; but it may not prevent ignition in closed spaces.

Small Spills: Take up with sand or other noncombustible absorbent material

and place into containers for later disposal.

Large Spills: Dike far ahead of liquid spill for later disposal.

**\*FIRST AID**

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and factual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement.

The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies or omissions within this database, or in any of its printed or displayed output forms.



OF IGNITION AND FLASH BACK.

ODOR DETECTED AT (ppm): 4.68 ppm  
DESCRIPTION: odor; characteristic odor Source:CHRIS  
ODOR DETECTION: No data

----- REGULATIONS -----

DOT hazard class: 3 FLAMMABLE LIQUID  
DOT guide: 27  
Identification number: UN1114  
DOT shipping name: Benzene  
Packing group: II  
Label(s) required: FLAMMABLE LIQUID  
Special provisions: T8  
Packaging exceptions: 173.150  
Non bulk packaging: 173.202  
Bulk packaging: 173.242  
Quantity limitations-  
Passenger air/rail: 5 L  
Cargo aircraft only: 60 L  
Vessel stowage: B  
Other stowage provisions:40

STCC NUMBER: 4908110

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:Yes

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.005 mg/L (01/09/89)

Maximum Contaminant Level Goals (MCLG): 0 mg/L (01/09/89)

CLEAN AIR ACT: CAA '90 Listed and CAA '77 Sect 109

EPA WASTE NUMBER: U019,D018,D001

CERCLA REF: Y

RQ DESIGNATION: A 10 pounds (4.54 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: Irritant  
Acute toxicity: adverse effect to target organs.  
Chronic toxicity: carcinogen  
Chronic toxicity: mutagen.  
Chronic toxicity: reproductive toxin.  
Fire hazard: flammable.

LISTED IN SARA Sect 313: Yes

de minimus CONCENTRATION: 0.1 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Hazard class: Not given

Mailability: Nonmailable

Max per parcel: 0

NFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.  
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.  
REACTIVITY (YELLOW): (0) Stable even under fire conditions.  
SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"  
ATSDR Toxicology Profile available (NTIS\*\* PB/89/209464/AS)  
BENZENE [71-43-2]  
California OSHA Carcinogens List.  
California Assembly Bill 1803 Well Monitoring Chemicals.  
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.  
California Assembly Bill 1807 Toxic Air Contaminants.  
Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act Section 111 List.  
Clean Air Act Section 112 Hazardous Air Pollutants List.  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
Clean Water Act Section 311 Hazardous Chemicals List.  
DOT Hazardous Materials Table. 49 CFR 172.101  
DOT Marine Pollutant. Proposed List. 57 FR 3854, Jan 31, 1992  
EPA Carcinogen Assessment Group List  
EPA list of VOC chemicals from 40 CFR 60.489  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
Massachusetts Substance List.  
National Toxicology Program (NTP) list of human carcinogens  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a carcinogen.  
New Jersey Right to Know Substance List. Listed as a mutagen.  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992  
OSHA Specifically regulated substance. See 29 CFR 1910.1028  
Pennsylvania Hazardous Substance List  
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264  
RCRA Hazardous Waste  
RCRA Toxicity Characteristics (TC) list dated March 29, 1990  
SARA Section 313 Toxic Chemicals List  
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)  
Suspected carcinogen (ACGIH). "Threshold Limit Values for 1992-1993"  
Washington State Discarded Chemical Products List, November 17, 1989  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

**TERM TOXICITY:** INHALATION: benzene may produce both nerve and blood effects. irritation of the nose, throat and lungs may occur (3,000 ppm may be tolerated for only 30 to 60 minutes). Lung congestion may occur. nerve effects may include an exaggerated feeling of well-being, excitement, headache, dizziness and slurred speech. at high levels, slowed breathing and death may result. death has occurred at 20,000 ppm for 5 to 10 minutes, or 7,500 ppm for 30 minutes. SKIN: irritation may occur, with redness and blistering if not promptly removed. benzene is poorly absorbed. whole body exposure for 30 minutes has been reported with no health effects. Eyes: may cause severe irritation. INGESTION: may cause irritation of mouth, throat and stomach. symptoms are similar to those listed under inhalation. one tablespoon may cause collapse, bronchitis, pneumonia and death.(NYDH)

**LONG TERM TOXICITY:** may cause loss of appetite, nausea, weight loss, fatigue, muscle weakness, headache, dizziness, nervousness and irritability. mild anemia has been reported from exposures of 25 ppm for several years and 100 ppm for 3 months. at levels between 100 and 200 ppm for periods of 6 months, or more, severe irreversible blood changes and damage to liver and heart may occur. temporary partial paralysis has been reported.(NYDH)

**TARGET ORGANS:** blood, CNS, skin, bone marrow, eyes, resp sys, skin [leukemia]

**SYMPTOMS:** Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death. Source: CHRIS

**CONC IDLH:** 500ppm

**NIOSH REL:** Potential occupational carcinogen 0.1 ppm Time weighted averages for 8-hour exposure 0.32 mg/M3 Time weighted averages for 8-hour exposure 1 ppm Ceiling exposures which shall at no time be exceeded 3.2 mg/M3 Ceiling exposures which shall at no time be exceeded

**ACGIH TLV:** TLV = 10ppm Suspected human carcinogen (A2)

**ACGIH STEL:** Suspected human carcinogen (A2)

**OSHA PEL:** Final Rule Limits:

TWA = 1 ppm

STEL = 5 ppm

CONSULT 29CFR 1910.1028

MAK INFORMATION: Danger of cutaneous absorption  
Capable of inducing malignant tumors as shown by  
experience with humans.

CARCINOGEN?: Y STATUS: See below

REFERENCES:  
HUMAN SUSPECTED IARC\*\* 7,203,74  
HUMAN SUSPECTED IARC\*\* 28,151,82  
ANIMAL SUSPECTED IARC\*\* 28,151,82  
ANIMAL SUSPECTED IARC\*\* 29,93,82  
HUMAN POSITIVE IARC\*\* 29,93,82  
ANIMAL INDEFINITE IARC\*\* 7,203,74

CARCINOGEN LISTS:

IARC: Carcinogen as defined by  
IARC as carcinogenic to humans,  
with sufficient epidemiological  
evidence.  
MAK: Capable of inducing malignant  
tumors as shown by experience in  
humans.  
NIOSH: Carcinogen defined by NIOSH  
with no further categorization.  
NTP: Carcinogen defined by NTP as  
known to be carcinogenic, with  
evidence from human studies.  
ACGIH: Carcinogen defined by ACGIH  
TLV Committee as a suspected  
carcinogen, based on either  
limited epidemiological evidence or  
demonstration of carcinogenicity  
in experimental animals.  
OSHA: Cancer hazard

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

\* ihl-hmn LCLo:2 pph/5M TABIA2 3,231,33  
  
\* orl-man LDLo:50 mg/kg YAKUD5 22,883,80  
  
\* ihl-hmn LCLo:2000 ppm/5M YAKUD5 22,883,80  
  
ihl-man TCLo:150 ppm/1Y-I BLUTA9 28,293,74  
BLOOD  
Other changes  
NUTRITIONAL AND GROSS METABOLIC  
Changes in:  
Body temperature increase  
  
ihl-hmn TCLo:100 ppm INMEAF 17,199,48  
BEHAVIORAL  
Somnolence(general depressed activity)  
GASTROINTESTINAL

Nausea or vomiting  
SKIN AND APPENDAGES  
Skin - after systemic exposure  
Dermatitis, other

ihl-hmn LCLo:65 mg/m<sup>3</sup>/5Y ARGEAR 44,145,74  
BLOOD  
Other changes

LD50 value: orl-rat LD50:930 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:930 mg/kg  
ihl-rat LC50:10000 ppm/7H  
ipr-rat LD50:2890 ug/kg  
orl-mus LD50:4700 mg/kg  
ihl-mus LC50:9980 ppm  
ipr-mus LD50:340 mg/kg  
orl-dog LDLo:2 gm/kg  
ihl-dog LCLo:146000 mg/m<sup>3</sup>  
ihl-cat LCLo:170000 mg/m<sup>3</sup>  
ihl-rbt LCLo:45000 ppm/30M  
skn-rbt LD50:>9400 mg/kg  
ivn-rbt LDLo:88 mg/kg  
skn-gpg LD50:>9400 mg/kg  
ipr-gpg LDLo:527 mg/kg  
scu-frg LDLo:1400 mg/kg  
ihl-mam LCLo:20000 ppm/5M  
ipr-mam LDLo:1500 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

ihl-rat TCLo:670 mg/m<sup>3</sup>/24H (15D pre/1-22D preg) HYSAAV  
33(1-3),327,68

EFFECTS ON FERTILITY

Female fertility index

ihl-rat TCLo:56600 ug/m<sup>3</sup>/24H (1-22D preg) HYSAAV  
33(7-9),112,68

EFFECTS ON NEWBORN

ihl-rat TCLo:50 ppm/24H (7-14D preg) JHEMA2 24,363,80  
EFFECTS ON EMBRYO OR FETUS  
Extra embryonic features(e.g.,placenta,umbilical  
cord)

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TCLo:150 ppm/24H (7-14D preg) JHEMA2 24,363,80

EFFECTS ON FERTILITY

Post-implantation mortality

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

orl-mus TDLo:9 gm/kg (6-15D preg) TJADAB 19,41A,79

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

orl-mus TDLo:12 gm/kg (6-15D preg) TJADAB 19,41A,79

EFFECTS ON FERTILITY

Post-implantation mortality

orl-mus TDLo:6500 mg/kg (8-12D preg) TCMUD8 6,361,86

EFFECTS ON NEWBORN

Growth statistics(e.g.,reduced weight gain)

ihl-mus TCLo:500 ppm/7H (6-15D preg) AIHAAP 40,993,79

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

ihl-mus TCLo:500 mg/m3/12H (6-15D preg) ATSUDG 8,425,85

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

ihl-mus TCLo:5 ppm (6-15D preg) TXCYAC 42,171,86

EFFECTS ON EMBRYO OR FETUS

Cytological changes(including somatic cell genetic material)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Blood and lymphatic systems(including spleen and marrow)

ihl-mus TCLo:20 ppm/6H (6-15D preg) FAATDF 10,224,88

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Blood and lymphatic systems(including spleen and marrow)

ipr-mus TDLo:5 mg/kg (1D male) TPKVAL 15,30,79

EFFECTS ON FERTILITY

Pre-implantation mortality

EFFECTS ON EMBRYO OR FETUS

Fetal death

ipr-mus TDLo:219 mg/kg (14D preg) EMMUEG 18,1,91

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Blood and lymphatic systems(including spleen and marrow)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Hepatobiliary system

scu-mus TDLo:1100 mg/kg (12D preg) TOXID9 1,125,81

EFFECTS ON EMBRYO OR FETUS

Other effects on embryo or fetus

scu-mus TDLo:7030 mg/kg (12-13D preg) SEIJBO 15,47,75

EFFECTS ON EMBRYO OR FETUS

Extra embryonic features(e.g.,placenta,umbilical cord)

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

ivn-mus TDLo:13200 ug/kg (13-16D preg) ICHUDW 4(6),24,82

EFFECTS ON EMBRYO OR FETUS

Cytological changes(including somatic cell genetic material)

par-mus TDLo:4 gm/kg (12D preg) NEZAAQ 25,438,70

EFFECTS ON NEWBORN

Weaning or lactation index(#alive at weaning per # alive at day 4)

ihl-rbt TCLo:1 gm/m3/24H (7-20D preg) ATSUDG 8,425,85

EFFECTS ON FERTILITY

Post-implantation mortality

EFFECTS ON FERTILITY

Abortion

EFFECTS ON EMBRYO OR FETUS

Fetal death

California Prop 65: Carcinogen (02/27/87)

No significant risk level 7. ugD (01/01/94)

----- EPA's IRIS DATA SUMMARY -----

'RTP51' LINE 1. [B28] Not enough string space - Out of Memory.



Label(s) required: CLASS 9  
Special provisions: 8, B54  
Shipping exceptions: 173.155  
Bulk packaging: 173.213  
Bulk packaging: 173.240  
Quantity limitations-  
Passenger air/rail: NONE  
Cargo aircraft only: NONE  
Vessel stowage: A  
Other stowage provisions:

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:No

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.005 mg/L (07/30/92)

Maximum Contaminant Level Goals (MCLG): 0.005 mg/L (07/30/92)

CLEAN AIR ACT: CAA '90 By category

EPA WASTE NUMBER: D006

CERCLA REF: Y

RQ DESIGNATION: A 10 pounds (4.54 kg) CERCLA for pieces of solid metal  
with diameter less than 100 micrometers (0.004  
inches).

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: adverse effect to target organs.

Chronic toxicity: carcinogen

Chronic toxicity: adverse effect to target organ  
after long period of exposure.

Chronic toxicity: mutagen.

Chronic toxicity: reproductive toxin.

Fire hazard: flammable.

Acute toxicity: Toxic. LD50 > 50 and <= 500  
mg/kg (oral rat).

LISTED IN SARA Sect 313: Yes

de minimus CONCENTRATION: 0.1 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Not given

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"

ATSDR Toxicology Profile available (NTIS\*\*

CADMIUM [7440-43-9]

California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.

California Assembly Bill 1807 Toxic Air Contaminants.

Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
EPA Carcinogen Assessment Group List  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
Massachusetts Substance List.  
National Toxicology Program list of anticipated human carcinogens  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a carcinogen.  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
Pennsylvania Hazardous Substance List  
RCRA Hazardous Waste  
RCRA Toxicity Characteristics (TC) list dated March 29, 1990  
SARA Section 110 Priority List of CERCLA Hazardous Substances  
SARA Section 313 Toxic Chemicals List  
Suspected carcinogen (ACGIH). "Threshold Limit Values for 1992-1993"  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: unknown

TARGET ORGANS: resp sys, lungs, kidneys, prostate, blood  
[prostatic and lung cancer]

SYMPTOMS: INHALATION, INGESTION: PULM EDEMA, DYSPNEA,  
COUGH, TIGHT CHEST, SUBSTERNAL PAIN;  
HEADACHE, CHILLS, MUSCLE ACHES; NAUSEA,  
VOMITING, DIARRHEA, ANOSMIA, EMPHYSEMA;  
PROTEINURIA, MILD ANEMIA; [CARC] Source:  
NIOSH

CONC IDLH: 9mg/M3(asCd)

NIOSH REL: Potential occupational carcinogen --LOWEST FEASIBLE  
(LOQ 0.01 mg/M3)

ACGIH TLV: TLV = RESPIRABLE FRACTION 0.002mg/M3 as CADMIUM--TOTAL  
DUST 0.01 Mg/M3 Suspected human carcinogen (A2)

ACGIH STEL: Not listed

OSHA PEL: Final Rule Limits:  
TWA = 5 ug/M3

Consult 29CFR 1910.1027

INFORMATION: Carcinogenic working material without MAK  
In the Commission's view, an animal carcinogen.

CARCINOGEN?: Y STATUS: See below

REFERENCES:  
ANIMAL POSITIVE IARC\*\* 2,74,73  
ANIMAL POSITIVE IARC\*\* 11,39,76

CARCINOGEN LISTS:

IARC: Carcinogen as defined by  
IARC as carcinogenic to humans,  
with sufficient epidemiological  
evidence.

MAK: An animal carcinogen.

NIOSH: Carcinogen defined by NIOSH  
with no further categorization.

NTP: Carcinogen defined by NTP as  
reasonably anticipated to be  
carcinogenic, with limited  
evidence in humans or sufficient  
evidence in experimental animals.

ACGIH: Carcinogen defined by ACGIH  
TLV Committee as a suspected  
carcinogen, based on either  
limited epidemiological evidence or  
demonstration of carcinogenicity  
in experimental animals.

OSHA: Cancer hazard

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-man TClO:88 ug/m<sup>3</sup>/8.6Y AEHLAU 28,147,74  
KIDNEY, URETER, BLADDER  
Proteinuria

ihl-hmn LClO:39 mg/m<sup>3</sup>/20M AIHAAP 31,180,70  
CARDIAC  
Other changes  
VASCULAR

Thrombosis distant from injection  
site(except brain,heart)  
LUNGS, THORAX, OR RESPIRATION  
Respiratory depression

LD50 value: orl-rat LD50:225 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:225 mg/kg  
ihl-rat LC50:25 mg/m<sup>3</sup>/30M  
ipr-rat LD50:4 mg/kg  
scu-rat LD50:9 mg/kg

ivn-rat LD50:1800 ug/kg  
unr-rat LD50:1140 mg/kg  
orl-mus LD50:890 mg/kg  
ihl-mus LCLo:170 mg/m3  
ipr-mus LD50:5700 ug/kg  
unr-mus LD50:890 mg/kg  
orl-rbt LDLo:70 mg/kg  
scu-rbt LDLo:6 mg/kg  
ivn-rbt LDLo:5 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:155 mg/kg (13W male/13W pre-3W preg)  
BECTA6 20,96,78

EFFECTS ON NEWBORN

Growth statistics(e.g.,reduced weight gain)

EFFECTS ON NEWBORN

Behavioral

orl-rat TDLo:220 mg/kg (1-22D preg) TOLED5 11,233,82

EFFECTS ON EMBRYO OR FETUS

Other effects on embryo or fetus

orl-rat TDLo:21500 ug/kg (multigenerations) ENVRAL  
22,466,80

EFFECTS ON FERTILITY

Pre-implantation mortality

EFFECTS ON NEWBORN

Germ cell effects(in offspring)

orl-rat TDLo:23 mg/kg (1-22D preg) PSEBAA 158,614,78

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Blood and lymphatic systems(including spleen and  
marrow)

ipr-rat TDLo:1124 ug/kg (1D male) TXAPA9 41,194,77

PATERNAL EFFECTS

Spermatogenesis

scu-rat TDLo:250 ug/kg (19D preg) APTOD9 19,A122,80

EFFECTS ON NEWBORN

ivn-rat TDLo:1250 ug/kg (14D preg) JJATDK 1,264,81

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Body wall

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Urogenital system

ivn-rat TDLo:1250 ug/kg (9D preg) JJATDK 1,264,81  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Central nervous system  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Eye,ear

ivn-rat TDLo:8 mg/kg (8-15D preg) JJATDK 1,264,81  
EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)

orl-mus TDLo:448 mg/kg (multigenerations) AEHLAU  
23,102,71  
EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)  
EFFECTS ON EMBRYO OR FETUS  
Fetal death

orl-mus TDLo:1700 mg/kg (8-12D preg) TCMUD8 6,361,86  
EFFECTS ON NEWBORN  
Viability index(# alive at day 4 per # born alive)  
EFFECTS ON NEWBORN  
Growth statistics(e.g.,reduced weight gain)

ipr-mus TDLo:1686 ug/kg (7D preg) TJADAB 28,39A,83  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Central nervous system

Crit. Effect: No significant risk level .05 ugD (01/01/94)

----- EPA's IRIS DATA SUMMARY -----  
Cadmium; CASRN 7440-43-9 (04/01/92)

II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Cadmium  
CASRN -- 7440-43-9  
Last Revised -- 03/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for

information on long-term toxic effects other than carcinogenicity.

## EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

### II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B1; probable human carcinogen

Basis -- Limited evidence from occupational epidemiologic studies of cadmium is consistent across investigators and study populations. There is sufficient evidence of carcinogenicity in rats and mice by inhalation and intramuscular and subcutaneous injection. Seven studies in rats and mice wherein cadmium salts (acetate, sulfate, chloride) were administered orally have shown no evidence of carcinogenic response.

### II.A.2. HUMAN CARCINOGENICITY DATA

Limited. A 2-fold excess risk of lung cancer was observed in cadmium smelter workers. The cohort consisted of 602 white males who had been employed in production work a minimum of 6 months during the years 1940-1969. The population was followed to the end of 1978. Urine cadmium data available for 261 workers employed after 1960 suggested a highly exposed population. The authors were able to ascertain that the increased lung cancer risk was probably not due to the presence of arsenic or to smoking (Thun et al., 1985). An evaluation by the Carcinogen Assessment Group of these possible confounding factors has indicated that the assumptions and methods used in accounting for them may not be valid. As the SMRs observed were low and there is a lack of clear cut evidence of a causal relationship of the cadmium exposure only, this study is considered to supply only limited evidence of human carcinogenicity.

An excess lung cancer risk was also observed in three other studies which were, however, compromised by the presence of other carcinogens (arsenic, smoking) in the exposure or by a small population (Varner, 1983; Sorahan and Waterhouse, 1983; Armstrong and Kazantzis, 1983).

Four studies of workers exposed to cadmium dust or fumes provided evidence of a statistically significant positive association with prostate cancer (Kipling and Waterhouse, 1967; Lemen et al., 1976; Holden, 1980; Sorahan and Waterhouse, 1983), but the total number of cases was small in each study. The Thun et al. (1985) study is an update of an earlier study (Lemen et al., 1976) and does not show excess prostate cancer risk in these workers. Studies of human ingestion of cadmium are inadequate to assess carcinogenicity.

### II.A.3. ANIMAL CARCINOGENICITY DATA

Exposure of Wistar rats to cadmium as cadmium chloride at concentrations of 12.5, 25 and 50 ug/cu.m for 18 months, with an additional 13-month obser-

vation period, resulted in significant increases in lung tumors (Takenaka et al., 1983). Intratracheal instillation of cadmium oxide did not produce lung tumors in Fischer 344 rats but rather mammary tumors in females and tumors at multiple sites in males (Sanders and Mahaffey, 1984). Injection site tumors and distant site tumors (for example, testicular) have been reported by a number of authors as a consequence of intramuscular or subcutaneous administration of cadmium metal and chloride, sulfate, oxide and sulfide compounds of cadmium to rats and mice (U.S. EPA, 1985). Seven studies in rats and mice where cadmium salts (acetate, sulfate, chloride) were administered orally have shown no evidence of a carcinogenic response.

\_\_II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Results of mutagenicity tests in bacteria and yeast have been inconclusive. Positive responses have been obtained in mutation assays in Chinese hamster cells (Dom and V79 lines) and in mouse lymphoma cells (Casto, 1976; Ochi and Ohsawa, 1983; Oberly et al., 1982).

Conflicting results have been obtained in assays of chromosomal aberrations in human lymphocytes treated in vitro or obtained from exposed workers. Cadmium treatment in vivo or in vitro appears to interfere with spindle formation and to result in aneuploidy in germ cells of mice and hamsters (Shimada et al., 1976; Watanabe et al., 1979; Gilliavod and Leonard, 1975).

\_\_II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available. There are no positive studies of orally ingested cadmium suitable for quantitation.

\_\_II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

\_\_II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk --  $1.8E-3$  per (ug/cu.m)

Extrapolation Method -- Two stage; only first affected by exposure; extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	$6E-2$ ug/cu.m

E-5 (1 in 100,000) 6E-3 ug/cu.m  
 E-6 (1 in 1,000,000) 6E-4 ug/cu.m

II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Tumor Type -- Lung, trachea, bronchus cancer deaths  
 Test Animals -- human/white male  
 Route -- inhalation, exposure in the workplace  
 Reference -- Thun et al., 1985

Cumulative Exposure (mg/day/cu.m)	Median Observation	24 hour/ug/cu.m Equivalent	No. of Expected Lung, Trachea and Bronchus Cancers Assuming No Cadmium Effect	Observed No. of Deaths (lung, trachea, bronchus cancers)
less than or equal to 584	280	168	3.77	2
585-2920	1210	727	4.61	7
greater than or equal to 2921	4200	2522	2.50	7

The 24-hour equivalent = median observation x 10E-3 x 8/24 x 1/365 x 240/365.

II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk should not be used if the air concentration exceeds 6 ug/cu.m, since above this concentration the unit risk may not be appropriate.

II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

The data were derived from a relatively large cohort. Effects of arsenic and smoking were accounted for in the quantitative analysis for cadmium effects.

An inhalation unit risk for cadmium based on the Takenaka et al. (1983) analysis is 9.2E-2 per (ug/cu.m). While this estimate is higher than that derived from human data [1.8E-3 per (ug/cu.m)] and thus more conservative, it was felt that the use of available human data was more reliable because of species variations in response and the type of exposure (cadmium salt vs. cadmium fume and cadmium oxide).

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I.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Updated Mutagenicity and Carcinogenicity Assessment of Cadmium: Addendum to the Health Assessment Document for Cadmium (May 1981, EPA 600/B-81-023). EPA 600/B-83-025F.

II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Addendum to the Cadmium Health Assessment has received both Agency and external review.

Agency Work Group Review: 11/12/86

Verification Date: 11/12/86

II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

W. E. Pepelko / ORD -- (202)260-5904 / FTS 260-5904

David Bayliss / ORD -- (202)260-5726 / FTS 260-5726

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED  
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

\*\* WEAR EYE PROTECTION TO PREVENT:

\*\* EXPOSED PERSONNEL SHOULD WASH:

At the end of each work shift when there was a reasonable probability of contact with the contaminant.

\*\* WORK CLOTHING SHOULD BE CHANGED DAILY:

If there is any possibility that the clothing may be contaminated.

\*\* THE FOLLOWING EQUIPMENT SHOULD BE MADE AVAILABLE:

Eyewash.

\*\* REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)  
OSHA (CADMIUM)

50 ug/M3 or less: Half mask, air purifying respirator equipped with a HEPA filter.

125 ug/M3 or less: A powered air purifying respirator (PAPR) with a loose-fitting hood or helmet equipped with a HEPA filter, or a supplied air respirator with a loose-fitting hood or helmet facepiece operated in the continuous flow mode.

250 ug/M3 or less: A full facepiece air-purifying respirator equipped with a HEPA filter, or a powered air-purifying respirator with a tight-fitting half-mask equipped with a HEPA filter, or a supplied-air respirator with a tight-fitting half mask operated in the continuous flow mode.

1250 ug/M3 or less: A powered air-purifying respirator with a tight fitting full facepiece equipped with a HEPA filter, or a supplied air respirator with a tight-fitting full facepiece operated in the continuous flow mode.

5000 ug/M3 or less: A supplied air respirator with half-mask or full facepiece operated in the pressure demand or other positive pressure mode.

Greater than 5000 ug/M3 or unknown concentration: A self-contained breathing apparatus with a full facepiece operated in the pressure demand or other positive pressure mode, or a supplied-air respirator with a full facepiece operated in the pressure demand or other positive pressure mode and equipped with an auxiliary escape type self-contained breathing apparatus operated in the pressure demand mode.

EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.:  
Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode.

FIRST AID SOURCE: NIOSH

EYE: irr immed

SKIN: soap wash

INHALATION: art resp

INGESTION: water, vomit

FIRST AID SOURCE: DOT Emergency Response Guide 1990.

In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).

DOT SHIPPING NAME: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (CADMIUM)

DOT ID NUMBER: UN3077

ERG93

GUIDE 31

\*POTENTIAL HAZARDS\*

**\*FIRE OR EXPLOSION**

Some of these materials may burn, but none of them ignites readily.

Material may be transported hot.

**HEALTH HAZARDS**

Contact may cause burns to skin and eyes.

Inhalation of asbestos dust may have a damaging effect on the lungs.

Fire may produce irritating or poisonous gases.

Runoff from fire control or dilution water may cause pollution.

**\*EMERGENCY ACTION\***

Keep unnecessary people away; isolate hazard area and deny entry.

Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

**\*FIRE**

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.

Move container from fire area if you can do it without risk.

\*Do not scatter spilled material with high-pressure water streams.

Dike fire control water for later disposal.

**\*SPILL OR LEAK**

Stop leak if you can do it without risk.

Avoid inhalation of asbestos dust.

Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.

Large Spills: Dike far ahead of liquid spill for later disposal.

Cover powder spill with plastic sheet or tarp to minimize spreading.

**\*FIRST AID**

In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and factual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement. The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies or omissions within this database, or in any of its printed or displayed output forms.



Packing group: III  
Label(s) required: CLASS 9  
Special provisions: 8, B54  
Shipping exceptions: 173.155  
Bulk packaging: 173.213  
Bulk packaging: 173.240  
Quantity limitations-  
Passenger air/rail: NONE  
Cargo aircraft only: NONE  
Vessel stowage: A  
Other stowage provisions:

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:No

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.1 mg/L (07/30/92)

Maximum Contaminant Level Goals (MCLG): 0.1 mg/L (07/30/92)

CLEAN AIR ACT: CAA '90 By category

EPA WASTE NUMBER: D007

CERCLA REF: Y

RQ DESIGNATION: D 5000 pounds (2270 kg) CERCLA for pieces of solid metal with diameter less than 100 micrometers (0.004 inches).

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Chronic toxicity: carcinogen

FOUND IN SARA Sect 313: Yes

de minimus CONCENTRATION: 1.0 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Not given

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"

ATSDR Toxicology Profile available (NTIS\*\* PB/89/236665/AS)

CHROMIUM [7440-47-3]

California Assembly Bill 1807 Toxic Air Contaminants.

Canadian Domestic Substances List

Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.

Clean Air Act of November 15, 1990. List of pollutants.

Clean Water Act Section 307 Priority Pollutants

EPA TSCA Chemical Inventory List 1986

EPA TSCA Chemical Inventory List 1989

EPA TSCA Chemical Inventory List 1990

EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
Massachusetts Substance List.  
National Toxicology Program (NTP) list of human carcinogens  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a carcinogen.  
New Jersey Right to Know Substance List. Listed as a mutagen.  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
Pennsylvania Hazardous Substance List  
RCRA Hazardous Waste  
RCRA Toxicity Characteristics (TC) list dated March 29, 1990  
SARA Section 110 Priority List of CERCLA Hazardous Substances  
SARA Section 313 Toxic Chemicals List  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

SHORT TERM TOXICITY: INHALATION: dust may cause irritation of the  
nose, throat and lungs. SKIN: dust may cause  
irritation. Eyes: dust may cause irritation.  
INGESTION: dust may cause irritation of the  
mouth and throat.(NYDH)

LONG TERM TOXICITY: no information found on exposure to chromium  
metal. see specific chromium  
compounds.(NYDH)

TARGET ORGANS: eyes, skin, resp sys

SYMPTOMS: INHALATION, INGESTION, CONTACT: IRRIT EYES,  
SKIN; HISTOLOGIC FIBROSIS OF LUNGS Source:  
NIOSH

CONC IDLH: 250mg/m<sup>3</sup>(ASCr)

NIOSH REL:

ACGIH TLV: TLV = 0.5mg/M<sup>3</sup> as CHROMIUM A4

ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:

PEL = 1mg/M<sup>3</sup>

Final Rule Limits:

TWA = 1 mg/M<sup>3</sup>

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

REFERENCES:  
ANIMAL SUSPECTED IARC\*\* 2,100,73

ANIMAL INDEFINITE IARC\*\* 23,205,80

NOGEN LISTS:

IARC: Not classified as to human  
carcinogenicity or probably not  
carcinogenic to humans.  
MAK: Not listed  
NIOSH: Not listed  
NTP: Not listed  
ACGIH: Not classifiable as a Human  
Carcinogen due to inadequate data.  
OSHA: Not listed

LD50 value: No LD50 in RTECS 1992

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

unr-rat LD50:27500 ug/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

----- EPA's IRIS DATA SUMMARY -----  
Chromium(VI); CASRN 7440-47-3 (04/01/92)

II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Chromium(VI)  
CASRN -- 7440-47-3  
Last Revised -- 03/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive

the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

## II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

### II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- A; human carcinogen

Basis -- Results of occupational epidemiologic studies of chromium-exposed workers are consistent across investigators and study populations. Dose-response relationships have been established for chromium exposure and lung cancer. Chromium-exposed workers are exposed to both chromium III and chromium VI compounds. Because only chromium VI has been found to be carcinogenic in animal studies, however, it was concluded that only chromium VI should be classified as a human carcinogen.

### II.A.2. HUMAN CARCINOGENICITY DATA

Sufficient. Epidemiologic studies of chromate production facilities in the United States (Machle and Gregorius, 1948; Brinton et al., 1952; Mancuso and Hueper, 1951, Mancuso, 1975; Baetjer, 1950; Taylor, 1966; Enterline, 1974; Hayes et al., 1979; Hill and Ferguson, 1979), Great Britain (Bidstrup, 1951; Bidstrup and Case, 1956; Alderson et al., 1981), Japan (Watanabe and Fukuchi, 1975; Ohsaki et al., 1978; Sano and Mitohara, 1978; Satoh et al., 1981) and Germany (Korallus et al., 1982; Bittersohl, 1971) have established an association between chromium (Cr) exposure and lung cancer. Most of these studies did not attempt to determine whether Cr III or Cr VI compounds were the etiologic agents.

Three studies of the chrome pigment industry, one in Norway (Langard and Norseth, 1975), one in England (Davies, 1978, 1979), and the third in the Netherlands and Germany (Frentzel-Beyme, 1983) also found an association between occupational chromium exposure (predominantly to Cr VI) and lung cancer.

Results of two studies of the chromium plating industry (Royle, 1975; Silverstein et al., 1981) were inconclusive, while the findings of a Japanese study of chrome platers were negative (Okubo and Tsuchiya, 1979). The results of studies of ferrochromium workers (Pokrovskaya and Shabynina, 1973; Langard et al., 1980; Axelsson et al., 1980) were inconclusive as to lung cancer risk.

### II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Hexavalent chromium compounds were carcinogenic in animal assays producing the following tumor types: intramuscular injection site tumors in Fischer 344 and Bethesda Black rats and in C57BL mice (Furst et

al., 1976; Maltoni, 1974, 1976; Payne, 1960; Heuper and Payne, 1959); intraplural implant site tumors for various chromium VI compounds in Sprague-Dawley and Bethesda Black rats (Payne, 1960; Heuper 1961; Heuper and Payne, 1960; Heuper and Payne, 1960; Heuper and Payne, 1960); intrabronchial implantation site tumors for various Cr VI compounds in Wistar rats (Levy and Martin, 1983; Laskin et al., 1970; Levy as quoted in NIOSH, 1975); and subcutaneous injection site sarcomas in Sprague-Dawley rats (Maltoni, 1974, 1976).

\_\_\_II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

A large number of chromium compounds have been assayed in in vitro genetic toxicology assays. In general, hexavalent chromium is mutagenic in bacterial assays whereas trivalent chromium is not (Lofroth, 1978; Petrellie and Flora, 1977, 1978). Likewise Cr VI but not Cr III was mutagenic in yeasts (Bonatti et al., 1976) and in V79 cells (Newbold et al., 1979). Chromium III and VI compounds decrease the fidelity of DNA synthesis in vitro (Loeb et al., 1977), while Cr VI compounds inhibit replicative DNA synthesis in mammalian cells (Levis et al., 1978) and produce unscheduled DNA synthesis, presumably repair synthesis, as a consequence of DNA damage (Raffetto, 1977). Chromate has been shown to transform both primary cells and cell lines (Fradkin et al., 1975; Tsuda and Kato, 1977; Casto et al., 1979). Chromosomal effects produced by treatment with chromium compounds have been reported by a number of authors; for example, both Cr VI and Cr III salts were clastogenic for cultured human leukocytes (Nakamuro et al., 1978).

There are no long-term studies of ingested Cr VI. There appears to be significant in vivo conversion of Cr VI to Cr III and III to VI; Cr III is an essential trace element.

\_\_\_II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

\_\_\_II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

\_\_\_II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk --  $1.2E-2$  per (ug/cu.m)

Extrapolation Method -- Multistage, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	8E-3 ug/cu.m
E-5 (1 in 100,000)	8E-4 ug/cu.m
E-6 (1 in 1,000,000)	8E-5 ug/cu.m

II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Species/Strain Tumor Type	Dose	Tumor Incidence	Reference
human	Route: Occupational exposure (inhalation)		
Age (years)	Midrange (ug/cu.m)	Deaths from Lung Cancer	Person Years
50	5.66	3	1345
	25.27	6	931
	46.83	6	299
60	4.68	4	1063
	20.79	5	712
	39.08	5	211
70	4.41	2	401
	21.29	4	345

II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The cancer mortality in Mancuso (1975) was assumed to be due to Cr VI, which was further assumed to be no less than one-seventh of total chromium. It was also assumed that the smoking habits of chromate workers were similar to those of the U.S. white male population. The unit risks of Langard et al. (1980), Axelsson et al. (1980), and Pokrovskaya and Shabynina (1973) are 1.3E-1, 3.5E-2 and 9.2E-2 per (ug/cu.m), respectively.

Hexavalent chromium compounds have not produced lung tumors in animals by inhalation. Trivalent chromium compounds have not been reported as carcinogenic by any route of administration.

The unit risk should not be used if the air concentration exceeds 8E-1 ug/cu.m, since above this concentration the unit risk may not be appropriate.

II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

Results of studies of chromium exposure are consistent across investigators and countries. A dose-relationship for lung tumors has been established. The assumption that the ratio of Cr III to Cr VI is 6:1 may lead to underestimation of risk. The use of 1949 hygiene data, which may underestimate worker exposure, may result in an overestimation of risk. Further overestimation of risk may be due to the implicit assumption that the smoking habits of chromate workers were similar to those of the general white male population, since it is generally accepted that the proportion of smokers is higher for industrial workers than for the general population.

-----

II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

II.D.1. EPA DOCUMENTATION

Mancuso, T.F. 1975. International Conference on Heavy Metals in the Environment. Toronto, Ontario, Canada.

U.S. EPA. 1984. Health Assessment Document for Chromium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. EPA 600/8-83-014F.

II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The quantification of cancer risk in the 1984 Health Assessment Document has received peer review in public sessions of the Environmental Health Committee of the U.S. EPA's Science Advisory Board.

Agency Work Group Review: 06/26/86

Verification Date: 06/26/86

II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Herman J. Gibb / ORD -- (202)260-5898 / FTS 260-5898

Chao W. Chen / ORD -- (202)260-5719 / FTS 260-5719

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED  
FROM THE CHRIS MANUAL:

**NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:**

**WEAR APPROPRIATE EQUIPMENT TO PREVENT:**

Repeated or prolonged skin contact.

**\*\* WEAR EYE PROTECTION TO PREVENT:**

Reasonable probability of eye contact.

**\*\* EXPOSED PERSONNEL SHOULD WASH:**

Promptly when skin becomes contaminated.

**\*\* REMOVE CLOTHING:**

Promptly remove non-impervious clothing that becomes contaminated.

**\*\* REFERENCE: NIOSH**

**RECOMMENDED RESPIRATION PROTECTION** Source: NIOSH POCKET GUIDE (85-114)  
**OSHA (CHROMIUM)**

**2.5 mg/M3:** Any dust and mist respirator except single-use respirators. \* Substance reported to cause eye irritation or damage may require eye protection.

**5 mg/M3:** Any dust and mist respirator except single-use and quarter-mask respirators. \* Substance reported to cause eye irritation or damage may require eye protection. / Any supplied-air respirator. \* Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus. \* Substance reported to cause eye irritation or damage may require eye protection.

**12.5 mg/M3:** Any powered air-purifying respirator with a dust and mist filter. \* Substance reported to cause eye irritation or damage may require eye protection. / Any supplied-air respirator operated in a continuous flow mode. \* Substance reported to cause eye irritation or damage may require eye protection.

**25 mg/M3:** Any air-purifying full facepiece respirator with a high-efficiency particulate filter. / Any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter. \* Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.

**250 mg/M3:** Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.

**EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.:** Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

**ESCAPE:** Any air-purifying full facepiece respirator with a high-efficiency particulate filter. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH  
EYE: irr immed  
SKIN: soap wash  
RESPIRATION: art resp  
INGESTION: water, vomit

FIRST AID SOURCE: DOT Emergency Response Guide 1990.  
In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

US Department of Transportation Guide to Hazardous Materials Transport  
Information - Publication DOT 5800.5 (1990).  
DOT SHIPPING NAME: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (CHROMIUM)  
DOT ID NUMBER: UN3077

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GUIDE 31

**\*POTENTIAL HAZARDS\***

**\*FIRE OR EXPLOSION**

Some of these materials may burn, but none of them ignites readily.  
Material may be transported hot.

**\*HEALTH HAZARDS**

Contact may cause burns to skin and eyes.  
Inhalation of asbestos dust may have a damaging effect on the lungs.  
Fire may produce irritating or poisonous gases.  
Runoff from fire control or dilution water may cause pollution.

**\*EMERGENCY ACTION\***

Remove unnecessary people away; isolate hazard area and deny entry.  
Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

**\*FIRE**

Small Fires: Dry chemical, CO2, water spray or regular foam.  
Large Fires: Water spray, fog or regular foam.  
Move container from fire area if you can do it without risk.  
\*Do not scatter spilled material with high-pressure water streams.  
Dike fire control water for later disposal.

**\*SPILL OR LEAK**

Stop leak if you can do it without risk.  
Avoid inhalation of asbestos dust.  
Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.  
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.  
Large Spills: Dike far ahead of liquid spill for later disposal.  
Cover powder spill with plastic sheet or tarp to minimize spreading.

**\*FIRST AID**

In case of contact with material, immediately flush eyes with running

water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

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## CHEMTOX DATA

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## ----- IDENTIFIERS -----

CHEMTOX RECORD 4731

LAST UPDATE OF THIS RECORD: 11/24/95

NAME: DIESEL FUEL  
 SYNONYMS: AUTOMOTIVE DIESEL OIL; DIESEL FUEL (DOT); DIESEL OIL  
 (PETROLEUM); DIESEL OILS; DIESEL TEST FUEL; FUEL OIL,  
 DIESEL (DOT); FUELS, DIESEL; NA 1993 (DOT); OLEJ NAPELOWY  
 III (Polish)  
 CAS: 68512-90-3 RTECS: HZ1800000  
 FORMULA: MOL WT:  
 WLN:  
 CHEMICAL CLASS: Aromatic hydrocarbon

See other identifiers listed below under Regulations.

## ----- PROPERTIES -----

PHYSICAL DESCRIPTION: clear liquid  
 BOILING POINT: NA  
 MELTING POINT: NA  
 FLASH POINT: 322.15 K 49 C 120.2 F  
 AUTO IGNITION: Not available  
 VAPOR PRESSURE:  
 UEL: 7.5 %  
 LEL: 0.5 %  
 DENSITY: > 4 (air=1)  
 SPECIFIC GRAVITY: 0.8  
 DENSITY: 0.8 g/cc or 7.44 lb/gal  
 WATER SOLUBILITY: NEGLIGIBLE  
 INCOMPATIBILITIES: strong oxidizers

REACTIVITY WITH WATER: No data on water reactivity  
 REACTIVITY WITH COMMON MATERIALS: No data  
 STABILITY DURING TRANSPORT: No Data  
 NEUTRALIZING AGENTS: No data  
 POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: NIOSH has recommended that whole diesel  
 exhaust be treated as an occupational  
 carcinogen based on its effects on  
 laboratory animals.

ODOR DETECTED AT (ppm): Unknown  
 ODOR DESCRIPTION: No data  
 100 % ODOR DETECTION: No data

## ----- REGULATIONS -----

DOT hazard class: 3 FLAMMABLE LIQUID  
 DOT guide: 27

Identification number: UN1993  
DOT shipping name: FLAMMABLE LIQUIDS, N.O.S. (DIESEL FUEL)  
Packing group: III  
(s) required: FLAMMABL LIQUID  
Special provisions: B1, B52, T7, T30  
Packaging exceptions: 173.150  
Non bulk packaging: 173.203  
Bulk packaging: 173.242  
Quantity limitations-  
Passenger air/rail: 60 L  
Cargo aircraft only: 220 L  
Vessel stowage: A  
Other stowage provisions:

STCC NUMBER: 4915113

CLEAN WATER ACT Sect.307:No

CLEAN WATER ACT Sect.311:No

CLEAN AIR ACT: Not listed

EPA WASTE NUMBER: D001

CERCLA REF:

RQ DESIGNATION: Not listed

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: Irritant

Fire hazard: combustible.

Chronic toxicity: carcinogen

STATED POSTAL SERVICE MAILABILITY:

Not given

**NFPA CODES:**

HEALTH HAZARD (BLUE): (0) No unusual health hazard.

FLAMMABILITY (RED) : (2) This material must be moderately heated before  
ignition will occur.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

DIESEL FUEL [68512-90-3]

DOT Hazardous Materials Table. 49 CFR 172.101

EPA TSCA Chemical Inventory List 1989

EPA TSCA Test Submission (TSCATS) Database - April 1990

RCRA Hazardous Waste

----- TOXICITY DATA -----

SHORT TERM TOXICITY: Unknown

TERM TOXICITY: unknown

TARGET ORGANS: eyes, skin

SYMPTOMS: Inhalation of mist or high concentrations of vapor can produce dizziness, headache, nausea, and possibly irritation of the eyes, nose and throat. Source:

CONC IDLH: Nonegiven

NIOSH REL: Not given

ACGIH TLV: Not listed

ACGIH STEL: Not listed

OSHA PEL: Not in Table Z-1-A

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed

MAK: Not listed

NIOSH: Not listed

NTP: Not listed

ACGIH: Not listed

OSHA: Not listed

LD50 value: orl-rat LD50:9 gm/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:9 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED

THE CHRIS MANUAL:

wear protective gloves and clothing. eye protection such as safety glasses recommended.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

FIRE EXTINGUISHMENT: DRY CHEMICAL, CARBON DIOXIDE, HALOGENATED AGENTS, FOAM. Note: CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).

DOT SHIPPING NAME: FLAMMABLE LIQUIDS, N.O.S. (DIESEL FUEL)

DOT ID NUMBER: UN1993

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GUIDE 27

\*POTENTIAL HAZARDS\*

\*FIRE OR EXPLOSION

Flammable/combustible material; may be ignited by heat, sparks or flames.

Vapors may travel to a source of ignition and flash back.

Container may explode in heat of fire.

Vapor explosion hazard indoors, outdoors or in sewers.

Leak to sewer may create fire or explosion hazard.

Material may be transported hot.

\*HEALTH HAZARDS

May be poisonous if inhaled or absorbed through skin.

Vapors may cause dizziness or suffocation.

Contact may irritate or burn skin and eyes.

Fire may produce irritating or poisonous gases.

Runoff from fire control or dilution water may cause pollution.

\*EMERGENCY ACTION\*

Keep unnecessary people away; isolate hazard area and deny entry. Stay

upwind; keep out of low areas. Positive pressure self-contained

breathing apparatus (SCBA) and structural firefighters' protective

clothing will provide limited protection. \*Isolate for 1/2 mile in all

directions if tank, rail car or tank truck is involved in fire. CALL

Emergency Response Telephone Number on Shipping Paper first. If

Shipping Paper not available or no answer, CALL CHEMTREC AT

1-800-424-9300. If water pollution occurs, notify the appropriate

authorities.

\*FIRE

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.

Move container from fire area if you can do it without risk. Apply

cooling water to sides of containers that are exposed to flames until

well after fire is out. Stay away from ends of tanks. For massive

fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any coloration of tank due to fire.

**\*SPILL OR LEAK**

Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you can do it without risk. Water spray may reduce vapor; but it may not prevent ignition in closed spaces.

**Small Spills:** Take up with sand or other noncombustible absorbent material and place into containers for later disposal.

**Large Spills:** Dike far ahead of liquid spill for later disposal.

**\*FIRST AID**

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and factual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement.

The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies or omissions within this database, or in any of its printed or displayed output forms.



DOT hazard class: 3 FLAMMABLE LIQUID  
Hazard code: 26  
Identification number: UN1175  
DOT shipping name: Ethylbenzene  
Packing group: II  
Label(s) required: FLAMMABLE LIQUID  
Special provisions: T1  
Packaging exceptions: 173.150  
Non bulk packaging: 173.202  
Bulk packaging: 173.242  
Quantity limitations-  
Passenger air/rail: 5 L  
Cargo aircraft only: 60 L  
Vessel stowage: B  
Other stowage provisions:

STCC NUMBER: 4909163

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:Yes

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.7 mg/L (07/30/92)

Maximum Contaminant Level Goals (MCLG): 0.7 mg/L (07/30/92)

CLEAN AIR ACT: CAA '90 Listed

EPA WASTE NUMBER: D001

CERCLA REF: Y

RQ DESIGNATION: C 1000 pounds (454 kg) CERCLA

TPQ VALUE: Not listed

Sect. 312

categories:

Acute toxicity: Irritant

Acute toxicity: adverse effect to target organs.

Chronic toxicity: mutagen.

Chronic toxicity: reproductive toxin.

Fire hazard: flammable.

LISTED IN SARA Sect 313: Yes

de minimus CONCENTRATION: 1.0 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Hazard class: Flammable liquid - Mailable as ORM-D

Mailability: Domestic surface mail only

Max per parcel: 1 QT METAL; 1 PT OTHER

NFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.

FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

TLV List "Threshold Limit Values for 1992-1993"  
California Assembly Bill 1803 Well Monitoring Chemicals.  
Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act Section 111 List.  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
Clean Water Act Section 311 Hazardous Chemicals List.  
DOT Hazardous Materials Table. 49 CFR 172.101  
EPA Carcinogen Assessment Group List  
EPA List of VOC chemicals from 40 CFR 60.489  
EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 11/19/82  
EPA TSCA 8(d) Health and Safety Data Rule - effective date 06/19/87  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
ETHYL BENZENE [100-41-4]  
Massachusetts Substance List.  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992  
Pennsylvania Hazardous Substance List  
Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264  
RCRA Hazardous Waste  
SARA Section 313 Toxic Chemicals List  
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

SHORT TERM TOXICITY: INHALATION: 200 ppm for 30 minutes can cause irritation of the nose and throat, dizziness, difficult breathing and depression. very high levels can cause unconsciousness. SKIN: can cause irritation, inflammation, blisters and burns. Eyes: 200 ppm can cause irritation. higher levels can cause burning, tearing and injury. INGESTION: can cause headache, sleepiness and coma.(NYDH)

LONG TERM TOXICITY: may cause skin rash and irritation of eyes, nose and throat.(NYDH)

TARGET ORGANS: eyes, upper resp sys, skin, CNS

SYMPTOMS: Inhalation may cause irritation of nose, dizziness,

depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters. Source: CHRIS

CUNIC IDLH: 800PPM

NIOSH REL:

ACGIH TLV: TLV = 100ppm(434 mg/M3)

ACGIH STEL: STEL = 125 ppm(543 mg/M3)

OSHA PEL: Transitional Limits:

PEL = 100 ppm(435mg/M3)

Final Rule Limits:

TWA = 100 ppm (435 mg/M3)

STEL = 125 ppm(545 mg/M3)

MAK INFORMATION: 100 ppm

440 mg/M3

Local irritant: Peak = 2xMAK for 5 minutes, 8 times per shift.

Danger of cutaneous absorption

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed

MAK: Not listed

NIOSH: Not listed

NTP: Not listed

ACGIH: Not listed

OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-hmn TCLo:100 ppm/8H AIHAAP 31,206,70

SENSE ORGANS

Eye

Other

BEHAVIORAL

Sleep

LUNGS, THORAX, OR RESPIRATION

Other changes

LD50 value: orl-rat LD50:3500 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:3500 mg/kg

ihl-rat LCLo:4000 ppm/4H

ihl-mus LDLo:50 gm/m3/2H

ipr-mus LD50:2272 mg/kg

skn-rbt LD50:17800 mg/kg

ihl-gpg LCLo:10000 ppm

IRITATION DATA: (Source: NIOSH RTECS 1992)

skn-rbt 15 mg/24H open MLD  
eye-rbt 100 mg

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

ihl-rat TCLo:97 ppm/7H (15D pre) NTIS\*\* PB83-208074  
EFFECTS ON FERTILITY  
Female fertility index

ihl-rat TCLo:985 ppm/7H (1-19D preg) NTIS\*\* PB83-208074  
EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TCLo:96 ppm/7H (1-19D preg) NTIS\*\* PB83-208074  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Musculoskeletal system

ihl-rat TCLo:600 mg/m<sup>3</sup>/24H (7-15D preg) ATSUDG 8,425,85  
EFFECTS ON FERTILITY  
Post-implantation mortality  
EFFECTS ON EMBRYO OR FETUS  
Fetal death  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Musculoskeletal system

ihl-rat TCLo:2400 mg/m<sup>3</sup>/24H (7-15D preg) ATSUDG  
8,425,85  
EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rbt TCLo:99 ppm/7H (1-18D preg) NTIS\*\* PB83-208074  
EFFECTS ON FERTILITY  
Litter size(# fetuses per litter;measured before  
birth)

ihl-rbt TCLo:500 mg/m<sup>3</sup>/24H (7-20D preg) ATSUDG 8,425,85  
EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)

California Prop 65: Not listed

----- EPA's IRIS DATA SUMMARY -----  
Ethylbenzene; CASRN 100-41-4 (04/01/92)

\_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Ethylbenzene  
CASRN -- 100-41-4

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

\_\_II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

\_\_II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity.

Basis -- nonclassifiable due to lack of animal bioassays and human studies.

\_\_II.A.2. HUMAN CARCINOGENICITY DATA

None.

\_\_II.A.3. ANIMAL CARCINOGENICITY DATA

None. NTP has plans to initiate bioassay. Metabolism and excretion studies at 3.5, 35 and 350 mg/kg are to be conducted as well.

\_\_II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

The metabolic pathways for humans and rodents are different (Engstrom et al., 1984). Major metabolites in humans, mandelic acid and phenylglyoxylic acid, are minor metabolites in rats and rabbits (Kiese and Lenk, 1974). The major animal metabolites were not detected in the urine of exposed workers (Engstrom et al., 1984).

Ethylbenzene at 0.4 mg/plate was not mutagenic for Salmonella strains TA98, TA1535, TA1537 and TA1538 with or without Aroclor 1254 induced rat

liver homogenates (S9) (Nestmann et al., 1980). Ethylbenzene was shown to increase the mean number of sister chromatid exchanges in human whole blood lymphocyte culture at the highest dose examined without any metabolic activation system (Norppa and Vainio, 1983).

Dean et al. (1985) used a battery of short-term tests including bacterial mutation assays, mitotic gene conversion in *Saccharomyces cerevisiae* JD1 in the presence and absence of S9 and chromosomal damage in a cultured rat liver cell line. Ethylbenzene was not mutagenic in the range of concentrations tested (0.2, 2, 20, 50 and 200 ug/plate) for *S. typhimurium* TA98, TA100, TA1535, TA1537 and TA1538 or for *Escherichia coli* WP2 and WP2uvrA. Ethylbenzene also showed no response in the *S. cerevisiae* JD1 gene conversion assay. In contrast, ethylbenzene hydroperoxide showed positive responses with *E. coli* WP2 at 200 ug/plate in the presence of S9 and an equally significant response with the gene conversion system of yeast.

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II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

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C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

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II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

II.D.1. EPA DOCUMENTATION

U.S. EPA. 1980. Ambient Water Quality Criteria Document for Ethylbenzene. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Water Regulations and Standards, Washington, DC. EPA 440/5-80-048. NTIS PB 81-117590.

U.S. EPA. 1984. Health Effects Assessment for Ethylbenzene. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-86/008.

U.S. EPA. 1987. Drinking Water Criteria Document for Ethylbenzene.  
Prepared by the Office of Health and Environmental Assessment, Environmental  
Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking  
Water, Washington, DC.

\_\_\_ II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Ambient Water Quality Criteria Document and the Health Assessment  
Document have received Agency and external review. The Drinking Water  
Criteria Document has been extensively reviewed.

Agency Work Group Review: 10/07/87

Verification Date: 10/07/87

\_\_\_ II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Arthur S. Chiu / ORD -- (202)260-6764 / FTS 260-6764

Lynn Papa / ORD -- (513)569-7523 / FTS 684-7523

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED

FROM THE CHRIS MANUAL:

self-contained breathing apparatus; safety goggles.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

\*\* WEAR APPROPRIATE EQUIPMENT TO PREVENT:

Repeated or prolonged skin contact.

\*\* WEAR EYE PROTECTION TO PREVENT:

Reasonable probability of eye contact.

\*\* EXPOSED PERSONNEL SHOULD WASH:

Promptly when skin becomes contaminated.

\*\* REMOVE CLOTHING:

Immediately remove any clothing that becomes wet to avoid any flammability hazard.

\*\* REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)

OSHA (ETHYL BENZENE)

1000 ppm: Any powered air-purifying respirator with organic vapor

cartridge(s). \* Substance reported to cause eye irritation or damage may require eye protection. / Any supplied-air respirator. \* Substance reported to cause eye irritation or damage may require eye protection. / self-contained breathing apparatus. \* Substance reported to cause eye irritation or damage may require eye protection. / Any chemical cartridge respirator with organic vapor cartridge(s). \* Substance reported to cause eye irritation or damage may require eye protection.

2000 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator with a full facepiece. / Any self-contained breathing apparatus with a full facepiece.

EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.:

Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

'RTP51' LINE 2. [B28] Not enough string space - Out of Memory.

## CHEMTOX DATA

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## ----- IDENTIFIERS -----

CHEMTOX RECORD 210

LAST UPDATE OF THIS RECORD: 03/13/96

**NAME:** ETHYLENE DICHLORIDE  
**SYNONYMS:** AETHYLENCHLORID (German); 1,2-BICHLOROETHANE; BICHLORURE  
 D'ETHYLENE (French); BORER SOL; BROCID; CHLORURE  
 D'ETHYLENE (French); CLORURO DI ETHENE (Italian);  
 DESTRIXOL BORER-SOL; 1,2-DICHLOROETHAAN (Dutch);  
 1,2-DICHLOR-AETHAN (German); DICHLOREMULSION;  
 1,2-DICHLOROETHANE; DI-CHLOR-MULSION; DICHLORO-1,2-ETHANE  
 (French); alpha,beta-DICHLOROETHANE; sym-DICHLOROETHANE;  
 1,2-DICHLOROETHANE; DICHLOROETHYLENE; 1,2-DICHLOROETANO  
 (Italian); DUTCH LIQUID; DUTCH OIL; EDC; ENT 1,656; ETHANE  
 DICHLORIDE; ETHYLEENDICHLORIDE (Dutch); ETHYLENE CHLORIDE;  
 ETHYLENE DICHLORIDE; ETHYLENE DICHLORIDE (DOT);  
 1,2-ETHYLENE DICHLORIDE; FREON 150; GLYCOL DICHLORIDE;  
 NCI-C00511; ETHANE, 1,2-DICHLORO-; ENT-1656; DOWFUME;  
 1,2-ETHYLIDENE DICHLORIDE  
**CAS:** 107-06-2                      **RTECS:** K10525000  
**FORMULA:** C2H4Cl2                      **MOL WT:** 98.96  
**WLN:** G2G  
**CHEMICAL CLASS:** Halogenated h-carbon

See other identifiers listed below under Regulations.

## ----- PROPERTIES -----

**PHYSICAL DESCRIPTION:** clear liquid with a sweet odor like chloroform [note:  
 decomposes slowly, becomes acidic, and darkens in  
 color.]

<b>BOILING POINT:</b>	356.7 K	83.5 C	182.3 F
<b>MELTING POINT:</b>	237.75 K	-35.4 C	-31.8 F
<b>FLASH POINT:</b>	288.7 K	15.55 C	59.9 F
<b>AUTO IGNITION:</b>	685.92 K	412.7 C	775 F
<b>CRITICAL TEMP:</b>	561 K	287.85 C	550.13 F
<b>CRITICAL PRESS:</b>	5.1 kN/M2	50.2 atm	738 psia
<b>HEAT OF VAP:</b>	138 Btu/lb	76.64 cal/g	3.206x E5 J/kg
<b>HEAT OF COMB:</b>	-3400 Btu/lb	-1890 cal/g	-79x E5 J/kg
<b>VAPOR PRESSURE:</b>	64MM @ 20 C		
<b>UEL:</b>	15.6 %		
<b>LEL:</b>	6.2 %		
<b>IONIZATION POTENTIAL (eV):</b>	10.5		
<b>VAPOR DENSITY:</b>	3.4 (air=1)		
<b>EVAPORATION RATE:</b>	5.05(n-BUTYL ACETATE=1)		
<b>SPECIFIC GRAVITY:</b>	1.2569		
<b>DENSITY:</b>	1.256		
<b>WATER SOLUBILITY:</b>	0.8%		
<b>INCOMPATIBILITIES:</b>	strong oxidizers, strong caustics, chemically active metals, such as aluminum or magnesium powder, sodium,		

potassium; liquid ammonia [note:  
decomposes to vinyl chloride and hcl  
above 1112 f.]

REACTIVITY WITH WATER: N/R - SINKS IN WATER  
REACTIVITY WITH COMMON MATERIALS: No data  
STABILITY DURING TRANSPORT: No Data  
NEUTRALIZING AGENTS: No data  
POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: TOXIC AND IRRITATING HYDROGEN CHLORIDE  
AND PHOSGENE GASES  
ODOR DETECTED AT (ppm): 100 ppm  
ODOR DESCRIPTION: ether-like Source:CHRIS  
100 % ODOR DETECTION: No data

----- REGULATIONS -----

DOT hazard class: 3 FLAMMABLE LIQUID  
DOT guide: 26  
Identification number: UN1184  
DOT shipping name: Ethylene dichloride  
Packing group: II  
Label(s) required: FLAMMABLE LIQUID, POISON  
Special provisions: T14  
Packaging exceptions: 173.None  
Non bulk packaging: 173.202  
Bulk packaging: 173.243  
Quantity limitations-  
Per container air/rail: 1 L  
Cargo aircraft only: 60 L  
Vessel stowage: B  
Other stowage provisions:40

STCC NUMBER: 4909166

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:No

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.005 mg/L (01/09/89)

Maximum Contaminant Level Goals (MCLG): 0 mg/L (01/09/89)

CLEAN AIR ACT: CAA '90 Listed

EPA WASTE NUMBER: U077,D028,D001

CERCLA REF: Y

RQ DESIGNATION: B 100 pounds (45.4 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: Irritant

Acute toxicity: adverse effect to target organs.

Chronic toxicity: carcinogen  
Chronic toxicity: adverse effect to target organ  
after long period of exposure.  
Chronic toxicity: mutagen.  
Chronic toxicity: reproductive toxin.  
Fire hazard: flammable.

LISTED IN SARA Sect 313: Yes  
de minimus CONCENTRATION: 0.1 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Hazard class: Flammable liquid - Mailable as ORM-D  
Mailability: Domestic surface mail only  
Max per parcel: 1 GAL

NFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with  
self-contained breathing apparatus.  
FLAMMABILITY (RED) : (3) This material can be ignited under almost all  
temperature conditions.  
REACTIVITY (YELLOW): (0) Stable even under fire conditions.  
SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"  
ATSDR Toxicology Profile available (NTIS\*\* PB/90/171422/AS)  
California Assembly Bill 1803 Well Monitoring Chemicals.  
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.  
California Assembly Bill 1807 Toxic Air Contaminants.  
Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act Section 111 List.  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
DOT Hazardous Materials Table. 49 CFR 172.101  
DOT Marine Pollutant. Proposed list. 57 FR 3854, Jan 31, 1992  
EPA Carcinogen Assessment Group List  
EPA List of VOC chemicals from 40 CFR 60.489  
EPA Office of Pesticide Programs. List of active ingredients, 24 April, 1989.  
EPA TSCA 8(d) Health and Safety Data Rule - effective date 06/01/87  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
ETHYLENE DICHLORIDE [107-06-2]  
Massachusetts Substance List.  
National Toxicology Program list of anticipated human carcinogens  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a carcinogen.  
New Jersey Right to Know Substance List. Listed as a mutagen.

OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992  
Pennsylvania Hazardous Substance List  
Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264  
RCRA Hazardous Waste  
RCRA Toxicity Characteristics (TC) list dated March 29, 1990  
SARA Section 110 Priority List of CERCLA Hazardous Substances  
SARA Section 313 Toxic Chemicals List  
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)  
TSCA Chemical Hazard Information Profile (CHIP) available - dated 09/01/77  
Washington State Discarded Chemical Products List, November 17, 1989  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

SHORT TERM TOXICITY: INHALATION: levels of 10 to 30 ppm may cause dizziness, nausea, and vomiting. levels up to 50 ppm may cause weakness, trembling, headaches, abdominal cramps, liver and kidney damage, and fluid build up in lungs. may cause coma and death at high levels. SKIN: prolonged contact may cause irritation and skin rashes. Eyes: may cause redness, pain, and blurred vision. vapor can damage the cornea. INGESTION: ingestion of 2 ounces has resulted in nausea, vomiting, faintness, drowsiness, difficulty breathing, pale skin, internal bleeding, kidney damage, and death due to respiratory failure. other possible symptoms may include abdominal spasms, severe headache, lethargy, lowered blood pressure, diarrhea, shock, physical collapse, and coma.(NYDH)

LONG TERM TOXICITY: may cause eye, nose and throat irritation, nausea, vomiting, loss of appetite, nerve damage, liver and kidney damage. this substance has been determined to cause cancer in laboratory animals. whether it does so in humans is not known.(NYDH)

TARGET ORGANS: kidneys, liver, eyes, skin, CNS, cardiovascular sys [in animals: forestomach, mammary gland, and circulatory sys cancer]

SYMPTOMS: Inhalation of vapors causes nausea, drunkenness, depression. Contact of liquid with eyes may produce corneal injury. Prolonged contact with skin may cause a burn. Source: CHRIS

CONC IDLH: 50PPM

NIOSH REL: Potential occupational carcinogen 1 ppm Time weighted averages for 8-hour exposure 4 mg/M3 Time weighted averages for 8-hour exposure 2 ppm Ceiling exposures which shall at no time be exceeded 8 mg/M3 Ceiling exposures which shall at no time be exceeded

ACGIH TLV: TLV = 10ppm(40 mg/M3)  
A STEL: Not listed

OSHA PEL: Transitional Limits:  
PEL = 50 PPM; CEILING = 100 PPM; MAXIMUM PEAK ABOVE CEILING FOR 5 MINUTES IN ANY 3 HOURS = 200  
Final Rule Limits:  
TWA = 1 ppm (4 mg/M3)  
STEL = 2 ppm(8 mg/M3)

MAK INFORMATION: Carcinogenic working material without MAK  
In the Commission's view, an animal carcinogen.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC  
to be possibly carcinogenic to  
humans, but having (usually) no  
human evidence.  
MAK: An animal carcinogen.  
NIOSH: Carcinogen defined by NIOSH  
with no further categorization.  
NTP: Carcinogen defined by NTP as  
reasonably anticipated to be  
carcinogenic, with limited  
evidence in humans or sufficient  
evidence in experimental animals.  
ACGIH: Not listed  
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-man TCLo:4000 ppm/1H PCOC\*\* -,500,66  
PERIPHERAL NERVE AND SENSATION  
Flaccid paralysis without anesthesia  
BEHAVIORAL  
Coma  
GASTROINTESTINAL  
Nausea or vomiting

orl-hmn LDLo:286 mg/kg CLCEAL 86,203,47  
GASTROINTESTINAL  
Ulceration or bleeding from stomach  
GASTROINTESTINAL  
Nausea or vomiting  
LIVER  
Fatty liver degeneration

orl-hmn TDLo:428 mg/kg SOMEAU 22(10),132,58  
BEHAVIORAL  
Somnolence(general depressed activity)

LUNGS, THORAX, OR RESPIRATION

Cough

GASTROINTESTINAL

Nausea or vomiting

orl-man TDLo:892 mg/kg WILEAR 28,983,75

GASTROINTESTINAL

Hypermotility,diarrhea

GASTROINTESTINAL

Nausea or vomiting

LIVER

Jaundice,other or unclassified

LD50 value: orl-rat LD50:670 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:670 mg/kg  
ihl-rat LC50:1000 ppm/7H  
ipr-rat LD50:807 mg/kg  
scu-rat LD50:1 gm/kg  
orl-mus LD50:413 mg/kg  
ihl-mus LCLo:5 gm/m3/2H  
ipr-mus LD50:470 mg/kg  
scu-mus LDLo:380 mg/kg  
orl-dog LD50:5700 mg/kg  
ivn-dog LDLo:175 mg/kg  
ihl-mky LC50:3000 ppm/7H  
orl-rbt LD50:860 mg/kg  
ihl-rbt LCLo:3000 ppm/7H  
skn-rbt LD50:2800 mg/kg  
scu-rbt LDLo:1200 mg/kg  
ihl-pig LCLo:3000 ppm/7H  
ihl-gpg LCLo:1500 ppm/7H  
ipr-gpg LDLo:600 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

skn-rbt 625 mg open MLD  
eye-rbt 63 mg SEV

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

ihl-rat TCLo:300 ppm/7H (6-15D preg) BAMRDU 5,149,80  
EFFECTS ON FERTILITY  
Post-implantation mortality

California Prop 65: Carcinogen (10/01/87)

----- EPA's IRIS DATA SUMMARY -----

1,2-Dichloroethane; CASRN 107-06-2 (04/01/92)

## II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Chemical Name -- 1,2-Dichloroethane  
-- 107-06-2  
Last Revised -- 01/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

### II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

#### II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Based on the induction of several tumor types in rats and mice treated by gavage and lung papillomas in mice after topical application

#### II.A.2. HUMAN CARCINOGENICITY DATA

None.

#### II.A.3. ANIMAL CARCINOGENICITY DATA

1,2-Dichloroethane in corn oil was administered by gavage to groups of 50 each male and female Osborne-Mendel rats and B6C3F1 mice. Treatment was for 78 weeks followed by an additional observation period of 12-13 weeks for mice or 32 weeks for low-dose rats. TWA dosages were 47 and 95 mg/kg/day for rats, 97 and 195 mg/kg/day for male mice and 149 and 299 mg/kg/day for female mice. All high-dose male rats died after 23 weeks of observation; the last high-dose female died after 15 weeks. Male rats had significantly increased incidence of forestomach squamous-cell carcinomas and circulatory system hemangiosarcomas. Female rats and mice were observed to have significant increases in mammary adenocarcinoma incidence. Mice of both sexes

developed alveolar/bronchiolar adenomas, females developed endometrial stromal polyps and sarcomas, and males developed hepatocellular carcinomas (NCI, 1978).

Inhalation exposure of Wistar, Sprague-Dawley rats and Swiss mice did not result in increased tumor incidence (Spencer et al., 1951; Maltoni et al., 1980). An elevation that was not statistically significant in lung adenomas was seen in A/st mice treated i.p. with 1,2-dichloroethane in tricapylin (Theiss et al., 1977). ICR/Ha Swiss mice treated topically had a significant increase in benign lung papillomas, but not skin carcinomas (van Duuren et al., 1979).

\_\_\_ II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

1,2-Dichloroethane was mutagenic for Salmonella in assays wherein excessive evaporation was prevented; exogenous metabolism by mammalian systems enhanced the response (Nestmann et al., 1980; Barber et al., 1981; Rannug et al., 1978). Both somatic cell mutations and sex-linked recessives were induced in Drosophila (Nylander et al., 1979; Shakarnis, 1969, 1970; King et al., 1979). Metabolites of 1,2-dichloroethane have been shown to form adducts with DNA after in vitro or in vivo exposures.

\_\_\_ II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

\_\_\_ II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor --  $9.1E-2$  per (mg/kg)/day

Drinking Water Unit Risk --  $2.6E-6$  per (ug/L)

Extrapolation Method -- Linearized multistage procedure with time-to-death analysis, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	$4E+1$ ug/L
E-5 (1 in 100,000)	$4E+0$ ug/L
E-6 (1 in 1,000,000)	$4E-1$ ug/L

\_\_\_ II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- hemangiosarcomas

Test Animals -- rat/Osborne-Mendel, male

Route -- gavage

Reference -- NCI, 1978

Administered Dose (mg/kg/day)	Human Equivalent Dose (mg/kg/day)	Tumor Incidence
0	0	0/40
47	4.46	9/48
95	8.23	7/27

### II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

Equivalent human dose was calculated using an assumed 70-kg human weight and the reported terminal rat weight of 0.5 kg. Metabolism of 1,2-dichloroethane after oral exposure is dose-dependent. Metabolism was estimated to be <50% saturation at the dose equal to the TWA for rats but near saturation for the high-dose mice in the NCI (1978) bioassay. Because of the high mortality rate in the high-dose rats, a time-to-event analysis was used to quantitate the risk estimate. It was assumed that rats with hemangiosarcomas were killed by the tumors. The 95% upper bound of the risk was calculated using 90 weeks to approximate the lifetime risk.

The unit risk should not be used if the water concentration exceeds  $4E+3$  ug/L, since above this concentration the unit risk may not be appropriate.

### II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Adequate numbers of animals were treated and observed for the majority of their expected lifespan. The incidence of hemangiosarcoma was significantly elevated in the treated animals and was dose-related. A slope factor of  $6.2E-2$  (mg/kg)/day, calculated from data on hepatocellular carcinomas in male mice (NCI, 1978), is supportive of the risk estimate.

### II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

#### II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk --  $2.6E-5$  per (ug/cu.m)

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
4 (1 in 10,000)	4E+0 ug/cu.m
5 (1 in 100,000)	4E-1 ug/cu.m
E-6 (1 in 1,000,000)	4E-2 ug/cu.m

\_\_\_ II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

The inhalation unit risk was calculated from oral data in Section II.B.2., assuming 100% absorption and metabolism at the low dose.

\_\_\_ II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

Reitz et al. (1982) found the major urinary metabolites in rats of ingested and inhaled 1,2-dichloroethane to be identical and generated in the same relative amounts.

The unit risk should not be used if the air concentration exceeds 4E+2 ug/cu.m, since above this concentration the unit risk may not be appropriate.

\_\_\_ II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

This inhalation risk estimate was derived from the oral data presented in Section II.B.2. Based on the negative inhalation study of Maltoni et al. (1980), a 95% upper bound on risk was inferred to be 1.0E-6 per (ug/cu.m) approximately 26 times smaller than in the unit risk calculated from the rat gavage data.

\_\_\_ II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

\_\_\_ II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Health Assessment Document for 1,2-Dichloroethane. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA 600/8-84-006F.

\_\_\_ II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Health Assessment Document for 1,2-Dichloroethane received both Agency and external review.

Agency Work Group Review: 12/04/86

Classification Date: 12/04/86

II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Charalingayya B. Hiremath / ORD -- (202)260-5725 / FTS 260-5725

Chao W. Chen / ORD -- (202)260-5898 / FTS 260-5898

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED

FROM THE CHRIS MANUAL:

clean, body-covering clothes & safety glasses with side shields.  
respiratory protection: up to 50 ppm, none; 50 ppm to 2%, full face mask  
& canister; greater than 2%, self-contained breathing apparatus.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

\*\* WEAR APPROPRIATE EQUIPMENT TO PREVENT:

Repeated or prolonged skin contact.

\*\* WEAR EYE PROTECTION TO PREVENT:

Reasonable probability of eye contact.

\*\* EXPOSED PERSONNEL SHOULD WASH:

Promptly when skin becomes contaminated.

\*\* REMOVE CLOTHING:

Immediately remove any clothing that becomes wet to avoid any flammability hazard.

\*\* REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)

NIOSH (ETHYLENE DICHLORIDE)

Greater at any detectable concentration. : Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991

INHALATION: if victim is overcome, remove him to fresh air, keep him

quiet and warm, and get medical attention immediately; if breathing stops, give artificial respiration.

**INGESTION:** induce vomiting; call a physician; treat the symptoms.

**EYES:** flush immediately with copious amounts of flowing water for at least 15 min.

**SKIN:** remove clothing and wash skin thoroughly with soap and water; wash contaminated clothing before reuse.

**FIRST AID SOURCE:** DOT Emergency Response Guide 1990.

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

**FIRE EXTINGUISHMENT:** Foam, carbon dioxide, dry chemical. Note: Water may be ineffective. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).

**DOT SHIPPING NAME:** Ethylene dichloride

**DOT ID NUMBER:** UN1184

ERG93

GUIDE 26

**\*POTENTIAL HAZARDS\***

**\*FIRE OR EXPLOSION**

Flammable/combustible material; may be ignited by heat, sparks or flames.

Vapor may travel to a source of ignition and flash back.

Container may explode in heat of fire.

Vapor explosion hazard indoors, outdoors or in sewers.

Runoff to sewer may create fire or explosion hazard.

**\*HEALTH HAZARDS**

May be poisonous if inhaled or absorbed through skin.

Vapors may cause dizziness or suffocation.

Contact may irritate or burn skin and eyes.

Fire may produce irritating or poisonous gases.

Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

**\*EMERGENCY ACTION\***

Keep unnecessary people away; isolate hazard area and deny entry.

Stay upwind; keep out of low areas. Positive pressure self-contained

breathing apparatus (SCBA) and structural firefighters' protective

clothing will provide limited protection. \*Isolate for 1/2 mile in all

directions if tank, rail car or tank truck is involved in fire. CALL

Emergency Response Telephone Number on Shipping Paper first. If

Shipping Paper not available or no answer, CALL CHEMTREC AT

1-800-424-9300. If water pollution occurs, notify the appropriate

authorities.

**FIRE**

**Small Fires:** Dry chemical, CO<sub>2</sub>, water spray or alcohol-resistant

foam. Do not use dry chemical extinguishers to control fires involving

nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

**\*SPILL OR LEAK**

Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you can do it without risk.

Water spray may reduce vapor; but it may not prevent ignition in closed spaces.

**Small Spills:** Take up with sand or other noncombustible absorbent material and place into containers for later disposal.

**Large Spills:** Dike far ahead of liquid spill for later disposal.

**\*FIRST AID**

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and factual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement.

The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies or omissions within this database, or in any of its printed or displayed output forms.

## CHEMTOX DATA

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## ----- IDENTIFIERS -----

CHEMTOX RECORD 5249

LAST UPDATE OF THIS RECORD: 03/13/96

NAME: ETHYLENE, TETRACHLORO-  
 SYNONYMS: ANKILOSTIN; ANTISOL 1; CARBON BICHLORIDE; CARBON  
 DICHLORIDE; CZTEROCHLOROETYLEN (Polish); DIDAKENE;  
 DOW-PER; ENT 1,860; ETHENE, TETRACHLORO-; ETHYLENE  
 TETRACHLORIDE; FEDAL-UN; NCI-C04580; NEMA; PER; PERAWIN;  
 PERC; PERCHLOORETHYLEEN, PER (Dutch); PERCHLOR;  
 PERCHLORAETHYLEN, PER (German); PERCHLORETHYLENE;  
 PERCHLORETHYLENE, PER (French); PERCHLOROETHYLENE;  
 PERCLEN; PERCLOROETILENE (Italian); PERCOSOLVE; PERK;  
 PERKLONE; PERSEC; TETLEN; TETRACAP; TETRACHLOORETHEEN  
 (Dutch); TETRACHLORAETHEN (German); TETRACHLORETHYLENE;  
 TETRACHLOROETHENE; TETRACHLOROETHYLENE;  
 1,1,2,2,-TETRACHLOROETHYLENE; TETRACHLOROETHYLENE (DOT);  
 TETRACLOROETENE (Italian); TETRALENO; TETRALEX; TETRAVEC;  
 TETROGUER; TETROPIL

CAS: 127-18-4 RTECS: KX3850000

FORMULA: C2Cl4 MOL WT: 165.82

WLN: GYGUYGG

CHEMICAL CLASS:Halogenated h-carbon

See other identifiers listed below under Regulations.

## ----- PROPERTIES -----

PHYSICAL DESCRIPTION: colorless liquid, chloroform-like odor.

BOILING POINT: 394.2 K 121 C 249.8 F

MELTING POINT: 254.26 K -18.9 C -2.1 F

FLASH POINT: Not available

AUTO IGNITION: Not available

VAPOR PRESSURE: 15.8MM @ 22C

UEL: -

LEL: -

IONIZATION POTENTIAL (eV): 9.32

VAPOR DENSITY: No data

EVAPORATION RATE: 2.59(n-BUTYL ACETATE=1)

SPECIFIC GRAVITY: 1.625 @20/4C

DENSITY: 1.6311 @ 15/4C

WATER SOLUBILITY: 0.02 % IN H2O; MISCIBLE WITH MOST  
ORGANIC SOLVENTS AND OILSINCOMPATIBILITIES: strong oxidizers, chemically active  
metals, such as barium, lithium,  
beryllium, sodium; caustic soda; sodium  
hydroxide; potash

REACTIVITY WITH WATER: No data on water reactivity

REACTIVITY WITH COMMON MATERIALS: No data

STABILITY DURING TRANSPORT: No Data  
NEUTRALIZING AGENTS: No data  
POLYMERIZATION POSSIBILITIES: No data  
FIRE GASES: HCL AND PHOSGENE\CORROSIVE  
ODOR DETECTED AT (ppm): 5 ppm  
ODOR DESCRIPTION: mildly sweet Source:CHRIS  
100 % ODOR DETECTION: No data

----- REGULATIONS -----

DOT hazard class: 6.1 POISON  
DOT guide: 74  
Identification number: UN1897  
DOT shipping name: Tetrachloroethylene  
Packing group: III  
Label(s) required: KEEP AWAY FROM FOOD  
Special provisions: N36,T1  
Packaging exceptions: 173.153  
Non bulk packaging: 173.203  
Bulk packaging: 173.241  
Quantity limitations-  
Passenger air/rail: 60 L  
Cargo aircraft only: 220 L  
Vessel stowage: A  
Other stowage provisions:40

STCC NUMBER: 4940355

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:No

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.005 mg/L (07/30/92)

Maximum Contaminant Level Goals (MCLG): 0 mg/L (07/30/92)

CLEAN AIR ACT: CAA '90 Listed

EPA WASTE NUMBER: U210,D039

CERCLA REF: Y

RQ DESIGNATION: B 100 pounds (45.4 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: Irritant

Acute toxicity: adverse effect to target organs.

Chronic toxicity: carcinogen

Chronic toxicity: adverse effect to target organ  
after long period of exposure.

Chronic toxicity: mutagen.

Chronic toxicity: reproductive toxin.

LISTED IN SARA Sect 313: Yes

Minimum CONCENTRATION: 0.1 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Hazard class: ORM-A  
Mailability: Domestic service and air transportation; shipper's declaration required  
Per parcel: 10 GAL; 1 PT

NFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.  
FLAMMABILITY (RED) : (0) This material does not readily burn.  
REACTIVITY (YELLOW): (0) Stable even under fire conditions.  
SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"  
California Assembly Bill 1803 Well Monitoring Chemicals.  
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.  
California Assembly Bill 1807 Toxic Air Contaminants.  
Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act Section 111 List.  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
DOT Hazardous Materials Table. 49 CFR 172.101  
DOT Marine Pollutant. Proposed list. 57 FR 3854, Jan 31, 1992  
EPA Carcinogen Assessment Group List  
EPA List of VOC chemicals from 40 CFR 60.489  
EPA TSCA 8(d) Health and Safety Data Rule - effective date 06/01/87  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
ETHYLENE, TETRACHLORO- [127-18-4]  
Massachusetts Substance List.  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a carcinogen.  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
Pennsylvania Hazardous Substance List  
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264  
RCRA Hazardous Waste  
RCRA Toxicity Characteristics (TC) list dated March 29, 1990  
SARA Section 313 Toxic Chemicals List  
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)  
Washington State Discarded Chemical Products List, November 17, 1989  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

SHORT TERM TOXICITY: INHALATION: exposures of 200 ppm for 1 hour can cause

irritation of the nose, mouth and throat, dizziness, headaches and lightheadedness; exposures of 1,000 ppm for 30 minutes can cause difficult breathing, weakness, loss of muscle control, irritability, tremors, convulsions, paralysis, coma, heart irregularities and death. SKIN: can cause dry, scaly skin, a mild to moderate burning sensation, redness and inflammation. Eyes: can cause burning and irritation. INGESTION: can cause nausea, vomiting, diarrhea, bloody stool, a reddening of face and neck, weakness and loss of muscle control.(NYDH)

**LONG TERM TOXICITY:** exposures over 200 ppm during weeks or months can cause irritation of the respiratory tract, nausea, headache, sleeplessness, abdominal pains, constipation, dizziness, increased perspiration, fatigue, skin infection, kidney and liver damage, fluid in the lungs and coma. most of these effects will disappear after exposure is stopped. tetrachloroethylene at high levels has caused cancer and birth defects in mice. whether it causes cancer in humans is unknown.(NYDH)

**TARGET ORGANS:** skin, mucous membrane, eyes, CNS, gastrointestinal tract. liver, kidneys; resp sys; [in animals: liver tumors]

**SYMPTOMS:** Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury. Source: CHRIS

**CONC IDLH:** 150ppm

**NIOSH REL:** Potential occupational carcinogen --MINIMIZE EXPOSURE (Limit of quantitation 0.4 ppm)

**ACGIH TLV:** TLV = 25ppm(170 mg/M3) A3

**ACGIH STEL:** STEL = 100 ppm(685 mg/M3)A3

**OSHA PEL:** Transitional Limits:

PEL = 100 PPM; CEILING = 200 PPM; MAXIMUM PEAK ABOVE CEILING FOR 5 MINUTES IN ANY 2 HOURS = 300

Final Rule Limits:

TWA = 25 ppm (170 mg/M3)

**MAK INFORMATION:** 50 ppm

345 mg/M3

Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.

There is no reason to fear a risk of damage to the developing embryo or fetus when MAK values are adhered

to.

A compound which is justifiably suspected of having carcinogenic potential.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be probably carcinogenic to humans with (usually) at least limited human evidence.

MAK: A compound which is justifiably suspected of having carcinogenic potential.

NIOSH: Carcinogen defined by NIOSH with no further categorization.

NTP: Carcinogen defined by NTP as reasonably anticipated to be carcinogenic, with limited evidence in humans or sufficient evidence in experimental animals.

ACGIH: Animal carcinogen. The chemical is carcinogenic in experimental animals at a relatively high dose, by routes or administration, at sites, or histological types, or by mechanisms that are not considered relevant to worker exposure.

OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-hmn TCLo:96 ppm/7H NTIS\*\* PB257-185  
PERIPHERAL NERVE AND SENSATION

Local anesthetic

SENSE ORGANS

Eye

Conjunctive irritation

BEHAVIORAL

Hallucinations, distorted perceptions

orl-chd TDLo:545 mg/kg JTCTDW 23,103,85

BEHAVIORAL

Coma

LD50 value: orl-rat LD50:2629 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:2629 mg/kg

ihl-rat LC50:34200 mg/m3/8H

ipr-rat LD50:4678 mg/kg

orl-mus LD50:8100 mg/kg

ihl-mus LC50:5200 ppm/4H  
scu-mus LD50:65 gm/kg  
orl-dog LDLo:4 gm/kg  
ipr-dog LD50:2100 mg/kg  
ivn-dog LDLo:85 mg/kg  
orl-cat LDLo:4 gm/kg  
orl-rbt LDLo:5 gm/kg  
scu-rbt LDLo:2200 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

skn-rbt 810 mg/24H SEV  
eye-rbt 162 mg MLD

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

ihl-rat TCLo:1000 ppm/24H (14D pre/1-22D preg) APTOD9  
19,A21,80

SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Musculoskeletal system

ihl-rat TCLo:1000 ppm/24H (1-22D preg) APTOD9 19,A21,80

EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TCLo:900 ppm/7H (7-13D preg) TJADAB 19,41A,79

EFFECTS ON NEWBORN  
Live birth index(# fetuses per liter)  
EFFECTS ON NEWBORN

EFFECTS ON NEWBORN  
Behavioral

ihl-rat TCLo:300 ppm/7H (6-15D preg) TXAPA9 32,84,75

EFFECTS ON FERTILITY  
Post-implantation mortality

ihl-mus TCLo:300 ppm/7H (6-15D preg) TXAPA9 32,84,75

EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Musculoskeletal system  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Homeostatis

California Prop 65: Carcinogen (04/01/88)

No significant risk level 14. ugD (01/01/94)

----- EPA's IRIS DATA SUMMARY -----  
Tetrachloroethylene; CASRN 127-18-4 (04/01/92)

\_II\_ CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Tetrachloroethylene  
CASRN -- 127-18-4

This substance/agent has been evaluated by the U.S. EPA for evidence of human carcinogenic potential. This does not imply that this agent is necessarily a carcinogen. The evaluation for this chemical is under review by an inter-office Agency work group. A risk assessment summary will be included on IRIS when the review has been completed.

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED  
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

\*\* WEAR APPROPRIATE EQUIPMENT TO PREVENT:  
Repeated or prolonged skin contact.

\*\* WEAR EYE PROTECTION TO PREVENT:  
Reasonable probability of eye contact.

\*\* EXPOSED PERSONNEL SHOULD WASH:  
Promptly when skin becomes contaminated.

\*\* REMOVE CLOTHING:  
Promptly remove non-impervious clothing that becomes contaminated.

\*\* REFERENCE: NIOSH

FIRST AID SOURCE: NIOSH

EYE: irr immed

SKIN: soap wash promptly

INHALATION: art resp

INGESTION: ipecac, vomit

FIRST AID SOURCE: CHRIS Manual 1991

INHALATION: if illness occurs, remove patient to fresh air, keep him warm and quiet, and get medical attention.

INGESTION: induce vomiting only on physician's recommendation.

YES AND

SKIN: flush with plenty of water and get medical attention if irritation or injury occurs.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

----- INITIAL INCIDENT RESPONSE -----

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).

DOT SHIPPING NAME: Tetrachloroethylene

DOT ID NUMBER: UN1897

ERG93

GUIDE 74

**\*POTENTIAL HAZARDS\***

**\*HEALTH HAZARDS**

Vapors may cause dizziness or suffocation.  
Exposure in an enclosed area may be very harmful.  
Contact may irritate or burn skin and eyes.  
Fire may produce irritating or poisonous gases.  
Runoff from fire control or dilution water may cause pollution.

**\*FIRE OR EXPLOSION**

Some of these materials may burn, but none of them ignites readily.  
Most vapors heavier than air.  
\*Air/vapor mixtures may explode when ignited.  
Container may explode in heat of fire.

**\*EMERGENCY ACTION\***

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. \*Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

**\*FIRE**

Small Fires: Dry chemical or CO2.  
Large Fires: Water spray, fog or regular foam.  
Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks.

**\*SPILL OR LEAK**

Shut off ignition sources; no flares, smoking or flames in hazard area.  
Stop leak if you can do it without risk.  
Small Liquid Spills: Take up with sand, earth or other noncombustible absorbent material.  
Large Spills: Dike far ahead of liquid spill for later disposal.

**FIRST AID**

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes

with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and factual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement. The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies or omissions within this database, or in any of its printed or displayed output forms.



National Primary Ambient Air Quality Standards

1.5 ug/M3 maximum arithmetic mean averaged over a calendar year

National Secondary Ambient Air Quality Standards

same as primary standard

DOT hazard class: 6.1 POISON  
DOT guide: 53  
Identification number: UN2291  
DOT shipping name: LEAD COMPOUNDS, SOLUBLE, N.O.S.  
Packing group: III  
Label(s) required: KEEP AWAY FROM FOOD  
Special provisions:  
Packaging exceptions: 173.153  
Non bulk packaging: 173.213  
Bulk packaging: 173.240  
Quantity limitations-  
Passenger air/rail: 100 KG  
Cargo aircraft only: 200 KG  
Vessel stowage: A  
Other stowage provisions:

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:No

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): Treatment technique (12/07/92)

Maximum Contaminant Level Goals (MCLG): 0 mg/L (12/07/92)

AIR ACT: CAA '90 Listed and CAA '77 Sect 109

EPA WASTE NUMBER: D008

CERCLA REF: Y

RQ DESIGNATION: A 10 pounds (4.54 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Chronic toxicity: carcinogen  
Chronic toxicity: adverse effect to target organ  
after long period of exposure.  
Chronic toxicity: mutagen.  
Chronic toxicity: reproductive toxin.

LISTED IN SARA Sect 313: Yes

de minimus CONCENTRATION: 0.1 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Hazard class: ORM-B

Mailability: Domestic service and air transportation; shipper's declaration required

Max per parcel: 25 LBS; 5 LBS

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"  
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.  
California Assembly Bill 1807 Toxic Air Contaminants.  
California Proposition 65 Developmental Toxin List  
California Proposition 65 Female Reproductive Toxin List  
California Proposition 65 Male Reproductive Toxin List  
Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act Section 109 National Ambient Air Quality Standards List  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
LEAD [7439-92-1]  
Massachusetts Substance List.  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a teratogen.  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
OSHA Specifically regulated substance. See 29 CFR 1910.1025  
Pennsylvania Hazardous Substance List  
RCRA Hazardous Waste  
RCRA Toxicity Characteristics (TC) list dated March 29, 1990  
Section 313 Toxic Chemicals List

----- TOXICITY DATA -----

SHORT TERM TOXICITY: LASSITUDE, INSOMNIA, PALLOR, EYE GROUND,  
ANOREXIA, LOW-WEIGHT, MALNUTRITION,  
CONSTIPATION, ABDOMINAL PAIN, COLIC;  
HYPOTENSE, ANEMIA; GINGIVAL LEAD LINE;  
TREMBLING PARALYSIS WRIST. \*\* Source: 2

LONG TERM TOXICITY: unknown

TARGET ORGANS: gi,CNS,kidneys,blood,gingival tissue,eyes

SYMPTOMS: INHALATION, INGESTION, CONTACT:  
ENCEPHALOPATHY; KIDNEY DISEASE; IRRIT EYES;  
HYPOTENSION, WEAKNESS, FACIAL PALLOR,  
LASSITUDE, INSOMNIA, PAL, EYE GROUND,  
ANOREXIA, WEIGHT LOSS, MALNUTRITION,  
CONSTIPATION, ABDOM PAIN, COLIC; HYPOTENSION,  
ANEMIA, GINGIVAL LEAD LINE; TREMORS,  
PARALYSIS WRIST, ANKLES. METALLIC TASTE,  
INCREASED SALIVATION, PYORRHEA (FLOW OF  
MUCOUS). NEUROMUSCULAR: NUMBNESS AND TINGLING

OF EXTREMITIES WITH SENSORY DISTURBANCE,  
EXTENSOR WEAKNESS OF WRISTS AND ANKLES, LOSS  
OF MUSCLE TONE, TREMOR INCREASED DEEP-TENDON  
REFLEXES, MUSCULAR CRAMPS AND ACHING,  
MUSCULAR ATROPHY. CNS: VISUAL DISTURBANCES,  
HEADACHE, NERVOUSNESS OF DEPRESSION,  
INSOMNIA, MENTAL CONFUSION, DELIRIUM. Source:  
NIOSH, THIC

CONC IDLH: 100mg/m<sup>3</sup>(ASPb)

NIOSH REL: <0.1 mg/M<sup>3</sup> Air level to be maintained so that worker  
blood level remains <0.06 mg/100 g of whole blood

ACGIH TLV: TLV = 0.15mg/M<sup>3</sup> as LEAD

ACGIH STEL: Not listed

OSHA PEL: Final Rule Limits:

TWA = See 29 CFR 1910.1025 and 1926.62  
50 ug/M<sup>3</sup>

MAK INFORMATION: 0.1 calculated as total dust mg/M<sup>3</sup>  
Substance with systemic effects, onset of effect over  
2 hours: Peak = 10xMAK for 30 minutes, once per shift  
of 8 hours.  
Risk of damage to the developing embryo or fetus must  
be considered probable. Damage cannot be excluded even  
when the MAK values are adhered to.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC  
to be possibly carcinogenic to  
humans, but having (usually) no  
human evidence.

MAK: Not listed

NIOSH: Not listed

NTP: Not listed

ACGIH: Animal carcinogen. The  
chemical is carcinogenic in  
experimental animals at a  
relatively high dose, by routes or  
administration, at sites, or  
histological types, or by  
mechanisms that are not considered  
relevant to worker exposure.

OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

oral-mn TDLo:450 mg/kg/6Y JAMAAP 237,2627,77  
PERIPHERAL NERVE AND SENSATION

Flaccid paralysis without anesthesia  
BEHAVIORAL  
Hallucinations, distorted perceptions  
BEHAVIORAL  
Muscle weakness

LD50 value: No LD50 in RTECS 1992

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

ipr-rat LDLo:1 gm/kg  
orl-pgn LDLo:160 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:790 mg/kg (multigenerations) AEHLAU  
23,102,71

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

EFFECTS ON EMBRYO OR FETUS

Fetal death

orl-rat TDLo:1140 mg/kg (14D pre-21D post) PHMCAA  
20,201,78

EFFECTS ON NEWBORN

Behavioral

orl-rat TDLo:520 mg/kg (7-22D preg/10D post) FEPRA7  
37,394,78

EFFECTS ON NEWBORN

orl-rat TDLo:1100 mg/kg (1-22D preg) FEPRA7 37,895,78

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Blood and lymphatic systems(including spleen and  
marrow)

EFFECTS ON NEWBORN

Growth statistics(e.g.,reduced weight gain)

ihl-rat TLo:10 mg/m<sup>3</sup>/24H (1-21D preg) ZHPMAT  
165,294,77

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Blood and lymphatic systems(including spleen and  
marrow)

ihl-rat TLo:3 mg/m<sup>3</sup>/24H (1-21D preg) ZHPMAT 165,294,77

EFFECTS ON NEWBORN

orl-mus TDLo:1120 mg/kg (multigenerations) AEHLAU  
23,102,71

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

EFFECTS ON EMBRYO OR FETUS

Fetal death

orl-mus TDLo:6300 mg/kg (1-21D preg) EXPEAM 31,1312,75

EFFECTS ON FERTILITY

Female fertility index

EFFECTS ON FERTILITY

Pre-implantation mortality

orl-mus TDLo:300 mg/kg (1-2D preg) TXCYAC 6,129,76

EFFECTS ON FERTILITY

Other measures of fertility

orl-mus TDLo:4800 mg/kg (1-16D preg) BECTA6 18,271,77

EFFECTS ON EMBRYO OR FETUS

Cytological changes(including somatic cell genetic  
material)

orl-dom TDLo:662 mg/kg (1-21W preg) TXAPA9 25,466,73

EFFECTS ON NEWBORN

Behavioral

California Prop 65: Developmental toxin (02/27/87)  
Female reproductive toxin (02/27/87)  
Male reproductive toxin (02/27/87)  
Acceptable intake level-inhalation .5 ugD (01/01/94)  
Carcinogen (10/01/92)

----- EPA's IRIS DATA SUMMARY -----

Lead and compounds (inorganic); CASRN 7439-92-1 (04/01/92)

\_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Lead and compounds (inorganic)

CASRN -- 7439-92-1

Last Revised -- 05/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L

drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Table 5) provides details on the rationale and methods used to derive carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

## II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

### II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Sufficient animal evidence. Ten rat bioassays and one mouse assay have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. Animal assays provide reproducible results in several laboratories, in multiple rat strains with some evidence of multiple tumor sites. Short term studies show that lead affects gene expression. Human evidence is inadequate.

### II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. There are four epidemiologic studies of occupational cohorts exposed to lead and lead compounds. Two studies (Dingwall-Fordyce and Lane, Nelson et al., 1982) did not find any association between exposure and mortality. Selevan et al. (1985), in their retrospective cohort mortality study of primary lead smelter workers, found a slight decrease in the total cancer mortality (SMR=95). Apparent excesses were observed for respiratory cancer (SMR=111, obs=41,  $p>0.05$ ) and kidney cancer (SMR=204, obs=6,  $p>0.05$ ). Cooper and Gaffey (1975) and Cooper (1985 update) performed a cohort mortality study of battery plant workers and lead smelter workers. They found statistically significant excesses for total cancer mortality (SMR=113, obs=344), stomach cancer (SMR=168, obs=34), and lung cancer (SMR=124, obs=109) in the battery plant workers. Although similar excesses were observed in the smelter workers, they were not statistically significant. Cooper and Gaffey (1975) felt it was possible that individual subjects were monitored primarily on the basis of obvious signs of lead exposure, while others who showed no symptoms of lead poisoning were not monitored.

All of the available studies lacked quantitative exposure information, as well as information on the possible contribution from smoking. All studies also included exposures to other metals such as arsenic, cadmium, and zinc for which no adjustment was done. The cancer excesses observed in the lung and stomach were relatively small (<200). There was no consistency of site among the various studies, and no study showed any dose-response relationship. Thus, the available human evidence is considered to be inadequate to refute or demonstrate any potential carcinogenicity for humans from lead exposure.

### II.A.3. ANIMAL CARCINOGENICITY DATA

sufficient. The carcinogenic potential of lead salts (primarily phosphates and acetates) administered via the oral route or by injection has been demonstrated in rats and mice by more than 10 investigators. The most characteristic cancer response is bilateral renal carcinoma. Rats given lead acetate or subacetate orally have developed gliomas, and lead subacetate also produced lung adenomas in mice after i.p. administration. Most of these investigations found a carcinogenic response only at the highest dose. The lead compounds tested in animals are almost all soluble salts. Metallic lead, lead oxide and lead tetraalkyls have not been tested adequately. Studies of inhalation exposure have not been located in the literature.

Azar et al. (1973) administered 10, 50, 100, and 500 ppm lead as lead acetate in dietary concentrations to 50 rats/sex/group for 2 years. Control rats (100/sex) received the basal laboratory diet. In a second 2-year feeding study, 20 rats/group were given diets containing 0, 1000, and 2000 ppm lead as lead acetate. No renal tumors were reported in the control groups or in treated animals of either sex receiving 10 to 100 ppm. Male rats fed 500, 1000, and 2000 ppm lead acetate had an increased renal tumor incidence of 5/50, 10/20, and 16/20, while 7/20 females in the 2000-ppm group developed renal tumors.

The Azar et al. (1973) study is limited by the lack of experimental detail. The possibility of environmental contamination from lead in the air or drinking water was not mentioned. The strains of rats used were not specified in the study, but the Health Effects Assessment for Lead (U.S. EPA, 1981) indicates the rats were Wistar strain. The weight gain at 1000 and 2000 ppm is reported to be depressed, but details were not given.

Kasprzak et al. (1985), in investigating the interaction of dietary calcium on lead carcinogenicity, fed 1% lead subacetate (8500 ppm Pb) to male Sprague-Dawley rats in the diet for 79 weeks. Of the rats surviving (29/30) in this treatment group beyond 58 weeks, 44.8% had renal tumors. Four rats had adenocarcinomas; the remaining nine had adenomas. Bilateral tumors were noted. No renal tumors were noted among the controls.

As part of a study to determine interactions between sodium nitrite, ethyl urea and lead, male Sprague-Dawley rats were given lead acetate in their drinking water for 76 weeks (Koller et al., 1986). The concentration of lead was 2600 ppm. No kidney tumors were detected among the 10 control rats. Thirteen of 16 (81%) lead-treated rats had renal tubular carcinoma; three tumors were detected at 72 weeks and the remainder detected at the termination of the study.

Van Esch and Kroes (1969) fed basic lead acetate at 0, 0.1%, and 1.0% in the diet to 25 Swiss mice/sex/group for 2 years. No renal tumors developed in the control group, but 6/25 male mice of 0.1% basic lead acetate group had renal tumors (adenomas and carcinomas combined). In the 1.0% group, one female had a renal tumor. The authors thought that the low incidence in the 1.0% group was due to early mortality.

Hamsters given lead subacetate at 0.5% and 1% in the diet had no significant renal tumor response (Van Esch and Kroes, 1969).

\_\_\_II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Lead acetate induces cell transformation in Syrian hamster embryo cells (DiPaolo et al., 1978) and also enhances the incidence of simian adenovirus induction. Lead oxide showed similar enhanced adenovirus induction (Casto et al., 1979).

Under certain conditions lead compounds are capable of inducing chromosomal aberrations in vivo and in tissue cultures. Grandjean et al. (1983) showed a relationship between SCE and lead exposure in exposed workers. Lead has been shown, in a number of DNA structure and function assays, to affect the molecular processes associated with the regulation of gene expression (U.S. EPA, 1986).

-----

\_\_\_II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

Quantifying lead's cancer risk involves many uncertainties, some of which are unique to lead. Age, health, nutritional state, body burden, and exposure duration influence the absorption, release, and excretion of lead. In addition, current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk. Thus, the Carcinogen Assessment Group recommends that a numerical estimate not be used.

-----

\_\_\_II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

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\_\_\_II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

\_\_\_II.D.1. EPA DOCUMENTATION

U.S. EPA. 1984. Health Effects Assessment for Lead. Prepared by the Office

of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-86/055. NTIS PB85-163996/AS.

U.S. EPA. 1986. Air Quality Criteria Document for Lead. Volumes III, IV. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC, for the Office of Air Quality Planning and Standards. EPA-600/8-83/028dF.

U.S. EPA. 1987. Preliminary review of the carcinogenic potential of lead associated with oral exposure. Prepared by the Office of Health and Environmental Assessment, Carcinogenic Assessment Group, Washington DC, for the Office of Drinking Water, Office of Solid Waste and the Office of Emergency and Remedial Response (Superfund). OHEA-C-267. Internal Review Draft.

II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The review of the carcinogenic potential of lead associated with oral exposure has received Agency review.

The 1986 Air Quality Criteria Document for Lead has received Agency and External Review.

Agency Work Group Review: 05/04/88

Verification Date: 05/04/88

II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

William Pepelko / ORD -- (202)260-5898 / FTS 260-5898

James Cogliano / ORD -- (202)260-9243 / FTS 260-9243

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED  
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

\* WEAR APPROPRIATE EQUIPMENT TO PREVENT:  
Repeated or prolonged skin contact.

\* WEAR EYE PROTECTION TO PREVENT:  
Reasonable probability of eye contact.

**\*\* EXPOSED PERSONNEL SHOULD WASH:**  
At the end of each work shift.

**REMOVE CLOTHING:**  
Promptly remove non-impervious clothing that becomes contaminated.

**\*\* REFERENCE: NIOSH**

**RECOMMENDED RESPIRATION PROTECTION** Source: NIOSH POCKET GUIDE (85-114)  
OSHA (LEAD)

Not in excess of 0.5 mg/M<sup>3</sup>: Half-mask, air-purifying respirator equipped with high efficiency filters.

Not in excess of 2.5 mg/M<sup>3</sup>: Full facepiece air-purifying respirator equipped with high-efficiency filters.

Not in excess of 50 mg/M<sup>3</sup>: (1) Any powered, air-purifying respirator with high efficiency filters; or (2) Half-mask supplied-air respirator operated in positive-pressure mode.

Not in excess of 100 mg/M<sup>3</sup>: Supplied air respirator with full facepiece hood, or helmet or suit and operated in positive pressure mode.

Unknown concentration or Firefighting: Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.

**FIRST AID SOURCE:** NIOSH

**EYE:** irr immed

**SKIN:** soap flush promptly

**INHALATION:** art resp

**INGESTION:** water, vomit

**AID SOURCE:** DOT Emergency Response Guide 1990.

Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).

**DOT SHIPPING NAME:** LEAD COMPOUNDS, SOLUBLE, N.O.S.

**DOT ID NUMBER:** UN2291

ERG93

GUIDE 53

**\*POTENTIAL HAZARDS\***

**\*HEALTH HAZARDS**

Poisonous if swallowed.

Inhalation of dust or mist may be poisonous.

Fire may produce irritating or poisonous gases.

Runoff from fire control or dilution water may cause pollution.

**\*FIRE OR EXPLOSION**

Some of these materials may burn, but none of them ignites readily.

**\*EMERGENCY ACTION\***

Keep unnecessary people away; isolate hazard area and deny entry. Stay

upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

**\*FIRE**

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.

Move container from fire area if you can do it without risk.

**\*SPILL OR LEAK**

Do not touch or walk through spilled material; stop leak if you can do it without risk.

Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.

Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

Large Spills: Dike far ahead of liquid spill for later disposal.

**\*FIRST AID**

Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and actual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement. The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies or omissions within this database, or in any of its printed or displayed output forms.

## CHEMTOX DATA

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## ----- IDENTIFIERS -----

TOXIC RECORD 323

LAST UPDATE OF THIS RECORD: 03/13/96

NAME: POLYCHLORINATED BIPHENYL(S) (PCBS)  
 SYNONYMS: AROCLOR; AROCLOR 1221; AROCLOR 1232; AROCLOR 1242; AROCLOR 1248; AROCLOR 1254; AROCLOR 1260; AROCLOR 1262; AROCLOR 1268; AROCLOR 2565; AROCLOR 4465; BIPHENYL, POLYCHLORO-; CHLOPHEN; CHLOREXTOL; CHLORINATED BIPHENYL; CHLORINATED DIPHENYL; CHLORINATED DIPHENYLENE; CHLORO BIPHENYL; CHLORO 1,1-BIPHENYL; CLOPHEN; DYKANOL; FENCLOR; INERTEEN; KANECHLOR; KANECHLOR 300; KANECHLOR 400; KANECHLOR 500; MONTAR; NOFLAMOL; PCB; PCBs; PHENOCHLOR; PHENOCLOR; POLYCHLORINATED BIPHENYL; POLYCHLOROBIPHENYL; PYRALENE; PYRANOL; SANTOTHERM; SANTOTHERM FR; SOVOL; THERMINOL FR-1; POLYCHLORINATED BIPHENYLS; PCB'S; 1,1'-BIPHENYL CHLORO DERIVS; 1,1'-BIPHENYL, CHLORO DERIVS.; AROCLOR - POLYCHLORINATED BIPHENYL; POLYCHLORINATED BIPHENYLS (PBB'S)

CAS: 1336-36-3 RTECS: Tq1350000

FORMULA: W99 MOL WT:

WLN:

CHEMICAL CLASS:Halogenated h-carbon

See other identifiers listed below under Regulations.

## ----- PROPERTIES -----

PHYSICAL DESCRIPTION: light yellow oily liquid or white solid powder with a weak odor

BOILING POINT: NA  
 MELTING POINT: NA  
 FLASH POINT: 468.15 K 195 C 383 F  
 AUTO IGNITION: Not available  
 VAPOR PRESSURE:  
 UEL: Not applicable  
 LEL: Not applicable  
 VAPOR DENSITY: No data  
 SPECIFIC GRAVITY: 1.3 - 1.8@ 20C  
 DENSITY: 1.3 g/cc or 12.09 lb/gal  
 WATER SOLUBILITY:  
 INCOMPATIBILITIES:

REACTIVITY WITH WATER: No data on water reactivity  
 REACTIVITY WITH COMMON MATERIALS: No data  
 STABILITY DURING TRANSPORT: No Data  
 NEUTRALIZING AGENTS: No data  
 POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: None reported other than possible unburned vapors

ODOR DETECTED AT (ppm): Data not available  
ODOR DESCRIPTION: Practically odorless Source:CHRIS  
100% ODOR DETECTION: No data

----- REGULATIONS -----

DOT hazard class: 9 CLASS 9  
DOT guide: 31  
Identification number: UN2315  
DOT shipping name: Polychlorinated biphenyls  
Packing group: II  
Label(s) required: CLASS 9  
Special provisions: 9  
Packaging exceptions: 173.N81  
Non bulk packaging: 173.155  
Bulk packaging: 173.202  
Quantity limitations-  
Passenger air/rail: 240  
Cargo aircraft only: 100 L  
Vessel stowage: 220 L  
Other stowage provisions:A

STCC NUMBER: 4961666

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:Yes

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.0005 mg/L (07/30/92)

Maximum Contaminant Level Goals (MCLG): 0 mg/L (07/30/92)

Clean Air Act: CAA '90 Listed

EPA WASTE NUMBER: None

CERCLA REF: Y

RQ DESIGNATION: X 1 pound (0.454 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Chronic toxicity: carcinogen

Chronic toxicity: adverse effect to target organ  
after long period of exposure.

Chronic toxicity: reproductive toxin.

LISTED IN SARA Sect 313: Yes

de minimus CONCENTRATION: 0.1 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Not given

IFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with

self-contained breathing apparatus.

FLAMMABILITY (RED) : (1) This material must be preheated before ignition  
can occur.

ACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

California Assembly Bill 1803 Well Monitoring Chemicals.  
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.  
Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
Clean Water Act Section 311 Hazardous Chemicals List.  
DOT Hazardous Materials Table. 49 CFR 172.101  
EPA Carcinogen Assessment Group List  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Section 12(b) Export Rule Notification.  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
Massachusetts Substance List.  
National Toxicology Program list of anticipated human carcinogens  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a carcinogen.  
New Jersey Right to Know Substance List. Listed as a teratogen.  
POLYCHLORINATED BIPHENYL(S) (PCBS) [1336-36-3]  
Pennsylvania Hazardous Substance List  
SARA Section 110 Priority List of CERCLA Hazardous Substances  
SARA Section 313 Toxic Chemicals List  
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: unknown

TARGET ORGANS: skin, liver

SYMPTOMS: Acne from skin contact. Source: CHRIS

CONC IDLH: Nonegiven

NIOSH REL: Not given

ACGIH TLV: Not listed

ACGIH STEL: Not listed

OSHA PEL: Not in Table Z-1-A

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed  
MAK: Not listed  
NIOSH: Carcinogen defined by NIOSH  
with no further categorization.  
NTP: Carcinogen defined by NTP as  
reasonably anticipated to be  
carcinogenic, with limited  
evidence in humans or sufficient  
evidence in experimental animals.  
ACGIH: Not listed  
OSHA: Not listed

LD50 value: No LD50 in RTECS 1992

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-mus LD50:1900 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:400 mg/kg (6-15D preg) FAATDF 11,440,88  
EFFECTS ON NEWBORN  
Behavioral

orl-rat TDLo:420 mg/kg (21D post) FAATDF 11,440,88  
EFFECTS ON NEWBORN  
Behavioral

orl-rat TDLo:247 mg/kg (60D pre-22D post) FAATDF  
15,457,90  
EFFECTS ON NEWBORN  
Behavioral

orl-rat TDLo:500 mg/kg (13D preg) GISAAA 56(9),44,91  
EFFECTS ON NEWBORN

ipr-rat TDLo:700 mg/kg (14D pre) FAATDF 11,440,88  
EFFECTS ON NEWBORN

Behavioral

oral-mam TDLo:325 mg/kg (30D pre/1-36D preg) AMBOCX  
6,239,77

EFFECTS ON NEWBORN

Stillbirth

EFFECTS ON NEWBORN

Live birth index(# fetuses per liter)

EFFECTS ON NEWBORN

Viability index(# alive at day 4 per # born alive)

California Prop 65: No significant risk level .09 ugD (01/01/94)

----- EPA's IRIS DATA SUMMARY -----  
Polychlorinated biphenyls (PCBs); CASRN 1336-36-3 (04/01/92)

II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Polychlorinated biphenyls (PCBs)  
CASRN -- 1336-36-3  
Last Revised -- 01/01/90

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- hepatocellular carcinomas in three strains of rats and two strains of mice and inadequate yet suggestive evidence of excess risk of liver cancer in humans by ingestion and inhalation or dermal contact.

II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. Although there are many studies, the data are inadequate due to confounding exposures or lack of exposure quantification. The first indication of carcinogenicity associated with PCB exposure was reported at a New Jersey petrochemical plant involving 31 research and development employees and 41 refinery workers (Bahn et al., 1976, 1977). Although a statistically significant increase in malignant melanomas was reported, the two studies failed to report a quantified exposure level and to account for the presence of other potential or known carcinogens. In an expanded report of these studies, NIOSH (1977) concurred with the Bahn et al. (1976) findings. Brown and Jones (1981) reported a retrospective cohort mortality study on 2567 workers who had completed at least 3 months of employment at one or two capacitor manufacturing plants. Exposure levels were 24-393 mg/cu.m at plant A and 318-1260 mg/cu.m at plant B. No excess risk of cancer was observed. In a 7-year follow-up study, Brown (1987) reported a statistically significant excess risk of liver and biliary cancer, with four of the five liver cancers in female workers at plant B. A review of the pathology reports indicated that two of the liver tumors counted in the follow-up study were not primary liver tumors. When these tumors are excluded the elevation in incidence is not statistically significant. The results also may be confounded by population differences in alcohol consumption, dietary habits, and ethnic composition.

Bertazzi et al. (1987) conducted a mortality study of 544 male and 1556 female employees of a capacitor-making facility in Northern Italy. Aroclor 1254 and Pyralene 1476 were used in this plant until 1964. These were progressively replaced by Pyralenes 3010 and 3011 until 1970, after which lower chlorinated Pyralenes were used exclusively. In 1980 the use of PCBs was abandoned. Some employees also used trichloroethylene but, according to the authors, were presumed to be protected by efficient ventilation. Air samples were collected and analyzed for PCBs in 1954 and 1977 because of reports of chloracne in workers. Quantities of PCBs on workers' hands and workplace surfaces also were measured in 1977. In 18 samples, levels ranged from 0.2-159.0 ug/sq.m on workplace surfaces and 0.3-9.2 ug/sq.m on workers' hands.

The authors compared observed mortality with that expected between 1946 and 1982 based on national and local Italian mortality rates. With vital status ascertainment 99.5% complete, relatively few deaths were reported by 1982 [30 males (5.5%) and 34 females (2.2%)]. In cohort males, the number of deaths from malignant tumors was significantly higher than expected compared with local or national rates, as was the number of deaths from cancer of the GI tract (6 observed vs. 1.7 national expected and 2.2 local expected). Of the six GI cancer deaths, one was due to liver cancer and one to biliary tract cancer. Deaths from hematologic neoplasms in males were also higher than expected, but the excess was not statistically significant. Total cancer deaths in females were significantly elevated in comparison to local rates (12 observed vs. 5.3 expected). None of these were liver or biliary cancers. The number of deaths from hematologic neoplasms in females was higher than expected when compared with local rates (4 observed vs. 1.1 expected). This study is limited by several factors, particularly the small number of deaths that occurred by the cut-off period. The power of the study is insufficient to detect an elevated risk of site-specific cancer. In addition, the authors

stated, after an examination of the individual cases, that interpretation of the increase in GI tract cancer in males was limited, as it appeared likely some of these individuals had only limited PCB exposure. Confounding factors may have included possible contamination of the PCBs by dibenzofurans, exposure of some of the workers to trichloroethylene, alkylbenzene, and epoxy resins.

Two occurrences of ingestion of PCB-contaminated rice oil have been reported: the Yusho incident of 1968 in Japan and the Yu-Cheng incident of 1979 in Taiwan. Amano et al. (1984) completed a 16-year retrospective cohort mortality study of 581 male and 505 female victims of the Yusho incident. A consistently high risk of liver cancer in females over the entire 16 years was observed; liver cancer in males was also significantly increased. Several serious limitations are evident in this study. There was a lack of information regarding job histories or the influence of alcoholism or smoking. The information concerning the diagnosis of liver cancer was obtained from the victims' families, and it is not clear whether this information was independently verified by health professionals. For some of the cancers described, the latency period is shorter than would be expected. Furthermore, the contaminated oils contained polychlorinated dibenzofurans and polychlorinated quinones as well as PCBs, and the study lacks data regarding exposure to the first two classes of compounds. There is strong evidence indicating that the health effects seen in Yusho victims were due to ingestion of polychlorinated dibenzofurans, rather than to PCBs themselves (reviewed in EPA, 1988). The results of the Amano et al. study can, therefore, be considered as no more than suggestive of carcinogenicity of PCBs.

### A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. PCB mixtures assayed in the following studies were commercial preparations and may not be the same as mixtures of isomers found in the environment. Although animal feeding studies demonstrate the carcinogenicity of commercial PCB preparations, it is not known which of the PCB congeners in such preparations are responsible for these effects, or if decomposition products, contaminants or metabolites are involved in the toxic response. Early bioassays with rats (Kimura and Baba, 1973; Ito et al., 1974) were inadequate to assess carcinogenicity due to the small number of animals and short duration of exposure to PCB. A long-term bioassay of Aroclor 1260 reported by Kimbrough et al. (1975) produced hepatocellular carcinomas in female Sherman rats when 100 ppm was administered for 630 days to 200 animals. Hepatocellular carcinomas and neoplastic nodules were observed in 14 and 78%, respectively, of the dosed animals, compared with 0.58 and 0%, respectively, of the controls.

The NCI (1978) reported results for 24 male and 24 female Fischer 344 rats treated with Aroclor 1254 at 25, 50, or 100 ppm for 104 to 105 weeks. Although carcinomas of the gastrointestinal tract were observed among the treated animals only, the incidence was not statistically significantly elevated. An apparent dose-related incidence of hepatic nodular hyperplasia in both sexes as well as hepatocellular carcinomas among mid- to high-dose treated males was reported (4-12%, compared to 0% in controls).

Norback and Weltman (1985) fed 70 male and 70 female Sprague-Dawley rats a diet containing Aroclor 1260 in corn oil at 100 ppm for 16 months, followed by a 10 ppm diet for an additional 8 months, then a basal diet for 5 months. Control animals (63 rats/sex) received a diet containing corn oil for 18 months, then a basal diet alone for 5 months. Among animals that survived for at least 18 months, females exhibited a 91% incidence (43/47) of hepatocellular carcinoma. An additional 4% (2/47) had neoplastic nodules. In males corresponding incidences were 4% (2/46) for carcinoma and 11% (5/46) for neoplastic nodules. Concurrent liver morphology studies were carried out on tissue samples obtained by partial hepatectomies of three animals/group at eight time points. These studies showed the sequential progression of liver lesions to hepatocellular carcinomas.

Orally administered PCB resulted in increased incidences of hepatocellular carcinomas in two mouse strains. Ito et al. (1973) treated male dd mice (12/group) with Kanechlors 500, 400 and 300 each at dietary levels of 100, 250 or 500 ppm for 32 weeks. The group fed 500 ppm of Kanechlor 500 had a 41.7% incidence of hepatocellular carcinomas and a 58.3% incidence of nodular hyperplasia. Hepatocellular carcinomas and nodular hyperplasia were not observed in mice fed 100 or 250 ppm of Kanechlor 500, nor among those fed Kanechlors 400 or 300 at any concentrations.

Schaeffer et al. (1984) fed male Wistar rats diets containing 100 ppm of the PCB mixtures Clophen A 30 (30% chlorine by weight) or Clophen A 60 (60% chlorine by weight) for 800 days. The PCB mixtures were reported to be free of furans. Clophen A 30 was administered to 152 rats, Clophen A 60 to 141 rats, and 139 rats received a standard diet. Mortality and histologic lesions were reported for animals necropsied during each 100-day interval for all three groups. Of the animals that survived the 800-day treatment period, 1/53 rats (2%) in the control group, 3/87 (3%) in the Clophen A 30 group and 52/85 (61%) in the Clophen A 60 group had developed hepatocellular carcinoma. The incidence in the Clophen A 60 group was significantly elevated in comparison to the control group. Neoplastic nodules were reported in 2/53 control, 35/87 Clophen A 30, and 34/85 Clophen A 60-treated animals. The incidence of nodules was significantly increased in both treatment groups in comparison to the control group. Neoplastic liver nodules and hepatocellular carcinomas appeared earlier and at higher incidence in the Clophen A 60 group relative to the Clophen A 30 group. The authors interpreted the results as indicative of a carcinogenic effect related to the degree of chlorination of the PCB mixture. The authors also suggested that these findings support those of others, including Ito et al. (1973) and Kimbrough et al. (1975), in which hepatocellular carcinomas were produced by more highly chlorinated mixtures.

Kimbrough and Linder (1974) dosed groups of 50 male BALB/cJ mice (a strain with a low spontaneous incidence of hepatoma) with Aroclor 1254 at 300 ppm in the diet for 11 months or 6 months, followed by a 5-month recovery period. Two groups of 50 mice were fed a control diet for 11 months. The incidence of hepatomas in survivors fed Aroclor 1254 for 11 months was 10/22. One hepatoma was observed in the 24 survivors fed Aroclor 1254 for 6 months.

II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Most genotoxicity assays of PCBs have been negative. The majority of in vivo assays of PCB mixtures and various congeners showed no evidence of carcinogenic effects (Schoeny et al., 1979; Schoeny, 1982; Wyndham et al., 1976). Of various tests on the clastogenic effect of PCBs (Heddle and Bruce, 1977; Green et al., 1975), only Peakall et al. (1972) reported results indicative of a possible clastogenic action by PCBs in dove embryos.

Chlorinated dibenzofurans (CDFs), known contaminants of PCBs, and chlorinated dibenzodioxins (CDDs) are structurally related to and produce certain biologic effects similar to those of PCB congeners. While the CDDs are known to be carcinogenic, the carcinogenicity of CDFs is still under evaluation.

II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 7.7/mg/kg/day

Drinking Water Unit Risk -- 2.2E-4/ug/L

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	5E-1 ug/L
E-5 (1 in 100,000)	5E-2 ug/L
E-6 (1 in 1,000,000)	5E-3 ug/L

II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- trabecular carcinoma/adenocarcinoma, neoplastic nodule

Test Animals -- rat/Sprague-Dawley, female

Route -- diet

Reference -- Norback and Weltman, 1985

Administered Dose (mg/kg)/day (TWA)	Human Equivalent Dose (mg/kg)/day	Tumor Incidence
0	0	1/49
3.45	0.59	45/47

### II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

Human equivalent dosage assumes a TWA daily dose of 3.45 mg/kg/day. This reflects the dosing schedule of 5 mg/kg/day (assuming the rat consumes an amount equal to 5% of its bw/day) for the first 16 months, 2.5 mg/kg/day for the next 8 months, and no dose for the last 5 months.

A slope factor of 3.9/mg/kg/day was based on data from the Kimbrough et al. (1975) study of female Sherman rats fed Aroclor 1260. The estimate based on the data of Norback and Weltman (1985) is preferred because Sprague-Dawley rats are known to have low incidence of spontaneous hepatocellular neoplasms. Moreover, the latter study spanned the natural life of the animal, and concurrent morphologic liver studies showed the sequential progression of liver lesions to hepatocellular carcinomas.

Although it is known that PCB congeners vary greatly as to their potency in producing biological effects, for purposes of this carcinogenicity assessment Aroclor 1260 is intended to be representative of all PCB mixtures. There is some evidence that mixtures containing more highly chlorinated biphenyls are more potent inducers of hepatocellular carcinoma in rats than mixtures containing less chlorine by weight (reviewed in Kimbrough, 1987 and Schaeffer et al., 1984).

The unit risk should not be used if the water concentration exceeds 50 ug/L, since above this concentration the slope factor may differ from that stated.

### II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

The Norback and Weltman study used an adequate number of animals, observed for their normal lifespan. Only one non-zero test dose was used. A second risk estimate was also calculated based on the numbers of malignant tumors alone, as called for in the EPA's guidelines for carcinogen risk assessment. The slope factor thus derived is 5.7/mg/kg/day, which is 26% less than that derived using combined malignant tumors and neoplastic nodules. This risk estimate is supported by one based on data of Kimbrough et al. (1975).

PCB mixtures in drinking water may not be the same as the mixtures introduced or used for testing carcinogenicity in animals.

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### II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

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EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

\_\_\_ II.D.1. EPA DOCUMENTATION

U.S. EPA. 1988. Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs). Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC.

\_\_\_ II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1988 Drinking Water Criteria Document for PCBs has received OHEA review.

Agency Work Group Review: 04/22/87

Verification Date: 04/22/87

\_\_\_ II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Chandrasekhar Hiremath / ORD -- (202)260-5725/ FTS 260-5725

Deodas Mukerjee / ORD -- (513)569-7572/ FTS 684-7572  
9-7572/ FTS 684-7572

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED  
FROM THE CHRIS MANUAL:

FIRST AID SOURCE: CHRIS Manual 1991  
SKIN: wash with soap and water.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.  
In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

----- INITIAL INCIDENT RESPONSE -----

FIRE EXTINGUISHMENT: Water, foam, dry chemical, or carbon dioxide. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport  
Information - Publication DOT 5800.5 (1990).

DOT SHIPPING NAME: Polychlorinated biphenyls

DOT ID NUMBER: UN2315

ERG93

GUIDE 31

**\*POTENTIAL HAZARDS\***

**\*FIRE OR EXPLOSION**

Some of these materials may burn, but none of them ignites readily.  
Material may be transported hot.

**\*HEALTH HAZARDS**

Contact may cause burns to skin and eyes.  
Inhalation of asbestos dust may have a damaging effect on the lungs.  
Fire may produce irritating or poisonous gases.  
Runoff from fire control or dilution water may cause pollution.

**\*EMERGENCY ACTION\***

Keep unnecessary people away; isolate hazard area and deny entry.  
Positive pressure self-contained breathing apparatus (SCBA) and  
structural firefighters' protective clothing will provide limited  
protection. CALL Emergency Response Telephone Number on Shipping Paper  
first. If Shipping Paper not available or no answer, CALL CHEMTREC AT  
1-800-424-9300. If water pollution occurs, notify the appropriate  
authorities.

**\*FIRE**

Small Fires: Dry chemical, CO<sub>2</sub>, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.

Move container from fire area if you can do it without risk.

Do not scatter spilled material with high-pressure water streams.

Dike fire control water for later disposal.

**\*SPILL OR LEAK**

Stop leak if you can do it without risk.

Avoid inhalation of asbestos dust.

Small Dry Spills: With clean shovel place material into clean, dry container  
and cover loosely; move containers from spill area.

Small Spills: Take up with sand or other noncombustible absorbent material  
and place into containers for later disposal.

Large Spills: Dike far ahead of liquid spill for later disposal.

Cover powder spill with plastic sheet or tarp to minimize spreading.

**\*FIRST AID**

In case of contact with material, immediately flush eyes with running  
water for at least 15 minutes. Wash skin with soap and water. Remove  
and isolate contaminated clothing and shoes at the site.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on  
the part of the compilers of the CHEMTOX database to obtain useful, accurate,  
and factual data. The use of these data shall be in accordance with the  
guidelines and limitations of the user's CHEMTOX license agreement.  
The COMPILERS of the CHEMTOX database shall not be held liable for inaccuracies  
or omissions within this database, or in any of its printed or displayed output



TOXIC FIRE GASES: HCl and unburned toxic vapors  
ODOR DETECTED AT (ppm): 260 ppm  
DESCRIPTION: Pleasant, sweet Source:CHRIS  
ODOR DETECTION: No data

----- REGULATIONS -----

DOT hazard class: 2.1 FLAMMABLE GAS  
DOT guide: 17  
Identification number: UN1086  
DOT shipping name: Vinyl chloride, inhibited  
Packing group:  
Label(s) required: FLAMMABLE GAS  
Special provisions: B44  
Packaging exceptions: 173.306  
Non bulk packaging: 173.304  
Bulk packaging: 173.314, 315  
Quantity limitations-  
Passenger air/rail: Forbidden  
Cargo aircraft only: 150 kg  
Vessel stowage: B  
Other stowage provisions:40

STCC NUMBER: 4905792

CLEAN WATER ACT Sect.307:Yes

CLEAN WATER ACT Sect.311:No

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 0.002 mg/L (01/09/89)

Maximum Contaminant Level Goals (MCLG): 0 mg/L (01/09/89)

CLEAN AIR ACT: CAA '90 Listed

CLEAN AIR ACT Sect 112 Flam TQ=10000

EPA WASTE NUMBER: U043,D043,D001

CERCLA REF: Not listed

RQ DESIGNATION: X 1 pound (0.454 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: adverse effect to target organs.  
Chronic toxicity: carcinogen  
Chronic toxicity: adverse effect to target organ  
after long period of exposure.  
Chronic toxicity: mutagen.  
Chronic toxicity: reproductive toxin.  
Fire hazard: flammable.  
Sudden pressure: compressed gases.  
Reactive hazard: unstable/reactive.  
Acute toxicity: Toxic. LD50 > 50 and <= 500  
mg/kg (oral rat).

LISTED IN SARA Sect 313: Yes

de minimus CONCENTRATION: 0.1 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Class: Not given  
Mailability: Nonmailable  
Max per parcel: 0

NFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.  
FLAMMABILITY (RED) : (4) This material forms readily ignitable mixtures in air.  
REACTIVITY (YELLOW): (2) Normally unstable and readily undergoes violent change, but does not detonate.  
SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV list "Threshold Limit Values for 1992-1993"  
ATSDR Toxicology Profile available (NTIS\*\* PB/90/103870/AS)  
California OSHA Carcinogens List.  
California Assembly Bill 1803 Well Monitoring Chemicals.  
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.  
California Assembly Bill 1807 Toxic Air Contaminants.  
Canadian Domestic Substances List  
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.  
Clean Air Act Section 111 List.  
Clean Air Act Section 112 Hazardous Air Pollutants List.  
Clean Air Act Section 112(r) Accidental Release List -Flammables:TQ = 10000 lbs  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 307 Priority Pollutants  
DOT Hazardous Materials Table. 49 CFR 172.101  
EPA Carcinogen Assessment Group List  
EPA List of VOC chemicals from 40 CFR 60.489  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
Known carcinogen (ACGIH). "Threshold Limit Values for 1992-1993"  
Massachusetts Substance List.  
National Toxicology Program (NTP) list of human carcinogens  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
New Jersey Right to Know Substance List. Listed as a carcinogen.  
New Jersey Right to Know Substance List. Listed as a mutagen.  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992  
Pennsylvania Hazardous Substance List  
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264  
RCRA Hazardous Waste  
RCRA Toxicity Characteristics (TC) list dated March 29, 1990

SARA Section 313 Toxic Chemicals List

Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)

VINYL CHLORIDE [75-01-4]

Washington State Discarded Chemical Products List, November 17, 1989

Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----- TOXICITY DATA -----

**SHORT TERM TOXICITY:** INHALATION: exposure at 8,000 ppm for 5 minutes can cause a feeling of intoxication, tiredness, drowsiness, abdominal pain, numbness and tingling in fingers and toes, pains in joints, coughing, sneezing, irritability and loss of appetite and weight. SKIN: contact with liquid may cause frostbite; contact with vapor may cause irritation and rash. absorption is possible through the skin. Eyes: can cause severe and immediate irritation. INGESTION: none found.(NYDH)

**LONG TERM TOXICITY:** may cause club-like swelling and shortening of finger tips. skin may become thickened and stiff with coarse, whitish patches. bones and joints of arms and legs may suffer damage. liver and spleen damage may occur. not all symptoms disappear after exposure stops. vinyl chloride has caused liver cancer in occupationally exposed individuals.(NYDH)

**TARGET ORGANS:** skin, eyes, mucous membranes, central nervous system, liver, kidneys, blood, resp sys, lymphatic sys; [liver cancer]

**SYMPTOMS:** INHALATION: high concentrations cause dizziness, anesthesia, lung irritation. SKIN: may cause frostbite; phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate. Source: CHRIS

**CONC IDLH:** None given

**NIOSH REL:** Potential occupational carcinogen (use 1910.1017)

**ACGIH TLV:** TLV = 5ppm(13 mg/M3) Confirmed human carcinogen (A1)

**ACGIH STEL:** Not listed

**OSHA PEL:** Final Rule Limits:  
TWA = 1 ppm  
CEILING = 5 ppm  
CONSULT 29CFR 1910.1017

**AK INFORMATION:** Carcinogenic working material without MAK  
Capable of inducing malignant tumors as shown by experience with humans.

CARCINOGEN?: Y STATUS: See below

REFERENCES:

HUMAN POSITIVE IARC\*\* 19,377,79  
ANIMAL POSITIVE IARC\*\* 7,291,74  
HUMAN SUSPECTED IARC\*\* 7,291,74  
ANIMAL POSITIVE IARC\*\* 19,377,79  
HUMAN POSITIVE IARC\*\* 28,151,82

CARCINOGEN LISTS:

IARC: Carcinogen as defined by  
IARC as carcinogenic to humans,  
with sufficient epidemiological  
evidence.  
MAK: Capable of inducing malignant  
tumors as shown by experience in  
humans.  
NIOSH: Carcinogen defined by NIOSH  
with no further categorization.  
NTP: Carcinogen defined by NTP as  
known to be carcinogenic, with  
evidence from human studies.  
ACGIH: Carcinogen defined by ACGIH  
TLV Committee as a confirmed human  
carcinogen, recognized to have  
carcinogenic or cocarcinogenic  
potential.  
OSHA: Cancer suspect

Value: orl-rat LD50:500 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:500 mg/kg  
ihl-rat LC50:18 pph/15M  
ihl-mam LCLo:200 ppm/18M

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

ihl-man TCLo:30 mg/m<sup>3</sup> (5Y male) GTPZAB 24(5),28,80

PATERNAL EFFECTS  
Spermatogenesis

ihl-rat TCLo:100 ppm/6H (26W male) EESADV 10,281,85

PATERNAL EFFECTS  
Testes,epididymis,sperm duct

ihl-rat TCLo:500 ppm/7H (6-15D preg) TXAPA9 33,134,75  
EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TClO:1500 ppm/24H (1-9D preg) TXCYAC 11,45,78  
EFFECTS ON FERTILITY  
Post-implantation mortality

ihl-rat TClO:500 ppm/7H (6-15D preg) EVHPAZ 41,171,81  
EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Musculoskeletal system

ihl-rat TClO:250 ppm/6H (55D pre) JTEHD6 3,965,77  
EFFECTS ON FERTILITY  
Female fertility index

ihl-mus TClO:30000 ppm/6H (5D male) EVHPAZ 21,71,77  
EFFECTS ON FERTILITY  
Pre-implantation mortality

ihl-mus TClO:500 ppm/7H (6-15D preg) EVHPAZ 41,171,81  
EFFECTS ON EMBRYO OR FETUS  
Fetotoxicity(except death,e.g.,stunted fetus)  
SPECIFIC DEVELOPMENTAL ABNORMALITIES  
Musculoskeletal system

California Prop 65: Carcinogen (02/27/87)  
No significant risk level 3. ugD (01/01/94)

----- PROTECTION AND FIRST AID -----

PROTECTION SUGGESTED  
FROM THE CHRIS MANUAL:

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)  
OSHA (VINYL CHLORIDE)

Unknown, or above 3600 ppm: Open-circuit, self-contained breathing apparatus, pressure demand type, with full facepiece.

Not over 3600 ppm: Combination type C supplied air respirator, pressure demand type, with full or half facepiece, and auxiliary self-contained air supply; or

Not over 1000 ppm: Combination type, supplied air respirator continuous flow type, with full or half facepiece, and auxiliary self-contained air supply. / Type C, Supplied air respirator, continuous flow type, with full or half facepiece, helmet or hood.

Not over 100 ppm: (A) Combination type C supplied air respirator demand type; with full facepiece, and auxiliary self-contained air supply; or (B) Open-circuit self-contained breathing apparatus with full facepiece, in demand mode; or (C) Type C supplied air respirator, demand type, with full facepiece.

Not over 25 ppm: (A) A powered air-purifying respirator with hood, helmet, full or half facepiece, and a canister which provides a service

life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm, or (B) Gas mask, front- or back-mounted canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm.

Over 10 ppm: (A) Combination type C supplied-air respirator, demand type, with half facepiece, and auxiliary self-contained air supply; or (B) Type C supplied-air respirator, demand type, with half facepiece; or (C) Any chemical cartridge respirator with an organic vapor cartridge which provides a service life of at least 1 hour for concentrations of vinyl chloride up to 10 ppm.

FIRST AID SOURCE: NIOSHP

EYE: if eye tissue is frozen, seek medical attention immediately; if tissue is not frozen, immediately and thoroughly flush the eyes with large amounts of water for at least 15 minutes, occasionally lifting the lower and upper eyelids. if irritation, pain, swelling, lacrimation, or photophobia persist, get medical attention as soon as possible.

SKIN: if frostbite has occurred, seek medical attention immediately; do not rub the affected areas of flush them with water. in order to prevent further tissue damage, do not attempt to remove frozen clothing from frostbitten areas. if frostbite has not occurred, immediately and thoroughly wash contaminated skin with soap and water.

INHALATION: if a person breathes large amounts of this chemical, move the exposed person to fresh air at once. if breathing has stopped, perform mouth-to-mouth resuscitation. keep the affected person warm and at rest. get medical attention as soon as possible.

INGESTION: None given

FIRST AID SOURCE: CHRIS Manual 1991

RESUSCITATION: remove patient to fresh air and keep him quiet and warm; call a doctor; give artificial respiration if breathing stops.

EYES AND

SKIN: flush with plenty of water for at least 15 min.; for eyes, get medical attention; remove contaminated clothing.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of frostbite, thaw frosted parts with water. Keep victim quiet and maintain normal body temperature.

----- INITIAL INCIDENT RESPONSE -----

FIRE EXTINGUISHMENT: For small fires use dry chemical or carbon dioxide. For large fires stop flow of gas. Cool exposed containers with water. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).

DOT SHIPPING NAME: Vinyl chloride, inhibited

DOT ID NUMBER: UN1086

ERG93

GUIDE 17

**\*POTENTIAL HAZARDS\***

**\*FIRE OR EXPLOSION**

Extremely flammable.

Ignited by heat, sparks or flames.

Vapors may travel to a source of ignition and flash back.

Container may explode violently in heat of fire.

Vapor explosion hazard indoors, outdoors or in sewers.

**\*HEALTH HAZARDS**

May be poisonous if inhaled.

Contact may cause burns to skin and eyes.

Vapors may cause dizziness or suffocation.

Contact with liquid may cause frostbite.

Fire may produce irritating or poisonous gases.

**\*EMERGENCY ACTION\***

Keep unnecessary people away; isolate hazard area and deny entry.

Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. See the Table of Initial Isolation and Protective Action Distances. If you find the ID Number and the name of the material there, begin protective action. \*Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300.

**\*FIRE**

Let tank, tank car or tank truck burn unless leak can be stopped; with smaller tanks or cylinders, extinguish/isolate from other flammables.

Small Fires: Dry chemical or CO2.

Large Fires: Water spray, fog or regular foam.

Move container from fire area if you can do it without risk.

For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. Cool container with water using unmanned device until well after fire is out.

**\*SPILL OR LEAK**

Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you can do it without risk. Water spray may reduce vapor; but it may not prevent ignition in closed spaces. Isolate area until gas has dispersed.

**\*FIRST AID**

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of frostbite, thaw frosted parts with water. Keep victim quiet and maintain normal body temperature.

**DISCLAIMER:** The data shown above on this chemical represents a best effort on the part of the compilers of the CHEMTOX database to obtain useful, accurate, and factual data. The use of these data shall be in accordance with the guidelines and limitations of the user's CHEMTOX license agreement.



Identification number: UN1307  
DOT shipping name: XYLENES  
Packing group: II  
Special provisions required: FLAMMABLE LIQUID  
Special provisions: T1  
Packaging exceptions: 173.150  
Non bulk packaging: 173.202  
Bulk packaging: 173.242  
Quantity limitations-  
Passenger air/rail: 5 L  
Cargo aircraft only: 60 L  
Vessel stowage: B  
Other stowage provisions:

STCC NUMBER: 4909350, 4909351

CLEAN WATER ACT Sect.307:No

CLEAN WATER ACT Sect.311:Yes

National Primary Drinking Water Regulations

Maximum Contaminant Levels (MCL): 10 mg/L (07/30/92)

Maximum Contaminant Level Goals (MCLG): 10 mg/L (07/30/92)

CLEAN AIR ACT: CAA '90 Listed

EPA WASTE NUMBER: U239,D001

CERCLA REF: Not listed

RQ DESIGNATION: B 100 pounds (45.4 kg) CERCLA

SARA TPQ VALUE: Not listed

SARA Sect. 312

categories:

Acute toxicity: Irritant

Acute toxicity: adverse effect to target organs.

Chronic toxicity: adverse effect to target organ  
after long period of exposure.

Chronic toxicity: reproductive toxin.

Fire hazard: flammable.

Chronic toxicity: carcinogen

LISTED IN SARA Sect 313: Yes

de minimus CONCENTRATION: 1.0 percent

UNITED STATES POSTAL SERVICE MAILABILITY:

Hazard class: Not given

Mailability: Nonmailable

Tax per parcel: 0

HFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with  
self-contained breathing apparatus.

FLAMMABILITY (RED) : (3) This material can be ignited under almost all  
temperature conditions.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

----- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON -----

ACGIH TLV List "Threshold Limit Values for 1992-1993"  
California Assembly Bill 1803 Well Monitoring Chemicals.  
Canadian Domestic Substances List  
Clean Air Act Section 111 List.  
Clean Air Act of November 15, 1990. List of pollutants.  
Clean Water Act Section 311 Hazardous Chemicals List.  
DOT Hazardous Materials Table. 49 CFR 172.101  
EPA List of VOC chemicals from 40 CFR 60.489  
EPA TSCA Chemical Inventory List 1986  
EPA TSCA Chemical Inventory List 1989  
EPA TSCA Chemical Inventory List 1990  
EPA TSCA Chemical Inventory List 1992  
EPA TSCA Test Submission (TSCATS) Database - April 1990  
EPA TSCA Test Submission (TSCATS) Database - September 1989  
Massachusetts Substance List.  
New Jersey DEQ100 list for release reporting.  
New Jersey Right To Know Substance List. (December 1987)  
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.  
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992  
Pennsylvania Hazardous Substance List  
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264  
RCRA Hazardous Waste  
SARA Section 110 Priority List of CERCLA Hazardous Substances  
SARA Section 313 Toxic Chemicals List  
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)  
Washington State Discarded Chemical Products List, November 17, 1989  
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)  
Y [1330-20-7]

----- TOXICITY DATA -----

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: unknown

TARGET ORGANS: CNS, eyes, gi tract, blood, liver, kidneys, skin

SYMPTOMS: DIZZ, EXCITEMENT, DROW, INCO, STAGGERING GAIT, IRRIT  
EYES, NOSE, THROAT, CORNEAL VACUOLIZATION, ANOREXIA,  
NAU, VOMIT, ABDOM PAIN; DERM Source: CHRIS

ONC IDLH: 1000ppm

IOSH REL: 100 ppm Time weighted averages for 8-hour exposure  
434 mg/M3 Time weighted averages for 8-hour exposure  
200 ppm Ceiling exposures which shall at no time be  
exceeded(10-MIN) 868 mg/M3 Ceiling exposures which  
shall at no time be exceeded(10-MIN)

ACGIH TLV: TLV = 100ppm(434 mg/M3)

ACGIH STEL: STEL = 150 ppm(651 mg/M3)

OSHA PEL: Transitional Limits:  
PEL = 100 ppm(435mg/M3)  
Final Rule Limits:  
TWA = 100 ppm (435 mg/M3)  
STEL = 150 ppm(655 mg/M3)

MAK INFORMATION: 100 ppm  
440 mg/M3  
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.

MAK: Not listed

NIOSH: Not listed

NTP: Not listed

ACGIH: Not listed

OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

\* orl-hmn LDLo:50 mg/kg YAKUD5 22,883,80

ihl-man LCLo:10000 ppm/6H BMJOAE 3,442,70

BEHAVIORAL

General anesthetic

LUNGS, THORAX, OR RESPIRATION

Cyanosis

BLOOD

Other changes

D50 value: orl-rat LD50:4300 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:4300 mg/kg

ihl-rat LC50:5000 ppm/4H

ipr-rat LD50:2459 mg/kg

scu-rat LD50:1700 mg/kg

ipr-mus LD50:1548 mg/kg

ivn-rbt LDLo:129 mg/kg

ihl-gpg LCLo:450 ppm

ipr-gpg LDLo:2 gm/kg

ipr-mam LDLo:2 gm/kg

IRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

ihl-rat TCLo:250 mg/m<sup>3</sup>/24H (7-15D preg) ATSUDG 8,425,85

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

ihl-rat TCLo:50 mg/m<sup>3</sup>/6H (1-21D preg) JHEMA2 27,337,83

EFFECTS ON FERTILITY

Post-implantation mortality

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Craniofacial(including nose and tongue)

ihl-rat TCLo:50 mg/m<sup>3</sup>/6H (1-21D preg) JHEMA2 27,337,83

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Other developmental abnormalities

EFFECTS ON NEWBORN

Growth statistics(e.g.,reduced weight gain)

ihl-rat TCLo:600 mg/m<sup>3</sup>/24H (7-15D preg) PCBRD2  
163B,295,85

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

orl-mus TDLo:20600 ug/kg (6-15D preg) JTEHD6 9,97,82

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Craniofacial(including nose and tongue)

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

orl-mus TDLo:31 mg/kg (6-15D preg) JTEHD6 9,97,82

EFFECTS ON FERTILITY

Post-implantation mortality

ihl-mus TCLo:4000 ppm/6H (6-12D preg) TJADAB 28,22A,83

EFFECTS ON NEWBORN

Growth statistics(e.g.,reduced weight gain)

EFFECTS ON NEWBORN

Physical

ihl-mus TCLo:2000 ppm/6H (6-12D preg) TJADAB 28,22A,83

EFFECTS ON EMBRYO OR FETUS

Fetotoxicity(except death,e.g.,stunted fetus)