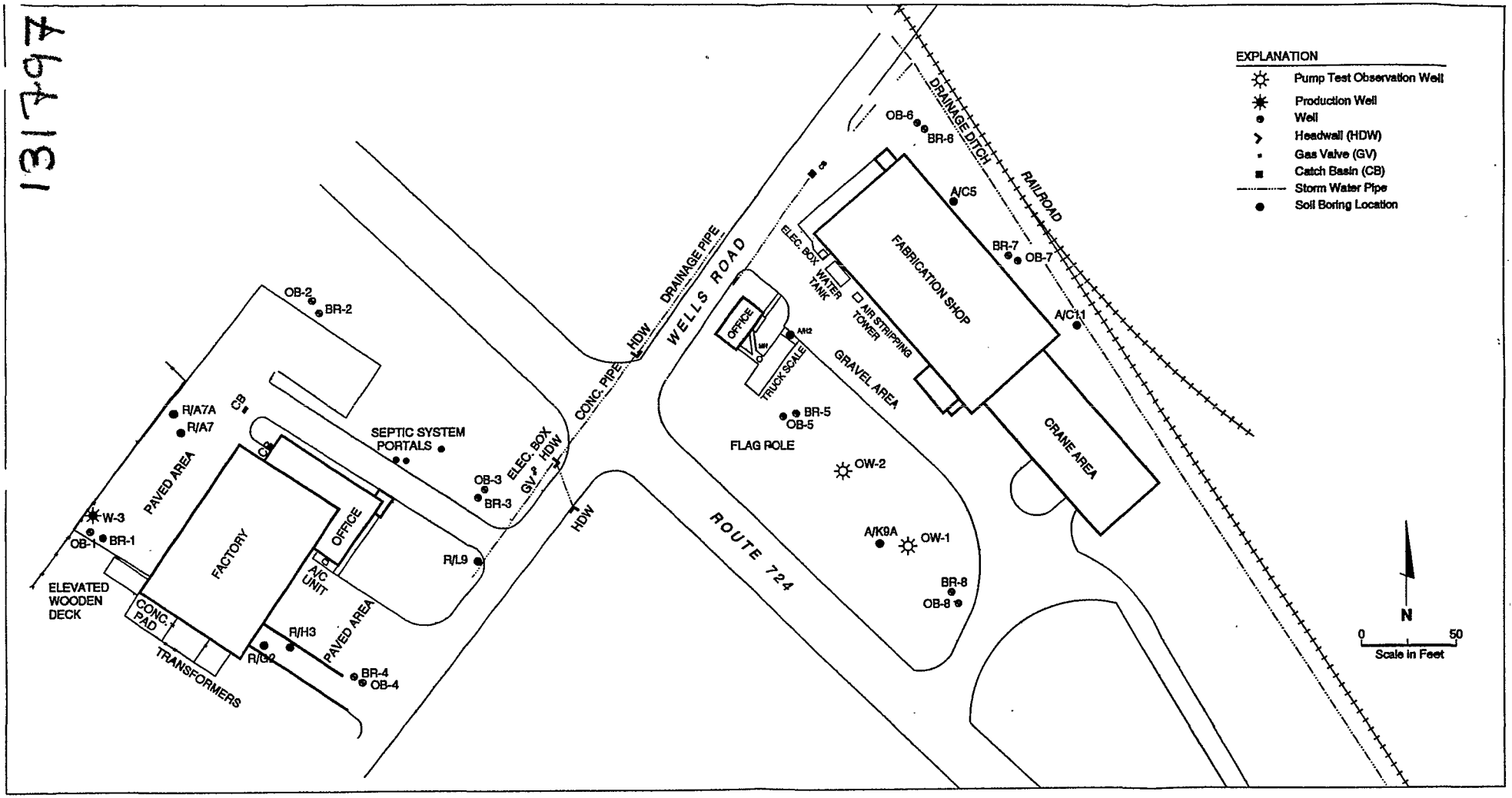


SOIL BORING LOCATIONS

Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

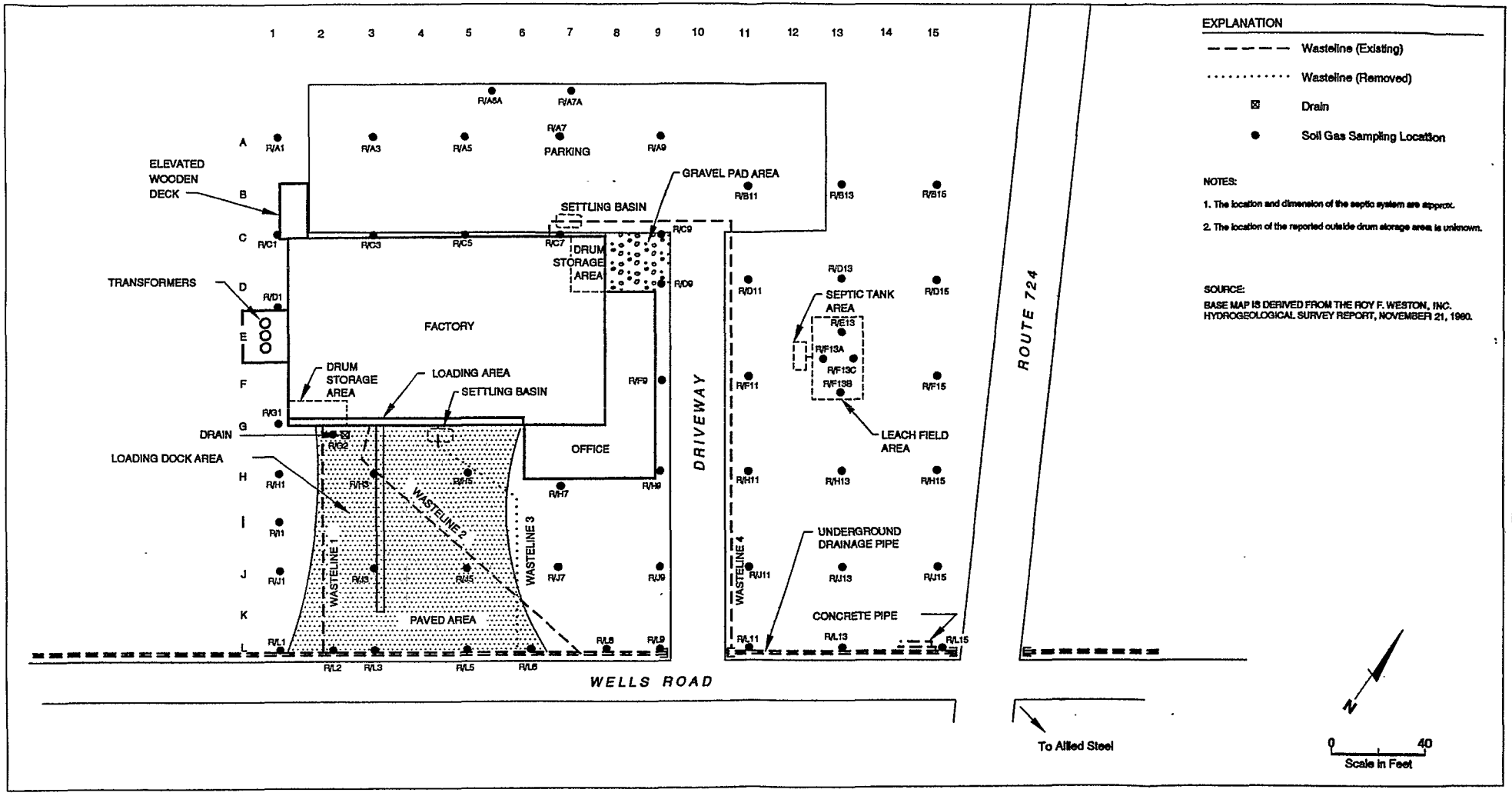
DAMES & MOORE

10839-126-032 SJR 9/24/92 SOILBOR

FIGURE B-2

AR304140

13174 7



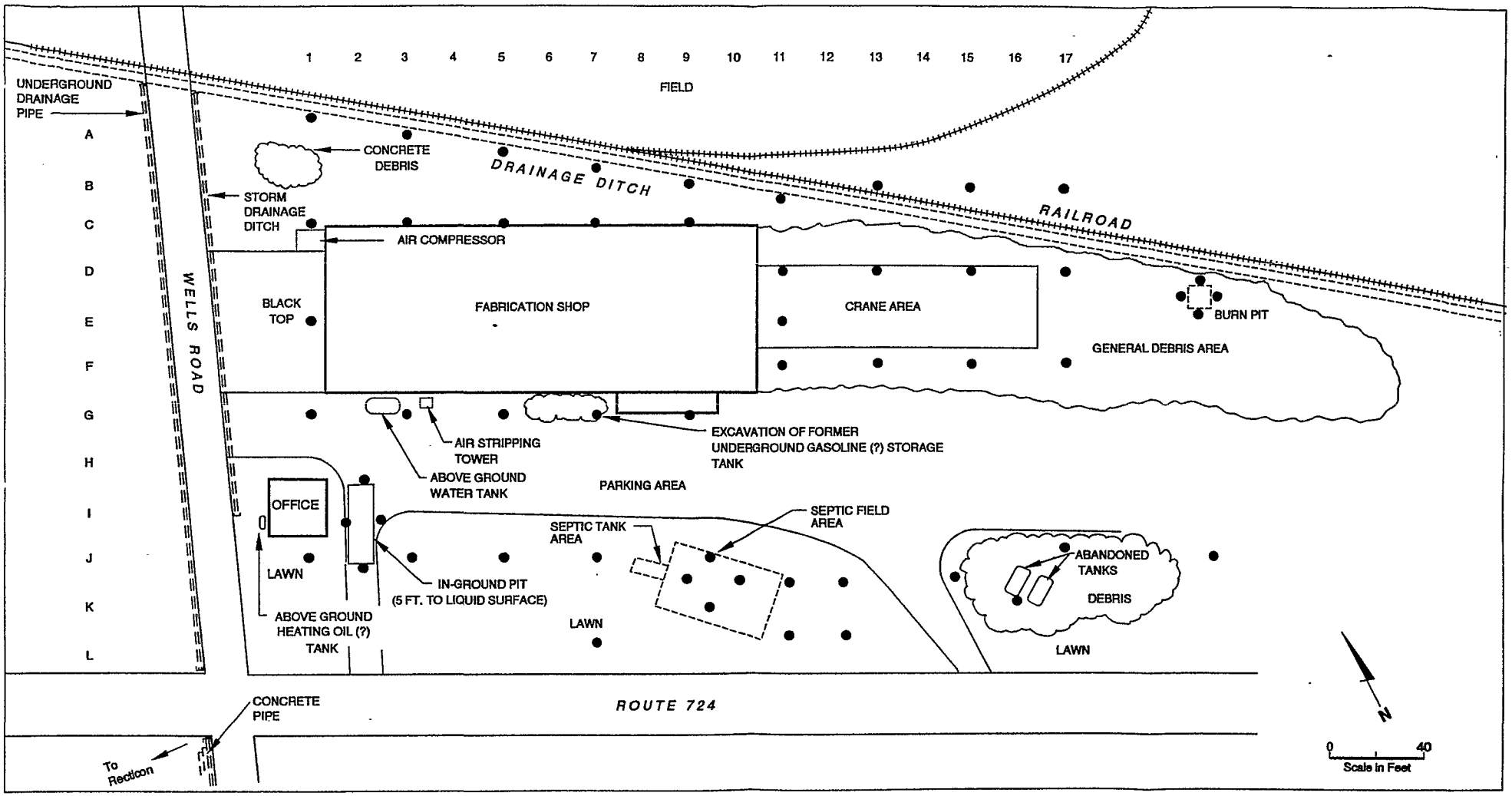
SOIL GAS SURVEY LOCATIONS
RECTICON FACILITY
Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/24/92 SG-SURV2

AR304141

FIGURE B-3



EXPLANATION

● Soil Gas Sampling Location

NOTES:

1. THE LOCATION AND DIMENSIONS OF THE SEPTIC SYSTEM ARE APPROXIMATE.
2. WASTE SOLVENT DRUMS WERE REPORTED TO BE STORED NEAR AIR COMPRESSOR AREA.

SOURCE:

BASE MAP IS DERIVED FROM THE S.M.C. MARTIN, INC. HYDROGEOLOGICAL STUDY REPORT, MARCH, 1984.

SOIL GAS SURVEY LOCATIONS
ALLIED STEEL FACILITY

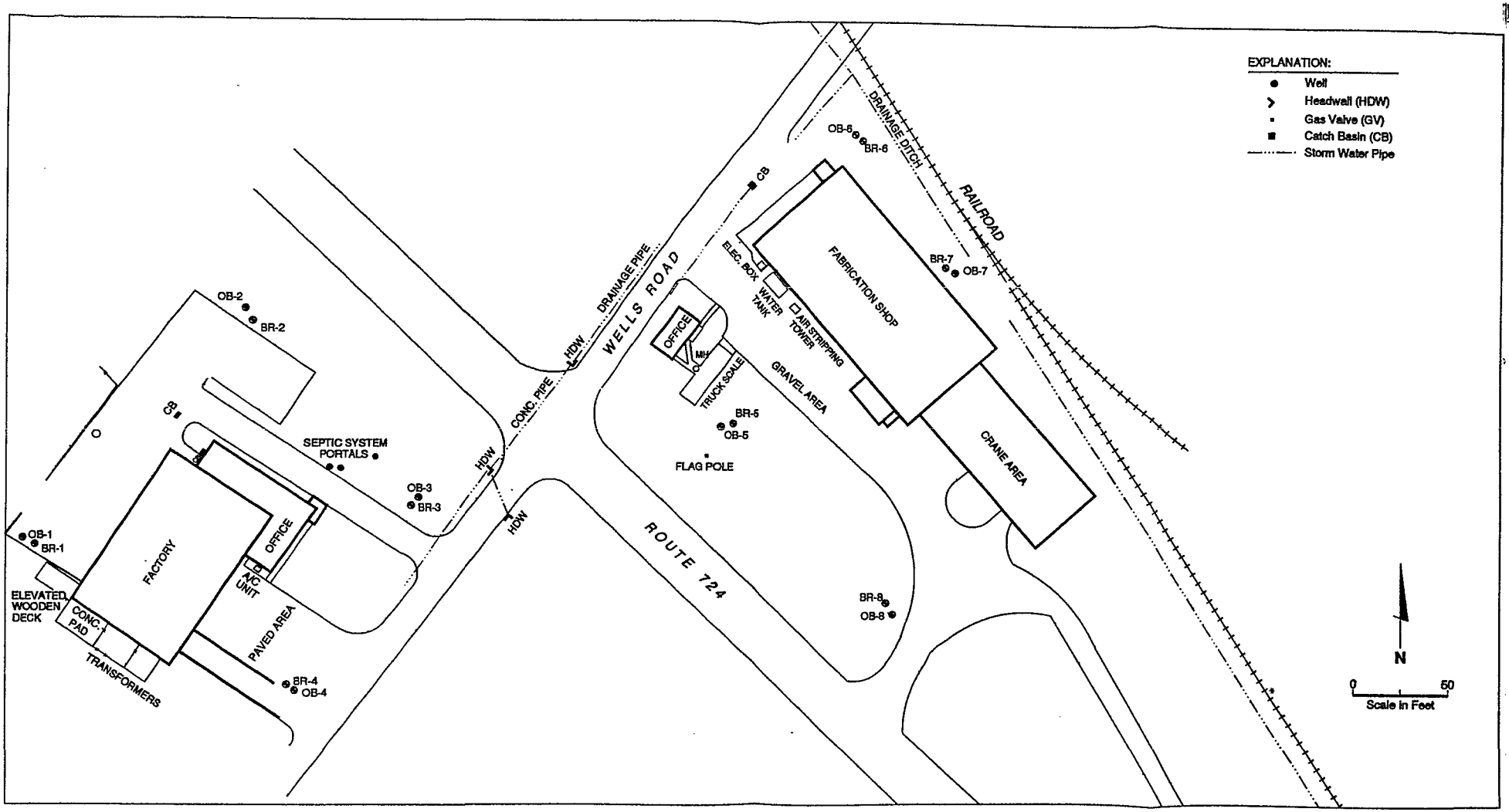
Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/24/92 SG-SURV

AR304142

FIGURE B-4



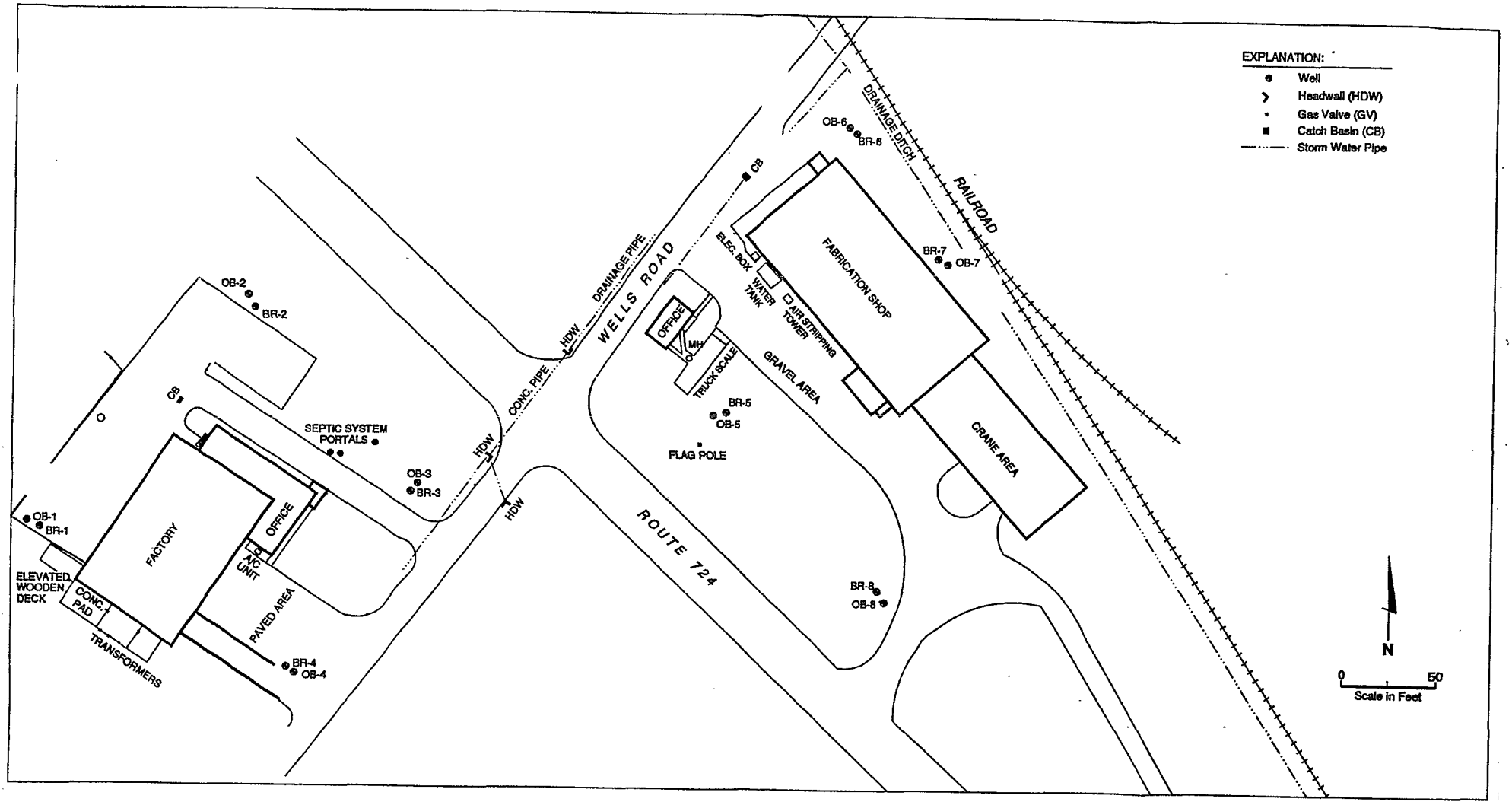
SAMPLING LOCATIONS
OVERBURDEN AQUIFER
Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/24/92 AQUIFER

AR304143

FIGURE B-5



SAMPLING LOCATIONS
BEDROCK AQUIFER

Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

FIGURE B-6

DAMES & MOORE

10639-126-032 SJR 9/24/92 BEDROCK

AR304144

ATTACHMENT C
SITE PHOTOGRAPHS

Photograph No. 3 - View of parking area, wooden deck, and Eastern corner of the Recticon Facility.

Photograph No. 4 - View toward Northern corner of Allied Steel Facility at the Northwest end of the fabrication shop.

SITE PHOTOGRA

Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

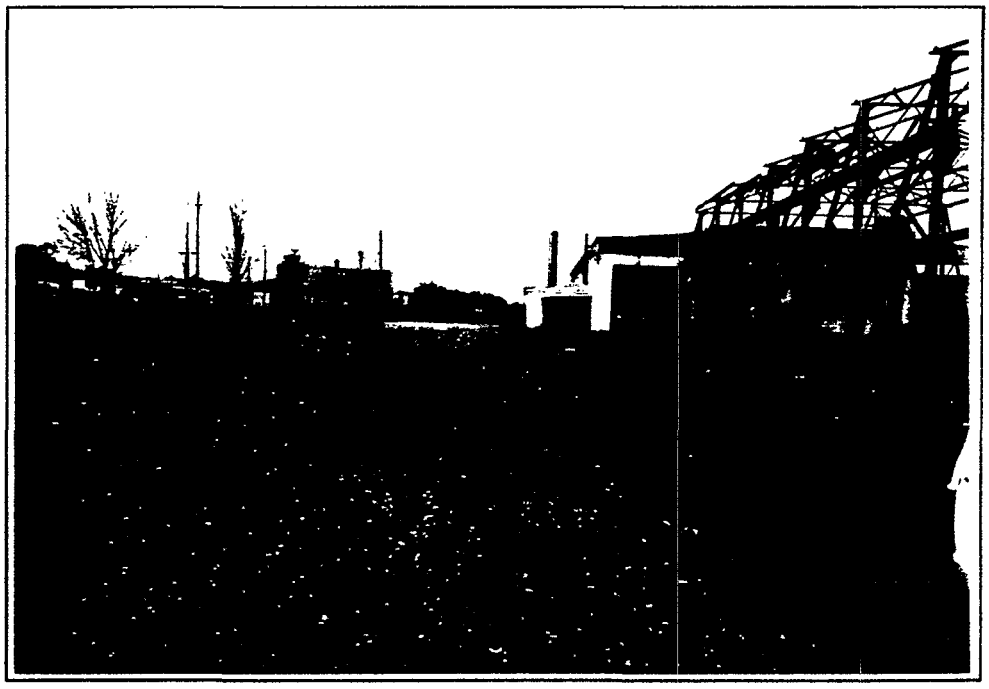
DAMES & MOORE

10839-126-032 SJR 9/29/92 PHOTO.1

FIGURE C-1

AR304146

Photograph No. 5 - View of railroad track and well OB-6 at the Northern corner of the Allied Steel Facility.



Photograph No. 6 - View toward office at Northwest end of the Allied Steel Facility, with crane area and fabrication shop to the right.

SITE PHOTOGRAPHS

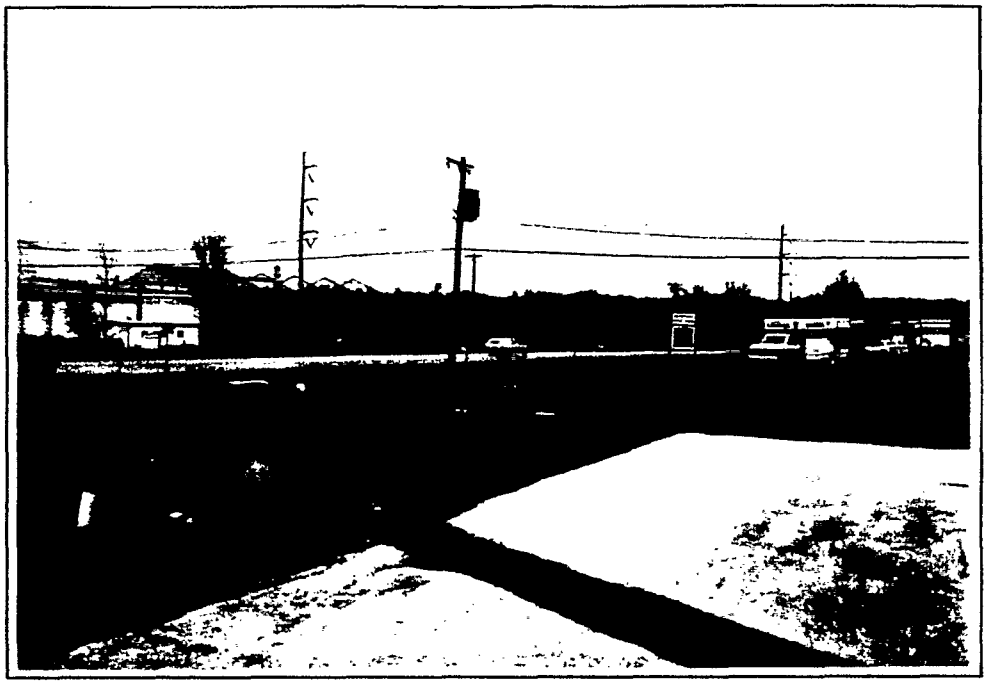
Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/29/92 PHOTO.1

FIGURE C-1

AR304147



Photograph No. 1 - View from the Recticon Facility toward the Allied Steel Facility.

Photograph No. 2 - View of the paved loading area and Southwest facility boundary of the Recticon Facility.

SITE PHOTOGRAPHS

Recticon / Allied Steel Site
Parker Ford, Pennsylvania
MARCH 1993

DAMES & MOORE

10839-126-032 SJR 9/29/92 PHOTO.1

FIGURE C-1

AR304148

ATTACHMENT D
AIR MODELING CALCULATION SPREADSHEETS

VOC EMISSIONS MODEL USING SOIL, SOIL GAS, & GROUNDWATER SAMPLES. MODEL ESTIMATES CHEMICAL CONCENTRATIONS IN AIR USING BOTH THE "BOX MODEL" & INDOOR AIR APPROACH.

PREPARED BY: ***DAMES & MOORE***
TOXICOLOGY AND RISK ASSESSMENT GROUP
SACRAMENTO, CALIFORNIA

VERSION NO.: **VEM_01.XLS** **LAST REVISED:** **24-Sep-92**

This multi-media model for estimating VOC emissions is based on Farmer's covered landfill emissions model presented in "Land Disposal of Hexachlorobenzene Wastes: Controlling Vapor Movement in Soil." EPA 600/2-80/119 (1980). The "box model" is based on the model presented in "Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup" EPA/600/6-86/002 (1986).

AR304150

INFORMATION

PROJECT: Risk Assessment for the Recticon/Allied Steel Site
PROJECT FILENAME: VEM_A01.XLS
SITE/STUDY AREA: Allied Steel Facility
SCENARIO: Current Trespasser - Outdoor Air (95% UCL of Site); and
Future Onsite Workers - Outdoor Air (95% UCL of Site); and
Future Onsite Residents - Indoor & Outdoor Air (95% UCL of Site)

NOTES:

MODEL PARAMETERS

Description	Parameter	*Value*	Units	Notes	Source
Emissions model parameters					
Soil moisture	W	0.25	unitless	Default value, HELP (EPA, 1983).	
Bulk density	p	0	g/cm^3	Not Used	
Particle density	d	0	g/cm^3	Not Used	
Fraction of soil organic matter	foc	0.0158	unitless	Default median value, Karickhoff, 1989.	
Total soil porosity	PT	0.588	unitless	Default value, HELP (EPA, 1983).	
Air-filled porosity	PA	0.338	unitless	Can be calculated from PT-W	
Box model parameters					
Surface area	A	100	m^2	Assumed value.	
Box height	H	2	m	Assumed value.	
Windspeed within mixing zone	V	2.13	m/s	1/2 of mean windspeed at Philly Int. Airport	
Width of area	L	10	m	Assumed value.	
Indoor air model parameters					
Building ventilation rate	Vn	1.40E-02	m^3/s	ASHRAE std. for general living areas	
Surface area of building		100	m^2	Assumed value.	
Leakage area of building		0.0001	m^2/m^2	Ranges from 1-10cm^2/m^2 (Grimsrud et al., 19	
Emission area of building	Ab	0.01	m^2	Based on product of the two previous entries.	
Miscellaneous parameters					
Ideal gas constant	R	8.21E-05	atm m^3/mol K		
Temperature	T	283	K		

AR304151

CHEMDATA

Chemical-specific input data

Chemical	Diffusion Coefficient D (cm^2/s)	Molecular Weight MW (g/mol)	Koc (mL/g)	Kd (m^3/kg)	Henry's Constant H (atm m^3/mol)
SVOCs					
Benzoic Acid	0.06956	122	19.2	3.03E-04	7.00E-08
bis(2-ethylhexyl)phthalate	0.05483	391	14350	2.27E-01	1.10E-05
TICs					
1,1,2-Trichloro-1,2,2-trifluoroetha	0.05784	187	426	6.73E-03	5.26E-01
tert-butylmethylether	0.07382	88	11.2	1.77E-04	5.87E-04
VOCs					
1,1,1-Trichloroethane	0.07496	133	152	2.40E-03	1.44E-02
Trichloroethane (total)	0.07496	133	56	8.85E-04	1.17E-03
1,1-Dichloroethane	0.08557	99	30	4.74E-04	4.31E-03
1,1-Dichloroethene	0.07442	97	65	1.03E-03	3.40E-02
1,2-Dichloroethane	0.08557	99	14	2.21E-04	9.78E-04
Benzene	0.08195	78	83	1.31E-03	5.59E-03
Carbon Tetrachloride	0.075	154	110	1.74E-03	2.41E-02
Chloroethane	0.09789	65	33.1	5.23E-04	8.48E-03
Chloroform	0.08345	120	31	4.90E-04	2.87E-03
cis-1,2-Dichloroethene	0.07442	97	49	7.74E-04	7.58E-03
Ethylbenzene	0.06274	106	1100	1.74E-02	6.43E-03
Methylene Chloride	0.0961	85	8.8	1.39E-04	2.03E-03
Tetrachloroethene	0.06968	166	364	5.75E-03	2.59E-02
Toluene	0.07367	92	300	4.74E-03	6.37E-03
trans-1,2-Dichloroethene	0.07442	97	59	9.32E-04	6.56E-03
Trichloroethene	0.07638	131	126	1.99E-03	9.10E-03
Trichlorofluoromethane	0.07391	137	159	2.51E-03	1.34E-01
Xylenes (mixed)	0.06742	106	240	3.79E-03	7.09E-03

Kd was calculated as follows: Kd = Koc x foc x (10^-6 m^3/mL) x (10^3 g/kg)

AR304152

CHEMICAL CONCENTRATIONS

Chemical	Soil Concentration Cs (mg/kg)	Depth Ls (m)	Groundwater Concentration Cw (mg/L)	Depth Lw (m)	Soil Gas Concentration Cv (ug/L)	Depth Lv (m)
SVOCs						
Benzoic Acid	0.12	3.658	--	--	--	--
bis(2-ethylhexyl)phthalate	0.062	3.658	0.01003	32.309	--	--
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethan	--	--	0.002	32.309	--	--
tert-butylmethylether	--	--	0.0012	32.309	--	--
VOCs						
1,1,1-Trichloroethane	--	--	0.00157	32.309	--	--
Trichloroethane (total)	--	--	--	--	0.018	1.067
1,1-Dichloroethane	--	--	0.00283	32.309	--	--
1,1-Dichloroethene	--	--	0.00033	32.309	--	--
1,2-Dichloroethane	--	--	0.00255	32.309	--	--
Benzene	--	--	--	--	0.2109	1.067
Carbon Tetrachloride	--	--	--	--	0.0005	1.067
Chloroethane	--	--	0.00026	32.309	--	--
Chloroform	--	--	--	--	0.0029	1.067
cis-1,2-Dichloroethene	--	--	0.04804	32.309	--	--
Ethylbenzene	--	--	--	--	0.3946	1.067
Methylene Chloride	0.001	3.658	0.00041	32.309	--	--
Tetrachloroethene	--	--	0.00629	32.309	0.159	1.067
Toluene	--	--	--	--	1.0564	1.067
trans-1,2-Dichloroethene	--	--	0.00025	32.309	--	--
Trichloroethene	--	--	--	--	0.0868	1.067
Trichlorofluoromethane	--	--	0.00025	32.309	--	--
Xylenes (mixed)	--	--	--	--	2.1524	1.067

SOIL VAPOR CALCULATIONS

Chemical	Soil Vapor Concentration (Cv) Estimated from		
	Soil Samples Cv (mg/m^3)	Groundwater Samples Cv (mg/m^3)	Soil Gas Cv (mg/m^3)
SVOCs			
Benzoic Acid	1.19E-03	--	--
bis(2-ethylhexyl)phthalate	1.29E-04	4.75E-03	--
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethan	--	4.53E+01	--
tert-butylmethylether	--	3.03E-02	--
VOCs			
1,1,1-Trichloroethane	--	9.73E-01	--
Trichloroethane (total)	--	--	1.80E-02
1,1-Dichloroethane	--	5.25E-01	--
1,1-Dichloroethene	--	4.83E-01	--
1,2-Dichloroethane	--	1.07E-01	--
Benzene	--	--	2.11E-01
Carbon Tetrachloride	--	--	5.00E-04
Chloroethane	--	9.49E-02	--
Chloroform	--	--	2.90E-03
cis-1,2-Dichloroethene	--	1.57E+01	--
Ethylbenzene	--	--	3.95E-01
Methylene Chloride	6.28E-01	3.58E-02	--
Tetrachloroethene	--	7.01E+00	1.59E-01
Toluene	--	--	1.06E+00
trans-1,2-Dichloroethene	--	7.06E-02	--
Trichloroethene	--	--	8.68E-02
Trichlorofluoromethane	--	1.44E+00	--
Xylenes (mixed)	--	--	2.15E+00

-- Not Applicable

Cv calculated from the following equations:

SOIL: Cv = Cs x H/(Kd x R x T)

GROUNDWATER: P = Cw x H/MW x (10^-3 g/mg) x (10^3 L/m^3) ; and Cv = P x MW/(R x T) x (10^3 mg/g)

SOIL VAPOR: Cv x (10^3 L/m^3) x (10^-3 mg/ug)

AR304154

EMISSIONS

Chemical	Emissions Rate (Q) Soil Q (mg/m^2/s)	Groundwater Q (mg/m^2/s)	Soil Gas Q (mg/m^2/s)	Selected (a) Emissions Rate Q (mg/m^2/s)
SVOCs				
Benzoic Acid	1.76E-10	--	--	1.76E-10
bis(2-ethylhexyl)phthalate	1.51E-11	6.27E-11	--	7.78E-11
TICs				
1,1,2-Trichloro-1,2,2-trifluoroetha	--	6.31E-07	--	6.31E-07
tert-butylmethylether	--	5.39E-10	--	5.39E-10
VOCs				
1,1,1-Trichloroethane	--	1.76E-08	--	1.76E-08
Trichloroethane (total)	--	--	9.84E-09	9.84E-09
1,1-Dichloroethane	--	1.08E-08	--	1.08E-08
1,1-Dichloroethene	--	8.65E-09	--	8.65E-09
1,2-Dichloroethane	--	2.21E-09	--	2.21E-09
Benzene	--	--	1.26E-07	1.26E-07
Carbon Tetrachloride	--	--	2.73E-10	2.73E-10
Chloroethane	--	2.24E-09	--	2.24E-09
Chloroform	--	--	1.76E-09	1.76E-09
cis-1,2-Dichloroethene	--	2.81E-07	--	2.81E-07
Ethylbenzene	--	--	1.81E-07	1.81E-07
Methylene Chloride	1.28E-07	8.29E-10	--	1.29E-07
Tetrachloroethene	--	1.18E-07	8.08E-08	8.08E-08
Toluene	--	--	5.67E-07	5.67E-07
trans-1,2-Dichloroethene	--	1.26E-09	--	1.26E-09
Trichloroethene	--	--	4.83E-08	4.83E-08
Trichlorofluoromethane	--	2.57E-08	--	2.57E-08
Xylenes (mixed)	--	--	1.06E-06	1.06E-06

NA = Not applicable if soil vapor samples available

(a) Emission rates based on soil gas samples were used in pereference to soil or groundwater samples.
If soil gas estimates were not available, the sum of soil and groundwater emission rates were used.

Q was calculated from the following equation:

Q = D x (Pa^(10/3)/Pt^2) (Cv/L) x (10^-4 m^2/cm^2)

Estimated Concentrations in Outdoor and Indoor Air

Chemical	Emission Rate Q (mg/m^2/s)	Concentrations in Air (Ca)	
		Box Model Ca (mg/m^3)	Indoor Air Model Ca (mg/m^3)
SVOCs			
Benzoic Acid	1.76E-10	4.14E-10	1.26E-10
bis(2-ethylhexyl)phthalate	7.78E-11	1.83E-10	5.56E-11
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethan	6.31E-07	1.48E-06	4.50E-07
tert-butylmethylether	5.39E-10	1.27E-09	3.85E-10
VOCs			
1,1,1-Trichloroethane	1.76E-08	4.12E-08	1.25E-08
Trichloroethane (total)	9.84E-09	2.31E-08	7.03E-09
1,1-Dichloroethane	1.08E-08	2.54E-08	7.73E-09
1,1-Dichloroethene	8.65E-09	2.03E-08	6.18E-09
1,2-Dichloroethane	2.21E-09	5.19E-09	1.58E-09
Benzene	1.26E-07	2.96E-07	9.00E-08
Carbon Tetrachloride	2.73E-10	6.42E-10	1.95E-10
Chloroethane	2.24E-09	5.25E-09	1.60E-09
Chloroform	1.76E-09	4.14E-09	1.26E-09
cis-1,2-Dichloroethene	2.81E-07	6.59E-07	2.01E-07
Ethylbenzene	1.81E-07	4.24E-07	1.29E-07
Methylene Chloride	1.29E-07	3.03E-07	9.23E-08
Tetrachloroethene	8.08E-08	1.90E-07	5.77E-08
Toluene	5.67E-07	1.33E-06	4.05E-07
trans-1,2-Dichloroethene	1.26E-09	2.97E-09	9.03E-10
Trichloroethene	4.83E-08	1.13E-07	3.45E-08
Trichlorofluoromethane	2.57E-08	6.02E-08	1.83E-08
Xylenes (mixed)	1.06E-06	2.48E-06	7.56E-07

NA = Not applicable

Ca calculated from the following equation:

(Box Model) $Ca = Q \times A/(L \times V \times H)$

(Indoor Air) $Ca = Q \times Ab/Vn$

AR304156

VOC EMISSIONS MODEL USING SOIL, SOIL GAS, & GROUNDWATER SAMPLES. MODEL ESTIMATES CHEMICAL CONCENTRATIONS IN AIR USING BOTH THE "BOX MODEL" & INDOOR AIR APPROACH.

PREPARED BY: *DAMES & MOORE*
TOXICOLOGY AND RISK ASSESSMENT GROUP
SACRAMENTO, CALIFORNIA

VERSION NO.: VEM_01.XLS **LAST REVISED:** 24-Sep-92

This multi-media model for estimating VOC emissions is based on Farmer's covered landfill emissions model presented in "Land Disposal of Hexachlorobenzene Wastes: Controlling Vapor Movement in Soil." EPA 600/2-80/119 (1980). The "box model" is based on the model presented in "Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup" EPA/600/6-86/002 (1986).

INFORMATION

PROJECT: Risk Assessment for the Recticon/Allied Steel Facilities
PROJECT FILENAME: VEM_A02.XLS
SITE/STUDY AREA: Allied Steel Facility
SCENARIO: Future Onsite Worker - Indoor Air (Max. Conc. Near Buildings)

NOTES:

MODEL PARAMETERS

Description	Parameter	*Value*	Units	Notes	Source
Emissions model parameters					
Soil moisture	W	0.25	unitless	Default value, HELP (EPA, 1983).	
Bulk density	p	0	g/cm^3	Not Used	
Particle density	d	0	g/cm^3	Not Used	
Fraction of soil organic matter	foc	0.0158	unitless	Default median value, Karickhoff, 1989.	
Total soil porosity	PT	0.588	unitless	Default value, HELP (EPA, 1983).	
Air-filled porosity	PA	0.338	unitless	Can be calculated from PT-W	
Box model parameters					
Surface area	A	100	m^2	Assumed value.	
Box height	H	2	m	Assumed value.	
Windspeed within mixing zone	V	2.13	m/s	1/2 of mean windspeed at Philly Int. Airport	
Width of area	L	10	m	Assumed value.	
Indoor air model parameters					
Building ventilation rate	Vn	1.40E-02	m^3/s	ASHRAE std. for general living areas	
Surface area of building		100	m^2	Assumed value.	
Leakage area of building		0.0001	m^2/m^2	Ranges from 1-10cm^2/m^2 (Grimsrud et al., 19	
Emission area of building	Ab	0.01	m^2	Based on product of the two previous entries.	
Miscellaneous parameters					
Ideal gas constant	R	8.21E-05	atm m^3/mol K		
Temperature	T	283	K		

AR304158

CHEMDATA

Chemical-specific input data

Chemical	Diffusion Coefficient D (cm^2/s)	Molecular Weight MW (g/mol)	Koc (mL/g)	Kd (m^3/kg)	Henry's Constant H (atm m^3/mol)
SVOCs					
Benzoic Acid	0.06956	122	19.2	0.00030336	7.00E-08
bis(2-ethylhexyl)phthalate	0.05483	391	14350	0.22673	1.10E-05
VOCs					
1,1,1-Trichloroethane	0.07496	133	152	0.0024016	1.44E-02
Trichloroethane (total)	0.07496	133	56	0.0008848	1.17E-03
Benzene	0.08195	78	83	0.0013114	5.59E-03
Carbon tetrachloride	0.075	154	110	0.001738	2.41E-02
Chloroform	0.08345	120	31	0.0004898	2.87E-03
cis-1,2-Dichloroethene	0.07442	97	49	0.0007742	7.58E-03
Ethylbenzene	0.06274	106	1100	0.01738	6.43E-03
Methylene Chloride	0.0961	85	8.8	0.00013904	2.03E-03
Tetrachloroethene	0.06968	166	364	0.0057512	2.59E-02
Toluene	0.07367	92	300	0.00474	6.37E-03
Trichloroethene	0.07638	131	126	0.0019908	9.10E-03
Xylenes (mixed)	0.06742	106	240	0.003792	7.09E-03

Kd was calculated as follows: Kd = Koc x foc x (10^-6 m^3/mL) x (10^3 g/kg)

CHEMICAL CONCENTRATIONS

Chemical	Soil Concentration Cs (mg/kg)	Depth Ls (m)	Groundwater Concentration Cw (mg/L)	Depth Lw (m)	Soil Gas Concentration Cv (ug/L)	Depth Lv (m)
SVOCs						
Benzoic Acid	0.12	3.658	--	--	--	--
bis(2-ethylhexyl)phthalate	--	--	0.001	32.309	--	--
VOCs						
1,1,1-Trichloroethane	--	--	0.00038	32.309	--	--
Trichloroethane (total)	--	--	--	--	0.2	1.067
Benzene	--	--	--	--	2	1.067
Carbon tetrachloride	--	--	--	--	0.002	1.067
Chloroform	--	--	--	--	0.029	1.067
cis-1,2-Dichloroethene	--	--	0.00029	32.309	--	--
Ethylbenzene	--	--	--	--	0.7	1.067
Methylene Chloride	--	--	0.00036	32.309	--	--
Tetrachloroethene	--	--	--	--	3	1.067
Toluene	--	--	--	--	10	1.067
Trichloroethene	--	--	--	--	0.3	1.067
Xylenes (mixed)	--	--	--	--	8	1.067

SOIL VAPOR CALCULATIONS

Chemical	Soil Vapor Concentration (Cv) Estimated from		
	Soil Samples Cv (mg/m^3)	Groundwater Samples Cv (mg/m^3)	Soil Gas Cv (mg/m^3)
SVOCs			
Benzoic Acid	1.19E-03	--	--
bis(2-ethylhexyl)phthalate	--	4.73E-04	--
VOCs			
1,1,1-Trichloroethane	--	2.36E-01	--
Trichloroethane (total)	--	--	2.00E-01
Benzene	--	--	2.00E+00
Carbon tetrachloride	--	--	2.00E-03
Chloroform	--	--	2.90E-02
cis-1,2-Dichloroethene	--	9.46E-02	--
Ethylbenzene	--	--	7.00E-01
Methylene Chloride	--	3.15E-02	--
Tetrachloroethene	--	--	3.00E+00
Toluene	--	--	1.00E+01
Trichloroethene	--	--	3.00E-01
Xylenes (mixed)	--	--	8.00E+00

-- Not Applicable

Cv calculated from the following equations:

SOIL: Cv = Cs x H/(Kd x R x T)

GROUNDWATER: P = Cw x H/MW x (10^-3 g/mg) x (10^3 L/m^3) ; and Cv = P x MW/(R x T) x (10^3 mg/g)

SOIL VAPOR: Cv x (10^3 L/m^3) x (10^-3 mg/ug)

EMISSIONS

Chemical	Emissions Rate (Q)			Selected (a) Emissions Rate
	Soil Q (mg/m^2/s)	Groundwater Q (mg/m^2/s)	Soil Gas Q (mg/m^2/s)	Q (mg/m^2/s)
SVOCs				
Benzoic Acid	1.76E-10	--	--	1.76E-10
bis(2-ethylhexyl)phthalate	--	6.25E-12	--	6.25E-12
VOCs				
1,1,1-Trichloroethane	--	4.25E-09	--	4.25E-09
Trichloroethane (total)	--	--	1.09E-07	1.09E-07
Benzene	--	--	1.20E-06	1.20E-06
Carbon tetrachloride	--	--	1.09E-09	1.09E-09
Chloroform	--	--	1.76E-08	1.76E-08
cis-1,2-Dichloroethene	--	1.70E-09	--	1.70E-09
Ethylbenzene	--	--	3.20E-07	3.20E-07
Methylene Chloride	--	7.28E-10	--	7.28E-10
Tetrachloroethene	--	--	1.52E-06	1.52E-06
Toluene	--	--	5.37E-06	5.37E-06
Trichloroethene	--	--	1.67E-07	1.67E-07
Xylenes (mixed)	--	--	3.93E-06	3.93E-06

NA = Not applicable if soil vapor samples available

(a) Emission rates based on soil gas samples were used in preference to soil or groundwater samples.
If soil gas estimates were not available, the sum of soil and groundwater emission rates were used.

Q was calculated from the following equation:

Q = D x (Pa^(10/3)/Pt^2) (Cv/L) x (10^-4 m^2/cm^2)

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Estimated Concentrations in Air using the Indoor Air Model

Chemical	Emission Rate Q (mg/m^2/s)	Concentrations in Air (Ca) Indoor Air Model Ca (mg/m^3)
SVOCs		
Benzoic Acid	1.76E-10	1.26E-10
bis(2-ethylhexyl)phthalate	6.25E-12	4.46E-12
VOCs		
1,1,1-Trichloroethane	4.25E-09	3.04E-09
Trichloroethane (total)	1.09E-07	7.81E-08
Benzene	1.20E-06	8.54E-07
Carbon tetrachloride	1.09E-09	7.81E-10
Chloroform	1.76E-08	1.26E-08
cis-1,2-Dichloroethene	1.70E-09	1.21E-09
Ethylbenzene	3.20E-07	2.29E-07
Methylene Chloride	7.28E-10	5.20E-10
Tetrachloroethene	1.52E-06	1.09E-06
Toluene	5.37E-06	3.84E-06
Trichloroethene	1.67E-07	1.19E-07
Xylenes (mixed)	3.93E-06	2.81E-06

NA = Not applicable

Ca Calculated from the following equation:

(Indoor Air)

$Ca = Q \times Ab/Vn$

VOC EMISSIONS MODEL USING SOIL, SOIL GAS, & GROUNDWATER SAMPLES. MODEL ESTIMATES CHEMICAL CONCENTRATIONS IN AIR USING BOTH THE "BOX MODEL" & INDOOR AIR APPROACH.

PREPARED BY: ***DAMES & MOORE***
TOXICOLOGY AND RISK ASSESSMENT GROUP
SACRAMENTO, CALIFORNIA

VERSION NO.: **VEM_01.XLS** **LAST REVISED:** **24-Sep-92**

This multi-media model for estimating VOC emissions is based on Farmer's covered landfill emissions model presented in "Land Disposal of Hexachlorobenzene Wastes: Controlling Vapor Movement in Soil." EPA 600/2-80/119 (1980). The "box model" is based on the model presented in "Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup" EPA/600/6-86/002 (1986).

INFORMATION

PROJECT: Risk Assessment for the Recticon/Allied Steel Facilities
PROJECT FILENAME: VEM_CGW.XLS
SITE/STUDY AREA: Recticon & Allied Steel Facilities
SCENARIO: Current Offsite Residents - Indoor & Outdoor Air (95% UCL of Overburden AQ Only)

NOTES:

AR304164

MODEL PARAMETERS

Description	Parameter	*Value*	Units	Notes	Source
Emissions model parameters					
Soil moisture	W	0.25	unitless	Default value, HELP (EPA, 1983).	
Bulk density	p	0	g/cm^3	Not Used	
Particle density	d	0	g/cm^3	Not Used	
Fraction of soil organic matter	foc	0.0158	unitless	Default median value, Karickhoff, 1989.	
Total soil porosity	PT	0.588	unitless	Default value, HELP (EPA, 1983).	
Air-filled porosity	PA	0.338	unitless	Can be calculated from PT-W	
Box model parameters					
Surface area	A	100	m^2	Assumed value.	
Box height	H	2	m	Assumed value.	
Windspeed within mixing zone	V	2.13	m/s	1/2 of mean windspeed at Philly Int. Airport	
Width of area	L	10	m	Assumed value.	
Indoor air model parameters					
Building ventilation rate	Vn	1.40E-02	m^3/s	ASHRAE std. for general living areas	
Surface area of building		100	m^2	Assumed value.	
Leakage area of building		0.0001	m^2/m^2	Ranges from 1-10cm^2/m^2 (Grimsrud et al., 19	
Emission area of building	Ab	0.01	m^2	Based on product of the two previous entries.	
Miscellaneous parameters					
Ideal gas constant	R	8.21E-05	atm m^3/mol K		
Temperature	T	283	K		

CHEMDATA

Chemical-specific input data

Chemical	Diffusion Coefficient D (cm^2/s)	Molecular Weight MW (g/mol)	Koc (mL/g)	Kd (m^3/kg)	Henry's Constant H (atm m^3/mol)
SVOCs					
bis(2-Ethylhexyl)phthalate	0.05483	391	14350	0.22673	1.10E-05
TICs					
1,1,2-Trichloro-1,2,2-trifluoroetha	0.05784	187	426	0.0067308	5.26E-01
tert-butylmethylether	0.07382	88	11.2	0.00017696	5.87E-04
VOCs					
1,1,1-Trichloroethane	0.07496	133	152	0.0024016	1.44E-02
1,1-Dichloroethane	0.08557	99	30	0.000474	4.31E-03
1,1-Dichloroethene	0.07442	97	65	0.001027	3.40E-02
1,2-Dichloroethane	0.08557	99	14	0.0002212	9.78E-04
Benzene	0.08195	78	83	0.0013114	5.59E-03
Chloroethane	0.09789	65	33.1	0.00052298	8.48E-03
cis-1,2-Dichloroethene	0.07442	97	49	0.0007742	7.58E-03
Methylene Chloride	0.0961	85	8.8	0.00013904	2.03E-03
Tetrachloroethene	0.06968	166	364	0.0057512	2.59E-02
trans-1,2-Dichloroethene	0.07442	97	59	0.0009322	6.56E-03
Trichloroethene	0.07638	131	126	0.0019908	9.10E-03
Trichlorofluoromethane	0.07391	137	159	0.0025122	1.34E-01
Xylenes (mixed)	0.06742	106	240	0.003792	7.09E-03

Kd was calculated as follows: Kd = Koc x foc x (10^-6 m^3/mL) x (10^3 g/kg)

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CHEMICAL CONCENTRATIONS

(note: verify units)

Chemical	Soil Concentration Cs (mg/kg)	Depth Ls (m)	Groundwater Concentration Cw (mg/L)	Depth Lw (m)	Soil Gas Concentration Cv (ug/L)	Depth Lv (m)
SVOCs						
bis(2-Ethylhexyl)phthalate	--	--	0.01003	32.309	--	--
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethan	--	--	0.002	32.309	--	--
tert-butylmethylether	--	--	0.0012	32.309	--	--
VOCs						
1,1,1-Trichloroethane	--	--	0.00157	32.309	--	--
1,1-Dichloroethane	--	--	0.00283	32.309	--	--
1,1-Dichloroethene	--	--	0.00033	32.309	--	--
1,2-Dichloroethane	--	--	0.00255	32.309	--	--
Benzene	--	--	0.00029	32.309	--	--
Chloroethane	--	--	0.00026	32.309	--	--
cis-1,2-Dichloroethene	--	--	0.04804	32.309	--	--
Methylene Chloride	--	--	0.00041	32.309	--	--
Tetrachloroethene	--	--	0.00629	32.309	--	--
trans-1,2-Dichloroethene	--	--	0.00025	32.309	--	--
Trichloroethene	--	--	0.25722	32.309	--	--
Trichlorofluoromethane	--	--	0.00025	32.309	--	--
Xylenes (mixed)	--	--	0.00025	32.309	--	--

SOIL VAPOR CALCULATIONS

Chemical	Soil Vapor Concentration (Cv) Estimated from		
	Soil Samples Cv (mg/m^3)	Groundwater Samples Cv (mg/m^3)	Soil Gas Cv (mg/m^3)
SVOCs			
bis(2-Ethylhexyl)phthalate	--	4.75E-03	--
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethan	--	4.53E+01	--
tert-butylmethylether	--	3.03E-02	--
VOCs			
1,1,1-Trichloroethane	--	9.73E-01	--
1,1-Dichloroethane	--	5.25E-01	--
1,1-Dichloroethene	--	4.83E-01	--
1,2-Dichloroethane	--	1.07E-01	--
Benzene	--	6.98E-02	--
Chloroethane	--	9.49E-02	--
cis-1,2-Dichloroethene	--	1.57E+01	--
Methylene Chloride	--	3.58E-02	--
Tetrachloroethene	--	7.01E+00	--
trans-1,2-Dichloroethene	--	7.06E-02	--
Trichloroethene	--	1.01E+02	--
Trichlorofluoromethane	--	1.44E+00	--
Xylenes (mixed)	--	7.63E-02	--

-- Not Applicable

Cv calculated from the following equations:

SOIL: Cv = Cs x H/(Kd x R x T)

GROUNDWATER: P = Cw x H/MW x (10^-3 g/mg) x (10^3 L/m^3) ; and Cv = P x MW/(R x T) x (10^3 mg/g)

SOIL VAPOR: Cv x (10^3 L/m^3) x (10^-3 mg/ug)

EMISSIONS

Chemical	Emissions Rate (Q)			Selected (a) Emissions Rate
	Soil Q (mg/m^2/s)	Groundwater Q (mg/m^2/s)	Soil Gas Q (mg/m^2/s)	Q (mg/m^2/s)
SVOCs				
bis(2-Ethylhexyl)phthalate	--	6.27E-11	--	6.27E-11
TICs				
1,1,2-Trichloro-1,2,2-trifluoroetha	--	6.31E-07	--	6.31E-07
tert-butylmethylether	--	5.39E-10	--	5.39E-10
VOCs				
1,1,1-Trichloroethane	--	1.76E-08	--	1.76E-08
1,1-Dichloroethane	--	1.08E-08	--	1.08E-08
1,1-Dichloroethene	--	8.65E-09	--	8.65E-09
1,2-Dichloroethane	--	2.21E-09	--	2.21E-09
Benzene	--	1.38E-09	--	1.38E-09
Chloroethane	--	2.24E-09	--	2.24E-09
cis-1,2-Dichloroethene	--	2.81E-07	--	2.81E-07
Methylene Chloride	--	8.29E-10	--	8.29E-10
Tetrachloroethene	--	1.18E-07	--	1.18E-07
trans-1,2-Dichloroethene	--	1.26E-09	--	1.26E-09
Trichloroethene	--	1.85E-06	--	1.85E-06
Trichlorofluoromethane	--	2.57E-08	--	2.57E-08
Xylenes (mixed)	--	1.24E-09	--	1.24E-09

NA = Not applicable if soil vapor samples available

(a) Emission rates based on soil gas samples were used in preference to soil or groundwater samples.
If soil gas estimates were not available, the sum of soil and groundwater emission rates were used.

Q was calculated from the following equation:

Q = D x (Pa^(10/3)/Pt^2) (Cv/L) x (10^-4 m^2/cm^2)

Estimated Concentrations in Air: "Box", and Indoor Air Models

Chemical	Emission Rate Q (mg/m^2/s)	Concentrations in Air (Ca)	
		Box Model Ca (mg/m^3)	Indoor Air Model Ca (mg/m^3)
SVOCs			
bis(2-Ethylhexyl)phthalate	6.27E-11	1.47E-10	4.48E-11
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethan	6.31E-07	1.48E-06	4.50E-07
tert-butylmethylether	5.39E-10	1.27E-09	3.85E-10
VOCs			
1,1,1-Trichloroethane	1.76E-08	4.12E-08	1.25E-08
1,1-Dichloroethane	1.08E-08	2.54E-08	7.73E-09
1,1-Dichloroethene	8.65E-09	2.03E-08	6.18E-09
1,2-Dichloroethane	2.21E-09	5.19E-09	1.58E-09
Benzene	1.38E-09	3.23E-09	9.83E-10
Chloroethane	2.24E-09	5.25E-09	1.60E-09
cis-1,2-Dichloroethene	2.81E-07	6.59E-07	2.01E-07
Methylene Chloride	8.29E-10	1.95E-09	5.92E-10
Tetrachloroethene	1.18E-07	2.76E-07	8.40E-08
trans-1,2-Dichloroethene	1.26E-09	2.97E-09	9.03E-10
Trichloroethene	1.85E-06	4.35E-06	1.32E-06
Trichlorofluoromethane	2.57E-08	6.02E-08	1.83E-08
Xylenes (mixed)	1.24E-09	2.91E-09	8.85E-10

NA = Not applicable

Ca calculated from the following equation:

(Box Model) $Ca = Q \times A/(L \times V \times H)$

(Indoor Air) $Ca = Q \times Ab/Vn$

VOC EMISSIONS MODEL USING SOIL, SOIL GAS, & GROUNDWATER SAMPLES. MODEL ESTIMATES CHEMICAL CONCENTRATIONS IN AIR USING BOTH THE "BOX MODEL" & INDOOR AIR APPROACH.

PREPARED BY: *DAMES & MOORE*
TOXICOLOGY AND RISK ASSESSMENT GROUP
SACRAMENTO, CALIFORNIA

VERSION NO.: VEM_01.XLS **LAST REVISED:** 24-Sep-92

This multi-media model for estimating VOC emissions is based on Farmer's covered landfill emissions model presented in "Land Disposal of Hexachlorobenzene Wastes: Controlling Vapor Movement in Soil." EPA 600/2-80/119 (1980). The "box model" is based on the model presented in "Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup" EPA/600/6-86/002 (1986).

INFORMATION

PROJECT:	Risk Assessment for the Recticon/Allied Steel Facilities
PROJECT FILENAME:	VEM_R01.XLS
SITE/STUDY AREA:	Recticon - (Unpaved Areas)
SCENARIO:	Current Trespassers - Outdoor Air (95% UCL of Unpaved Areas); and Future Onsite Workers - Outdoor Air (95% UCL of Unpaved Areas)
NOTES:	

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MODEL PARAMETERS

Description	Parameter	*Value*	Units	Notes	Source
Emissions model parameters					
Soil moisture	W	0.25	unitless	Default value, HELP (EPA, 1983).	
Bulk density	p	0	g/cm^3	Not Used	
Particle density	d	0	g/cm^3	Not Used	
Fraction of soil organic matter	foc	0.0158	unitless	Default median value, Karickhoff, 1989.	
Total soil porosity	PT	0.588	unitless	Default value, HELP (EPA, 1983).	
Air-filled porosity	PA	0.338	unitless	Can be calculated from PT-W	
Box model parameters					
Surface area	A	100	m^2	Assumed value.	
Box height	H	2	m	Assumed value.	
Windspeed within mixing zone	V	2.13	m/s	1/2 of mean windspeed at Philly Int. Airport	
Width of area	L	10	m	Assumed value.	
Indoor air model parameters	(NOT USED)				
Building ventilation rate	Vn	1.40E-02	m^3/s	ASHRAE std. for general living areas	
Surface area of building		100	m^2	Assumed value.	
Leakage area of building		0.0001	m^2/m^2	Ranges from 1-10cm^2/m^2 (Grimsrud et al., 19	
Emission area of building	Ab	0.01	m^2	Based on product of the two previous entries.	
Miscellaneous parameters					
Ideal gas constant	R	8.21E-05	atm m^3/mol K		
Temperature	T	283	K		

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CHEMDATA

Chemical-specific input data

Chemical	Diffusion Coefficient D (cm^2/s)	Molecular Weight MW (g/mol)	Koc (mL/g)	Kd (m^3/kg)	Henry's Constant H (atm m^3/mol)
SVOCs					
Benzoic Acid	0.06956	122	19.2	0.00030336	7.00E-08
bis(2-ethylhexyl)phthalate	0.05483	391	14350	0.22673	1.10E-05
Di-n-butylphthalate	0.04252	278	170000	2.686	2.82E-07
TICs					
1,1,2-Trichloro-1,2,2-trifluoroetha	0.05784	187	426	0.0067308	5.26E-01
tert-butylmethylether	0.07382	88	11.2	0.00017696	5.87E-04
VOCs					
1,1,1-Trichloroethane	0.07496	133	152	0.0024016	1.44E-02
Trichloroethane (total)	0.07496	133	56	0.0008848	1.17E-03
1,1-Dichloroethane	0.08557	99	30	0.000474	4.31E-03
1,1-Dichloroethene	0.07442	97	65	0.001027	3.40E-02
1,2-Dichloroethane	0.08557	99	14	0.0002212	9.78E-04
1,2-Dichloroethene (total)	0.07442	97	56.6	0.00089428	6.81E-03
Acetone	0.09699	58	2.2	0.00003476	2.06E-05
Benzene	0.08195	78	83	0.0013114	5.59E-03
Carbon Tetrachloride	0.07500	154	110	0.001738	2.41E-02
Chloroethane	0.09789	65	33.1	0.00052298	8.48E-03
Chloroform	0.08345	120	31	0.0004898	2.87E-03
cis-1,2-Dichloroethene	0.07442	97	49	0.0007742	7.58E-03
Methylene Chloride	0.0961	85	8.8	0.00013904	2.03E-03
Tetrachloroethene	0.06968	166	364	0.0057512	2.59E-02
Toluene	0.07367	92	300	0.00474	6.37E-03
trans-1,2-Dichloroethene	0.07442	97	59	0.0009322	6.56E-03
Trichloroethene	0.07638	131	126	0.0019908	9.10E-03
Trichlorofluoromethane	0.07391	137	159	0.0025122	1.34E-01
Xylenes (mixed)	0.06742	106	240	0.003792	7.09E-03

Kd was calculated as follows: Kd = Koc x foc x (10^-6 m^3/mL) x (10^3 g/kg)

CHEMICAL CONCENTRATIONS

Chemical	Soil Concentration Cs (mg/kg)	Depth Ls (m)	Groundwater Concentration Cw (mg/L)	Depth Lw (m)	Soil Gas Concentration Cv (ug/L)	Depth Lv (m)
SVOCs						
Benzoic Acid	0.099	3.962	--	--	--	--
bis(2-ethylhexyl)phthalate	--	--	0.01003	32.309	--	--
Di-n-butylphthalate	0.16	3.962	--	--	--	--
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethan	--	--	0.002	32.309	--	--
tert-butylmethylether	--	--	0.0012	32.309	--	--
VOCs						
1,1,1-Trichloroethane	--	--	0.00157	32.309	--	--
Trichloroethane (total)	--	--	--	--	0.0086	0.914
1,1-Dichloroethane	--	--	0.00283	32.309	--	--
1,1-Dichloroethene	--	--	0.00033	32.309	--	--
1,2-Dichloroethane	--	--	0.00255	32.309	--	--
1,2-Dichloroethene (total)	0.048	3.962	--	--	--	--
Acetone	0.114	3.962	--	--	--	--
Benzene	--	--	0.00029	32.309	--	--
Carbon Tetrachloride	--	--	--	--	0.0004	0.914
Chloroethane	--	--	0.00026	32.309	--	--
Chloroform	--	--	--	--	0.0015	0.914
cis-1,2-Dichloroethene	--	--	0.04804	32.309	--	--
Methylene Chloride	0.003	3.962	0.00041	32.309	--	--
Tetrachloroethene	--	--	0.00629	32.309	0.0006	0.914
Toluene	--	--	--	--	0.4754	0.914
trans-1,2-Dichloroethene	--	--	0.00025	32.309	--	--
Trichloroethene	--	--	--	--	0.5909	0.914
Trichlorofluoromethane	--	--	0.00025	32.309	--	--
Xylenes (mixed)	--	--	0.00025	32.309	--	--

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SOIL VAPOR CALCULATIONS

Chemical	Soil Vapor Concentration (Cv) Estimated from		
	Soil Samples Cv (mg/m^3)	Groundwater Samples Cv (mg/m^3)	Soil Gas Cv (mg/m^3)
SVOCs			
Benzoic Acid	9.83E-04	--	--
bis(2-ethylhexyl)phthalate	--	4.75E-03	--
Di-n-butylphthalate	7.23E-07	--	--
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethan	--	4.53E+01	--
tert-butylmethylether	--	3.03E-02	--
VOCs			
1,1,1-Trichloroethane	--	9.73E-01	--
Trichloroethane (total)	--	--	8.60E-03
1,1-Dichloroethane	--	5.25E-01	--
1,1-Dichloroethene	--	4.83E-01	--
1,2-Dichloroethane	--	1.07E-01	--
1,2-Dichloroethene (total)	1.57E+01	--	--
Acetone	2.91E+00	--	--
Benzene	--	6.98E-02	--
Carbon Tetrachloride	--	--	4.00E-04
Chloroethane	--	9.49E-02	--
Chloroform	--	--	1.50E-03
cis-1,2-Dichloroethene	--	1.57E+01	--
Methylene Chloride	1.89E+00	3.58E-02	--
Tetrachloroethene	--	7.01E+00	6.00E-04
Toluene	--	--	4.75E-01
trans-1,2-Dichloroethene	--	7.06E-02	--
Trichloroethene	--	--	5.91E-01
Trichlorofluoromethane	--	1.44E+00	--
Xylenes (mixed)	--	7.63E-02	--

-- Not Applicable

Cv calculated from the following equations:

SOIL: Cv = Cs x H/(Kd x R x T)

GROUNDWATER: P = Cw x H/MW x (10^-3 g/mg) x (10^3 L/m^3) ; and Cv = P x MW/(R x T) x (10^3 mg/g)

SOIL VAPOR: Cv x (10^3 L/m^3) x (10^-3 mg/ug)

EMISSIONS

Chemical	Emissions Rate (Q)			Selected (a) Emissions Rate
	Soil Q (mg/m^2/s)	Groundwater Q (mg/m^2/s)	Soil Gas Q (mg/m^2/s)	Q (mg/m^2/s)
SVOCs				
Benzoic Acid	1.34E-10	--	--	1.34E-10
bis(2-ethylhexyl)phthalate	--	6.27E-11	--	6.27E-11
Di-n-butylphthalate	6.04E-14	--	--	6.04E-14
TICs				
1,1,2-Trichloro-1,2,2-trifluoroetha	--	6.31E-07	--	6.31E-07
tert-butylmethylether	--	5.39E-10	--	5.39E-10
VOCs				
1,1,1-Trichloroethane	--	1.76E-08	--	1.76E-08
Trichloroethane (total)	--	--	5.49E-09	5.49E-09
1,1-Dichloroethane	--	1.08E-08	--	1.08E-08
1,1-Dichloroethene	--	8.65E-09	--	8.65E-09
1,2-Dichloroethane	--	2.21E-09	--	2.21E-09
1,2-Dichloroethene (total)	2.30E-06	--	--	2.30E-06
Acetone	5.54E-07	--	--	5.54E-07
Benzene	--	1.38E-09	--	1.38E-09
Carbon Tetrachloride	--	--	2.55E-10	2.55E-10
Chloroethane	--	2.24E-09	--	2.24E-09
Chloroform	--	--	1.07E-09	1.07E-09
cis-1,2-Dichloroethene	--	2.81E-07	--	2.81E-07
Methylene Chloride	3.56E-07	8.29E-10	--	3.57E-07
Tetrachloroethene	--	1.18E-07	3.56E-10	3.56E-10
Toluene	--	--	2.98E-07	2.98E-07
trans-1,2-Dichloroethene	--	1.26E-09	--	1.26E-09
Trichloroethene	--	--	3.84E-07	3.84E-07
Trichlorofluoromethane	--	2.57E-08	--	2.57E-08
Xylenes (mixed)	--	1.24E-09	--	1.24E-09

NA = Not applicable if soil vapor samples available

(a) Emission rates based on soil gas samples were used in preference to soil or groundwater samples.
If soil gas estimates were not available, the sum of soil and groundwater emission rates were used.

Q was calculated from the following equation:

Q = D x (Pa^(10/3)/Pt^2) (Cv/L) x (10^-4 m^2/cm^2)

Estimated Concentrations in Outdoor Air using the "Box" Model

Chemical	Emission Rate Q (mg/m^2/s)	Concentrations in Air (Ca) Box Model Ca (mg/m^3)
SVOCs		
Benzoic Acid	1.34E-10	3.15E-10
bis(2-ethylhexyl)phthalate	6.27E-11	1.47E-10
Di-n-butylphthalate	6.04E-14	1.42E-13
TICs		
1,1,2-Trichloro-1,2,2-trifluoroethan	6.31E-07	1.48E-06
tert-butylmethylether	5.39E-10	1.27E-09
VOCs		
1,1,1-Trichloroethane	1.76E-08	4.12E-08
Trichloroethane (total)	5.49E-09	1.29E-08
1,1-Dichloroethane	1.08E-08	2.54E-08
1,1-Dichloroethene	8.65E-09	2.03E-08
1,2-Dichloroethane	2.21E-09	5.19E-09
1,2-Dichloroethene (total)	2.30E-06	5.40E-06
Acetone	5.54E-07	1.30E-06
Benzene	1.38E-09	3.23E-09
Carbon Tetrachloride	2.55E-10	5.99E-10
Chloroethane	2.24E-09	5.25E-09
Chloroform	1.07E-09	2.50E-09
cis-1,2-Dichloroethene	2.81E-07	6.59E-07
Methylene Chloride	3.57E-07	8.37E-07
Tetrachloroethene	3.56E-10	8.35E-10
Toluene	2.98E-07	7.00E-07
trans-1,2-Dichloroethene	1.26E-09	2.97E-09
Trichloroethene	3.84E-07	9.02E-07
Trichlorofluoromethane	2.57E-08	6.02E-08
Xylenes (mixed)	1.24E-09	2.91E-09

NA = Not applicable

Ca calculated from the following equation:

(Box Model)

$$Ca = Q \times A/(L \times V \times H)$$

VOC EMISSIONS MODEL USING SOIL, SOIL GAS, & GROUNDWATER SAMPLES. MODEL ESTIMATES CHEMICAL CONCENTRATIONS IN AIR USING BOTH THE "BOX MODEL" & INDOOR AIR APPROACH.

PREPARED BY: *DAMES & MOORE*
TOXICOLOGY AND RISK ASSESSMENT GROUP
SACRAMENTO, CALIFORNIA

VERSION NO.: VEM_01.XLS **LAST REVISED:** 24-Sep-92

This multi-media model for estimating VOC emissions is based on Farmer's covered landfill emissions model presented in "Land Disposal of Hexachlorobenzene Wastes: Controlling Vapor Movement in Soil." EPA 600/2-80/119 (1980). The "box model" is based on the model presented in "Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup" EPA/600/6-86/002 (1986).

INFORMATION

PROJECT: Risk Assessment for the Recticon/Allied Steel Facilities
PROJECT FILENAME: VEM_R02.XLS
SITE/STUDY AREA: Recticon - (Paved Areas)
SCENARIO: Future Onsite Resident - Indoor & Outdoor Air (95% UCL of Paved Areas)

NOTES:

AR304178

MODEL PARAMETERS

Description	Parameter	*Value*	Units	Notes	Source
Emissions model parameters					
Soil moisture	W	0.25	unitless	Default value, HELP (EPA, 1983).	
Bulk density	p	0	g/cm^3	Not Used	
Particle density	d	0	g/cm^3	Not Used	
Fraction of soil organic matter	foc	0.0158	unitless	Default median value, Karickhoff, 1989.	
Total soil porosity	PT	0.588	unitless	Default value, HELP (EPA, 1983).	
Air-filled porosity	PA	0.338	unitless	Can be calculated from PT-W	
Box model parameters					
Surface area	A	100	m^2	Assumed value.	
Box height	H	2	m	Assumed value.	
Windspeed within mixing zone	V	2.13	m/s	1/2 of mean windspeed at Philly Int. Airport	
Width of area	L	10	m	Assumed value.	
Indoor air model parameters					
Building ventilation rate	Vn	1.40E-02	m^3/s	ASHRAE std. for general living areas	
Surface area of building		100	m^2	Assumed value.	
Leakage area of building		0.0001	m^2/m^2	Ranges from 1-10cm^2/m^2 (Grimsrud et al., 19	
Emission area of building	Ab	0.01	m^2	Based on product of the two previous entries.	
Miscellaneous parameters					
Ideal gas constant	R	8.21E-05	atm m^3/mol K		
Temperature	T	283	K		

CHEMDATA

Chemical-specific input data

Chemical	Diffusion Coefficient D (cm^2/s)	Molecular Weight MW (g/mol)	Koc (mL/g)	Kd (m^3/kg)	Henry's Constant H (atm m^3/mol)
SVOCs					
Benzoic Acid	0.06956	122	19.2	0.00030336	7.00E-08
bis(2-ethylhexyl)phthalate	0.05483	391	14350	0.22673	1.10E-05
Di-n-butylphthalate	0.04252	278	170000	2.686	2.82E-07
TICs					
1,1,2-Trichloro-1,2,2-trifluoroetha	0.05784	187	426	0.0067308	5.26E-01
tert-butylmethylether	0.07382	88	11.2	0.00017696	5.87E-04
VOCs					
1,1,1-Trichloroethane	0.07496	133	152	0.0024016	1.44E-02
Trichloroethane (total)	0.07496	133	56	0.0008848	1.17E-03
1,1-Dichloroethane	0.08557	99	30	0.000474	4.31E-03
1,1-Dichloroethene	0.07442	97	65	0.001027	3.40E-02
1,2-Dichloroethane	0.08557	99	14	0.0002212	9.78E-04
1,2-Dichloroethene (total)	0.07442	97	56.6	0.00089428	6.81E-03
Acetone	0.09699	58	2.2	0.00003476	2.06E-05
Benzene	0.08195	78	83	0.0013114	5.59E-03
Carbon Tetrachloride	0.075	154	110	0.001738	2.41E-02
Chloroethane	0.09789	65	33.1	0.00052298	8.48E-03
Chloroform	0.08345	120	31	0.0004898	2.87E-03
cis-1,2-Dichloroethene	0.07442	97	49	0.0007742	7.58E-03
Methylene Chloride	0.0961	85	8.8	0.00013904	2.03E-03
Tetrachloroethene	0.06968	166	364	0.0057512	2.59E-02
Toluene	0.07367	92	300	0.00474	6.37E-03
trans-1,2-Dichloroethene	0.07442	97	59	0.0009322	6.56E-03
Trichloroethene	0.07638	131	126	0.0019908	9.10E-03
Trichlorofluoromethane	0.07391	137	159	0.0025122	1.34E-01
Xylenes (mixed)	0.06742	106	240	0.003792	7.09E-03

Kd was calculated as follows: Kd = Koc x foc x (10^-6 m^3/mL) x (10^3 g/kg)

AR304180

CHEMICAL CONCENTRATIONS

Chemical	Soil Concentration Cs (mg/kg)	Depth Ls (m)	Groundwater Concentration Cw (mg/L)	Depth Lw (m)	Soil Gas Concentration Cv (ug/L)	Depth Lv (m)
SVOCs						
Benzoic Acid	0.099	3.962	--	--	--	--
bis(2-ethylhexyl)phthalate	--	--	0.01003	32.309	--	--
Di-n-butylphthalate	0.16	3.962	--	--	--	--
TICs						
1,1,2-Trichloro-1,2,2-trifluoroethan	--	--	0.002	32.309	--	--
tert-butylmethylether	--	--	0.0012	32.309	--	--
VOCs						
1,1,1-Trichloroethane	--	--	0.00157	32.309	--	--
Trichloroethane (total)	--	--	--	--	0.3245	0.914
1,1-Dichloroethane	--	--	0.00283	32.309	--	--
1,1-Dichloroethene	--	--	0.00033	32.309	--	--
1,2-Dichloroethane	--	--	0.00255	32.309	--	--
1,2-Dichloroethene (total)	0.048	3.962	--	--	--	--
Acetone	0.114	3.962	--	--	--	--
Benzene	--	--	0.00029	32.309	--	--
Carbon Tetrachloride	--	--	--	--	0.2051	0.914
Chloroethane	--	--	0.00026	32.309	--	--
Chloroform	--	--	--	--	0.0077	0.914
cis-1,2-Dichloroethene	--	--	0.04804	32.309	--	--
Methylene Chloride	0.003	3.962	0.00041	32.309	--	--
Tetrachloroethene	--	--	0.00629	32.309	0.0092	0.914
Toluene	--	--	--	--	1.8669	0.914
trans-1,2-Dichloroethene	--	--	0.00025	32.309	--	--
Trichloroethene	--	--	--	--	0.4519	0.914
Trichlorofluoromethane	--	--	0.00025	32.309	--	--
Xylenes (mixed)	--	--	0.00025	32.309	--	--

SOIL VAPOR CALCULATIONS

Chemical	Soil Vapor Concentration (Cv) Estimated from		
	Soil Samples Cv (mg/m^3)	Groundwater Samples Cv (mg/m^3)	Soil Gas Cv (mg/m^3)
SVOCs			
Benzoic Acid	9.83E-04	--	--
bis(2-ethylhexyl)phthalate	--	4.75E-03	--
Di-n-butylphthalate	7.23E-07	--	--
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethan	--	4.53E+01	--
tert-butylmethylether	--	3.03E-02	--
VOCs			
1,1,1-Trichloroethane	--	9.73E-01	--
Trichloroethane (total)	--	--	3.25E-01
1,1-Dichloroethane	--	5.25E-01	--
1,1-Dichloroethene	--	4.83E-01	--
1,2-Dichloroethane	--	1.07E-01	--
1,2-Dichloroethene (total)	1.57E+01	--	--
Acetone	2.91E+00	--	--
Benzene	--	6.98E-02	--
Carbon Tetrachloride	--	--	2.05E-01
Chloroethane	--	9.49E-02	--
Chloroform	--	--	7.70E-03
cis-1,2-Dichloroethene	--	1.57E+01	--
Methylene Chloride	1.89E+00	3.58E-02	--
Tetrachloroethene	--	7.01E+00	9.20E-03
Toluene	--	--	1.87E+00
trans-1,2-Dichloroethene	--	7.06E-02	--
Trichloroethene	--	--	4.52E-01
Trichlorofluoromethane	--	1.44E+00	--
Xylenes (mixed)	--	7.63E-02	--

-- Not Applicable

Cv calculated from the following equations:

SOIL: Cv = Cs x H/(Kd x R x T)

GROUNDWATER: P = Cw x H/MW x (10^-3 g/mg) x (10^3 L/m^3) ; and Cv = P x MW/(R x T) x (10^3 mg/g)

SOIL VAPOR: Cv x (10^3 L/m^3) x (10^-3 mg/ug)

EMISSIONS

Chemical	Emissions Rate (Q) Soil Q (mg/m^2/s)	Groundwater Q (mg/m^2/s)	Soil Gas Q (mg/m^2/s)	Selected (a) Emissions Rate Q (mg/m^2/s)
SVOCs				
Benzoic Acid	1.34E-10	--	--	1.34E-10
bis(2-ethylhexyl)phthalate	--	6.27E-11	--	6.27E-11
Di-n-butylphthalate	6.04E-14	--	--	6.04E-14
TICs				
1,1,2-Trichloro-1,2,2-trifluoroetha	--	6.31E-07	--	6.31E-07
tert-butylmethylether	--	5.39E-10	--	5.39E-10
VOCs				
1,1,1-Trichloroethane	--	1.76E-08	--	1.76E-08
Trichloroethane (total)	--	--	2.07E-07	2.07E-07
1,1-Dichloroethane	--	1.08E-08	--	1.08E-08
1,1-Dichloroethene	--	8.65E-09	--	8.65E-09
1,2-Dichloroethane	--	2.21E-09	--	2.21E-09
1,2-Dichloroethene (total)	2.30E-06	--	--	2.30E-06
Acetone	5.54E-07	--	--	5.54E-07
Benzene	--	1.38E-09	--	1.38E-09
Carbon Tetrachloride	--	--	1.31E-07	1.31E-07
Chloroethane	--	2.24E-09	--	2.24E-09
Chloroform	--	--	5.47E-09	5.47E-09
cis-1,2-Dichloroethene	--	2.81E-07	--	2.81E-07
Methylene Chloride	3.56E-07	8.29E-10	--	3.57E-07
Tetrachloroethene	--	1.18E-07	5.46E-09	5.46E-09
Toluene	--	--	1.17E-06	1.17E-06
trans-1,2-Dichloroethene	--	1.26E-09	--	1.26E-09
Trichloroethene	--	--	2.94E-07	2.94E-07
Trichlorofluoromethane	--	2.57E-08	--	2.57E-08
Xylenes (mixed)	--	1.24E-09	--	1.24E-09

NA = Not applicable if soil vapor samples available

(a) Emission rates based on soil gas samples were used in preference to soil or groundwater samples.
If soil gas estimates were not available, the sum of soil and groundwater emission rates were used.

Q was calculated from the following equation:

Q = D x (Pa^(10/3)/Pt^2) (Cv/L) x (10^-4 m^2/cm^2)

AR304183

Estimated Concentrations in Outdoor and Indoor Air using the "Box" and Indoor Air Models

Chemical	Emission Rate Q (mg/m^2/s)	Concentrations in Air (Ca)	
		Box Model Ca (mg/m^3)	Indoor Air Model Ca (mg/m^3)
SVOCs			
Benzoic Acid	1.34E-10	3.15E-10	9.59E-11
bis(2-ethylhexyl)phthalate	6.27E-11	1.47E-10	4.48E-11
Di-n-butylphthalate	6.04E-14	1.42E-13	4.31E-14
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethan	6.31E-07	1.48E-06	4.50E-07
tert-butylmethylether	5.39E-10	1.27E-09	3.85E-10
VOCs			
1,1,1-Trichloroethane	1.76E-08	4.12E-08	1.25E-08
Trichloroethane (total)	2.07E-07	4.86E-07	1.48E-07
1,1-Dichloroethane	1.08E-08	2.54E-08	7.73E-09
1,1-Dichloroethene	8.65E-09	2.03E-08	6.18E-09
1,2-Dichloroethane	2.21E-09	5.19E-09	1.58E-09
1,2-Dichloroethene (total)	2.30E-06	5.40E-06	1.64E-06
Acetone	5.54E-07	1.30E-06	3.96E-07
Benzene	1.38E-09	3.23E-09	9.83E-10
Carbon Tetrachloride	1.31E-07	3.07E-07	9.35E-08
Chloroethane	2.24E-09	5.25E-09	1.60E-09
Chloroform	5.47E-09	1.28E-08	3.91E-09
cis-1,2-Dichloroethene	2.81E-07	6.59E-07	2.01E-07
Methylene Chloride	3.57E-07	8.37E-07	2.55E-07
Tetrachloroethene	5.46E-09	1.28E-08	3.90E-09
Toluene	1.17E-06	2.75E-06	8.36E-07
trans-1,2-Dichloroethene	1.26E-09	2.97E-09	9.03E-10
Trichloroethene	2.94E-07	6.90E-07	2.10E-07
Trichlorofluoromethane	2.57E-08	6.02E-08	1.83E-08
Xylenes (mixed)	1.24E-09	2.91E-09	8.85E-10

NA = Not applicable

Ca calculated from the following equation:

(Box Model) $Ca = Q \times A/(L \times V \times H)$

(Indoor Air) $Ca = Q \times Ab/Vn$

AR304184

VOC EMISSIONS MODEL USING SOIL, SOIL GAS, & GROUNDWATER SAMPLES. MODEL ESTIMATES CHEMICAL CONCENTRATIONS IN AIR USING BOTH THE "BOX MODEL" & INDOOR AIR APPROACH.

PREPARED BY: ***DAMES & MOORE***
TOXICOLOGY AND RISK ASSESSMENT GROUP
SACRAMENTO, CALIFORNIA

VERSION NO.: **VEM_01.XLS** **LAST REVISED:** **24-Sep-92**

This multi-media model for estimating VOC emissions is based on Farmer's covered landfill emissions model presented in "Land Disposal of Hexachlorobenzene Wastes: Controlling Vapor Movement in Soil." EPA 600/2-80/119 (1980). The "box model" is based on the model presented in "Development of Advisory Levels for Polychlorinated Biphenyls (PCBs) Cleanup" EPA/600/6-86/002 (1986).

INFORMATION

PROJECT: Risk Assessment for the Recticon/Allied Steel Facilities Site
PROJECT FILENAME: VEM_R03.XLS
SITE/STUDY AREA: Recticon
SCENARIO: Future Onsite Workers - Indoor Air (Maximum Concentration Near Buildings)

NOTES:

MODEL PARAMETERS

Description	Parameter	*Value*	Units	Notes	Source
Emissions model parameters					
Soil moisture	W	0.25	unitless	Default value, HELP (EPA, 1983).	
Bulk density	p	0	g/cm^3	Not Used	
Particle density	d	0	g/cm^3	Not Used	
Fraction of soil organic matter	foc	0.0158	unitless	Default median value, Karickhoff, 1989.	
Total soil porosity	PT	0.588	unitless	Default value, HELP (EPA, 1983).	
Air-filled porosity	PA	0.338	unitless	Can be calculated from PT-W	
Box model parameters					
Surface area	A	100	m^2	Assumed value.	
Box height	H	2	m	Assumed value.	
Windspeed within mixing zone	V	2.13	m/s	1/2 of mean windspeed at Philly Int. Airport	
Width of area	L	10	m	Assumed value.	
Indoor air model parameters					
Building ventilation rate	Vn	1.40E-02	m^3/s	ASHRAE std. for general living areas	
Surface area of building		100	m^2	Assumed value.	
Leakage area of building		0.0001	m^2/m^2	Ranges from 1-10cm^2/m^2 (Grimsrud et al., 19	
Emission area of building	Ab	0.01	m^2	Based on product of the two previous entries.	
Miscellaneous parameters					
Ideal gas constant	R	8.21E-05	atm m^3/mol K		
Temperature	T	283	K		

AR304186

CHEMDATA

Chemical-specific input data

Chemical	Diffusion Coefficient D (cm^2/s)	Molecular Weight MW (g/mol)	Koc (mL/g)	Kd (m^3/kg)	Henry's Constant H (atm m^3/mol)
VOCs					
Trichloroethane (total)	0.07496	133	56	8.85E-04	1.17E-03
Acetone	0.09699	58	2.2	3.48E-05	2.06E-05
Carbon Tetrachloride	0.075	154	110	1.74E-03	2.41E-02
Chloroform	0.08345	120	31	4.90E-04	2.87E-03
Methylene Chloride	0.0961	85	8.8	1.39E-04	2.03E-03
Tetrachloroethene	0.06968	166	364	5.75E-03	2.59E-02
Toluene	0.07367	92	300	4.74E-03	6.37E-03
Trichloroethene	0.07638	131	126	1.99E-03	9.10E-03

Kd was calculated as follows: Kd = Koc x foc x (10^-6 m^3/mL) x (10^3 g/kg)

CHEMICAL CONCENTRATIONS

Chemical	Soil Concentration Cs (mg/kg)	Depth Ls (m)	Groundwater Concentration Cw (mg/L)	Depth Lw (m)	Soil Gas Concentration Cv (ug/L)	Depth Lv (m)
VOCs						
Trichloroethane (total)	--	--	--	--	0.2	0.914
Acetone	0.114	3.962	--	--	--	--
Carbon Tetrachloride	--	--	--	--	0.001	0.914
Chloroform	--	--	--	--	0.05	0.914
Methylene Chloride	0.003	3.962	--	--	--	--
Tetrachloroethene	--	--	--	--	0.007	0.914
Toluene	--	--	--	--	2	0.914
Trichloroethene	--	--	--	--	6	0.914

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SOIL VAPOR CALCULATIONS

Chemical	Soil Vapor Concentration (Cv) Estimated from		
	Soil Samples Cv (mg/m^3)	Groundwater Samples Cv (mg/m^3)	Soil Gas Cv (mg/m^3)
VOCs			
Trichloroethane (total)	--	--	2.00E-01
Acetone	2.91E+00	--	--
Carbon Tetrachloride	--	--	1.00E-03
Chloroform	--	--	5.00E-02
Methylene Chloride	1.89E+00	--	--
Tetrachloroethene	--	--	7.00E-03
Toluene	--	--	2.00E+00
Trichloroethene	--	--	6.00E+00

-- Not Applicable

Cv calculated from the following equations:

SOIL: Cv = Cs x H/(Kd x R x T)

GROUNDWATER: P = Cw x H/MW x (10^-3 g/mg) x (10^3 L/m^3) ; and Cv = P x MW/(R x T) x (10^3 mg/g)

SOIL VAPOR: Cv x (10^3 L/m^3) x (10^-3 mg/ug)

EMISSIONS

Chemical	Emissions Rate (Q)			Selected (a) Emissions Rate
	Soil Q (mg/m^2/s)	Groundwater Q (mg/m^2/s)	Soil Gas Q (mg/m^2/s)	Q (mg/m^2/s)
VOCs				
Trichloroethane (total)	--	--	1.28E-07	1.28E-07
Acetone	5.54E-07	--	--	5.54E-07
Carbon Tetrachloride	--	--	6.38E-10	6.38E-10
Chloroform	--	--	3.55E-08	3.55E-08
Methylene Chloride	3.56E-07	--	--	3.56E-07
Tetrachloroethene	--	--	4.15E-09	4.15E-09
Toluene	--	--	1.25E-06	1.25E-06
Trichloroethene	--	--	3.90E-06	3.90E-06

NA = Not applicable if soil vapor samples available

(a) Emission rates based on soil gas samples were used in preference to soil or groundwater samples.
If soil gas estimates were not available, the sum of soil and groundwater emission rates were used.

Q was calculated from the following equation:

Q = D x (Pa^(10/3)/Pt^2) (Cv/L) x (10^-4 m^2/cm^2)

Estimated Concentrations in Indoor Air

Chemical	Emission Rate Q (mg/m^2/s)	Concentrations in Air (Ca) Indoor Air Model Ca (mg/m^3)
VOCs		
Trichloroethane (total)	1.28E-07	9.11E-08
Acetone	5.54E-07	3.96E-07
Carbon Tetrachloride	6.38E-10	4.56E-10
Chloroform	3.55E-08	2.54E-08
Methylene Chloride	3.56E-07	2.54E-07
Tetrachloroethene	4.15E-09	2.97E-09
Toluene	1.25E-06	8.96E-07
Trichloroethene	3.90E-06	2.79E-06

NA = Not applicable

Ca calculated from the following equation:

(Indoor Air)

$$Ca = Q \times Ab/Vn$$

ATTACHMENT E
TOXICITY PROFILES FOR SELECTED CHEMICALS OF CONCERN

SUMMARY TOXICITY PROFILES FOR INORGANIC COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Arsenic	Acute oral exposure can cause muscular cramps, facial swelling, cardiovascular reactions, severe gastrointestinal damage, and vascular collapse leading to death. Sensory loss and hematopoietic symptoms delayed after exposure to high concentrations are usually reversible. Inhalation exposure can cause severe irritation of nasal lining, larynx, and bronchi.	Chronic oral or inhalation exposure can produce: changes in skin, including hyperpigmentation and hyperkeratosis; peripheral neuropathy; liver injury; cardiovascular disorders; peripheral vascular disease associated with oral exposures; and blackfoot disease.	Excess skin cancers have been observed in individuals drinking water with elevated levels of arsenic from natural sources. Excess lung cancers have been observed in workers exposed to elevated concentrations of arsenic in air.	Toxicity varies for different compounds; inorganic trivalent arsenic compounds are usually more toxic than pentavalent compounds; high doses of some inorganic arsenic compounds to pregnant laboratory animals produced malformations in offspring.
Barium	Ingestion of barium salts can cause prolonged muscular stimulation, gastroenteritis, hypokalemia, and cardiovascular effects such as ventricular fibrillation and extra systoles.	Prolonged occupational inhalation has resulted in baritosis--a benign, reversible pneumoconiosis.	The cancer potential is not indicated.	The toxicity of barium compounds depends on their solubility.
Beryllium	Acute lung disease (chemical pneumonitis) has been observed immediately after inhalation of aerosols of soluble and insoluble beryllium compounds in broken fluorescent light tubes. Several months after exposure the entire respiratory tract may become inflamed with fulminating pneumonitis in severe reactions. Recoveries usually occur within weeks, but fatalities have occurred. In studies with monkeys, high concentrations of aerosols of beryllium fluoride or beryllium phosphate produced severe lung reactions in all animals and damaged the liver and kidney as well as affecting adrenals, pancreas, thyroid, and spleen; many lesions were similar to those inpatients who died of pneumonitis. Conjunctivitis and contact dermatitis may follow exposure to beryllium, with skin lesions or ulcerations. Beryllium compounds may produce hypersensitivity with delayed allergic reactions.	The lung is a major target organ for toxic effects of beryllium. Berylliosis, a chronic granulomatous lung disease that is frequently fatal, has been described for over 40 years among workers exposed to insoluble beryllium compounds; symptoms may include shortness of breath, cyanosis, clubbed fingers, and lesions that progress to fibrotic tissue and nodules with respiratory dysfunction.	Beryllium compounds or alloys have produced cancer in rats, rabbits, and monkeys. Lung tumors have been reported in rats and monkeys exposed by inhalation, intratracheally, or intrabronchial implantation, and bone tumors have been produced in rabbits after intravenous or intraosseus administration. Excess lung cancer has been observed in some studies of workers occupationally exposed to beryllium, but data on exposure and confounding factors were lacking. Beryllium and its compounds have been classified by IARC as having sufficient evidence of being carcinogenic in animals and limited evidence in humans, and by EPA as a probable human carcinogen. Some beryllium compounds are mutagenic in vitro.	Wide variations in individual sensitivity have been reported, perhaps because of an immune reaction; individuals exposed to low doses may exhibit severe effects. Beryllium is stored in the body for many years with detectable amounts in lung reported as long as 23 years after exposure.

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SUMMARY TOXICITY PROFILES FOR INORGANIC COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Chromium	The major acute effect from oral exposure is renal tubular necrosis. Inhalation of chromate salts results in irritation and inflammation of nasal mucosa, ulceration, and perforation of nasal septum.	Chronic exposure to hexavalent chromium has resulted in kidney damage in animals and humans. Inhalation exposures to chromates in industrial settings have resulted in nasal membrane inflammation, chronic rhinitis, laryngitis, and pharyngitis. Exposures to skin can result in allergic skin reactions in sensitive individuals. Overall, hexavalent forms are usually more toxic than trivalent forms.	Excess lung cancer has been associated with workers in the chromate-producing industry. Chromate salts have been shown to be carcinogenic in rats exposed by inhalation in some studies. Hexavalent chromium is considered a known human carcinogen.	Trivalent chromium is an essential element in human nutrition. Chromium toxicity is related to valence state.

AR304194

SUMMARY TOXICITY PROFILES FOR INORGANIC COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Cobalt	High doses can produce decreased appetite, weight loss, and debilitation. Death can occur in animals injected intravenously with cobalt salts.	Oral exposures of humans and animals can result in polycythemia (abnormal increase in red blood cells). Vomiting, diarrhea, and flushing have been reported in humans. Changes in blood pressure and tinnitus (ringing in the ears) and deafness have occurred in animals after intravenous injection. Severe cardiac effects, including effects on contractility, conductivity, and perhaps structural changes in the heart, and congestive heart failure occurred among people drinking beer containing cobalt as a foam stabilizer at levels of approximately 1.5 mg/l beer, apparently because of synergistic effects of alcohol and cobalt. Among some children treated for anemia with cobalt, toxicity included goiter, decreased thyroid function, increased cardiac and respiration rate, and skin and blood pressure changes. Cobalt may pose a health hazard to humans at levels above 1 mg/kg, especially people with ailments. Workers exposed occupationally may exhibit respiratory effects, probably from irritation. Cobalt salts may produce allergic contact dermatitis. Cobalt inhibits enzyme reactions catalyzed by cytochrome P-450 and may affect metabolism of other chemicals.	Sarcomas at injection site have been observed in animals administered cobalt powder or salts subcutaneously or intramuscularly.	Cobalt is an essential nutrient as part of vitamin B12 in humans; divalent, trivalent forms ??

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SUMMARY TOXICITY PROFILES FOR INORGANIC COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Copper	Inhalation of copper dusts results in symptoms similar to metal fume fever. Exposure to metal fumes results in upper respiratory tract irritation, metallic or sweet taste, metal fume fever, and skin and hair discoloration. Exposure to dusts and mists of copper salts result in congestion of nasal mucous membranes, sometimes of the pharynx, and occasional ulceration and perforation of nasal septum. Acute copper sulfate poisoning in humans (oral) is sometimes fatal; symptoms include vomiting, diarrhea, hypotension, coma, and jaundice.	Hemolytic anemia occurs after chronic exposure in some dialysis patients. Sensitive to individuals with metabolism disorders (Wilson's disease and Menke's disease).	Copper is not known to be carcinogenic in humans or laboratory animals.	Copper is an essential nutrient in human nutrition. The organoleptic threshold in water is 1 to 5 mg/l.
Lead	Acute inorganic lead intoxication in humans is characterized by encephalopathy, abdominal pain, hemolysis, liver damage, renal tubular necrosis, seizures, coma, and respiratory arrest.	Chronic low levels of exposure to lead can affect the hematopoietic system, the nervous system, and the cardiovascular system. Lead inhibits several key enzymes involved in heme biosyntheses. One characteristic effect of chronic lead intoxication is anemia, by reduction of both hemoglobin production and shortened erythrocyte survival. In humans, lead exposure has resulted in nervous system injury including reduced hand-eye coordination, reaction time, visual motor performance, and nerve conduction velocity. Developing children appear especially sensitive to lead-induced nervous system injury. Lead can also affect the immune system and produce gingival lead lines. Epidemiological studies have indicated that chronic lead exposure may be associated with increased blood pressure in humans. Exposure to lead is associated with sterility, abortion, neonatal mortality, and morbidity. Organolead compounds are neurotoxic.	Lead salts have shown some evidence of carcinogenicity in animals at very high exposure levels.	Children are especially sensitive to low-level exposures to lead.

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SUMMARY TOXICITY PROFILES FOR INORGANIC COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Nickel	Signs of acute nickel toxicity may include headaches, nausea, vomiting, chest pain, cough, hyperpnea, cyanosis, gastrointestinal and CNS effects, weakness, fever, pneumonia, respiratory failure, cerebral edema, and death. Acute exposures to nickel-containing dust may result in chemical pneumonitis.	Rhinitis, nasal sinusitis, and nasal mucosal injury are among the effects reported among workers chronically exposed to various nickel compounds. Allergic contact dermatitis and other dermatological effects are the most frequent effects of dermal exposure to nickel and nickel-containing compounds.	There is extensive epidemiological evidence indicating excess cancer of the lung and nasal cavity for workers exposed to certain nickel compounds. Nickel compounds implicated as having carcinogenic potential include insoluble dusts of nickel subsulfide and nickel oxides, vapor of nickel carbonyl and soluble sulfate, nickel carbonyl.	Nickel may be an essential element.
Vanadium	Signs and symptoms of exposure to vanadium pentoxide include irritation of mouth and stomach, vomiting, abdominal spasms, and tongue discoloration. Inhalation of dust irritates the nose and throat and can result in pulmonary edema. Contact with eyes and skin causes irritation and redness.	Chronic inhalation exposure to vanadium pentoxide may cause bronchitis, emphysema, and bronchial pneumonia.	The cancer potential of vanadium is not indicated.	The toxicity of vanadium increases with its valence. Vanadium is not readily absorbed through the skin or gastrointestinal tract; most adverse health effects occur from inhalation.
Zinc	Acute adverse effects of zinc include: metal fume fever by inhalation of fumes; and fever, nausea, vomiting, stomach cramps, and diarrhea from ingestion.	Prolonged ingestion of zinc can result in irritability, muscular stiffness and pain, loss of appetite, and nausea. High levels of zinc in diet may retard growth and produce defective mineralization of bone.	Zinc is not known to be carcinogenic in humans or laboratory animals.	Zinc is an essential nutrient in human nutrition. The taste threshold is 15 ppm in water; 40 ppm soluble zinc salts in water imparts a metallic taste.

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SUMMARY TOXICITY PROFILES FOR POLYCYCLIC AROMATIC HYDROCARBONS

CHEMICALS	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Acenaphthene	In humans, acenaphthene may be irritating to skin and mucous membranes. Ingestion of large quantities may cause vomiting.	Subchronic oral exposure in laboratory animals has caused morphological damage to liver and kidneys, and mild bronchitis. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Cancer potential is not indicated.	
Benzo[a]anthracene	No information is available on short-term dermal or inhalation effects.	No information is available on systemic effects. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Evidence exists that benzo[a]anthracene is carcinogenic to laboratory animals through dermal and ingestion exposure routes. May cause skin and lung cancer. Benzo[a]anthracene has been shown to be mutagenic in laboratory experiments.	Benzo[a]anthracene may be metabolized into reactive derivatives.
Benzo[a]pyrene	Acute toxicity appears low when administered by oral or dermal routes to laboratory animals.	Prolonged exposure may produce chronic dermatitis and reproductive changes. Repeated oral doses to mice have caused hypoplastic anemia. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Benzo[a]pyrene is a constituent of coal tar, which is classified as a known carcinogen by IARC and a probable carcinogen by the EPA. Ingestion may produce stomach tumors, and inhalation may produce lung cancer. Prolonged skin exposure has been linked to an increase in skin cancer among workers. Benzo[a]pyrene is considered to be the most potently carcinogenic PAH. Benzo[a]pyrene is a mutagen.	
Benzo[b]fluoranthene	No information is available.	Systemic effects specific to benzo[b]fluoranthene have not been reported. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Experimental evidence exists of lung and skin cancer in laboratory animals induced by dermal absorption and intratracheal distillation.	
Benzo[g,h,i]perylene	Limited information is available.	Limited information is available. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Benzo[g,h,i]perylene is a liver and skin carcinogen in laboratory animals. It has been reported to produce cocarcinogenic effects when applied to mouse skin along with benzo[a]pyrene.	
Chrysene	Chrysene is absorbed orally and dermally.	Chrysene accumulates in adipose and mammary tissues. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Chrysene is carcinogenic in laboratory animals exposed to prolonged dermal doses. There is limited evidence that chrysene is mutagenic.	Epidemiological reports indicate the incidence of skin cancer due to exposure to PAH mixtures which included chrysene.

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SUMMARY TOXICITY PROFILES FOR POLYCYCLIC AROMATIC HYDROCARBONS

CHEMICALS	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Dibenzo[a,h]anthracene	Oral absorption but has slow dermal absorption. High doses in laboratory animals have produced fetal death.	PAHs as a group may cause skin disorders and have immunosuppressive effects. PAHs as a group may cause skin disorders and have immunosuppressive effects.	There is sufficient evidence that dibenzo[a,h]anthracene is carcinogenic in laboratory animals. Oral doses have caused tumors in mice. Lung tumors in rats resulted from intratracheal distillation, and skin cancer resulted following dermal application.	
Fluoranthene	Fluoranthene is toxic by oral and dermal absorption. It is a defatting agent that may affect the skin, and can cross epithelial membranes.	Limited information is available. PAHs as a group may cause skin disorders and have immunosuppressive effects.	There is no evidence that fluoranthene is carcinogenic. Cocarcinogenic effects have occurred following simultaneous dermal exposures with other PAHs.	
Fluorene	Fluorene may be toxic by inhalation, ingestion, or dermal contact.	Limited information is available. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Cancer potential is not indicated.	
Naphthalene	Inhalation of vapor may cause eye irritation, headache, and confusion. Ingestion may cause abdominal pain, nausea, and vomiting. Skin or eye contact may lead to systemic effects such as bladder irritation, kidney effects, and hemolytic effects. In animal studies, bronchial necrosis was observed in rats.	Occurrence of cataracts upon exposure to naphthalene vapor and dust has been observed in humans. Subchronic animal studies have shown that oral doses produced cataracts and degeneration of the retina. Dermatitis has been reported with repeated skin exposure. Two studies have reported hemolytic anemia in infants born to women exposed during pregnancy. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Studies have not shown that naphthalene is carcinogenic. Naphthalene is commonly found in coal tar and epidemiological studies have shown coal tar to be carcinogenic. The role of naphthalene alone could not be determined.	Hemolytic effects from acute exposure are more pronounced in individuals with a hereditary deficiency of glucose-6-phosphate dehydrogenase.
Phenanthrene	Phenanthrene is an irritant through inhalation and ingestion exposure, and may also be dermally absorbed. Phenanthrene can cause photosensitization of the skin.	Phenanthrene may be an allergen. PAHs as a group may cause skin disorders and have immunosuppressive effects.	The cancer potential is not indicated.	
Pyrene	Limited information is available.	Limited information is available. PAHs as a group may cause skin disorders and have immunosuppressive effects.	Evidence suggests that pyrene is cocarcinogenic in laboratory animal experiments.	

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SUMMARY TOXICITY PROFILES FOR AROMATIC HYDROCARBONS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
1,3-Dichlorobenzene (*m*-Dichlorobenzene)	Possible CNS disruption results in excitation, seizures, respiratory depression, tremor, ataxia, convulsions, nervousness, and amnesia. Ingestion can result in nausea, vomiting, and diarrhea. Extensive contact results in dermal irritation. Methemoglobinemia may result.	No chronic toxicity information is available.	This compound is not classifiable as to human carcinogenicity.	
Bis(2-ethylhexyl) phthalate	This compound is not considered to be acutely or chronically toxic.		This compound is classified as a probable human carcinogen, based on significant dose-related increases in liver tumor responses in rats and mice of both sexes.	
Benzene	Signs and symptoms from mild exposure include dizziness, weakness, euphoria, headache, ataxia and tightness in the chest. A burning sensation of the oral mucous membranes, esophagus, and stomach as well as nausea, vomiting, and abdominal pain may occur after ingestion. Inhalation results in bronchial irritation, cough, and hoarseness; pulmonary edema may be noted. Inhalation exposure to high levels of benzene may lead to depression of the central nervous system and induce blurred vision, tremors, shallow and rapid respiration, ventricular irregularities (including fatal cardiac arrhythmias), paralysis, unconsciousness, and death.	Fatigue, headache, anorexia and dizziness may be noted following chronic exposure to benzene.	Benzene is listed as known human carcinogen. Benzene exposure has been associated with the development of leukemia in humans. Lifetime exposure to 100 ppm is associated with 140 excess deaths from leukemia/1,000 individuals; 10 ppm is associated with 14 excess deaths from leukemia/1,000 individuals. The major toxic effect is hematopoietic toxicity (affecting blood formation); chronic exposure of workers to low levels has been associated with blood disorders, such as leukemia and aplastic anemia (depression of all three types of blood cells in the absence of functioning marrow). Benzene is weakly mutagenic in human lymphocytes. Both gavage and inhalation exposure to rodents have resulted in development of neoplasia.	Chromosomal aberrations in bone marrow and blood have been reported in experimental animals and some workers. 100 ml is the estimated lethal dose.

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SUMMARY TOXICITY PROFILES FOR AROMATIC HYDROCARBONS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Chlorobenzene	CNS depression and irritation of the eye and respiratory tract have been reported in humans exposed to chlorobenzene. Workers exposed to chlorobenzene exhibited blood dyscrasia. Cardiac effects and toxemia of pregnancy were noted in workers exposed to chlorobenzene and other chemicals. Liver necrosis and interference with porphyrin metabolism occurred in rats dosed orally with chlorobenzene. Kidneys of rabbits were swollen after injection with chlorobenzene.	In dogs exposed to chlorobenzene via inhalation increased adrenal gland weights, increased liver-to-body weight ratios, and emesis were documented. In rats dosed orally, increased liver and kidney weights and histopathological changes in the liver were observed. Histopathological changes in lymphoid, liver, and kidney tissues and depressed body weight gain were also found in another study with mice and rats receiving chlorobenzene by gavage. In a NTP chronic study of rats and mice receiving chlorobenzene by gavage, liver necrosis occurred in rats and decreased survival was found in low-dose male mice but not high-dose male mice. No teratogenic effects were seen in two-phase inhalation study of rats and rabbits.	Findings regarding human carcinogenicity are inconclusive. Increased incidence of neoplastic nodules was observed in the livers of male rats receiving chlorobenzene in corn oil by gavage, but judged to be of borderline significance because of carcinomas in vehicle controls. Mutagenicity test results are mixed.	Chlorobenzene is lipophilic.
Ethylbenzene	Acute toxicity is low. Low-level ingestion or inhalation exposure causes irritation of the eyes, nose, throat, skin, and mucous membranes. At high levels of exposure the irritating effects are more pronounced and the exposed subject may feel week, dizzy, and drowsy.	Histopathologic changes in the liver and kidneys, narcotic effects, and adverse reproductive effects were noted in oral and inhalation animal studies. Inhalation exposure to concentrations of up to 1,000 ppm did not induce embryotoxicity, phytotoxicity, or teratogenicity in rats or rabbits. No adverse health effects were noted in human volunteers inhaling vapors at 100 ppm for eight hours.	Cancer potential is not indicated. Mutagenicity has not been demonstrated in this chemical.	Inhalation is the primary route of exposure.

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SUMMARY TOXICITY PROFILES FOR AROMATIC HYDROCARBONS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Toluene	Toluene appears to produce reversible effects upon liver, renal, and nervous systems. Lower-level acute exposures in humans produce dizziness, exhilaration and confusion. High-level toluene exposure (or exposure in confined areas) has produced incoordination, ataxia, unconsciousness and eventually, death. Ingestion of toluene probably causes transient CNS depression. Ingestion may also result in a burning sensation of the oropharynx and stomach followed by nausea, vomiting (including hematemesis), and abdominal pain. Inhalation may result in bronchial and laryngeal irritation, upper bronchial lacrimation, and respiratory failure. However, concentrations in air of up to 800 ppm have caused only slight irritation to the human eye.	Profound muscle weakness secondary to hypokalemia may be noted following chronic inhalation. Hallucinations may be noted, especially following repeated inhalation. Rats exposed to 1,500 mg/cu m of air showed no signs of teratogenic effects.	No skin tumors developed in several strains of mice painted with toluene. A chronic bioassay of toluene in rats of both sexes reported no carcinogenic effects. Toluene did not change the number of sister-chromatid exchanges or chromosomal aberrations in human lymphocytes in vitro. It is non mutagenic in *Salmonella typhimurium* strains TA1535, TA1537, TA1538, TA98 and TA100 in the Ames assay, both with and without metabolic activation, and has been provisionally classified as non-mutagenic.	The nervous system appears to be the most sensitive to the effects of toluene. Lethal levels in human blood are reported to be 10.0 μg/ml. Human death has resulted from exposure to toluene at 10,000 ppm.
Xylenes (o-Xylene, m-Xylene, and p-Xylene)	Industrial exposure to vapors in confined areas has resulted in collapse, coma, and death. Acute ingestion of xylene solvents probably causes transient CNS depression. Inhalation may result in bronchial and laryngeal irritation and lacrimation; respiratory failure and cardiac arrhythmia may also occur. Ingestion may result in a burning sensation of the oropharynx and stomach, nausea, vomiting (including hematemesis), and abdominal pain. Transient liver injury may be noted.	Animal studies have shown xylene to be both fetotoxic and teratogenic in several mice species at high doses. An increase in tumor incidence or response was not found in rats or mice ingesting technical grade xylene mixtures. Bioassays for mutagenicity have shown both positive and negative results. Myoglobinemia, proteinuria, oliguria, rhabdomyolysis, and acute renal failure may be noted especially following repeated inhalation or accidental ingestion.	Xylenes are not classifiable as to human carcinogenicity.	Blood concentrations of 3 to 40 μg/ml are likely to cause death in humans. Xylenes are absorbed readily through the skin, mucous membranes, and pulmonary system, where they are translocated through the vascular system, and have been reported to cross the human placenta.

AR304202

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
1,1,1-Trichloroethane (1,1,1-TCA)	1,1,1-trichloroethane is a CNS and respiratory depressant, and a skin and mucous membrane irritant. Contact with eyes will result in chemosis and hyperemia. Following extreme acute exposure, hypotension and cardiac arrhythmia due to myocardial sensitization have occurred. Trichloroethane has a rapid anesthetic action. Acute overdoses may cause dizziness, unconsciousness and coma. Cerebral hypoxia has been reported. Human males exposed to 1,1,1-TCA at concentrations of up to 1,000 ppm experienced transient mild irritation and minimal impairment of coordination. However, at concentrations below 1,000 ppm, perceptual speed and manual dexterity were impaired. Nausea, vomiting, diarrhea, and burns of the esophagus have been noted after large ingestion exposures. May cause transient increases in liver enzyme levels and renal impairment. Extreme exposure may have adverse effects on the cardiac system.	Prolonged dermal exposure has caused transient mild to severe dermatitis in humans. Significant changes in liver cells were noted in a high-level inhalation study of male mice. Chick embryo malformations were noted from air space injections of 1,1,1-TCA. It tested negative for teratogenicity and mutagenicity in a two-generation reproductive study performed on ICR Swiss mice and has proven to be non-fetotoxic in mice and rats.	Three out of 49 male rats ingesting high doses of 1,1,1-TCA developed liver-cell adenomas, and one rat developed hepatocellular carcinomas. It is not classifiable as to human carcinogenicity. 1,1,1-TCA showed mutagenic activity when tested by the *Salmonella*/microsome test, the basic test on *Drosophila*, and the micronucleus test on mouse bone marrow.	1,1,1-TCA levels in human blood above 1.0 to 1.5 mg/100 ml can result in death. From the available data, it can be estimated that a single exposure to concentrations of 1,1,1-TCA less than 5,000 ppm is probably not life- threatening to humans. Inhalation and lung absorption is the most important and rapid route of intake into the body. Unlike other chlorinated hydrocarbons, it has not been associated with evidence of liver or kidney damage.
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	Exposures greater than 2,500 ppm can produce CNS depression which may induce lightheadedness, giddiness, disorientation, shortness of breath, incoordination, and possible cardiac arrhythmia. Slight impairment of psychomotor performance was reported in male volunteers during a 2.75-hour inhalation study.	Repeated or prolonged contact with skin may cause defatting and possible dermatitis. Several high-dose animal inhalation studies have reported negative adverse results.	No carcinogenicity assessment exists for this chemical. Mutagenicity testing using the Ames assay was negative.	

AR304203

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
1,1,2-Trichloroethane (1,1,2-TCA)	This chemical is a CNS and respiratory depressant, and a skin and mucous membrane irritant. Toxic by dermal contact and inhalation, 1,1,2-TCA can also cause headache and dizziness, liver and kidney damage, cerebral hypoxia, and death. Hypotension and cardiac arrhythmia have occurred. Nausea, vomiting, diarrhea, and esophagus burns have been noted after large ingestions.	Clinical chemistry indications of adverse effects on liver and erythrocytes in mice given 2,000 mg/l in water for 90 days.	1,1,2-TCA is classified as a possible human carcinogen. Hepatocellular carcinomas and pheochromocytomas observed in one mouse strain form the basis for this classification. Other tumor types were noted as well. This chemical is structurally related to 1,2-dichloroethane, a probable human carcinogen. 1,1,2-TCA was found to be nonmutagenic for *Salmonella typhimurium*.	Humoral immune status and macrophage function were depressed in higher-dose mice after 90 days of treatment. Spleen lymphocyte responsiveness was significantly decreased in high-dose females.
1,1-Dichloroethane (1,1-DCA)	This compound can cause salivation, sneezing, and coughing. Anesthetic effects have been observed, with associated dizziness, nausea and vomiting. In severe and fatal cases, hepatic and renal injury have been observed.	1,1-DCA has little capacity to cause liver or kidney injury on repeated exposure; however, repeated or prolonged dermal exposure can cause skin burns, scaliness, and rash. Limited evidence exists of the occurrence of mammary and benign uterine polyps in female rats and mice respectively, and of liver carcinomas in male mice.	This is a possible human carcinogen based on limited animal data and structural similarity to 1,2-DCA, a probable human carcinogen. This chemical is mutagenic in *Salmonella* strains TA 98, 100, 1537 and negative in strain TA 1535. Additionally, it is classified as a weak initiator due to its ability to covalently bind to DNA. Specifically, it is able to bind to mouse and rat RNA and DNA in liver, lung, and stomach tissue.	
1,1-Dichloroethene (Vinylidene chloride; 1,1-DCE)	Contact may irritate or burn the skin, is irritating to the eyes and may cause conjunctivitis and transient corneal injury. Inhalation of high concentrations produces CNS depression resulting in poor coordination, stupor, drunkenness, and unconsciousness. Narcosis has been noted at concentrations exceeding 4,000 ppm.	Inhalation may produce hepatic and renal dysfunction. Low-level oral or inhalation exposure produces symptoms similar to acute exposure. It was shown to be mutagenic in several bacterial test strains. It was also shown to be non-mutagenic in chinese hamster cells. Rats exposed by inhalation for six hours daily, five days per week, for 18 months at 25 or 75 ppm showed a target organ effect on the liver. The liver lesions, however, were reversible, as they disappeared during the last six months of the study after exposures had been discontinued.	1,1-DCE is classified as a possible human carcinogen, based on tumors observed in one mouse strain after inhalation exposure. It is mutagenic for Salmonella typhimurium in multiple assays. 1,1-DCE is structurally related to vinyl chloride, a known human carcinogen.	No toxic levels have been reported. A human study of 138 employees exposed to 5 to 20 ppm showed no changes in mortality or health parameters.

AR304204

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
1,2-Dichloroethane (1,2-DCA)	This is a CNS depressant that produces signs and symptoms ranging from nausea, vomiting, headache, lightheadedness, weakness, stupor, and disequilibrium, to coma and respiratory arrest. Ingestion of large amounts has also produced widespread organ damage (especially in kidneys, liver, and adrenal glands) as well as gastrointestinal bleeding.	Weight loss, low blood pressure, jaundice, oliguria, or anemia may occur after repeated minimal exposure via inhalation or skin absorption. Skin tissue defatting occurs. Pathological evidence exists of damage to the liver, kidneys, and adrenal glands in humans and several animal species exists. It is not considered to be a teratogen in laboratory animals. Single-stranded breaks in DNA of hamster cells and chromosomal aberrations in barley kernels have been produced. 1,2-DCA has a weak direct mutagenic effect in *Salmonella typhimurium* strain TA-1535, and is considered to be a probable mutagen.	This compound is a probable human carcinogen and is suspected of producing excess occupational mortality from tumors and diseases of the circulatory system. 1,2-DCA has been shown to be a carcinogen in laboratory animals. Tumors produced include increased incidence of mammary and uterine adenocarcinomas, endometrial stromal neoplasms of the uterus, and squamous-cell carcinomas of the forestomach in females; lung adenomas and malignant histiocytic lymphomas in males and females; and hepatocellular carcinomas in male mice.	The primary target appears to be the CNS. Ingestion of 400 to 1,000 mg/kg body weight is fatal in humans. Death is thought to be caused by circulatory or respiratory failure. Autopsies have revealed liver necrosis and focal adrenal degeneration and necrosis.
Acetone	Systemic and central nervous system (CNS) depression are likely to occur due to inhalation, ingestion, or dermal absorption of acetone. CNS toxicity ranges from ataxia and sedation to varying degrees of coma. Respiratory depression, cough, and bronchial irritation may occur if inhaled. Vomiting (including hematemesis) may be noted after ingestion. Renal tubular necrosis may occur following exposure, but is rare. Hyperglycemia and ketonemia mimicking acute diabetic coma are commonly reported as a result of acetone metabolism. Occupational exposure for 15 minutes to concentrations of 1,660 ppm causes irritation to the eyes and nose.	Liver and kidney weight, and tubular degeneration of the kidneys increased significantly in orally dosed rats. There have been no reports that prolonged exposure to low vapor concentrations results in any serious chronic effects in humans.	Not classifiable as to human carcinogenicity. Acetone was found to be non-mutagenic in the Ames assay. Furthermore, acetone gave negative result in assays for teratogenicity, chromosomal aberrations, and DNA binding studies.	Because of its high water solubility, acetone is rapidly absorbed, transported, and excreted from the body. Ingestion of 10 to 20 ml generally does not result in toxicity. Ingestion of 200 ml produced severe coma and hyperglycemia in adults. The toxic dose for children is considered to be 2 to 3 ml.

AR304205

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Carbon tetrachloride	Acute toxicity signs and symptoms include dyspnea, cyanosis, proteinuria, hematuria, jaundice, hepatomegaly, optic neuritis, ventricular fibrillation, eye-nose-throat irritation, headache, dizziness, nausea, vomiting, abdominal cramps, and diarrhea. CNS depression with deepening coma and death from respiratory arrest or circulatory collapse may result. In massive exposures, general kidney and liver damage may occur. In general, the main target organ is the liver.	Chronic exposure usually results in nausea, vomiting, headache, drowsiness, and fatigue. Hepatic cirrhosis and necrosis, renal damage, and serum changes may result. Carbon tetrachloride has reduced fetal weights after maternally toxic inhalation exposures. Fetal effects have been noted in several studies.	Carbon tetrachloride is classified as a probable human carcinogen based on inadequate human data and sufficient evidence of hepatocellular carcinoma in rats, mice, and hamsters. All mutagenicity studies have been negative; this may be due to inadequate activation in the test systems.	Carbon tetrachloride is metabolized to a reactive radical intermediate, which is believed to induce lipid peroxidation and subsequent hepatotoxicity. There may be an age difference in susceptibility to carbon tetrachloride-induced hepatotoxicity. It is rapidly absorbed and distributed in the body, and is excreted primarily via the lung.
Chloroform	Chloroform is a CNS and cardiac depressant; signs and symptoms include inebriation, dizziness, excitation, unconsciousness, nausea, and vomiting. Extreme exposure may cause cardiac irregularities, liver and kidney injury, death from cardiac arrest, and delayed liver and kidney damage. Delayed renal and hepatic toxicity as well as nausea, vomiting, and gastrointestinal irritation may also occur after ingestion. Respiratory depression, chemical pneumonitis, and pulmonary edema may occur following inhalation. Conjunctivitis and blepharospasm may occur from exposure to vapors of chloroform. Liquid chloroform in the eyes causes immediate burning pain, tearing, and reddening of conjunctiva. The corneal epithelium is usually injured and may temporarily be partially lost.	Repeated exposure results in liver injury and possible kidney injury. Chloroform with metabolic activation failed to induce chromosome breakage or sister-chromatid exchanges in human lymphocytes. Chloroform is fetotoxic in rats. Chloroform may be embryotoxic.	Listed as a probable human carcinogen, based on inadequate evidence in humans and sufficient evidence in animals. A statistically significant increased incidence of hepatocellular carcinoma was found in mice, due to oral ingestion of chloroform. Oral ingestion also induced kidney epithelial tumors in male rats. It is proven to be non-mutagenic in the Ames assay with and without metabolic activators.	Chloroform is rapidly and extensively absorbed through both respiratory and gastrointestinal tracts. Signs of chloroform poisoning in humans include a characteristic sweetish odor on the breath, dilated pupils, cold and clammy skin, initial excitation alternating with apathy, loss of sensation, abolition of motor functions, prostration, unconsciousness and eventual death. Toxic blood level: 70.0 to 250 mg/l; Lethal blood level: 390.0 mg/l. Fatal dose by ingestion or inhalation is reported to be 10 ml.

AR304206

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Chloromethane	Little information exists regarding the toxicity of chloromethane. In one study, the inhalation of 7,000 ppm had no serious effects on experimental animals for up to 60 minutes of exposure.	Decreased survival and neuromuscular effects resulted from exposure to 1,000 ppm for 6 hours per day, 6 days per week, for up to 175 days. Some response was seen at 500 ppm, in monkeys only. Effects on the CNS, blood, and eye were noted in rats exposed to 20 and 120 ppm.	Chloromethane is not known to be carcinogenic in humans or laboratory animals.	
cis-1,2-Dichloroethene (*cis*-1,2-DCE)	This chemical is toxic via all exposure routes. It is an irritant of the skin and mucous membranes. Inhalation causes nausea, vomiting, weakness, tremor, epigastric cramps, and CNS depression. Ingestion also causes CNS depression. In general, the liver is the primary target organ.	This isomer was not mutagenic in the Salmonella/microsome preincubation assay using five different strains, in both the presence and absence of rat and hamster liver. In a host-mediated assay using *Saccharomyces cerevisiae*, the *cis*-isomer showed evidence of mutagenic activity. The *cis*-isomer also induced unscheduled DNA synthesis in isolated hepatocytes.	This is not known to be carcinogenic in humans or laboratory animals.	
Dichlorodifluoromethane	Motor stimulation, placidity, rapid respiration, immobility, tremors, and narcosis were observed in mice after inhaling acute doses.		The carcinogenicity of dichlorodifluoromethane has not been determined.	Dichlorodifluoromethane is not readily soluble in water, nor is it readily metabolized.
Methylene chloride	At high levels, it is a CNS depressant producing behavioral and performance deficits, depression, and coma, as well as toxicity to the liver, kidneys, and cardiovascular system. The CNS and liver are the primary target organs.	Oral exposure to drinking water resulted in changes in the blood and liver of rats. The potential for teratogenicity is low.	Methylene chloride is a probable human carcinogen based on evidence of carcinogenicity from inhalation bioassays using rats and mice, and lack of evidence in humans. Rats developed benign mammary gland neoplasms, and mice alveolar/bronchiolar and hepatocellular neoplasms. No conclusive association between exposure and incidence of liver or lung tumors found from human epidemiological studies. It is judged to be weakly mutagenic.	Methylene chloride is lethal to humans if swallowed or inhaled. It is absorbed through and is distributed rapidly from lung and gut, and is highly lipid-soluble.

AR304207

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Tetrachloroethene (Perchloroethylene, PCE)	PCE is a central and peripheral nervous system depressant producing dizziness, confusion, headache, and nausea. It is also an irritant of eyes and mucous tissue. Overexposure can cause malaise, dizziness, fatigue, headache, lightheadedness, sweating, staggering, inebriation, and mental dullness which most often clear rapidly when the victim is moved to fresh air. Transient liver and kidney damage in humans has been associated with high dose exposures. Workers rendered unconscious for hours have survived without sequelae.	Dermal blistering and dermatitis may occur with repeated direct skin contact. Chronic inhalation exposure has been associated with the development of peripheral neuropathies. Occupational exposure has resulted in hepatitis, confusion, disorientation, muscle cramps, fatigue, and agitation. Chromosome abnormalities were seen in lymphocytes from exposed workers. In one study, no fetal toxicity or teratogenicity was detected from pregnant rats and mice exposed to 300 ppm PCE. However, fetotoxicity and developmental abnormalities have been described in other experimental animals. PCE is a proven hepatotoxin in mice.	PCE is carcinogenic in experimental animals, but epidemiologic evidence from studies of laundry and dry cleaning workers has been judged to be inadequate in the assessment of its potential for human carcinogenicity. It was not mutagenic in two strains of *Salmonella typhimurium*, but was mutagenic in a test using L5178Y mouse lymphoma cells, and is considered to be a weak mutagen.	PCE is readily absorbed and eliminated from the body via the lung. Metabolism of PCE is relatively slow, with only a few percent of the total dose being excreted as metabolites. An autopsy after a fatal PCE exposure revealed an eight-fold greater concentration in the brain than in the blood.
trans-1,2-Dichloroethene (*trans*-1,2-DCE)	Inhalation causes nausea, vomiting, weakness, tremor, epigastric cramps, and CNS depression. Contact with liquid causes irritation of eyes and (on prolonged contact) skin. Ingestion causes CNS depression.	Cats and rabbits repeatedly exposed to the *trans*-isomer at concentrations of 0.16% to 0.19% in air showed loss of appetite and some respiratory irritation but no histopathological changes in organs.	Cancer effects have not been studied in humans or animals. The *trans*-isomer was not mutagenic to *Escherichia coli* strain k-12 in culture medium containing mouse liver microsomes. Additionally, it was not mutagenic in tests using *Salmonella typhimurium* strains in vitro without metabolic activation, nor in vivo with metabolic activation (host-mediated assay), nor in a cytogenetic analysis of bone marrow cells from female mice after single and repeated injections.	Human and animal studies are limited. Human studies have been limited to the neurological effects from inhalation exposure. Dichloroethene is largely excreted through the lungs.

AR304208

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Trichloroethene (TCE)	TCE is toxic by ingestion, inhalation or dermal exposure. Optic neuritis and blindness have been reported following ingestion. Eye exposure to 160 ppm causes pain and irritation, but permanent injury is unlikely. Respiratory depression and cyanosis, and pulmonary hemorrhage and edema have been reported following ingestion and inhalation, respectively. TCE is a CNS depressant, producing headaches, dizziness, tremors, nausea and vomiting, fatigue and incoordination (full narcosis was noted at exposure concentrations of 2,500-6,000 ppm). Cases of severe liver necrosis have been reported as a result of anesthetic use of TCE. Renal failure may occur following oral or inhalation exposure to TCE. TCE is mildly irritating to the skin.	Prolonged exposures produce irritation of mucous membranes, and have been associated with impairment of peripheral nervous system function, persistent neuritis and temporary loss of tactile sense and paralysis of the fingers after direct contact with the solvent. Chronic exposure may produce varying degrees of dermatitis. Trigeminal nerve impairment has been noted in individuals chronically exposed to TCE. Female rats exposed to vapors of 1,800 ppm for two weeks showed no effects indicative of treatment-related maternal toxicity, embryotoxicity, severe teratogenicity or behavioral defects. It was neither embryotoxic nor teratogenic in Sprague-Dawley rats and Swiss Webster mice by inhalation but was embryotoxic in rats at 131 ppb concentration in water.	TCE is a probable human carcinogen based on hepatocellular tumors observed in mice. Epidemiological studies in the late 1970s and early 1980s indicated that there were no increased cancer incidence associated with human occupational exposure to TCE. These studies were considered by EPA to be limited by the lack of exposure data, limited sample size and exposure to multiple substances. In the largest study to date, a retrospective cohort study of 6,929 workers exposed to TCE at an aircraft maintenance facility did not show any significant or persuasive association between TCE exposure and excess of cancer. Women employed in areas in which fabric cleaning and parachute repair were performed had more deaths than expected from multiple myeloma and non-Hodgkin's lymphoma. The investigators concluded that it was difficult to ascribe these excess cancers to any chemical, due to inconsistent mortality by sex, multiple and overlapping exposures and small numbers of exposed individuals. The result of this study was concluded to be consistent with the results of previous epidemiological studies of worker exposure to TCE. It has been shown to be mutagenic in vivo and in vitro.	The lowest concentration that produces unconsciousness in adult humans is 16 mg/l; the equivalent oral dose is 40-150 ml. Lethal blood levels range from 3 to 110 μg/ml in human blood, with an estimated fatal oral dose of 3 to 5 ml/kg.
Trichlorofluoromethane	Sudden death following intentional inhalation has been reported, and appears to be due to ventricular fibrillation. Severe corneal damage and opacity have occurred in animal studies. Pulmonary edema, bronchial constriction, and lung irritation may follow inhalation.	Chronic industrial exposure may produce palpitations and lightheadedness.	No carcinogenic effects have been noted.	Fluorocarbons can be retained in body fat and slowly released into the bloodstream. Subsequent elimination from the blood is relatively rapid.

AR304209

SUMMARY TOXICITY PROFILES FOR SELECTED NONAROMATIC VOLATILE COMPOUNDS

CHEMICAL	ACUTE TOXICITY SUMMARY	CHRONIC TOXICITY SUMMARY	CANCER POTENTIAL	OTHER
Vinyl chloride	This compound may cause CNS depression, fatigue, headache, vertigo, ataxia, euphoria, visual disturbances, numbness and tingling in the extremities, narcosis, loss of consciousness, and death from respiratory failure. Additionally, various pulmonary abnormalities have occurred including dyspnea, asthma, and pneumonoconiosis. Nausea, vomiting, diarrhea, and severe epigastric pain can result from ingestion of the liquid. Angiosarcoma, hepatomegaly, and splenomegaly have been reported as toxic effects of this agent.		Vinyl chloride is a human carcinogen. Fetotoxicity and congenital malformations have been seen in animals. Vinyl chloride can induce angiosarcoma, a rare form of liver cancer. Cancers of the brain, lung, and blood and digestive systems, and melanoma have also been documented. Human birth defects have not been substantiated. Vinyl chloride has induced DNA damage, unscheduled DNA synthesis, DNA inhibition, mutations, chromosome aberrations, sister chromatid exchanges, micronuclei, and oncogenic transformation in a variety of in vivo or in vitro assays.	There may be a long latency period between initial exposure and the onset of symptoms.

AR304210

REFERENCES

Casarett and Doull's Toxicology: the Basic Science of Poisons, 3rd edition. C. Klaassen, M. Amdur and J. Doull, eds. New York: Macmillan Publishing Company.

EPA. Health Effects Assessment Summary Tables (HEAST). Office of Emergency and Remedial Response.

EPA. Hazardous Substances Data Bank (HSDB). Computerized database. Available through TOXNET.

EPA. Integrated Risk Information System (IRIS). Computerized database. Available through TOXNET.

IARC. 1984a. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Volume 34. Polynuclear Aromatic Compounds, Part 3, Industrial Exposures in Aluminum Production, Coal Gasification, Coke Production, and Iron and Steel Founding. International Agency for Research on Cancer, World Health Organization. Lyon, France.

IARC. 1984b. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemical to Humans. Polynuclear Aromatic Hydrocarbons, Part 2. Carbon Blacks, Mineral Oils (Lubricant Base Oils and Derived Products) and Some Nitroarenes. Volume 33. International Agency for Research on Cancer. Lyon, France.

IARC. 1985. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Volume 35. Polynuclear Aromatic Hydrocarbons, Part 4, Bitumens, Coal-tars and Derived Products, Shale-oils and Soots. International Agency for Research on Cancer, World Health Organization. Lyon, France.

NRC. 1977-89. *Drinking Water and Health*. Volumes 1-9. Washington, D.C.: National Academy of Sciences.

Sullivan, J.B. and G.R. Krieger. 1992. *Hazardous Materials Toxicology: Clinical Principles of Environmental Health*. Baltimore, MD: Williams & Wilkins.

ATTACHMENT F
SUMMARY OF HAZARD QUOTIENTS AND CANCER RISKS BY MEDIUM

Table F-1

HAZARD QUOTIENT SUMMARY OF SOIL CONTACT PATHWAYS FOR THE CURRENT TRESPASSER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL *	DERMAL CONTACT	SOIL INGESTION	PARTICULATE INHALATION	TOTAL FROM ALL SOIL PATHWAYS
Non-carcinogenic effects				
METALS				
Chromium	<0.001	<0.001	0.004	0.004
Copper	<0.001	<0.001	<0.001	<0.001
Lead	NA	NA	NA	<0.001
Nickel	<0.001	<0.001	<0.001	<0.001
Zinc	<0.001	<0.001	<0.001	<0.001
PAHs				
2-Methylnaphthalene	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	NA	NA	NA	<0.001
Anthracene	<0.001	<0.001	<0.001	<0.001
Benzo(a)anthracene	NA	NA	NA	<0.001
Benzo(a)pyrene	NA	NA	NA	<0.001
Benzo(b)fluoranthene	NA	NA	NA	<0.001
Benzo(g,h,i)perylene	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	NA	NA	NA	<0.001
Chrysene	NA	NA	NA	<0.001
Dibenz(a,h)anthracene	NA	NA	NA	<0.001
Dibenzofuran	<0.001	<0.001	<0.001	<0.001
Fluoranthene	<0.001	<0.001	<0.001	<0.001
Fluorene	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-cd)pyrene	NA	NA	NA	<0.001
Naphthalene	<0.001	<0.001	<0.001	<0.001
Phenanthrene	<0.001	<0.001	<0.001	<0.001
Pyrene	<0.001	<0.001	<0.001	<0.001
SVOCs				
Benzoic Acid	<0.001	<0.001	<0.001	<0.001
bis(2-ethylhexyl)phthalate	<0.001	<0.001	<0.001	<0.001
Butylbenzylphthalate	<0.001	<0.001	<0.001	<0.001
Di-n-butylphthalate	<0.001	<0.001	<0.001	<0.001
VOCs				
Acetone	<0.001	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	NA	<0.001
HAZARD INDEX FOR SOIL PATHWAYS:				0.004

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

AR304213

Table F-2
HAZARD QUOTIENT SUMMARY OF AIR PATHWAYS FOR THE
CURRENT TRESPASSER SCENARIO AT THE RECTICON FACILITY

CHEMICAL	OUTDOOR VAPORS	INDOOR VAPORS	TOTAL FROM ALL AIR PATHWAYS
Non-carcinogenic effects			
SVOCs			
Benzoic Acid	<0.001	<0.001	<0.001
bis(2-ethylhexyl)phthalate	<0.001	<0.001	<0.001
Di-n-butylphthalate	<0.001	<0.001	<0.001
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001	<0.001
tert-butylmethylether	NA	NA	<0.001
VOCs			
1,1,1-Trichloroethane	<0.001	<0.001	<0.001
Trichloroethane (total)	<0.001	<0.001	<0.001
1,1-Dichloroethane	<0.001	<0.001	<0.001
1,1-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethane	NA	NA	<0.001
cis-1,2-Dichloroethene	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethene (total)	<0.001	<0.001	<0.001
Acetone	<0.001	<0.001	<0.001
Benzene	NA	NA	<0.001
Carbon Tetrachloride	<0.001	<0.001	<0.001
Chloroethane	NA	NA	<0.001
Chloroform	<0.001	<0.001	<0.001
Methylene Chloride	<0.001	<0.001	<0.001
Tetrachloroethene	<0.001	<0.001	<0.001
Toluene	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001	<0.001
Xylenes (mixed)	<0.001	<0.001	<0.001
HAZARD INDEX FOR AIR PATHWAYS:			**<0.001**

NA = Not Applicable, no criteria.

AR304214

Table F-3
HAZARD QUOTIENT SUMMARY OF AIR PATHWAYS FOR THE
CURRENT TRESPASSER SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	OUTDOOR VAPORS	TOTAL FROM ALL AIR PATHWAYS
Non-carcinogenic effects		
SVOCs		
Benzoic Acid	<0.001	<0.001
bis(2-Ethylhexyl)phthalate	<0.001	<0.001
TICs		
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001
tert-butylmethylether	NA	<0.001
VOCs		
1,1,1-Trichloroethane	<0.001	<0.001
Trichloroethane (total)	<0.001	<0.001
1,1-Dichloroethane	<0.001	<0.001
1,1-Dichloroethene	<0.001	<0.001
1,2-Dichloroethane	NA	<0.001
cis-1,2-Dichloroethene	<0.001	<0.001
trans-1,2-Dichloroethene	<0.001	<0.001
Benzene	NA	<0.001
Carbon Tetrachloride	<0.001	<0.001
Chloroethane	NA	<0.001
Chloroform	<0.001	<0.001
Ethylbenzene	<0.001	<0.001
Methylene Chloride	<0.001	<0.001
Tetrachloroethene	<0.001	<0.001
Toluene	<0.001	<0.001
Trichloroethene	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001
Xylenes (mixed)	<0.001	<0.001
HAZARD INDEX FOR AIR PATHWAYS:		<0.001

NA = Not Applicable, no criteria.

AR304215

Table F-4
SUMMARY OF HAZARD QUOTIENTS OF AIR PATHWAYS FOR THE
CURRENT OFFSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	OUTDOOR VAPORS	INDOOR VAPORS	TOTAL FROM ALL AIR PATHWAYS
Non-carcinogenic effects			
SVOCs			
bis(2-Ethylhexyl)phthalate	<0.001	<0.001	<0.001
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001	<0.001
tert-butylmethylether	NA	NA	<0.001
VOCs			
1,1,1-Trichloroethane	<0.001	<0.001	<0.001
1,1-Dichloroethane	<0.001	<0.001	<0.001
1,1-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethane	NA	NA	<0.001
cis-1,2-Dichloroethene	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	<0.001	<0.001	<0.001
Benzene	NA	NA	<0.001
Chloroethane	NA	NA	<0.001
Methylene Chloride	<0.001	<0.001	<0.001
Tetrachloroethene	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001	<0.001
Xylenes (mixed)	<0.001	<0.001	<0.001
HAZARD INDEX FOR AIR PATHWAYS:			<0.001

NA = Not Applicable, no criteria.

Table F-5
HAZARD QUOTIENT SUMMARY OF GROUNDWATER PATHWAYS FOR THE CURRENT OFFSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	GROUNDWATER INGESTION	TOTAL FROM ALL GROUNDWATER PATHWAYS
Non-carcinogenic effects		
VOCs		
1,1,1-Trichloroethane	0.001	0.001
Methylene Chloride	0.001	0.001
Toluene	<0.001	<0.001
Trichloroethene	NA	<0.001
HAZARD INDEX FOR GROUNDWATER PATHWAYS:		0.003

NA = Not Applicable, no criteria.

Table F-6
HAZARD QUOTIENT SUMMARY OF SOIL CONTACT PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	SOIL INGESTION	PARTICULATE INHALATION	TOTAL FROM ALL SOIL PATHWAYS
Non-carcinogenic effects				
METALS				
Chromium	<0.001	<0.001	0.005	0.005
Copper	<0.001	<0.001	<0.001	<0.001
Lead	NA	NA	NA	<0.001
Nickel	<0.001	<0.001	<0.001	<0.001
Zinc	<0.001	<0.001	<0.001	<0.001
PAHs				
2-Methylnaphthalene	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	NA	NA	NA	<0.001
Anthracene	<0.001	<0.001	<0.001	<0.001
Benzo(a)anthracene	NA	NA	NA	<0.001
Benzo(a)pyrene	NA	NA	NA	<0.001
Benzo(b)fluoranthene	NA	NA	NA	<0.001
Benzo(g,h,i)perylene	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	NA	NA	NA	<0.001
Chrysene	NA	NA	NA	<0.001
Dibenz(a,h)anthracene	NA	NA	NA	<0.001
Dibenzofuran	<0.001	<0.001	<0.001	<0.001
Fluoranthene	<0.001	<0.001	<0.001	<0.001
Fluorene	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-cd)pyrene	NA	NA	NA	<0.001
Naphthalene	<0.001	<0.001	<0.001	<0.001
Phenanthrene	<0.001	<0.001	<0.001	<0.001
Pyrene	<0.001	<0.001	<0.001	<0.001
SVOCs				
Benzoic Acid	<0.001	<0.001	<0.001	<0.001
bis(2-ethylhexyl)phthalate	<0.001	<0.001	<0.001	<0.001
Butylbenzylphthalate	<0.001	<0.001	<0.001	<0.001
Di-n-butylphthalate	<0.001	<0.001	<0.001	<0.001
VOCs				
Acetone	<0.001	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	NA	<0.001
HAZARD INDEX FOR SOIL PATHWAYS:				**0.005**

NA = Not Applicable, no criteria.

AR304218

Table F-8
HAZARD QUOTIENT SUMMARY OF AIR PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	OUTDOOR VAPORS	INDOOR VAPORS	TOTAL FROM ALL AIR PATHWAYS
Non-carcinogenic effects			
SVOCs			
Benzoic Acid	<0.001	<0.001	<0.001
bis(2-Ethylhexyl)phthalate	<0.001	<0.001	<0.001
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001	<0.001
tert-butylmethylether	NA	NA	<0.001
VOCs			
1,1,1-Trichloroethane	<0.001	<0.001	<0.001
Trichloroethane (total)	<0.001	<0.001	<0.001
1,1-Dichloroethane	<0.001	<0.001	<0.001
1,1-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethane	NA	NA	<0.001
cis-1,2-Dichloroethene	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	<0.001	<0.001	<0.001
Benzene	NA	NA	<0.001
Carbon Tetrachloride	<0.001	<0.001	<0.001
Chloroethane	NA	NA	<0.001
Chloroform	<0.001	<0.001	<0.001
Ethylbenzene	<0.001	<0.001	<0.001
Methylene Chloride	<0.001	<0.001	<0.001
Tetrachloroethene	<0.001	<0.001	<0.001
Toluene	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001	<0.001
Xylenes (mixed)	<0.001	<0.001	<0.001
HAZARD INDEX FOR AIR PATHWAYS:			<0.001

NA = Not Applicable, no criteria.

AR304219

Table F-7
HAZARD QUOTIENT SUMMARY OF AIR PATHWAYS FOR THE
FUTURE ONSITE WORKER SCENARIO AT THE RECTICON FACILITY

CHEMICAL	OUTDOOR VAPORS	INDOOR VAPORS	TOTAL FROM ALL AIR PATHWAYS
Non-carcinogenic effects			
SVOCs			
Benzoic Acid	<0.001	<0.001	<0.001
bis(2-ethylhexyl)phthalate	<0.001	<0.001	<0.001
Di-n-butylphthalate	<0.001	<0.001	<0.001
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001	<0.001
tert-butylmethylether	NA	NA	<0.001
VOCs			
1,1,1-Trichloroethane	<0.001	<0.001	<0.001
Trichloroethane (total)	<0.001	<0.001	<0.001
1,1-Dichloroethane	<0.001	<0.001	<0.001
1,1-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethane	NA	NA	<0.001
cis-1,2-Dichloroethene	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethene (total)	<0.001	<0.001	<0.001
Acetone	<0.001	<0.001	<0.001
Benzene	NA	NA	<0.001
Carbon Tetrachloride	<0.001	<0.001	<0.001
Chloroethane	NA	NA	<0.001
Chloroform	<0.001	<0.001	<0.001
Methylene Chloride	<0.001	<0.001	<0.001
Tetrachloroethene	<0.001	<0.001	<0.001
Toluene	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001	<0.001
Xylenes (mixed)	<0.001	<0.001	<0.001
HAZARD INDEX FOR AIR PATHWAYS:			**<0.001**

NA = Not Applicable, no criteria.

AR304220

Table F-9
HAZARD QUOTIENT SUMMARY OF GROUNDWATER PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	GROUNDWATER INGESTION	TOTAL FROM ALL GROUNDWATER PATHWAYS
Non-carcinogenic effects		
METALS		
Aluminum	NA	<0.001
Arsenic	0.111	0.111
Barium	0.085	0.085
Beryllium	0.003	0.003
Chromium	<0.001	<0.001
Cobalt	NA	<0.001
Copper	0.005	0.005
Manganese	0.161	0.161
Nickel	0.014	0.014
Vanadium	0.012	0.012
SVOCs		
Dimethylphthalate	<0.001	<0.001
TICs		
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001
Carbon Disulfide	0.110	0.110
tert-butylmethylether	NA	<0.001
VOCs		
1,1,1-Trichloroethane	<0.001	<0.001
1,1,2-Trichloroethane	0.001	0.002
1,1-Dichloroethane	<0.001	<0.001
1,1-Dichloroethene	0.004	0.007
1,2,3-Trichlorobenzene	<0.001	0.002
1,2,4-Trimethylbenzene	NA	<0.001
1,2-Dichloroethane	NA	<0.001
cis-1,2-Dichloroethene	0.810	1.620
trans-1,2-Dichloroethene	0.002	0.004
1,3-Dichlorobenzene	<0.001	<0.001
Benzene	NA	<0.001
Carbon Tetrachloride	0.009	0.017

AR304221

Table F-9
HAZARD QUOTIENT SUMMARY OF GROUNDWATER PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	GROUNDWATER INGESTION	TOTAL FROM ALL GROUNDWATER PATHWAYS
Non-carcinogenic effects		
Chlorobenzene	<0.001	<0.001
Chloroethane	NA	<0.001
Chloroform	<0.001	<0.001
Chloromethane	NA	<0.001
Dichlorodifluoromethane	<0.001	<0.001
Methylene Chloride	<0.001	<0.001
Tetrachloroethene	0.006	0.013
Trichloroethene	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001
Vinyl Chloride	NA	<0.001
m,p-Xylene	<0.001	<0.001
HAZARD INDEX FOR GROUNDWATER PATHWAYS:		**2.165**

NA = Not Applicable, no criteria.

Table F-10

HAZARD QUOTIENT SUMMARY OF SOIL CONTACT PATHWAYS FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	SOIL INGESTION	PARTICULATE INHALATION	TOTAL FROM ALL SOIL PATHWAYS
Non-carcinogenic effects				
METALS				
Chromium	<0.001	<0.001	0.021	0.021
Copper	<0.001	<0.001	<0.001	<0.001
Lead	NA	NA	NA	<0.001
Nickel	<0.001	<0.001	<0.001	<0.001
Zinc	<0.001	<0.001	<0.001	<0.001
PAHs				
2-Methylnaphthalene	<0.001	<0.001	<0.001	<0.001
Acenaphthylene	NA	NA	NA	<0.001
Anthracene	<0.001	<0.001	<0.001	<0.001
Benzo(a)anthracene	NA	NA	NA	<0.001
Benzo(a)pyrene	NA	NA	NA	<0.001
Benzo(b)fluoranthene	NA	NA	NA	<0.001
Benzo(g,h,i)perylene	<0.001	<0.001	<0.001	<0.001
Benzo(k)fluoranthene	NA	NA	NA	<0.001
Chrysene	NA	NA	NA	<0.001
Dibenz(a,h)anthracene	NA	NA	NA	<0.001
Dibenzofuran	<0.001	<0.001	<0.001	<0.001
Fluoranthene	<0.001	<0.001	<0.001	<0.001
Fluorene	<0.001	<0.001	<0.001	<0.001
Indeno(1,2,3-cd)pyrene	NA	NA	NA	<0.001
Naphthalene	<0.001	<0.001	<0.001	<0.001
Phenanthrene	<0.001	<0.001	<0.001	<0.001
Pyrene	<0.001	<0.001	<0.001	<0.001
SVOCs				
Benzoic Acid	<0.001	<0.001	<0.001	<0.001
bis(2-ethylhexyl)phthalate	<0.001	<0.001	<0.001	<0.001
Butylbenzylphthalate	<0.001	<0.001	<0.001	<0.001
Di-n-butylphthalate	<0.001	<0.001	<0.001	<0.001
VOCs				
Acetone	<0.001	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	NA	<0.001
HAZARD INDEX FOR SOIL PATHWAYS:				**0.021**

NA = Not Applicable, no criteria.

AR304223

Table F-11
HAZARD QUOTIENT SUMMARY OF AIR PATHWAYS FOR THE
FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON FACILITY

CHEMICAL	OUTDOOR VAPORS	INDOOR VAPORS	TOTAL FROM ALL AIR PATHWAYS
Non-carcinogenic effects			
SVOCs			
Benzoic Acid	<0.001	<0.001	<0.001
bis(2-ethylhexyl)phthalate	<0.001	<0.001	<0.001
Di-n-butylphthalate	<0.001	<0.001	<0.001
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001	<0.001
tert-butylmethylether	NA	NA	<0.001
VOCs			
1,1,1-Trichloroethane	<0.001	<0.001	<0.001
Trichloroethane (total)	<0.001	<0.001	<0.001
1,1-Dichloroethane	<0.001	<0.001	<0.001
1,1-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethane	NA	NA	<0.001
cis-1,2-Dichloroethene	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethene (total)	<0.001	<0.001	<0.001
Acetone	<0.001	<0.001	<0.001
Benzene	NA	NA	<0.001
Carbon Tetrachloride	<0.001	<0.001	<0.001
Chloroethane	NA	NA	<0.001
Chloroform	<0.001	<0.001	<0.001
Methylene Chloride	<0.001	<0.001	<0.001
Tetrachloroethene	<0.001	<0.001	<0.001
Toluene	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001	<0.001
Xylenes (mixed)	<0.001	<0.001	<0.001
HAZARD INDEX FOR AIR PATHWAYS:			**<0.001**

NA = Not Applicable, no criteria.

AR304224

Table F-12
HAZARD QUOTIENT SUMMARY OF AIR PATHWAYS FOR THE
FUTURE ONSITE RESIDENTIAL SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	OUTDOOR VAPORS	INDOOR VAPORS	TOTAL FROM ALL AIR PATHWAYS
Non-carcinogenic effects			
SVOCs			
Benzoic Acid	<0.001	<0.001	<0.001
bis(2-Ethylhexyl)phthalate	<0.001	<0.001	<0.001
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001	<0.001
tert-butylmethylether	NA	NA	<0.001
VOCs			
1,1,1-Trichloroethane	<0.001	<0.001	<0.001
Trichloroethane (total)	<0.001	<0.001	<0.001
1,1-Dichloroethane	<0.001	<0.001	<0.001
1,1-Dichloroethene	<0.001	<0.001	<0.001
1,2-Dichloroethane	NA	NA	<0.001
cis-1,2-Dichloroethene	<0.001	<0.001	<0.001
trans-1,2-Dichloroethene	<0.001	<0.001	<0.001
Benzene	NA	NA	<0.001
Carbon tetrachloride	<0.001	<0.001	<0.001
Chloroethane	NA	NA	<0.001
Chloroform	<0.001	<0.001	<0.001
Ethylbenzene	<0.001	<0.001	<0.001
Methylene Chloride	<0.001	<0.001	<0.001
Tetrachloroethene	<0.001	<0.001	<0.001
Toluene	<0.001	<0.001	<0.001
Trichloroethene	NA	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001	<0.001
Xylenes (mixed)	<0.001	<0.001	<0.001
HAZARD INDEX FOR AIR PATHWAYS:			**<0.001**

NA = Not Applicable, no criteria.

AR304225

Table F-13
HAZARD QUOTIENT SUMMARY OF GROUNDWATER PATHWAYS FOR THE
FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	GROUNDWATER INGESTION	VAPOR INHALATION	TOTAL FROM ALL GROUNDWATER PATHWAYS
Non-carcinogenic effects				
METALS				
Aluminum	NA	NA	--	<0.001
Arsenic	<0.001	0.185	--	0.185
Barium	<0.001	0.141	--	0.141
Beryllium	<0.001	0.005	--	0.005
Chromium	<0.001	<0.001	--	<0.001
Cobalt	NA	NA	--	<0.001
Copper	<0.001	0.009	--	0.009
Manganese	<0.001	0.267	--	0.267
Nickel	<0.001	0.023	--	0.023
Vanadium	<0.001	0.019	--	0.019
SVOCs				
Dimethylphthalate	<0.001	<0.001	--	<0.001
TICs				
1,1,2-Trichloro-1,2,2-trifluoroethane	<0.001	<0.001	--	<0.001
Carbon Disulfide	0.009	0.182	--	0.191
tert-butylmethylether	NA	NA	--	<0.001
VOCs				
1,1,1-Trichloroethane	<0.001	<0.001	<0.001	<0.001
1,1,2-Trichloroethane	<0.001	0.002	0.002	0.004
1,1-Dichloroethane	<0.001	<0.001	<0.001	<0.001
1,1-Dichloroethene	<0.001	0.006	0.006	0.012
1,2,3-Trichlorobenzene	<0.001	<0.001	0.003	0.003
1,2,4-Trimethylbenzene	NA	NA	NA	<0.001
1,2-Dichloroethane	NA	NA	NA	<0.001
cis-1,2-Dichloroethene	0.029	1.345	1.345	2.719
trans-1,2-Dichloroethene	<0.001	0.003	0.003	0.006
1,3-Dichlorobenzene	<0.001	<0.001	<0.001	<0.001
Benzene	NA	NA	NA	<0.001
Carbon Tetrachloride	<0.001	0.014	0.014	0.029

AR304226

Table F-13
HAZARD QUOTIENT SUMMARY OF GROUNDWATER PATHWAYS FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	GROUNDWATER INGESTION	VAPOR INHALATION	TOTAL FROM ALL GROUNDWATER PATHWAYS
Non-carcinogenic effects				
Chlorobenzene	<0.001	<0.001	0.002	0.002
Chloroethane	NA	NA	NA	<0.001
Chloroform	<0.001	0.001	0.001	0.002
Chloromethane	NA	NA	NA	<0.001
Dichlorodifluoromethane	<0.001	<0.001	<0.001	<0.001
Methylene Chloride	<0.001	<0.001	<0.001	<0.001
Tetrachloroethene	0.001	0.010	0.010	0.022
Trichloroethene	NA	NA	NA	<0.001
Trichlorofluoromethane	<0.001	<0.001	<0.001	<0.001
Vinyl Chloride	NA	NA	NA	<0.001
m,p-Xylene	<0.001	<0.001	<0.001	<0.001
HAZARD INDEX FOR GROUNDWATER PATHWAYS:				**3.639**

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000

-- = Only VOCs were evaluated for the inhalation pathway (see text).

Table F-14

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF SOIL CONTACT PATHWAYS FOR THE CURRENT TRESPASSER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	PERCENT	SOIL INGESTION	PERCENT	PARTICULATE INHALATION	PERCENT	TOTAL FROM ALL SOIL PATHWAYS
Carcinogenic effects							
METALS							
Chromium	NA	NA	NA	NA	NA	NA	0.00E+00
Copper	NA	NA	NA	NA	NA	NA	0.00E+00
Lead	NA	NA	NA	NA	NA	NA	0.00E+00
Nickel	NA	NA	NA	NA	6.95E-11	0.02%	6.95E-11
Zinc	NA	NA	NA	NA	NA	NA	0.00E+00
PAHs							
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	0.00E+00
Acenaphthylene	NA	NA	NA	NA	NA	NA	0.00E+00
Anthracene	NA	NA	NA	NA	NA	NA	0.00E+00
Benzo(a)anthracene	1.89E-08	6.36%	3.54E-09	1.19%	2.54E-12	0.00%	2.24E-08
Benzo(a)pyrene	1.50E-07	50.63%	2.82E-08	9.50%	2.11E-11	0.01%	1.78E-07
Benzo(b)fluoranthene	4.12E-08	13.87%	7.72E-09	2.60%	5.77E-12	0.00%	4.89E-08
Benzo(g,h,i)perylene	1.53E-09	0.52%	2.87E-10	0.10%	2.15E-13	0.00%	1.82E-09
Benzo(k)fluoranthene	2.44E-09	0.82%	4.59E-10	0.15%	3.29E-13	0.00%	2.90E-09
Chrysene	5.49E-10	0.18%	1.03E-10	0.03%	7.79E-14	0.00%	6.52E-10
Dibenz(a,h)anthracene	3.20E-08	10.77%	5.99E-09	2.02%	4.51E-12	0.00%	3.80E-08
Dibenzofuran	NA	NA	NA	NA	NA	NA	0.00E+00
Fluoranthene	NA	NA	NA	NA	NA	NA	0.00E+00
Fluorene	NA	NA	NA	NA	NA	NA	0.00E+00
Indeno(1,2,3-cd)pyrene	2.83E-09	0.95%	5.31E-10	0.18%	4.12E-13	0.00%	3.36E-09
Naphthalene	NA	NA	NA	NA	NA	NA	0.00E+00
Phenanthrene	NA	NA	NA	NA	NA	NA	0.00E+00
Pyrene	NA	NA	NA	NA	NA	NA	0.00E+00
SVOCs							
Benzoic Acid	NA	NA	NA	NA	NA	NA	0.00E+00
bis(2-ethylhexyl)phthalate	1.72E-10	0.06%	4.19E-11	0.01%	NA	NA	2.14E-10
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA	0.00E+00
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	0.00E+00
VOCs							
Acetone	NA	NA	NA	NA	NA	NA	0.00E+00
Trichloroethene	1.81E-12	0.00%	1.77E-13	0.00%	2.45E-16	0.00%	1.99E-12
TOTAL RISK FROM SOIL PATHWAYS:							**3 E-07**

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

AR304228

Table F-15

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF AIR PATHWAYS FOR THE CURRENT TRESPASSER SCENARIO AT THE RECTICON FACILITY

CHEMICAL	OUTDOOR VAPORS	PERCENT	TOTAL FROM ALL AIR PATHWAYS
Carcinogenic effects			
SVOCs			
Benzoic Acid	NA	NA	0.00E+00
bis(2-ethylhexyl)phthalate	NA	NA	0.00E+00
Di-n-butylphthalate	NA	NA	0.00E+00
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	0.00E+00
VOCs			
1,1,1-Trichloroethane	NA	NA	0.00E+00
Trichloroethane (total)	1.54E-12	3.31%	1.54E-12
1,1-Dichloroethane	NA	NA	0.00E+00
1,1-Dichloroethene	7.60E-12	16.30%	7.60E-12
1,2-Dichloroethane	1.01E-12	2.17%	1.01E-12
cis-1,2-Dichloroethene	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	0.00E+00
1,2-Dichloroethene (total)	NA	NA	0.00E+00
Acetone	NA	NA	0.00E+00
Benzene	2.00E-13	0.43%	2.00E-13
Carbon Tetrachloride	1.66E-13	0.36%	1.66E-13
Chloroethane	NA	NA	0.00E+00
Chloroform	4.28E-13	0.92%	4.28E-13
Methylene Chloride	2.86E-12	6.14%	2.86E-12
Tetrachloroethene	3.21E-14	0.07%	3.21E-14
Toluene	NA	NA	0.00E+00
Trichloroethene	3.28E-11	70.31%	3.28E-11
Trichlorofluoromethane	NA	NA	0.00E+00
Xylenes (mixed)	NA	NA	0.00E+00
TOTAL RISK FROM AIR PATHWAYS:			**5 E-11**

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

AR304229

Table F-16

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF AIR PATHWAYS FOR THE CURRENT TRESPASSER SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	OUTDOOR VAPORS	PERCENT	TOTAL FROM ALL AIR PATHWAYS
Carcinogenic effects			
SVOCs			
Benzoic Acid	NA	NA	0.00E+00
bis(2-Ethylhexyl)phthalate	5.46E-15	0.01%	5.46E-15
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	0.00E+00
VOCs			
1,1,1-Trichloroethane	NA	NA	0.00E+00
Trichloroethane (total)	2.76E-12	6.42%	2.76E-12
1,1-Dichloroethane	NA	NA	0.00E+00
1,1-Dichloroethene	7.60E-12	17.65%	7.60E-12
1,2-Dichloroethane	1.01E-12	2.35%	1.01E-12
cis-1,2-Dichloroethene	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	0.00E+00
Benzene	1.83E-11	42.59%	1.83E-11
Carbon Tetrachloride	1.78E-13	0.41%	1.78E-13
Chloroethane	NA	NA	0.00E+00
Chloroform	7.08E-13	1.64%	7.08E-13
Ethylbenzene	NA	NA	0.00E+00
Methylene Chloride	1.04E-12	2.41%	1.04E-12
Tetrachloroethene	7.29E-12	16.94%	7.29E-12
Toluene	NA	NA	0.00E+00
Trichloroethene	4.12E-12	9.58%	4.12E-12
Trichlorofluoromethane	NA	NA	0.00E+00
Xylenes (mixed)	NA	NA	0.00E+00
TOTAL RISK FROM AIR PATHWAYS:			**4 E-11**

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

0.00% = <0.01%

AR304230

Table F-17

SUMMARY OF CANCER RISKS AND THE PERCENT CONTRIBUTION OF AIR PATHWAYS FOR CURRENT OFFSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	OUTDOOR VAPORS	PERCENT	TOTAL FROM ALL AIR PATHWAYS
Carcinogenic effects			
SVOCs			
bis(2-Ethylhexyl)phthalate	NA	NA	0.00E+00
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	0.00E+00
VOCs			
1,1,1-Trichloroethane	NA	NA	0.00E+00
1,1-Dichloroethane	NA	NA	0.00E+00
1,1-Dichloroethene	1.64E-10	2.66%	2.64E-10
1,2-Dichloroethane	2.19E-11	0.35%	3.51E-11
cis-1,2-Dichloroethene	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	0.00E+00
Benzene	4.33E-12	0.07%	6.97E-12
Chloroethane	NA	NA	0.00E+00
Methylene Chloride	1.44E-13	0.00%	2.32E-13
Tetrachloroethene	2.30E-10	3.72%	3.70E-10
Trichloroethene	3.42E-09	55.36%	5.50E-09
Trichlorofluoromethane	NA	NA	0.00E+00
Xylenes (mixed)	NA	NA	0.00E+00
TOTAL RISK FROM AIR PATHWAYS:			**6 E-09**

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

0.00% = <0.01%

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Table F-18

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF GROUNDWATER PATHWAYS FOR THE CURRENT OFFSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	GROUNDWATER INGESTION	PERCENT	TOTAL FROM ALL GROUNDWATER PATHWAYS
Carcinogenic effects			
VOCs			
1,1,1-Trichloroethane	NA	NA	0.00E+00
Methylene Chloride	2.09E-07	57.69%	2.09E-07
Toluene	NA	NA	0.00E+00
Trichloroethene	1.53E-07	42.31%	1.53E-07
TOTAL RISK FROM GROUNDWATER PATHWAYS:			**4 E-07**

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

0.00% = <0.01%

Table F-19

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF SOIL CONTACT PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	PERCENT	SOIL INGESTION	PERCENT	PARTICULATE INHALATION	PERCENT	TOTAL FROM ALL SOIL PATHWAYS
Carcinogenic effects							
METALS							
Chromium	NA	NA	NA	NA	NA	NA	0.00E+00
Copper	NA	NA	NA	NA	NA	NA	0.00E+00
Lead	NA	NA	NA	NA	NA	NA	0.00E+00
Nickel	NA	NA	NA	NA	2.84E-10	0.02%	2.84E-10
Zinc	NA	NA	NA	NA	NA	NA	0.00E+00
PAHs							
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	0.00E+00
Acenaphthylene	NA	NA	NA	NA	NA	NA	0.00E+00
Anthracene	NA	NA	NA	NA	NA	NA	0.00E+00
Benzo(a)anthracene	1.07E-07	6.93%	9.61E-09	0.62%	1.04E-11	0.00%	1.17E-07
Benzo(a)pyrene	8.56E-07	55.20%	7.65E-08	4.94%	8.63E-11	0.01%	9.32E-07
Benzo(b)fluoranthene	2.34E-07	15.12%	2.10E-08	1.35%	2.36E-11	0.00%	2.55E-07
Benzo(g,h,i)perylene	8.70E-09	0.56%	7.78E-10	0.05%	8.79E-13	0.00%	9.48E-09
Benzo(k)fluoranthene	1.39E-08	0.90%	1.24E-09	0.08%	1.34E-12	0.00%	1.52E-08
Chrysene	3.13E-09	0.20%	2.80E-10	0.02%	3.18E-13	0.00%	3.41E-09
Dibenz(a,h)anthracene	1.82E-07	11.74%	1.63E-08	1.05%	1.84E-11	0.00%	1.98E-07
Dibenzofuran	NA	NA	NA	NA	NA	NA	0.00E+00
Fluoranthene	NA	NA	NA	NA	NA	NA	0.00E+00
Fluorene	NA	NA	NA	NA	NA	NA	0.00E+00
Indeno(1,2,3-cd)pyrene	1.61E-08	1.04%	1.44E-09	0.09%	1.69E-12	0.00%	1.76E-08
Naphthalene	NA	NA	NA	NA	NA	NA	0.00E+00
Phenanthrene	NA	NA	NA	NA	NA	NA	0.00E+00
Pyrene	NA	NA	NA	NA	NA	NA	0.00E+00
SVOCs							
Benzoic Acid	NA	NA	NA	NA	NA	NA	0.00E+00
bis(2-ethylhexyl)phthalate	9.78E-10	0.06%	1.14E-10	0.01%	NA	NA	1.09E-09
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA	0.00E+00
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	0.00E+00
VOCs							
Acetone	NA	NA	NA	NA	NA	NA	0.00E+00
Trichloroethene	1.03E-11	0.00%	4.81E-13	0.00%	1.00E-15	0.00%	1.08E-11
TOTAL RISK FROM SOIL PATHWAYS:							2 E-06

NA = Not applicable, no criteria.
1E-6 = 1/1,000,000

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Table F-21

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF AIR PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	OUTDOOR VAPORS	PERCENT	INDOOR VAPORS	PERCENT	TOTAL FROM ALL AIR PATHWAYS
Carcinogenic effects					
SVOCs					
Benzoic Acid	NA	NA	NA	NA	0.00E+00
bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	0.00E+00
TICs					
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	NA	NA	0.00E+00
VOCs					
1,1,1-Trichloroethane	NA	NA	NA	NA	0.00E+00
Trichloroethane (total)	1.13E-11	0.34%	2.67E-10	7.99%	2.79E-10
1,1-Dichloroethane	NA	NA	NA	NA	0.00E+00
1,1-Dichloroethene	3.11E-11	0.93%	0.00E+00	0.00%	3.11E-11
1,2-Dichloroethane	4.13E-12	0.12%	0.00E+00	0.00%	4.13E-12
cis-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
Benzene	7.49E-11	2.24%	1.51E-09	45.22%	1.59E-09
Carbon Tetrachloride	7.29E-13	0.02%	6.21E-12	0.19%	6.94E-12
Chloroethane	NA	NA	NA	NA	0.00E+00
Chloroform	2.89E-12	0.09%	6.17E-11	1.84%	6.46E-11
Ethylbenzene	NA	NA	NA	NA	0.00E+00
Methylene Chloride	4.24E-12	0.13%	5.09E-14	0.00%	4.29E-12
Tetrachloroethene	2.98E-11	0.89%	1.20E-09	35.80%	1.23E-09
Toluene	NA	NA	NA	NA	0.00E+00
Trichloroethene	1.69E-11	0.50%	1.24E-10	3.71%	1.41E-10
Trichlorofluoromethane	NA	NA	NA	NA	0.00E+00
Xylenes (mixed)	NA	NA	NA	NA	0.00E+00

TOTAL RISK FROM AIR PATHWAYS: 3 E-09

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

0.00% = <0.01%

AR304234

Table F-20

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF AIR PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON FACILITY

CHEMICAL	OUTDOOR VAPORS	PERCENT	INDOOR VAPORS	PERCENT	TOTAL FROM ALL AIR PATHWAYS
Carcinogenic effects					
SVOCs					
Benzoic Acid	NA	NA	NA	NA	0.00E+00
bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	0.00E+00
Di-n-butylphthalate	NA	NA	NA	NA	0.00E+00
TICs					
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	NA	NA	0.00E+00
VOCs					
1,1,1-Trichloroethane	NA	NA	NA	NA	0.00E+00
Trichloroethane (total)	6.30E-12	0.18%	3.12E-10	8.78%	3.18E-10
1,1-Dichloroethane	NA	NA	NA	NA	0.00E+00
1,1-Dichloroethene	3.11E-11	0.87%	0.00E+00	0.00%	3.11E-11
1,2-Dichloroethane	4.13E-12	0.12%	0.00E+00	0.00%	4.13E-12
cis-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
1,2-Dichloroethene (total)	NA	NA	NA	NA	0.00E+00
Acetone	NA	NA	NA	NA	0.00E+00
Benzene	8.19E-13	0.02%	0.00E+00	0.00%	8.19E-13
Carbon Tetrachloride	6.81E-13	0.02%	3.63E-12	0.10%	4.31E-12
Chloroethane	NA	NA	NA	NA	0.00E+00
Chloroform	1.75E-12	0.05%	1.24E-10	3.49%	1.26E-10
Methylene Chloride	1.17E-11	0.33%	2.49E-11	0.70%	3.66E-11
Tetrachloroethene	1.31E-13	0.00%	3.26E-12	0.09%	3.40E-12
Toluene	NA	NA	NA	NA	0.00E+00
Trichloroethene	1.34E-10	3.77%	2.90E-09	81.48%	3.03E-09
Trichlorofluoromethane	NA	NA	NA	NA	0.00E+00
Xylenes (mixed)	NA	NA	NA	NA	0.00E+00
TOTAL RISK FROM AIR PATHWAYS:					**4 E-09**

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

0.00% = <0.01%

AR304235

Table F-22

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION TO GROUNDWATER PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	GROUNDWATER INGESTION	PERCENT	TOTAL FROM ALL GROUNDWATER PATHWAYS
Carcinogenic effects			
METALS			
Aluminum	NA	NA	0.00E+00
Arsenic	2.08E-05	7.53%	2.08E-05
Barium	NA	NA	0.00E+00
Beryllium	2.26E-05	8.18%	2.26E-05
Chromium	NA	NA	0.00E+00
Cobalt	NA	NA	0.00E+00
Copper	NA	NA	0.00E+00
Manganese	NA	NA	0.00E+00
Nickel	NA	NA	0.00E+00
Vanadium	NA	NA	0.00E+00
SVOCs			
Dimethylphthalate	NA	NA	0.00E+00
TICs			
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	0.00E+00
Carbon Disulfide	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	0.00E+00
VOCs			
1,1,1-Trichloroethane	NA	NA	0.00E+00
1,1,2-Trichloroethane	1.01E-07	0.04%	2.01E-07
1,1-Dichloroethane	NA	NA	0.00E+00
1,1-Dichloroethene	7.16E-06	2.59%	9.25E-06
1,2,3-Trichlorobenzene	NA	NA	0.00E+00
1,2,4-Trimethylbenzene	NA	NA	0.00E+00
1,2-Dichloroethane	5.73E-07	0.21%	1.15E-06
cis-1,2-Dichloroethene	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	0.00E+00
1,3-Dichlorobenzene	NA	NA	0.00E+00
Benzene	5.03E-08	0.02%	1.01E-07
Carbon Tetrachloride	2.83E-07	0.10%	5.66E-07

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Table F-22

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION TO GROUNDWATER PATHWAYS FOR THE FUTURE ONSITE WORKER SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	GROUNDWATER INGESTION	PERCENT	TOTAL FROM ALL GROUNDWATER PATHWAYS
Carcinogenic effects			
Chlorobenzene	NA	NA	0.00E+00
Chloroethane	NA	NA	0.00E+00
Chloroform	1.40E-08	0.01%	1.98E-07
Chloromethane	3.09E-08	0.01%	4.59E-08
Dichlorodifluoromethane	NA	NA	0.00E+00
Methylene Chloride	1.03E-08	0.00%	1.25E-08
Tetrachloroethene	1.14E-06	0.41%	1.54E-06
Trichloroethene	8.16E-05	29.51%	2.08E-04
Trichlorofluoromethane	NA	NA	0.00E+00
Vinyl Chloride	1.07E-05	3.87%	1.23E-05
m,p-Xylene	NA	NA	0.00E+00
TOTAL RISK FROM GROUNDWATER PATHWAYS:			**3 E-04**

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
0.00% = <0.01%

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Table F-23

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF SOIL CONTACT PATHWAYS FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	PERCENT	SOIL INGESTION	PERCENT	PARTICULATE INHALATION	PERCENT	TOTAL FROM ALL SOIL PATHWAYS
Carcinogenic effects							
METALS							
Chromium	NA	NA	NA	NA	NA	NA	0.00E+00
Copper	NA	NA	NA	NA	NA	NA	0.00E+00
Lead	NA	NA	NA	NA	NA	NA	0.00E+00
Nickel	NA	NA	NA	NA	1.51E-09	0.04%	1.51E-09
Zinc	NA	NA	NA	NA	NA	NA	0.00E+00
PAHs							
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	0.00E+00
Acenaphthylene	NA	NA	NA	NA	NA	NA	0.00E+00
Anthracene	NA	NA	NA	NA	NA	NA	0.00E+00
Benzo(a)anthracene	2.21E-07	6.25%	4.60E-08	1.30%	5.49E-11	0.00%	2.67E-07
Benzo(a)pyrene	1.76E-06	49.78%	3.66E-07	10.34%	4.57E-10	0.01%	2.13E-06
Benzo(b)fluoranthene	4.83E-07	13.64%	1.00E-07	2.83%	1.25E-10	0.00%	5.83E-07
Benzo(g,h,i)perylene	1.79E-08	0.51%	3.72E-09	0.11%	4.65E-12	0.00%	2.17E-08
Benzo(k)fluoranthene	2.87E-08	0.81%	5.96E-09	0.17%	7.12E-12	0.00%	3.46E-08
Chrysene	6.44E-09	0.18%	1.34E-09	0.04%	1.69E-12	0.00%	7.78E-09
Dibenz(a,h)anthracene	3.75E-07	10.59%	7.79E-08	2.20%	9.77E-11	0.00%	4.53E-07
Dibenzofuran	NA	NA	NA	NA	NA	NA	0.00E+00
Fluoranthene	NA	NA	NA	NA	NA	NA	0.00E+00
Fluorene	NA	NA	NA	NA	NA	NA	0.00E+00
Indeno(1,2,3-cd)pyrene	3.32E-08	0.94%	6.90E-09	0.19%	8.93E-12	0.00%	4.01E-08
Naphthalene	NA	NA	NA	NA	NA	NA	0.00E+00
Phenanthrene	NA	NA	NA	NA	NA	NA	0.00E+00
Pyrene	NA	NA	NA	NA	NA	NA	0.00E+00
SVOCs							
Benzoic Acid	NA	NA	NA	NA	NA	NA	0.00E+00
bis(2-ethylhexyl)phthalate	2.02E-09	0.06%	5.44E-10	0.02%	NA	NA	2.56E-09
Butylbenzylphthalate	NA	NA	NA	NA	NA	NA	0.00E+00
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	0.00E+00
VOCs							
Acetone	NA	NA	NA	NA	NA	NA	0.00E+00
Trichloroethene	2.13E-11	0.00%	2.30E-12	0.00%	5.31E-15	0.00%	2.36E-11
TOTAL RISK FROM SOIL PATHWAYS:							**4 E-06**

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
0.00% = <0.01%

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Table F-24

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF AIR PATHWAYS FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON FACILITY

CHEMICAL	OUTDOOR VAPORS	PERCENT	INDOOR VAPORS	PERCENT	TOTAL FROM ALL AIR PATHWAYS
Carcinogenic effects					
SVOCs					
Benzoic Acid	NA	NA	NA	NA	0.00E+00
bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	0.00E+00
Di-n-butylphthalate	NA	NA	NA	NA	0.00E+00
TICs					
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	NA	NA	0.00E+00
VOCs					
1,1,1-Trichloroethane	NA	NA	NA	NA	0.00E+00
Trichloroethane (total)	1.26E-09	19.76%	7.66E-10	12.03%	2.02E-09
1,1-Dichloroethane	NA	NA	NA	NA	0.00E+00
1,1-Dichloroethene	1.64E-10	2.58%	1.00E-10	1.57%	2.64E-10
1,2-Dichloroethane	2.19E-11	0.34%	1.33E-11	0.21%	3.51E-11
cis-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
1,2-Dichloroethene (total)	NA	NA	NA	NA	0.00E+00
Acetone	NA	NA	NA	NA	0.00E+00
Benzene	4.33E-12	0.07%	2.64E-12	0.04%	6.97E-12
Carbon Tetrachloride	1.85E-09	29.01%	1.12E-09	17.66%	2.97E-09
Chloroethane	NA	NA	NA	NA	0.00E+00
Chloroform	4.75E-11	0.75%	2.89E-11	0.45%	7.64E-11
Methylene Chloride	6.19E-11	0.97%	3.77E-11	0.59%	9.96E-11
Tetrachloroethene	1.07E-11	0.17%	6.49E-12	0.10%	1.72E-11
Toluene	NA	NA	NA	NA	0.00E+00
Trichloroethene	5.42E-10	8.51%	3.30E-10	5.18%	8.72E-10
Trichlorofluoromethane	NA	NA	NA	NA	0.00E+00
Xylenes (mixed)	NA	NA	NA	NA	0.00E+00
TOTAL RISK FROM AIR PATHWAYS:					**6 E-09**

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

0.00% = <0.01%

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Table F-25

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION OF AIR PATHWAYS FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE ALLIED STEEL FACILITY

CHEMICAL	OUTDOOR VAPORS	PERCENT	INDOOR VAPORS	PERCENT	TOTAL FROM ALL AIR PATHWAYS
Carcinogenic effects					
SVOCs					
Benzoic Acid	NA	NA	NA	NA	0.00E+00
bis(2-Ethylhexyl)phthalate	NA	NA	NA	NA	0.00E+00
TICs					
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	0.00E+00
tert-butylmethylether	NA	NA	NA	NA	0.00E+00
VOCs					
1,1,1-Trichloroethane	NA	NA	NA	NA	0.00E+00
Trichloroethane (total)	5.98E-11	3.99%	3.64E-11	2.43%	9.62E-11
1,1-Dichloroethane	NA	NA	NA	NA	0.00E+00
1,1-Dichloroethene	1.64E-10	10.97%	1.00E-10	6.68%	2.64E-10
1,2-Dichloroethane	2.19E-11	1.46%	1.33E-11	0.89%	3.51E-11
cis-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	NA	NA	0.00E+00
Benzene	3.97E-10	26.48%	2.41E-10	16.11%	6.38E-10
Carbon tetrachloride	3.86E-12	0.26%	2.35E-12	0.16%	6.21E-12
Chloroethane	NA	NA	NA	NA	0.00E+00
Chloroform	1.53E-11	1.02%	9.33E-12	0.62%	2.47E-11
Ethylbenzene	NA	NA	NA	NA	0.00E+00
Methylene Chloride	2.25E-11	1.50%	1.37E-11	0.91%	3.61E-11
Tetrachloroethene	1.58E-10	10.53%	9.61E-11	6.41%	2.54E-10
Toluene	NA	NA	NA	NA	0.00E+00
Trichloroethene	8.92E-11	5.95%	5.43E-11	3.62%	1.44E-10
Trichlorofluoromethane	NA	NA	NA	NA	0.00E+00
Xylenes (mixed)	NA	NA	NA	NA	0.00E+00

TOTAL RISK FROM AIR PATHWAYS: 1 E-09

NA = Not Applicable, no criteria.

1E-6 = 1/1,000,000

0.00% = <0.01%

AR304240

Table F-26
CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION TO GROUNDWATER PATHWAYS FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	PERCENT	GROUNDWATER INGESTION	PERCENT	VAPOR INHALATION	PERCENT	TOTAL FROM ALL GROUNDWATER PATHWAYS
Carcinogenic effects							
METALS							
Aluminum	NA	NA	NA	NA	--	--	0.00E+00
Arsenic	8.83E-08	0.02%	4.15E-05	7.44%	--	--	4.16E-05
Barium	NA	NA	NA	NA	--	--	0.00E+00
Beryllium	9.59E-08	0.02%	4.51E-05	8.08%	--	--	4.52E-05
Chromium	NA	NA	NA	NA	--	--	0.00E+00
Cobalt	NA	NA	NA	NA	--	--	0.00E+00
Copper	NA	NA	NA	NA	--	--	0.00E+00
Manganese	NA	NA	NA	NA	--	--	0.00E+00
Nickel	NA	NA	NA	NA	--	--	0.00E+00
Vanadium	NA	NA	NA	NA	--	--	0.00E+00
SVOCs							
Dimethylphthalate	NA	NA	NA	NA	--	--	0.00E+00
TICs							
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	--	--	0.00E+00
Carbon Disulfide	NA	NA	NA	NA	--	--	0.00E+00
tert-butylmethylether	NA	NA	NA	NA	--	--	0.00E+00
VOCs							
1,1,1-Trichloroethane	NA	NA	NA	NA	NA	NA	0.00E+00
1,1,2-Trichloroethane	3.61E-09	0.00%	2.02E-07	0.04%	1.99E-07	0.04%	4.04E-07
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	0.00E+00
1,1-Dichloroethene	4.85E-07	0.09%	1.43E-05	2.56%	4.16E-06	0.75%	1.89E-05
1,2,3-Trichlorobenzene	NA	NA	NA	NA	NA	NA	0.00E+00
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	0.00E+00
1,2-Dichloroethane	1.29E-08	0.00%	1.14E-06	0.20%	1.14E-06	0.20%	2.30E-06
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	0.00E+00
trans-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	0.00E+00
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA	0.00E+00
Benzene	4.48E-09	0.00%	1.00E-07	0.02%	1.00E-07	0.02%	2.05E-07
Carbon Tetrachloride	2.64E-08	0.00%	5.64E-07	0.10%	5.64E-07	0.10%	1.15E-06

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Table F-26

CARCINOGENIC RISK SUMMARY AND THE PERCENT CONTRIBUTION TO GROUNDWATER PATHWAYS FOR THE FUTURE ONSITE RESIDENTIAL SCENARIO AT THE RECTICON/ALLIED STEEL SITE

CHEMICAL	DERMAL CONTACT	PERCENT	GROUNDWATER INGESTION	PERCENT	VAPOR INHALATION	PERCENT	TOTAL FROM ALL GROUNDWATER PATHWAYS
Carcinogenic effects							
Chlorobenzene	NA	NA	NA	NA	NA	NA	0.00E+00
Chloroethane	NA	NA	NA	NA	NA	NA	0.00E+00
Chloroform	5.28E-10	0.00%	2.79E-08	0.01%	3.66E-07	0.07%	3.95E-07
Chloromethane	5.50E-10	0.00%	6.17E-08	0.01%	2.99E-08	0.01%	9.21E-08
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA	0.00E+00
Methylene Chloride	1.96E-10	0.00%	2.05E-08	0.00%	4.37E-09	0.00%	2.50E-08
Tetrachloroethene	2.32E-07	0.04%	2.28E-06	0.41%	8.03E-07	0.14%	3.31E-06
Trichloroethene	5.53E-06	0.99%	1.63E-04	29.15%	2.51E-04	45.04%	4.20E-04
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	0.00E+00
Vinyl Chloride	3.31E-07	0.06%	2.13E-05	3.82%	3.26E-06	0.58%	2.49E-05
m,p-Xylene	NA	NA	NA	NA	NA	NA	0.00E+00
TOTAL RISK FROM GROUNDWATER PATHWAYS:							**6 E-04**

NA = Not Applicable, no criteria.
1E-6 = 1/1,000,000
0.00% = <0.01%

-- = Intake from vapor inhalation considered equivalent to ingestion for VOCs only (see text).

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