3-8-94

NASA PLUM BROOK STATION
GARAGE AND MAINTENANCE AREA

FINAL REPORT

February 25, 1994

Prepared for:

Office of Environmental Programs
NASA/Lewis Research Center
21000 BROOKPARK ROAD
Cleveland, Ohio

Prepared by:

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bionetics

February 25, 1994

NASA Lewis Research Center
Attn: Peter McCallum
21000 Brookpark Rd MS 6-4
Cleveland, OH 44135

RE: Risk Assessment, Plum Brook Garage and Maintenance Area

Dear Mr. McCallum:

Bionetics was previously tasked to conduct risk analysis of three sites at the Plum Brook Station. You have received the final reports on two sites.

In the process of completing the risk assessments, a schedule conflict developed which threatened the timely completion of the third risk analysis, representing the Garage and Maintenance Area. As a compromise, to allow subsequent work to proceed, a preliminary risk was conducted, and was previously conveyed to your office.

That risk assessment concluded:

The tanks at B7132 were used only for petroleum fuels, and thus were not regulated under RCRA closure rules

The situation at B7131 meets the criteria for clean closure

The situation at B7121 does not meet the criteria for clean closure, and order of magnitude reductions in soil/water concentrations have to be planned.

The writeup of the preliminary risk assessment was terse, did not provide supporting information, and some of the analyses were approximate. Since that submission, a full risk assessment was completed, and is presented here in the format of previously submitted risk assessments. Findings in this fuller report conclude:

As before, the tanks at B7132 were used only for petroleum fuels, and thus were not evaluated in this risk assessment.

As before, the situation at B7131 meets the criteria for clean closure.

As before, the situation at B7121 does not meet the criteria for clean closure. As before, an order of magnitude reduction in soil/water concentrations needs to be planned. Specific example options provide alternative cleanup goals.

Because this document is to be used for internal purposes only, we are submitting it as a final report. Technical questions should be directed to Mr. Donald Easterling, PE, of my staff.

Sincerely,

Theodore James Thomas

Theodore J. Thomas, P.E., Ph.D
Project Manager

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Appendix A: Morrison Knudsen Ferguson Group, Preliminary Site Investigation Report, January 28, 1993.

Appendix B: EBASCO Environmental, Underground Storage Tank Corrective Actions Remedial Investigation/Feasibility Study - Phase 1 Report, November 1991.

Appendix C: EBASCO Environmental, Closure Assessment for Tanks 24, 25, 28, 29, 30, 31, 32, and 39, undated (1989).

EXECUTIVE SUMMARY

This report assesses the level of risk to human health resulting from residual chemical contamination associated with five former underground storage tanks at the NASA Plum Brook Station Garage and Maintenance Area. The format of the assessment, including the use of highly conservative assumptions and default values, is designed to conform primarily to the Ohio EPA hazardous waste closure guidance document dated September, 1993. This approach is necessary since portions of this area were utilized to manage chemical solvents which are designated as hazardous wastes by the Ohio Environmental Protection Agency (Ohio EPA), and Ohio EPA is the authorized agency responsible for regulating hazardous wastes within the state of Ohio. In addition to providing specific requirements, the Ohio EPA guidance references a number of U.S. EPA Office of Superfund guidance documents. Therefore, the assessment also conforms to U.S. EPA guidelines.

Within the general Garage and Maintenance Area there are four areas where underground tanks were previously located. The tanks at Building 7132 (tanks 33, 34, and 35) were used only for gasoline and diesel fuel and therefore are not included in the assessment of risk. Tanks 29, 30 and 31 were located adjacent to Building 7121 and tank 28 was located across the roadway from these three tanks. The two tank areas at Building 7121 are separated by a distance of approximately 50 feet. Due to the proximity of these four tanks and the pattern of distribution of contaminants, the two Building 7121 tank areas are treated as a single site and evaluated through a single risk assessment. The final tank site (tank 32), located at building 7131, is evaluated separately. Therefore, the assessment of risk at the Garage and Maintenance Area consists of two distinct assessments; the Building 7131 site and the Building 7121 site.

The assessments evaluate only hazardous waste constituents, and do not include fuel components. Toxic risk and carcinogen risk are evaluated separately. Although the assessment of risk at the Building 7131 site includes five chemicals, it is impacted significantly by only one (trichloroethylene). The assessment of risk at Building 7121 includes 18 chemicals, but is significantly impacted by only six (1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene, carbon tetrachloride, 1,1-dichloroethylene), and vinyl chloride).

Three reports were used in this evaluation to define site conditions. The first is an undated Site Assessment report describing tank removal and sampling activities during December 1989. The second report is a corrective actions Remedial Investigation/Feasibility Study dated November 1991. This report includes information collected from December 1989 through the date of the report. The third report is a preliminary site investigation dated January 28, 1993. The reports contain differing levels of quality assurance information and documentation, and represent separate phases of a continuing environmental investigation of the area.

When viewed collectively these investigations provide a fairly clear definition of soil contamination, but provide only a limited characterization of groundwater contamination. The possibility of encountering unexpected conditions during the closure process decreases as the level of site definition increases. Also, Ohio EPA generally requires a fairly high degree of site characterization to support RCRA risk assessments. Therefore, the adequacy of existing data to support risk assessment conclusions should be discussed with Ohio EPA as early in the closure process as possible to assist with closure planning.

FINDINGS FOR THE BUILDING 7131 SITE:

1. Existing levels of soil and groundwater contamination, as determined in the above noted reports, meet the criteria for clean closure established by Ohio EPA.

2. Soil contamination levels appear to be adequately defined, but additional groundwater information may be needed to adequately support the findings of the Building 7131 risk assessment. The issue of adequacy of existing data to support the Building 7131 risk assessment should be addressed in the RCRA closure plan for the Garage and Maintenance Area.

3. Toxicity data (inhalation reference doses) were incomplete and had to be estimated for both trichloroethylene and tetrachloroethylene. The assessment of risk should still be fairly reliable since carcinogenicity data is complete and the level of toxic risk is only 10% of the allowable levels established by Ohio EPA for RCRA risk assessment closure. However, it should be noted that Ohio EPA has a caveat within its closure manual which states that Ohio EPA may not accept risk assessments for chemicals having incomplete toxicity or carcinogenicity data. Ohio EPA maintains the option of requiring cleanup to analytical detection limits when such data are incomplete.

FINDINGS FOR THE BUILDING 7121 SITE:

1. Existing levels of contamination, as determined in the above noted reports, do not meet the criteria for clean closure established by Ohio EPA.

2. The level of risk at Building 7121 is significantly impacted by six chemicals (1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene, carbon tetrachloride, 1,1-dichloroethylene, and vinyl chloride). In order to decrease risk to a level which meets Ohio EPA criteria for risk assessment closure 1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene, and 1,1-dichloroethylene concentrations will need to be reduced in the groundwater. Carbon tetrachloride and trichloroethylene concentrations will need to be reduced in the air pathway. Vinyl chloride concentrations also may need to be reduced in the air pathway, depending upon the effectiveness of the previously noted required reductions. Since Ohio EPA policy does not allow use of controls in risk assessment closures, it will be necessary to reduce contaminant concentrations in the soil in order to reduce air pathway risk levels. Contaminant concentrations will need to be reduced more than 90 % in order to meet Ohio EPA criteria. Target remedial goals are shown in Table 51.

3. Carcinogenic toxicity data were complete, but portions of noncarcinogen toxicity data were incomplete and had to be estimated for nine chemicals. This included three of the chemicals that require remediation (tetrachloroethylene, trichloroethylene, and 1,1-dichloroethylene). The maximum clean levels noted in Table 51 do not take into account a caveat within Ohio EPA's closure manual that states that Ohio EPA may not accept risk assessments for chemicals having incomplete toxicity or carcinogenicity data. Ohio EPA maintains the option of requiring cleanup to analytical detection limits when such data are incomplete.

INTRODUCTION

This report assesses the level of risk presented by residual level hazardous waste contamination at the NASA Plum Brook Station Garage and Maintenance Area and sets target remediation goals. It does not serve as a closure plan for the facility. For the purpose of Resource Conservation and Recovery Act (RCRA) risk assessment closure, the Garage and Maintenance Area consists of two separate sites. Existing contamination levels and the resulting levels of risk at these two sites are markedly different. Therefore, the sites are addressed in separate sections of this report.

BUILDING 7131 TANK SITE

DESCRIPTION OF THE BUILDING 7131 TANK SITE

LOCATION, GEOLOGY AND HYDROGEOLOGY

The location of the Building 7131 tank site (tank 32) is shown on the last page of Appendix A.[1] Local geologic and hydrogeologic conditions for the Building 7131 area are best described in the EBASCO Environmental report dated November 1991 (see Appendix B).[2]

EXISTING LEVELS OF SOIL CONTAMINATION

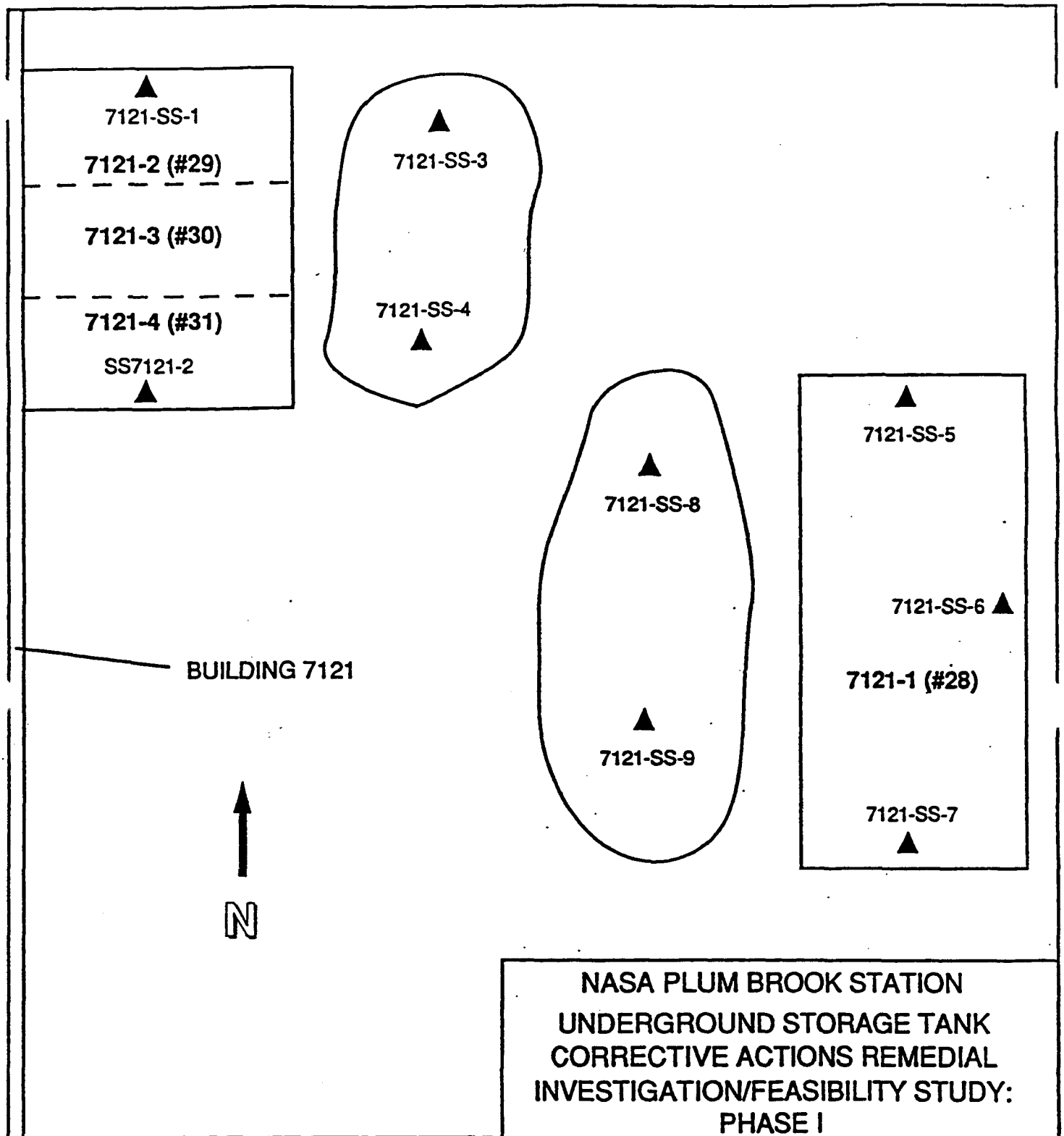
Existing soil contamination levels immediately adjacent to the tank boundaries at the Building 7131 site were determined at the time of the tank removals in December, 1989. The reports for this sampling provided the laboratory analytical reports, but failed to summarize the data in a manner that distinguished individual samples. Instead, the reports provided summaries of the highest values encountered at each site. Therefore, data summaries in the original reports do not distinguish between excavated soils which have been removed from the site and in-situ soils at the boundaries of the excavation.

A sketch of the sample locations is provided in Figure 1. A full description of the sampling activities, the tank removal process, and the laboratory analytical reports are provided in the Ebasco Services Site Assessment for Tanks 24, 25, 28, 29, 30, 31, 32, and 39 (Appendix C).[3] Sample numbers 7131-SS-1, 7131-SS-2, and 7131-SS-3 are samples of in-situ soil. The results of in-situ soil sampling are provided in Table 1.

The EBASCO Environmental report, dated November 1991 (Appendix B), reported one additional soil sample (GM-SB-03). The location of this sample is shown in Figure 2. Although the laboratory reported values for methylene chloride, acetone, and carbon disulfide, the report noted that these values were the result of laboratory contamination of the sample.

The November 1991 report also provided the results of a sediment sample collected from a nearby ditch and a soil gas survey. The location of the sediment sample (PBS-GM-SS-02) is shown in Figure 3. This sample found 1,1-dichloroethane and acetone (Table C-1 of Appendix B) , but the acetone was determined to be the result of laboratory contamination of the sample. The soil gas survey failed to detect contamination within the immediate vicinity of the Building 7131 site. The locations of the soil gas sampling points are shown in Figure 4 and the analytical results are provided in Table 3-7 of Appendix B.

Three additional soil samples were collected during 1993. The locations of these samples (B-3, B-4, and B-5) are shown in Figure 5. The results of this sampling, as provided in the M.K. Ferguson report, dated January 28, 1993, are shown in Table 2. All in-situ soil sample results, excluding those noted as being due to laboratory contamination, are included in Table 1.



NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL
INVESTIGATION/FEASIBILITY STUDY:
PHASE I

LEGEND

▲ Soil Sample

Tank Pit

Excavated Soil Pile

Sampling Locations Associated With the Building 7121 USTs

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE [1]

TABLE 1

GARAGE AND MAINTENANCE AREA - BUILDING 7131

SOIL SAMPLING RESULTS

	7131-SS-1	7131-SS-2	7131-SS-3	B-3 and B-5	B-4	PBS-GM-SS02
1,1-dichloroethane	-	-	-	-	19	21
hexachlorobutadiene	14	-	-	-	-	-
methylene chloride	7	-	7	-	-	-
naphthalene	1 and 4	1 and 3	1	-	-	-
toluene	-	-	1	-	-	-
1,2,3,-trichlorobenzene	18	-	-	-	-	-
1,1,1,-trichloroethane	3	3	6	-	17	-
trichloroethylene	372 and 301	359 and 301	417 and 606	-	-	-

Note: EBASCO, November 1991 Sample PBS-GM-5803 found: Methylene chloride at 13 and 100 ppb, acetone at 23 and 68 ppb, and carbon disulfide at 400 and 14 ppb. These values noted were determined to be laboratory contamination of the sample.

Units: parts per billion

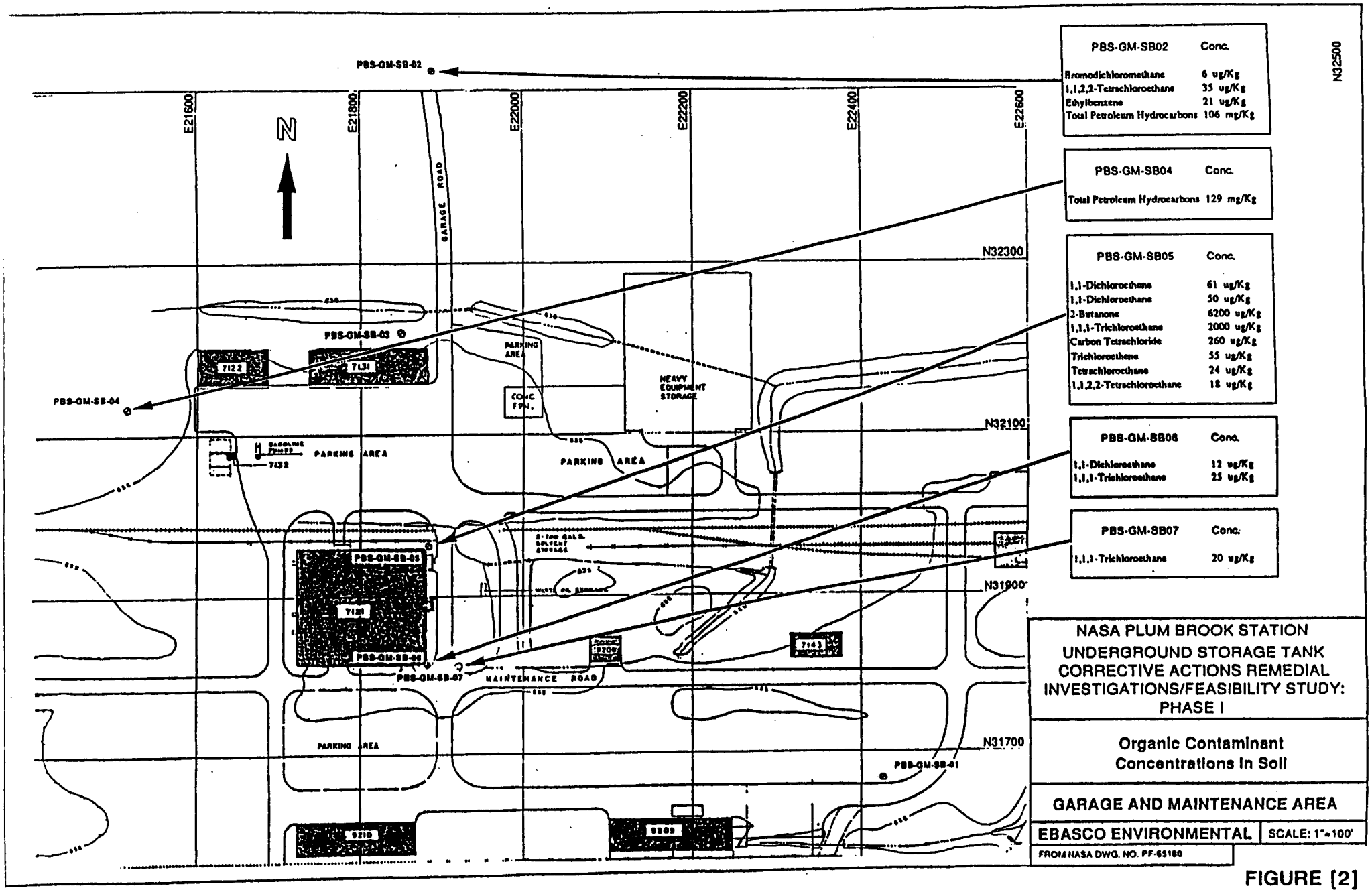
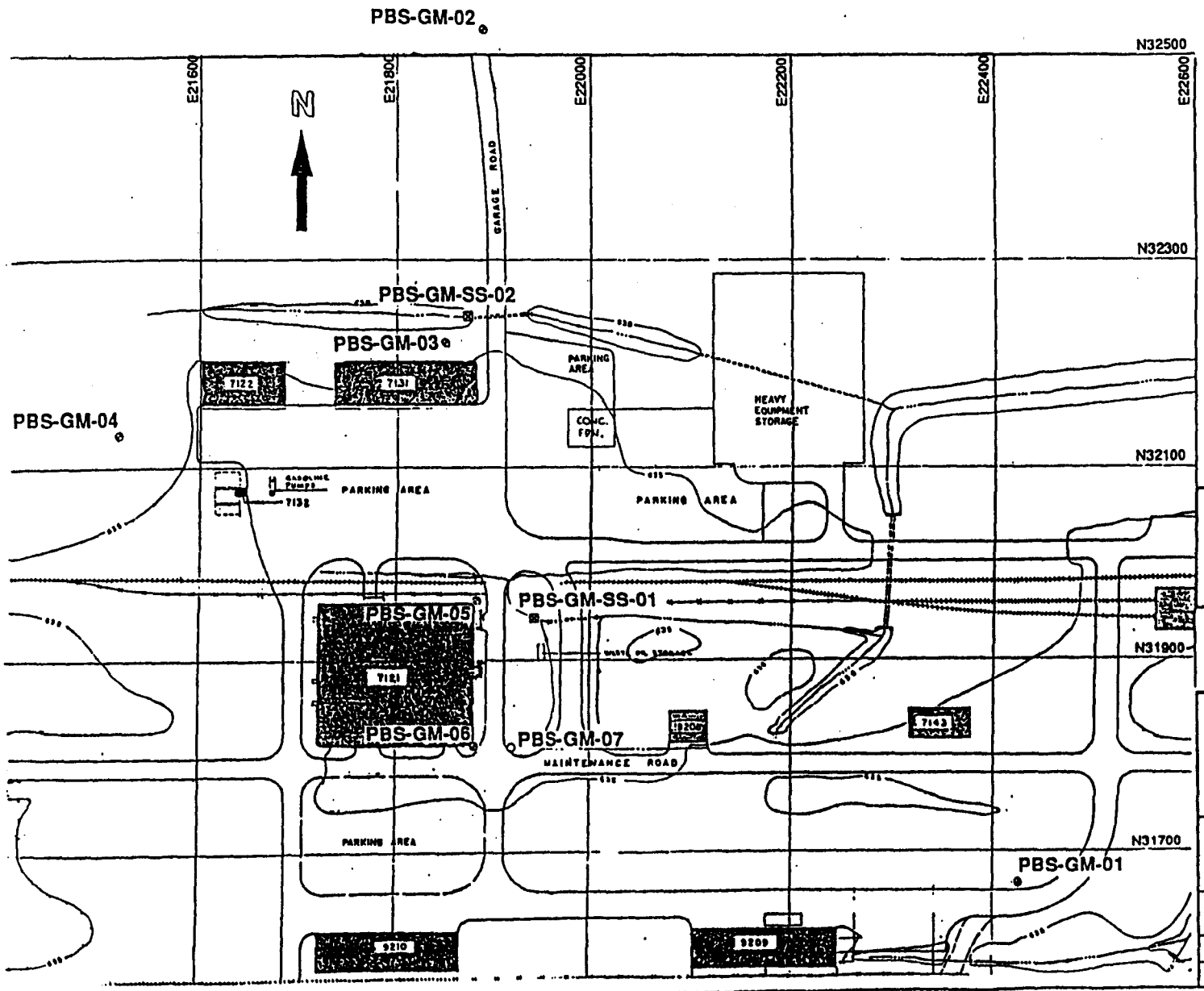

PBS-GM-SB-02
PBS-GM-SB-03
PBS-GM-SB-04
PBS-GM-SB-05
PBS-GM-SB-06
PBS-GM-SB-07
PBS-GM-SB-01
E21600
E21800
E22000
E22200
E22400
E22600
N32500
N32300
N32100
N31900
N31700
N
GARAGE ROAD
PARKING AREA
HEAVY EQUIPMENT STORAGE
CONC. FDN.
GASOLINE PUMPS
7122
7131
7132
7181
7143
9210
9209
MAINTENANCE ROAD
PBS-GM-SB02 Conc.
Bromodichloromethane 6 ug/Kg
1,1,2,2-Tetrachloroethane 35 ug/Kg
Ethylbenzene 21 ug/Kg
Total Petroleum Hydrocarbons 106 mg/Kg
PBS-GM-SB04 Conc.
Total Petroleum Hydrocarbons 129 mg/Kg
PBS-GM-SB05 Conc.
1,1-Dichloroethene 61 ug/Kg
1,1-Dichloroethane 50 ug/Kg
2-Butanone 6200 ug/Kg
1,1,1-Trichloroethane 2000 ug/Kg
Carbon Tetrachloride 260 ug/Kg
Trichloroethene 55 ug/Kg
Tetrachloroethane 24 ug/Kg
1,1,2,2-Tetrachloroethane 18 ug/Kg
PBS-GM-SB06 Conc.
1,1-Dichloroethane 12 ug/Kg
1,1,1-Trichloroethane 25 ug/Kg
PBS-GM-SB07 Conc.
1,1,1-Trichloroethane 20 ug/Kg
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL
INVESTIGATIONS/FEASIBILITY STUDY:
PHASE I
Organic Contaminant
Concentrations In Soil
GARAGE AND MAINTENANCE AREA
EBASCO ENVIRONMENTAL
SCALE: 1"=100'
FROM NASA DWG. NO. PF-65180

FIGURE [2]



LEGEND

- Ground Water Monitoring Well Location
- Soil Boring Location
- Sediment Sample Location

NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK
CORRECTIVE ACTIONS REMEDIAL
INVESTIGATION/FEASIBILITY STUDY:
PHASE I

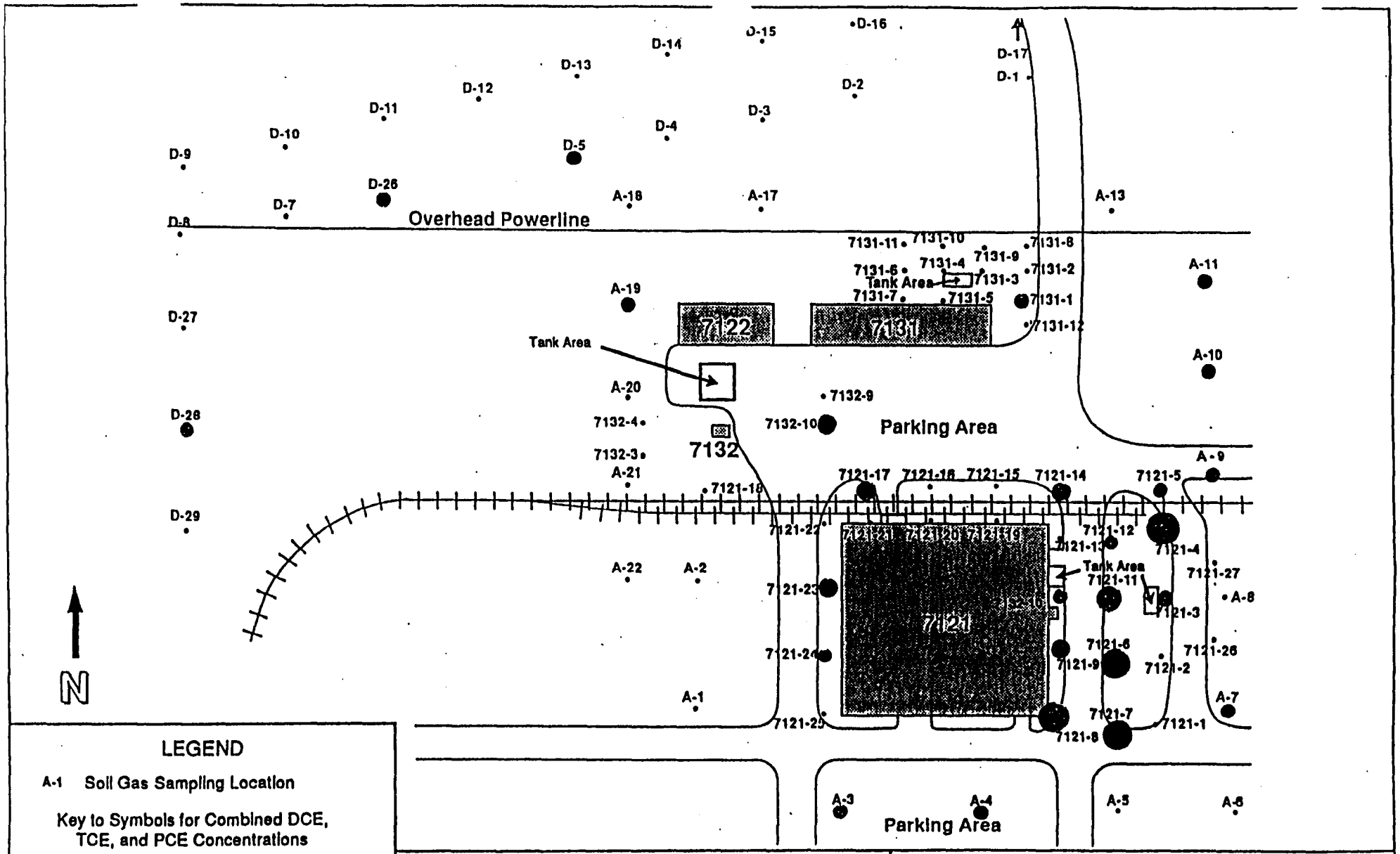
Locations of Sediment Samples

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | SCALE: 1" = 100'

FROM NASA DWG. NO. PF-65180

FIGURE [3]



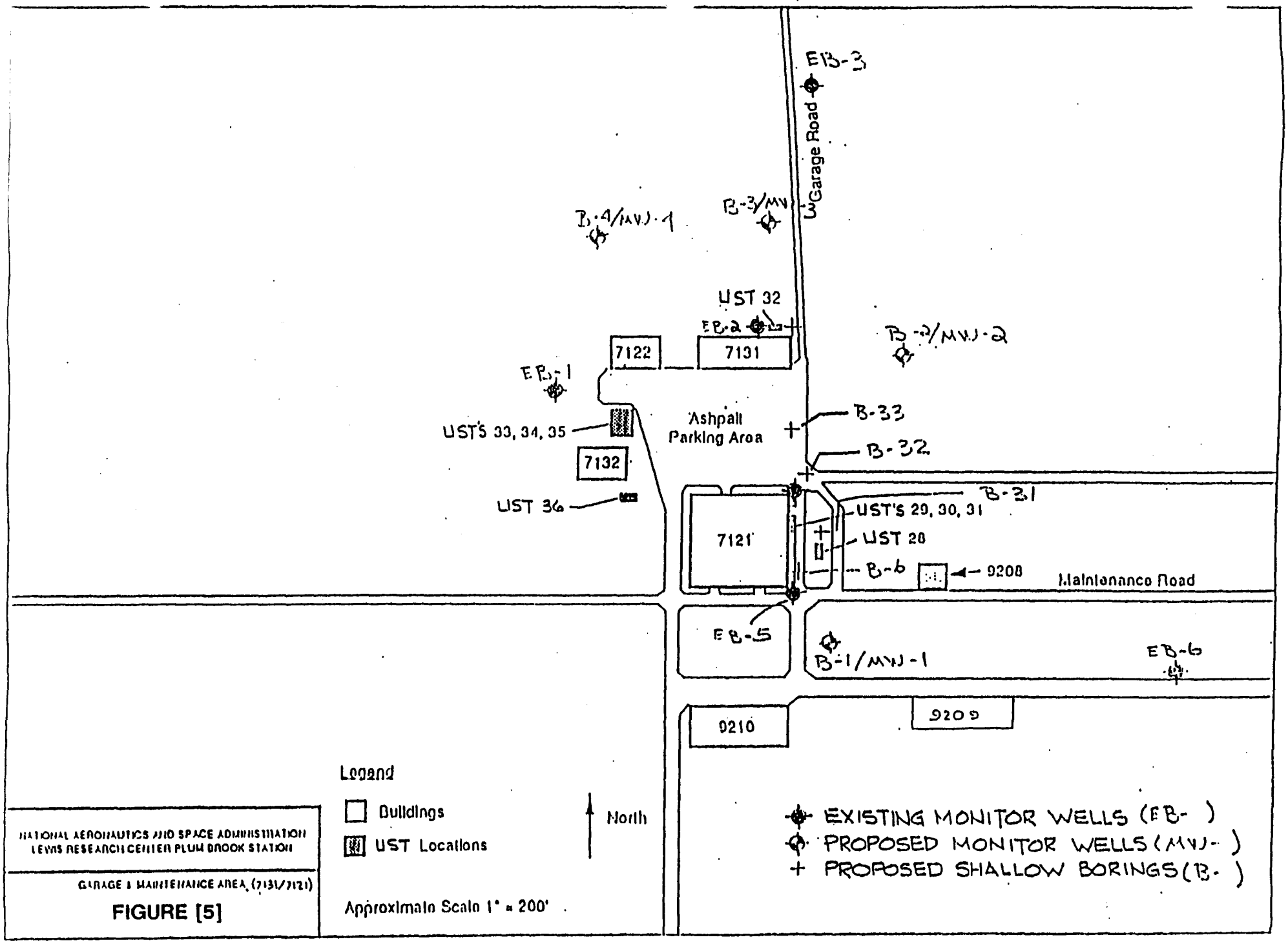
NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

EBASCO ENVIRONMENTAL | NOT TO SCALE

Soil Gas Sampling Locations and Results for DCE, TCE and PCE

GARAGE AND MAINTENANCE AREA

FIGURE [4]



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER PLUM BROOK STATION

GARAGE & MAINTENANCE AREA (7131/7121)

FIGURE [5]

TABLE [2]

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN SOIL

BUILDINGS 7121/7131
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (ug/kg)[1]	PQL (ug/L)[2]
B1	0'-2'	---	---[3]	---
B1	2'-4'	---	---	---
B1	8'-10'	---	---	---
B2	2'-4'	---	---	---
B2	6'-8'	TETRAHYDROFURAN[4]	243	10
B2	10'-12'	---	---	---
B3	4'-6'	---	---	---
B3	2'-4'	---	---	---
B3	6'-8'	TETRAHYDROFURAN[4]	287	10
B4	4'-6'	---	---	---
B4[D(5)]	4'-6'	---	---	---
B4	6'-8'	1,1-DICHLOROETHANE	19.4	5
B4	6'-8'	1,1,1-TRICHLOROETHANE	16.8	5
B4	10'-12'	---	---	---
B5	0'-2'	---	---	---
B5[D(5)]	0'-2'	---	---	---
B5	2'-4'	---	---	---
B5	4'-6'	---	---	---
B6	1'-3'	ACETONE	64.6	50
B6	3'-5'	ACETONE	106	10
B6	3'-5'	2-BUTANONE (MEK)[4]	50	10
B6	5'-7'	1,1,1-TRICHLOROETHANE	65.2	5
B-31-1	2'-4'	METHYLENE	7.45	
B-31-1	2'-4'	TOLUENE	6.44	
B-31-2	4'-6'	1,1,1-TCA	17.8	
B-31-2	4'-6'	NAPHTHALENE	5.60	
B-31-2	4'-6'	1,2,3-TRICHLOROBENZENE	5.08	

TABLE [2]

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN SOIL

BUILDINGS 7121/7131
TASK NO. 6105-006

BORING NUMBER	SAMPLE DEPTH	COMPOUND	RESULT (ug/kg)(1)	PQL (ug/L)(2)
B-32-1	4'-6'	METHYLENE CHLORIDE	12.2	
B-32-1	4'-6'	1,1,1-TCA	82.2	
B-32-2	6'-8'	METHYLENE CHLORIDE	10.3	
B-32-2	6'-8'	1,1,1-TCA	43.3	
B-32-2	6'-8'	TOLUENE	7.43	
B-33-1	0'-2'	TOLUENE	10.2	
B-33-2	2'-4'	1,1,1-TCA	8.94	
B-33-2D	2'-4'			
B-33-3	4'-6'	1,1,1-TCA	7.50	

(1) ug/kg = ppb

(2) PQL = Practical Quantification Limit

(3) --- = Compound/Concentrations Below PQL

(4) = Tetrahydrofuran and 2-Butanone (MEK) are Laboratory Contaminants, per BEC Labs

(5) D = Duplicate Sample

GROUNDWATER CONTAMINATION

The first two investigations did not evaluate groundwater contamination at the Building 7131 site. The last investigation, which included sampling of three wells within the Building 7131 area, was used to evaluate the level of risk posed by contaminated groundwater. This report may not provide sufficient sampling data to confirm the findings of the risk assessment.

The report for the final investigation, conducted by the Morrison Knudsen Ferguson, is provided in Appendix A. Table 3 summarizes the findings of the sampling of all of the wells in the Garage and Maintenance Area. The Building 7131 site is characterized by wells MW3, MW4, and EB2. The well immediately adjacent to the site (EB2) found only 10 ppb of 1,1,1-trichloroethane. Well MW3, located 150 feet from the site found no detectable hazardous waste constituents. Well MW4, located approximately three hundred feet found 2 ppb of 1,1-dichloroethylene and 18 ppb of 1,1-dichloroethane. Contaminants found in well MW4 were included in the assessment of risk even though there is a possibility that the presence of these contaminants is unrelated to the Building 7131 site.

RISK ASSESSMENT MODELS UTILIZED

The Ohio EPA has developed a guidance manual which clarifies its requirements for conducting risk assessments for hazardous waste management facilities. This manual was recently revised and released as an interim final document dated September 1, 1993.[4] In addition to general and procedural guidance, the manual provides a series of tables which present the necessary exposure equations and default values for the most commonly encountered pathways (see Tables 4 through 8). These tables form the basis of the exposure assessment for the Reactor area.

Exposure levels (intake) and toxicity values are combined to determine the degree of risk utilizing the concept of hazard index for toxins and probability index for carcinogens. The following calculations are used to determine these indexes:

for toxins: hazard index = intake/reference dose

for carcinogens: probability index = intake x slope factor

Risks are assumed additive per constituent and per pathway. A hazard index of less than or equal to one and a probability index of less than or equal to 1E-6 are considered protective of human health.

Although some of the Ohio EPA exposure assessment tables depend upon determination of chemical specific concentrations in air, the Ohio EPA guidance manual does not provide models or default values for making such determinations. Instead the Ohio EPA defers to U.S. EPA guidance in this area. One of the methods for determining contaminant concentrations in air is provided in section 3.3 of the U.S. EPA Risk Assessment Guidance for Superfund

TABLE [3]

GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS IN WATER

BUILDINGS 7121/7131
TASK NO. 6105-006

MONITOR WELL	COMPOUND	RESULT (ug/L)[1]	PQL (ug/L)[2]
MW1	---	---[3]	---
MW2	---	---	---
MW2A[4]	---	---	---
MW3	---	---	---
MW4	1,1-DICHLOROETHANE	18.0	1
MW4	1,1-DICHLOROETHENE	1.74	1
EB1	---	---	---
EB2	1,1,1-TRICHLOROETHANE	9.88	1
EB3	---	---	---
EB4	CHLOROETHANE	4.13	2
EB4	1,1-DICHLOROETHANE	48.5	1
EB4	1,1-DICHLOROETHENE	51.6	1
EB4	CIS-1,2-DICHLOROETHENE	2.93	1
EB4	TETRACHLOROETHENE	5.72	1
EB4	1,1,1-TRICHLOROETHANE	551	1
EB4	1,1,2-TRICHLOROETHANE	2.13	1
EB4	TRICHLOROETHENE	13.4	1
EB5	CHLOROETHANE	2.17	2
EB5	1,1-DICHLOROETHANE	112	1
EB5	1,1-DICHLOROETHENE	52.9	1
EB5	1,1,1-TRICHLOROETHANE	1,130	1
EB5	1,1,2-TRICHLOROETHANE	1.25	1
EB5	TRICHLOROETHENE	5.60	1
EB6	---	---	---

(1) ug/L = ppb

(2) PQL = Practical Quantification Limit

(3) --- = Compound/Concentrations Below PQL

TABLE [4] INTERIM FINAL

RESIDENTIAL EXPOSURE: INGESTION OF CHEMICALS IN DRINKING WATER

$$Intake\ (mg/kg\text{-}d) = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

Exposure Parameters		Value	Comments
CW:	Chemical Concentration in Water site-specific (mg/l)	95% UCL	1
IR:	Ingestion Rate (l/day)	2	
EF:	Exposure Frequency (days/yr)	350	4
ED:	Exposure Duration (yrs)		5
	child	6	
	adult	30	
BW:	Body Weight (kg)		6
	child	15	
	adult	70	
AT:	Averaging Time (days)		7
	child noncarcinogens	2,190	
	adult noncarcinogens	10,950	
	child carcinogens	25,550	
	adult carcinogens	25,550	

00211

INTERIM FINAL

TABLE [5]

RESIDENTIAL EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN WATER

$$\text{Absorbed dose (mg/kg-d)} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF^{*}}{BW \times AT}$$

Exposure Parameters		Value	Comments
CW:	Chemical Concentration in Water site-specific (mg/l)	95% UCL	1
SA:	Skin Surface Area (cm^2/day)		8
	child	7,000	
	adult	20,000	
PC:	Dermal Permeability Constant chemical-specific (cm^2/hr)		13
ET:	Exposure Time (hrs/day)		
EF:	Exposure Frequency (days/yr)	350	4
ED:	Exposure Duration (yrs)		5
	child	6	
	adult	30	
CF:	Conversion Factor (l/cm^3)	1/1000	
BW:	Body Weight (kg)		6
	child	15	
	adult	70	
AT:	Averaging Time (days)		7
	child noncarcinogens	2,190	
	adult noncarcinogens	10,950	
	child carcinogens	25,550	
	adult carcinogens	25,550	

* Refer to Comment 11

00212

INTERIM FINAL

TABLE [6]

RESIDENTIAL EXPOSURE: INGESTION OF CHEMICALS IN SOILS AND DUST

$$Intake\ (mg/kg\text{-}d) = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Exposure Parameters		Value	Comments
CS:	Chemical Concentration in Soil site-specific (mg/kg)	95% UCL	1
IR:	Ingestion Rate (mg/d)		2
	child	200	
	adult	100	
CF:	Conversion Factor (kg/mg)	1×10^{-6}	
FI:	Fraction Ingested (unitless)	1	3
EF:	Exposure Frequency (days/yr)	350	4
ED:	Exposure Duration (yrs)		5
	child	6	
	adult	30	
BW:	Body Weight (kg)		6
	child	15	
	adult	70	
AT:	Averaging Time (days)		7
	child noncarcinogens	2,190	
	adult noncarcinogens	10,950	
	child carcinogens	25,550	
	adult carcinogens	25,550	

00209

TABLE [7]

INTERIM FINAL

RESIDENTIAL EXPOSURE: DERMAL CONTACT WITH CHEMICALS IN SOIL

$$\text{Absorbed dose (mg/kg-d)} = \frac{CS \times CF\ SA \times AF \times ABS \times EF \times ED^{*}}{BW \times AT}$$

Exposure Parameters		Value	Comments
CS:	Chemical Concentration in Soil site-specific (mg/kg)	95% UCL	1
CF:	Conversion Factor (kg/mg)	1×10^{-6}	
SA:	Skin Surface Area (cm^2/day)		8
	child	2,000	
	adult	5,000	
AF:	Adherence Factor (unitless)	1.0	9
ABS:	Absorption Factor (unitless)		10
EF:	Exposure Frequency (days/yr)	350	4
ED:	Exposure Duration (yrs)		5
	child	6	
	adult	30	
BW:	Body Weight (kg)		6
	child	15	
	adult	70	
AT:	Averaging Time (days)		7
	child noncarcinogens	2,190	
	adult noncarcinogens	10,950	
	child carcinogens	25,550	
	adult carcinogens	25,550	

* Refer to Comment 11

00210

INTERIM FINAL

TABLE [8]

RESIDENTIAL EXPOSURE: INHALATION OF AIRBORNE CHEMICALS

$$Intake\ (mg/kg\text{-}d) = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT}$$

Exposure Parameters		Value	Comments
CA:	Chemical Concentration in Air site-specific (mg/m^3)	modelled	1
IR:	Inhalation Rate		14
	child/adult, outdoor (m^3/hr)	0.83	
	showering	0.6	
ET:	Exposure Time (hrs/day)		15
	child/adult, outdoor	24	
	showering	0.2	
EF:	Exposure Frequency (days/yr)	350	4
ED:	Exposure Duration (yrs)		5
	child	6	
	adult	30	
BW:	Body Weight (kg)		6
	child	15	
	adult	70	
AT:	Averaging Time (days)		7
	child noncarcinogens	2,190	
	adult noncarcinogens	10,950	
	child carcinogens	25,550	
	adult carcinogens	25,550	

00213

(RAGS),volume 1, Part B.[5] This numerical model is utilized because the underlying model assumptions are representative of site conditions. This model assumes that soil contaminant concentrations are at or below saturation (no free liquid is present). The use of calculations to confirm this assumption is unnecessary due to the absence of free liquid and the very low residual levels of contaminants at the site. The model also assumes that surface soil is not covered by any material that will impede volatilization and assumes unlimited erosion potential. These assumptions maximize calculated values by ruling out scenarios which involve barriers or land use restrictions.

The basic equations, shown in Tables [9] and [10], determine a volatilization factor (VF) for vapors and gasses and a particulate emission factor (PEF) for particles. The RAGS Part B fails to explicitly relate these term to chemical concentrations in air. However, comparison of the equations presented on pages 53 and 54 of that document with Ohio EPA tables reveals that the resulting concentrations in air are equal to 1/VF and 1/PEF. Conversion of units is unnecessary in order to insert the calculated air concentrations into the Ohio EPA tables.

The Ohio EPA guidance also references a number of U.S. EPA Office of Superfund guidance documents, but clarifies that Ohio EPA guidance prevails in cases of conflicting guidance. The validity and underlying assumptions of the Ohio EPA numerical models and default values are not evaluated in this risk assessment since they have been subjected to substantial peer review and are State policy. These models and associated default values are highly conservative and protective of human health and the environment.

SELECTION OF CHEMICAL SPECIFIC VALUES

CONTAMINANT CONCENTRATIONS IN SOIL

This risk assessment is designed to determine the impact of the contamination resulting from the hazardous waste management unit. Since the fuel tank at Building 7131 was known to have leaked the assessment does not include fuels components. Detected chemicals that are considered to be fuel related are: toluene and naphthalene. The assessment also does not include 1,2,3-trichlorobenzene which is used as an ingredient in insecticides and found only at very low concentrations (18 ppb in only one sample). Hexachlorobutadiene is not included in the assessment because it is commonly utilized in transformer fluids, it is not known to have been placed in the tanks, and the concentration is limited (14 ppb). The selected chemicals are shown in the first column of Table 11.

The selected values representing soil contamination levels at the Building 7131 site are shown in the third column of Table 11. These values represent the highest concentration for each contaminant present in in-situ soils. Utilization of the 95% upper confidence limit (UCL) of the arithmetic mean of the sample population in lieu of maximum values to characterize site conditions was considered but not selected since sampling did not conform to significant assumptions inherent to the 95% UCL method. The 95% UCL method assumes spatially random sampling and assumes that the number of samples is statistically significant. The reported samples were located using directed techniques, and there were only three samples representing in-situ soil contamination adjacent to the site boundaries.

TABLE [9]

SOIL-TO-AIR VOLATILIZATION FACTOR

$$VF\ (m^3/kg) = \frac{(LS \times V \times DH)}{A} \times \frac{(3.14 \times \alpha \times T)^{1/2}}{(2 \times D_{ei} \times E \times K_{as} \times 10^{-3}\ kg/g)}$$

where:

$$\alpha\ (cm^2/s) = \frac{(D_{ei} \times E)}{E + (p_s)(1-E)/K_{as}}$$

Standard default parameter values that can be used to reduce Equation (8) are listed below. These represent "typical" values as identified in a number of sources. For example, when site-specific values are not available, the length of a side of the contaminated area (LS) is assumed to be 45 m; this is based on a contaminated area of 0.5 acre which approximates the size of an average residential lot. The "typical" values LS, DH, and V are from EPA 1986. "Typical" values for E, OC, and p_s are from EPA 1984, EPA 1988b, and EPA 1988f. Site-specific data should be substituted for the default values listed below wherever possible. Standard values for chemical-specific D_i, H, and K_{oc} can be obtained by calling the Superfund Health Risk Technical Support Center.

Parameter	Definition (units)	Default
VF	volatilization factor (m^3/kg)	—
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (cm^2)	20,250,000 cm^2
D_{ei}	effective diffusivity (cm^2/s)	$D_i \times E^{0.33}$
E	true soil porosity (unitless)	0.35
K_{as}	soil/air partition coefficient (g soil/cm^3 air)	$(H/K_d) \times 41$, where 41 is a units conversion factor
p_s	true soil density or particulate density (g/cm^3)	2.65 g/cm^3
T	exposure interval (s)	7.9×10^8 s
D_i	molecular diffusivity (cm^2/s)	chemical-specific
H	Henry's law constant (atm-m^3/mol)	chemical-specific
K_d	soil-water partition coefficient (cm^3/g)	chemical-specific, or $K_{oc} \times OC$
K_{oc}	organic carbon partition coefficient (cm^3/g)	chemical-specific
OC	organic carbon content of soil (fraction)	site-specific, or 0.02

TABLE [10]

PARTICULATE EMISSION FACTOR

$$PEF\ (m^3/kg) = \frac{LS \times V \times DH \times 3600\ s/hr}{A} \times \frac{1000\ g/kg}{0.036 \times (1-G) \times (U_m/U_t)^3 \times F(x)}$$

where:

Parameter	Definition (units)	Default
PEF	particulate emission factor (m^3/kg)	$4.63 \times 10^9\ m^3/kg$
LS	width of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (m^2)	2025 m^2
0.036	respirable fraction (g/m^2-hr)	0.036 g/m^2-hr
G	fraction of vegetative cover (unitless)	0
U_m	mean annual wind speed (m/s)	4.5 m/s
U_t	equivalent threshold value of wind speed at 10 m (m/s)	12.8 m/s
F(x)	function dependent on U_m/U_t (unitless)	0.0497 (determined using Cowherd 1985)

GARAGE AND MAINTENANCE BUILDING 7131
BASIS OF ASSESSMENT

Table 11

chemical	CW	CS	oral RfD	inhaled RfD	carcinogen class	oral slope factor	inhaled slope factor	oral absorption factor	Koc	H	Di
1,1-dichloroethane	1.80E-02	2.10E-02	1.00E-01	1.43E-01	C			8.10E-01	3.00E+01	4.31E-03	1.08E-01
1,1-dichloroethylene	2.00E-03	0.00E+00	9.00E-03	9.00E-03	C			5.00E-01	6.50E+01	3.40E-02	9.38E-02
methylene chloride	0.00E+00	7.00E-03	6.00E-02	8.57E-01	B2	7.50E-03	1.65E-03	4.00E-01	8.80E+00	2.03E-03	1.16E-01
1,1,1-trichloroethane	1.00E-02	1.70E-02	9.00E-02	2.86E-01	D			1.00E+00	1.52E+02	1.44E-02	9.45E-02
trichloroethylene	0.00E+00	6.06E-01	6.00E-03	6.00E-03	B2	1.10E-02	6.00E-03	5.00E-01	1.26E+02	9.10E-03	9.63E-02

UNITS:

CW and CS = mg/l or mg/kg
oral absorption factor = % as decimal fraction
Koc = ml/g
H = atm-m3/mol
Di = cm2/sec

CONTAMINANT CONCENTRATIONS IN GROUNDWATER

The selected values representing groundwater contamination levels at the Building 7131 site are provided in the second column of Table 11. These values represent the highest concentration for each contaminant found in the groundwater wells. Utilization of the 95% upper confidence limit (UCL) of the arithmetic mean of the sample population in lieu of maximum values to characterize site conditions was considered but not selected for the same reasons noted above for soil contaminant levels.

TOXICITY VALUES

The selected toxicity values are provided in Table 11. Toxicity values were selected using the data source hierarchy system established by U.S. EPA and required by Ohio EPA. The Integrated Risk Information System (IRIS) was the primary source, and the Health Effects Assessment Summary Tables (HEAST) was the secondary source.[6, 7] Carcinogen risk was assessed for all class A and class B carcinogens as specified by Ohio EPA closure guidance. Oral slope factors and inhaled slope factors were available for both of the carcinogens present at the site. Therefore, the toxicity assessment for carcinogenicity has a relatively high degree of certainty.

The toxicity assessment for toxins has a lesser degree of certainty due to a lack of available data. However, as will be shown later, toxic effects were determined to have much less impact on the level of risk than carcinogenic effects. The inhaled reference dose for 1,1-dichloroethylene and trichloroethylene were estimated using each chemical's oral RfD value. A similar method of filling in partial data gaps was recently utilized by the U.S. EPA Region III Senior Toxicologist in a memo dated July 9, 1993.[8]

Adjustment of toxicity values for dermal exposure was performed according to the methods presented in the U.S. EPA RAGS, volume 1, Part B, Appendix A.[5] This adjustment is necessary since the toxicity data is expressed as administered doses while exposure assessment values are expressed as absorbed doses. This adjustment was made using the following calculations:

Dermal RfD = administered RfD x oral absorption factor

Dermal slope factor = administered slope factor / oral absorption factor

Selected oral absorption values are shown in the ninth column of Table 11. Ohio EPA's closure guidance document was used as the source of oral absorption factors for 1,1-dichloroethane, methylene chloride, and 1,1,1-trichloroethane. Oral absorption factors for the remaining chemicals were estimated conservatively at 0.5.

OTHER CONSTANTS AND PROPERTIES

In order to determine air pathway contributions it is necessary to calculate the concentrations in air that can be expected. Such calculations are necessary since direct air monitoring using commonly employed methods is not likely to have sufficiently low method detection limits to be able to detect the chemicals of concern. The calculated values depend upon several chemical-specific physical constants. These are the organic carbon partitioning coefficient (Koc), Henry's Law coefficient (H), and molecular diffusivity (Di). The selected values for these constants are provided in Table 11.

Values for Koc and H were obtained from a table provided by Ohio EPA (appendix F). Diffusion coefficients of contaminant in air (Di) were obtained from Table 2-3 of the Superfund Exposure Assessment Manual (SEAM) with the exception of methylene chloride which was calculated based upon equation 2-5 of the SEAM.[9] The reference chemical used in this equation was 1,1-dichloroethane.

RESULTS OF ASSESSMENT

Tables 12 through 23 present the calculations of hazard and probability indexes for the Building 7131 site. Each pathway consists of two tables; one for toxins and one for carcinogens. The various factors used in the calculations are presented in columns. The far right column provides the calculated index. Each chemical comprises two rows. One row for the child population and one for the Adult population. In the lower right portion of each table the index is totaled for both the child and adult populations. The pathways assessed include ingestion of groundwater; dermal contact with groundwater; ingestion of soil and dust; dermal contact with soil; and inhalation of vapors, gasses, and dusts.

Tables 24 through 27 summarize these data in a manner that allows the chemical and pathway contributions to be compared. Table 24 presents all of the cumulative indexes per pathway and Table 25 presents all of the cumulative indexes per chemical. Comparison of the totals for each mode of sorting also provides a check for addition errors. Table 26 provides a sorting of the data according to both pathway and chemical for the hazard index for the child population, since this population was the most restrictive for the toxins.

Table 25 provides a sorting of the data according to both pathway and chemical for the probability index for the adult population, since this population was the most restrictive for the carcinogens. Tables 28 and 29 present the calculations which were necessary to determine the air concentrations (CA) which were utilized in Tables 20 through 23.

In order to more effectively analyze the resulting data, Tables 24 through 27 were graphed. These graphs, presented in Figures 6 through 11, provide a way to rapidly evaluate and compare a large amount of information. However, care should be utilized in using these graphs. Due to minor limitations in the graphical software the bar heights can be slightly higher or lower than the scale indicates. These differences are minor and do not interfere with analysis of the data. Also, it is important to note that probability values are graphed using log scales.

GARAGE AND MAINTENANCE - BUILDING 7131 - TOXIC RISK ASSESSMENT
PATHWAY: INGESTION OF GROUND WATER

Table 12

chemical	Population	cw	IR	EF	ED	BW	AT	INTAKE	oral RfD	hazard index
1,1-dichloroethane	Child	1.80E-02	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.30E-03	1.00E-01	2.30E-02
	Adult	1.80E-02	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.93E-04	1.00E-01	4.93E-03
1,1-dichloroethylene	Child	2.00E-03	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.56E-04	9.00E-03	2.84E-02
	Adult	2.00E-03	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.48E-05	9.00E-03	6.09E-03
methylene chloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	6.00E-02	0.00E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	6.00E-02	0.00E+00
1,1,1-trichloroethane	Child	1.00E-02	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.28E-03	9.00E-02	1.42E-02
	Adult	1.00E-02	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.74E-04	9.00E-02	3.04E-03
trichloroethylene	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	6.00E-03	0.00E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	6.00E-03	0.00E+00

Child Hazard Index **6.6E-02**
Adult Hazard Index **1.4E-02**

GARAGE AND MAINTENANCE - BUILDING 7131 - CARCINOGEN RISK ASSESSMENT

Table 13

PATHWAY: INGESTION OF GROUND WATER

chemical	population	CW	IR	EF	ED	BW	AT	intake	oral slope	prob. indx
methylene chloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	0.00E+00	7.50E-03	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	0.00E+00	7.50E-03	0.0E+00
trichloroethylene	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	0.00E+00	1.10E-02	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	0.00E+00	1.10E-02	0.0E+00

Child Probability Index 0.0E+00

Adult Probability Index 0.0E+00

GARAGE AND MAINTENANCE - BUILDING 7131 - TOXIC RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH WATER

Table 14

chemical	population	CW	SA	PC	ET	EF	ED	CF	BW	AT	absorbed dose	oral RfD	oral absorption factor	dermal RfD	hazard index
1,1-dichloroethane	Child	1.80E-02	7.00E+03	8.90E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	1.43E-05	1.00E-01	8.10E-01	8.10E-02	1.8E-04
	Adult	1.80E-02	2.00E+04	8.90E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	8.78E-06	1.00E-01	8.10E-01	8.10E-02	1.1E-04
1,1-dichloroethylene	Child	2.00E-03	7.00E+03	1.60E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	2.86E-06	9.00E-03	5.00E-01	4.50E-03	6.4E-04
	Adult	2.00E-03	2.00E+04	1.60E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	1.75E-06	9.00E-03	5.00E-01	4.50E-03	3.9E-04
methylene chloride	Child	0.00E+00	7.00E+03	4.50E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	6.00E-02	4.00E-01	2.40E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	4.50E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	6.00E-02	4.00E-01	2.40E-02	0.0E+00
1,1,1-trichloroethane	Child	1.00E-02	7.00E+03	1.70E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	1.52E-05	9.00E-02	1.00E+00	9.00E-02	1.7E-04
	Adult	1.00E-02	2.00E+04	1.70E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	9.32E-06	9.00E-02	1.00E+00	9.00E-02	1.0E-04
trichloroethylene	Child	0.00E+00	7.00E+03	1.60E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	6.00E-03	5.00E-01	3.00E-03	0.0E+00
	Adult	0.00E+00	2.00E+04	1.60E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	6.00E-03	5.00E-01	3.00E-03	0.0E+00

child Hazard Index **9.8E-04**
Adult Hazard Index **6.0E-04**

GARAGE AND MAINTENANCE - BUILDING 7131 - CARCINOGEN RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH WATER

Table 15

chemical	population	CW	SA	PC	ET	EF	ED	CF	BW	AT	absorbed dose	oral slope factor	oral absorption factor	dermal slope factor	probability index
methylene chloride	Child	0.00E+00	7.00E+03	4.50E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	0.00E+00	7.50E-03	4.00E-01	1.88E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	4.50E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	0.00E+00	7.50E-03	4.00E-01	1.88E-02	0.0E+00
trichloroethylene	Child	0.00E+00	7.00E+03	1.60E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	0.00E+00	1.10E-02	5.00E-01	2.20E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	1.60E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	0.00E+00	1.10E-02	5.00E-01	2.20E-02	0.0E+00

child probability index 0.0E+00
adult probability index 0.0E+00

GARAGE AND MAINTENANCE - BUILDING 7131 - TOXIC RISK ASSESSMENT
PATHWAY: INGESTION OF SOIL AND DUST

Table 16

chemical	population	CS	IR	CF	FI	EF	ED	BW	AT	INTAKE	ORAL RfD	hazard index
1,1-dichloroethane	Child	2.10E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.68E-07	1.00E-01	2.7E-06
	Adult	2.10E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.88E-08	1.00E-01	2.9E-07
1,1-dichloroethylene	Child	0.00E+00	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	9.00E-03	0.0E+00
	Adult	0.00E+00	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	9.00E-03	0.0E+00
methylene chloride	Child	7.00E-03	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.95E-08	6.00E-02	1.5E-06
	Adult	7.00E-03	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	9.59E-09	6.00E-02	1.6E-07
1,1,1-trichloroethane	Child	1.70E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.17E-07	9.00E-02	2.4E-06
	Adult	1.70E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.33E-08	9.00E-02	2.6E-07
trichloroethylene	Child	6.06E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.75E-06	6.00E-03	1.3E-03
	Adult	6.06E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	8.30E-07	6.00E-03	1.4E-04

child hazard index **1.3E-03**
adult hazard index **1.4E-04**

GARAGE AND MAINTENANCE - BUILDING 7131 - CARCINOGEN RISK ASSEMENT
PATHWAY: INGESTION OF SOIL AND DUST

TABLE 17

chemical	population	CS	IR	CF	FI	EF	ED	BW	AT	INTAKE	ORAL SLOPE	PROBABILITY INDEX
methylene chloride	child	7.00E-03	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	7.67E-09	7.50E-03	5.8E-11
	adult	7.00E-03	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	4.11E-09	7.50E-03	3.1E-11
trichloroethylene	child	6.06E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	6.64E-07	1.10E-02	7.3E-09
	adult	6.06E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	3.56E-07	1.10E-02	3.9E-09

Child Hazard Index **7.4E-09**
Adult Hazard Index **3.9E-09**

GARAGE AND MAINTENANCE - BUILDING 7131 - TOXIC RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH SOIL

Table 18

chemical	population	CS	CF	SA	AF	ABS	EF	ED	BW	AT	absorbed dose	oral RfD	Oral Absorption factor	dermal RfD	hazard index
1,1-dichlorothane	Child	2.10E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	6.71E-07	1.00E-01	8.10E-01	8.10E-02	8.3E-06
	Adult	2.10E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.60E-07	1.00E-01	8.10E-01	8.10E-02	4.4E-06
1,1-dichloroethylene	Child	0.00E+00	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	9.00E-03	5.00E-01	4.50E-03	0.0E+00
	Adult	0.00E+00	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	9.00E-03	5.00E-01	4.50E-03	0.0E+00
methylene chloride	Child	7.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.24E-07	6.00E-02	4.00E-01	2.40E-02	9.3E-06
	Adult	7.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.20E-07	6.00E-02	4.00E-01	2.40E-02	5.0E-06
1,1,1-trichloroethane	Child	1.70E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	5.43E-07	9.00E-02	1.00E+00	9.00E-02	6.0E-06
	Adult	1.70E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.91E-07	9.00E-02	1.00E+00	9.00E-02	3.2E-06
trichloroethylene	Child	6.06E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.94E-05	6.00E-03	5.00E-01	3.00E-03	6.5E-03
	Adult	6.06E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.04E-05	6.00E-03	5.00E-01	3.00E-03	3.5E-03

child Hazard Index **6.5E-03**
adult hazard Index **3.5E-03**

GARAGE AND MAINTENANCE - BUILDING 7131 - CARCINOGEN RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH SOIL

Table 19

Chemical	Population	CS	CF	SA	AF	ABS	EF	ED	BW	AT	absorbed dose	Oral Slope Factor	Oral Absorbtion factor	Dermal Slope Factor	probability index
methylene chloride	Child	7.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	1.92E-08	7.50E-03	4.00E-01	1.88E-02	3.6E-10
	Adult	7.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	5.14E-08	7.50E-03	4.00E-01	1.88E-02	9.6E-10
trichloroethylene	Child	6.06E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	1.66E-06	1.10E-02	5.00E-01	2.20E-02	3.7E-08
	Adult	6.06E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	4.45E-06	1.10E-02	5.00E-01	2.20E-02	9.8E-08

Child Probability Index: 3.7E-08
Adult Probability Index: 9.9E-08

GARAGE AND MAINTENANCE - BUILDING 7131 - TOXIC RISK ASSESSMENT
PATHWAY: INHALATION OF VAPORS AND GASSES

Table 20

chemical	population	CA	outdoor IR	shower IR	outdoor ET	shower ET	EF	ED	BW	AT	INT AKE		inhaled RfD	hazard index	
											outdoor	shower		outdoor	shower
1,1-dichloroethane	Child	1.35E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.72E-05	1.03E-07	1.43E-01	1.2E-04	7.2E-07
	Adult	1.35E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.68E-06	2.21E-08	1.43E-01	2.6E-05	1.5E-07
1,1-dichloroethylene	Child	0.00E+00	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	0.00E+00	9.00E-03	0.0E+00	0.0E+00
	Adult	0.00E+00	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	0.00E+00	9.00E-03	0.0E+00	0.0E+00
methylene chloride	Child	6.01E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.65E-06	4.61E-08	8.57E-01	8.9E-06	5.4E-08
	Adult	6.01E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.64E-06	9.88E-09	8.57E-01	1.9E-06	1.2E-08
1,1,1-trichloroethane	Child	8.21E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.05E-05	6.30E-08	2.86E-01	3.7E-05	2.2E-07
	Adult	8.21E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.24E-06	1.35E-08	2.86E-01	7.8E-06	4.7E-08
trichloroethylene	Child	2.57E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.27E-04	1.97E-06	6.00E-03	5.4E-02	3.3E-04
	Adult	2.57E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	7.00E-05	4.22E-07	6.00E-03	1.2E-02	7.0E-05

child hazard index	**5.5E-02**	**3.3E-04**
adult hazard index	**1.2E-02**	**7.1E-05**

GARAGE AND MAINTENANCE - BUILDING 7131 - CARCINOGEN RISK ASSESSMENT
PATHWAY: INHALATION OF VAPORS AND GASSES

Table 21

chemical	population	CA	outdoor IR	shower IR	outdoor ET	shower ET	EF	ED	BW	AT	INTAKE outdoor	INTAKE shower	inhaled slope factor	probability index outdoor	probability index shower
methylene chloride	Child	6.01E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	6.56E-07	3.95E-09	1.65E-03	1.1E-09	6.5E-12
	Adult	6.01E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	7.03E-07	4.23E-09	1.65E-03	1.2E-09	7.0E-12
trichloroethylene	Child	2.57E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.80E-05	1.69E-07	6.00E-03	1.7E-07	1.0E-09
	Adult	2.57E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	3.00E-05	1.81E-07	6.00E-03	1.8E-07	1.1E-09

child probability index	**1.7E-07**	**1.0E-09**
adult probability index	**1.8E-07**	**1.1E-09**

GARAGE AND MAINTENANCE - BUILDING 7131 - TOXIC ASSESSMENT
PATHWAY: INHALATION OF DUSTS

TABLE 22

chemical	population	CA	IR	ET	EF	ED	BW	AT	INTAKE	INHALED RfD	hazard index
1,1-dichloroethane	child	7.07E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	9.00E-12	1.43E-01	6.3E-11
	adult	7.07E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.93E-12	1.43E-01	1.3E-11
1,1-dichloroethylene	child	0.00E+00	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	9.00E-03	0.0E+00
	adult	0.00E+00	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	9.00E-03	0.0E+00
methylene chloride	child	2.36E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.00E-12	8.57E-01	3.5E-12
	adult	2.36E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	6.43E-13	8.57E-01	7.5E-13
1,1,1-trichloroethane	child	5.72E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.28E-12	2.86E-01	2.5E-11
	adult	5.72E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.56E-12	2.86E-01	5.5E-12
trichloroethylene	child	2.04E-10	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.60E-10	6.00E-03	4.3E-08
	adult	2.04E-10	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.56E-11	6.00E-03	9.3E-09

child hazard index **4.3E-08**
adult hazard index **9.3E-09**

GARAGE AND MAINTENANCE - BUILDING 7131 - CARCINOGEN RISK ASSESSMENT TABLE 23
PATHWAY: INHALATION OF DUSTS

chemical	population	CA	IR	ET	EF	ED	BW	AT	INTAKE	INHALED SLOPE FACTOR	PROBABILITY INDEX
methylene chloride	child	2.36E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.57E-13	1.650E-03	4.2E-16
	adult	2.36E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	2.75E-13	1.650E-03	4.5E-16
trichloroethylene	child	2.04E-10	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.23E-11	6.000E-03	1.3E-13
	adult	2.04E-10	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	2.38E-11	6.000E-03	1.4E-13

child probability index 1.3E-13
adult probability index 1.4E-13

GARAGE AND MAINTENANCE - BUILDING 7131 - RISK ASSESSMENT
PATHWAY SUMMARY

Table 24

Pathway	Hazard Index Child	Hazard Index Adult	Prob. Index Child	Prob. Index Adult
Ingestion of Ground Water	6.6E-02	1.4E-02	0.0E+00	0.0E+00
Dermal Contact With Ground Water	9.8E-04	6.0E-04	0.0E+00	0.0E+00
Ingestion of Soil & Dust	1.3E-03	1.4E-04	7.4E-09	3.9E-09
Dermal Contact With Soil	6.5E-03	3.5E-03	3.7E-08	9.9E-08
Inhalation of Vapor & Gas	5.5E-02	1.2E-02	1.7E-07	1.8E-07
Inhalation of Dust	4.3E-08	9.3E-09	1.3E-13	1.4E-13
Total	**1E-01**	**3E-02**	**2E-07**	**3E-07**

Table 25

GARAGE AND MAINTENANCE - BUILDING 7131 - RISK ASSESSMENT
CHEMICAL CONTRIBUTIONS SUMMARY

CHEMICAL	Haz. Index Child	Haz. Index Adult	Prob. Index Child	Prob. Index Adult
1,1-dichloroethane	2.3E-02	5.1E-03		
1,1-dichloroethylene	2.9E-02	6.5E-03		
methylene chloride	2.0E-05	7.1E-06	1.5E-09	2.2E-09
1,1,1-trichloroethane	1.4E-02	3.2E-03		
trichloroethylene	6.3E-02	1.5E-02	2.1E-07	2.8E-07
Total	**1E-01**	**3E-02**	**2E-07**	**3E-07**

Table 26

GARAGE AND MAINTENANCE - BUILDING 7131 - RISK ASSESSMENT
CHEMICAL AND PATHWAY SUMMARY OF HAZARD INDEX - CHILD

CHEMICAL	INGESTION OF GROUNDWATER	DERMAL CONTACT WITH GROUNDWATER	INGESTION OF SOIL	DERMAL CONTACT WITH SOIL	INHALATION OF GAS AND DUST
1,1-dichloroethane	2.3E-02	1.8E-04	2.7E-06	8.3E-06	1.2E-04
1,1-dichloroethylene	2.8E-02	6.4E-04	0.0E+00	0.0E+00	0.0E+00
methylene chloride	0.0E+00	0.0E+00	1.5E-06	9.3E-06	9.0E-06
1,1,1-trichloroethane	1.4E-02	1.7E-04	2.4E-06	6.0E-06	3.7E-05
trichloroethylene	0.0E+00	0.0E+00	1.3E-03	6.5E-03	5.5E-02
total	**7E-02**	**1E-03**	**1E-03**	**6E-03**	**5E-02**

Table 27

GARAGE AND MAINTENANCE - BUILDING 7131 - RISK ASSESSMENT

CHEMICAL AND PATHWAY SUMMARY OF PROBABILITY INDEX - ADULT

CHEMICAL	INGESTION OF GROUNDWATER	DERMAL CONTACT WITH GROUNDWATER	INGESTION OF SOIL	DERMAL CONTACT WITH SOIL	INHALATION OF GAS AND DUST
methylene chloride	0.0E+00	0.0E+00	3.1E-11	9.6E-10	1.2E-09
trichloroethylene	0.0E+00	0.0E+00	3.9E-09	9.8E-08	1.8E-07
total	**0E+00**	**0E+00**	**4E-09**	**1E-07**	**2E-07**

CONCENTRATIONS IN AIR FROM GAS PHASE EMISSIONS

TABLE 28

chemical	Koc	OC	H	Kd	Kas	DI	E	Del	Ps	ALPHA	LS	V	DH	A	T	VF	CS	CA
1,1-dichloroethane	3.00E+01	2.00E-02	4.31E-03	6.00E-01	2.95E-01	1.08E-01	3.50E-01	7.63E-02	2.65E+00	4.31E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	1.56E+03	2.10E-02	1.35E-05
	3.00E+01	2.00E-02	4.31E-03	6.00E-01	2.95E-01	1.08E-01	3.50E-01	7.63E-02	2.65E+00	4.31E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	1.56E+03	2.10E-02	1.35E-05
1,1-dichloroethylene	6.50E+01	2.00E-02	3.40E-02	1.30E+00	1.07E+00	9.38E-02	3.50E-01	6.63E-02	2.65E+00	1.19E-02	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	8.17E+02	0.00E+00	0.00E+00
	6.50E+01	2.00E-02	3.40E-02	1.30E+00	1.07E+00	9.38E-02	3.50E-01	6.63E-02	2.65E+00	1.19E-02	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	8.17E+02	0.00E+00	0.00E+00
methylene chloride	8.80E+00	2.00E-02	2.03E-03	1.76E-01	4.73E-01	1.16E-01	3.50E-01	8.23E-02	2.65E+00	7.22E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	1.16E+03	7.00E-03	6.01E-06
	8.80E+00	2.00E-02	2.03E-03	1.76E-01	4.73E-01	1.16E-01	3.50E-01	8.23E-02	2.65E+00	7.22E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	1.16E+03	7.00E-03	6.01E-06
1,1,1-trichloroethane	1.52E+02	2.00E-02	1.44E-02	3.04E+00	1.94E-01	9.45E-02	3.50E-01	6.68E-02	2.65E+00	2.54E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	2.07E+03	1.70E-02	8.21E-06
	1.52E+02	2.00E-02	1.44E-02	3.04E+00	1.94E-01	9.45E-02	3.50E-01	6.68E-02	2.65E+00	2.54E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	2.07E+03	1.70E-02	8.21E-06
trichloroethylene	1.26E+02	2.00E-02	9.10E-03	2.52E+00	1.48E-01	9.63E-02	3.50E-01	6.81E-02	2.65E+00	1.99E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	2.36E+03	6.06E-01	2.57E-04
	1.26E+02	2.00E-02	9.10E-03	2.52E+00	1.48E-01	9.63E-02	3.50E-01	6.81E-02	2.65E+00	1.99E-03	6.00E+01	2.25E+00	2.00E+00	3.60E+07	7.90E+08	2.36E+03	6.06E-01	2.57E-04

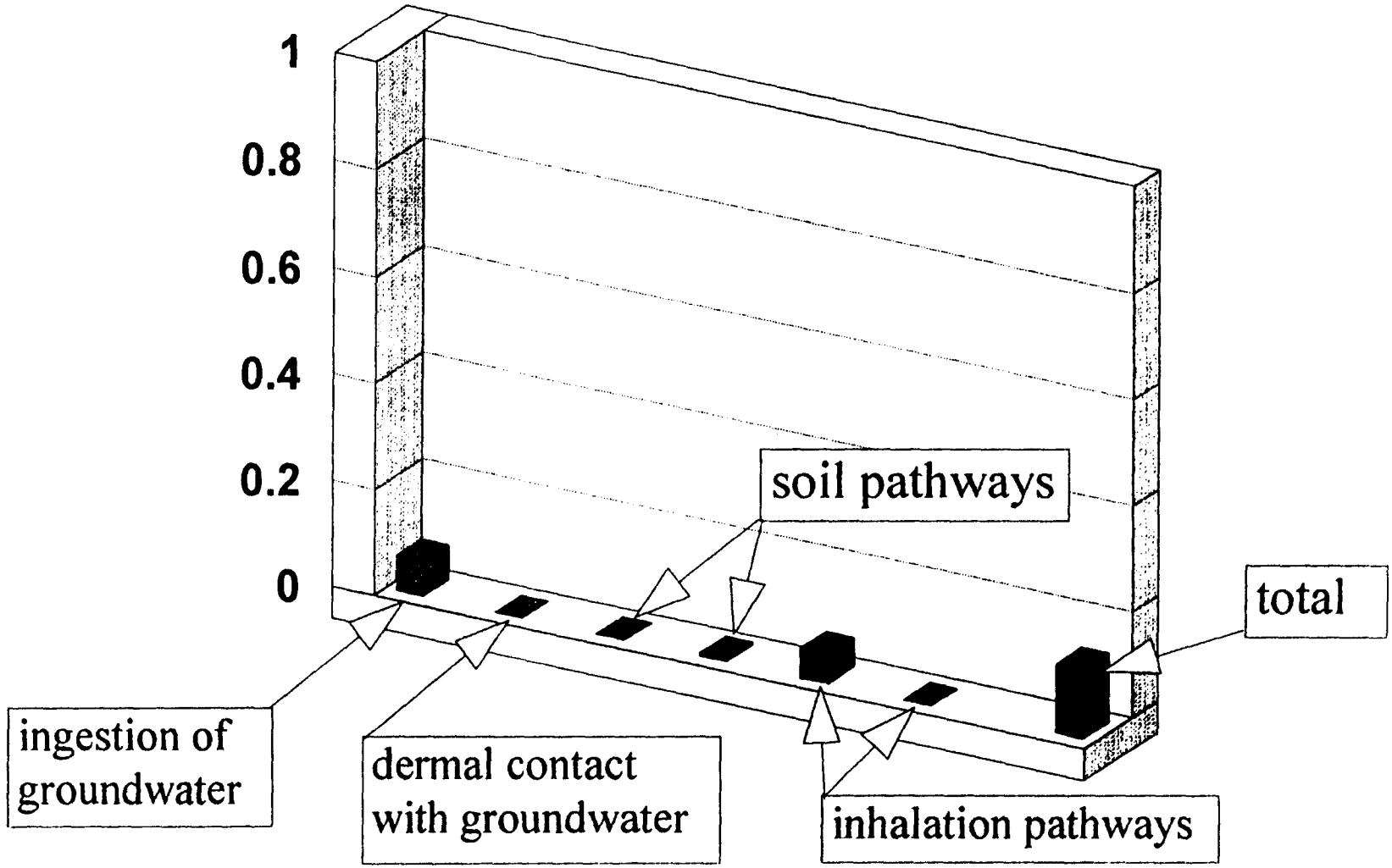
CONCENTRATIONS IN AIR FROM PARTICULATE EMISSIONS

TABLE 29

chemical	LS	V	DH	A	G	Um	Ut	F(x)	PEF	CS	CA
1,1-dichloroethane	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.10E-02	7.07E-12
	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.10E-02	7.07E-12
1,1-dichloroethylene	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	0.00E+00	0.00E+00
	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	0.00E+00	0.00E+00
methylene chloride	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	7.00E-03	2.36E-12
	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	7.00E-03	2.36E-12
1,1,1-trichloroethane	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.70E-02	5.72E-12
	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.70E-02	5.72E-12
trichloroethylene	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.06E-01	2.04E-10
	6.00E+01	2.25E+00	2.00E+00	3.60E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.06E-01	2.04E-10

PATHWAY SUMMARY

Hazard Index - Child



G&M - 7131 - Feb. 1994

FIGURE 6

CHEMICAL SUMMARY

Hazard Index - Child

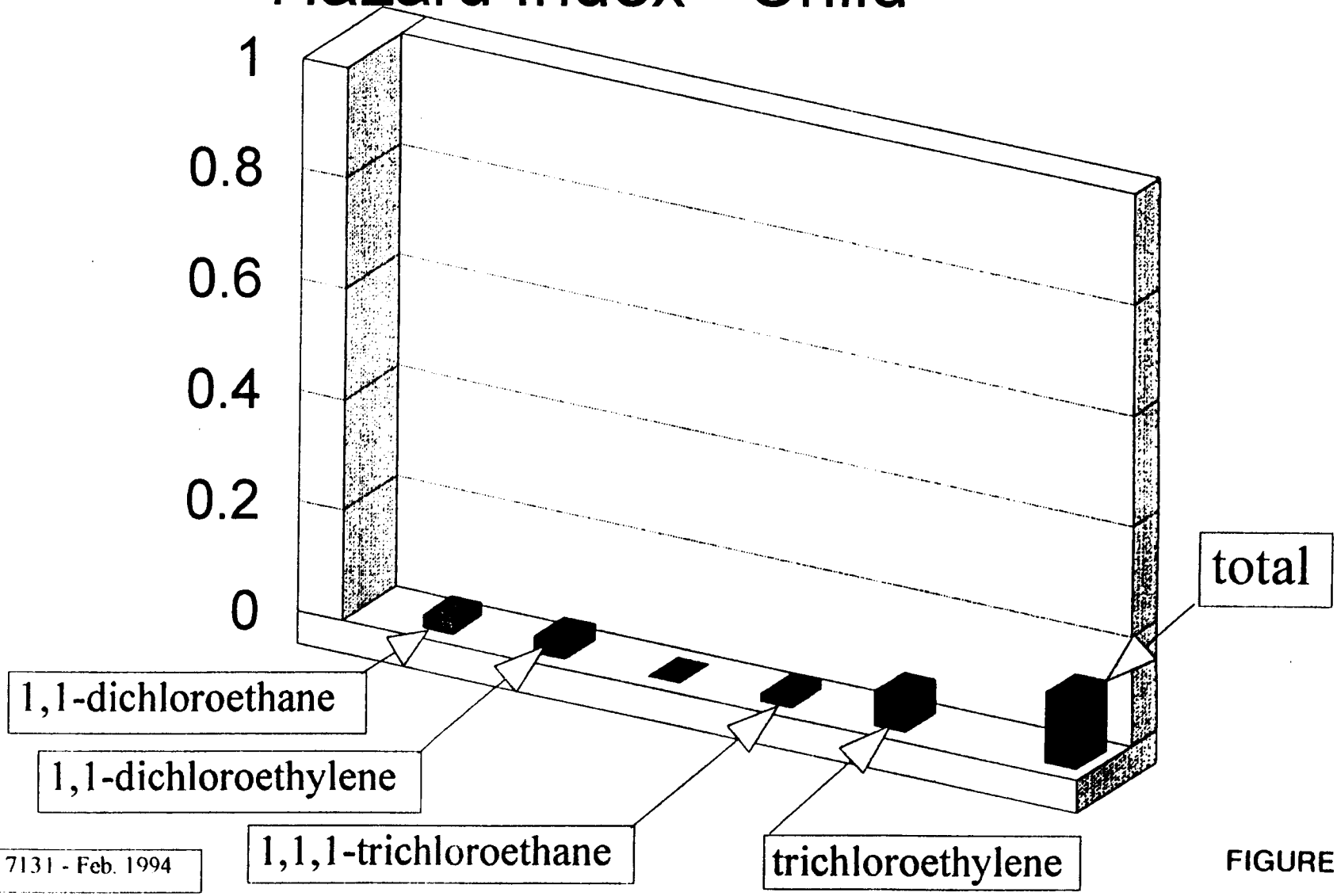


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FIGURE 7

PATHWAY SUMMARY

Probability Index - Adult

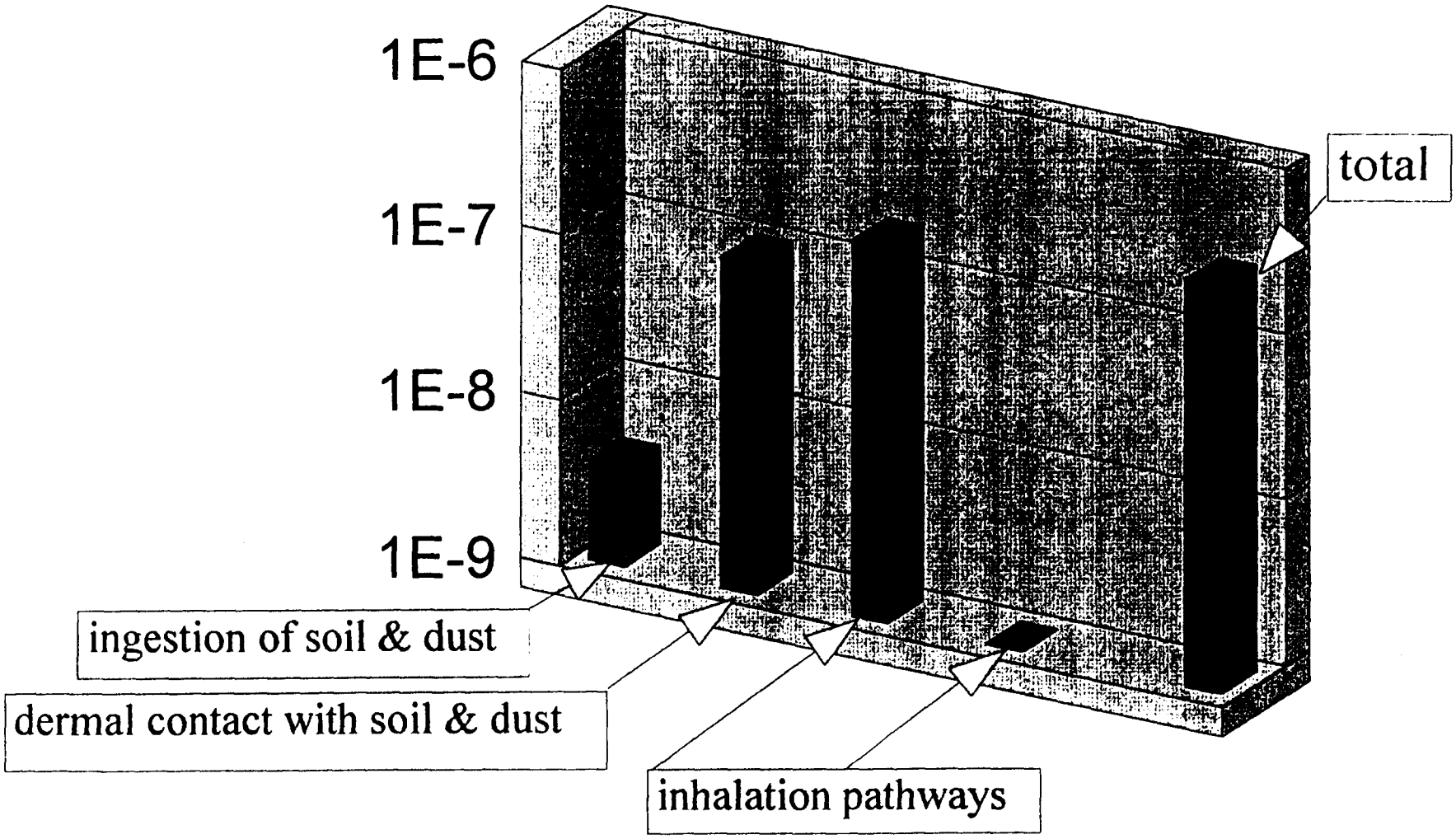

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FIGURE 8

CHEMICAL SUMMARY

Probability Index - Adult

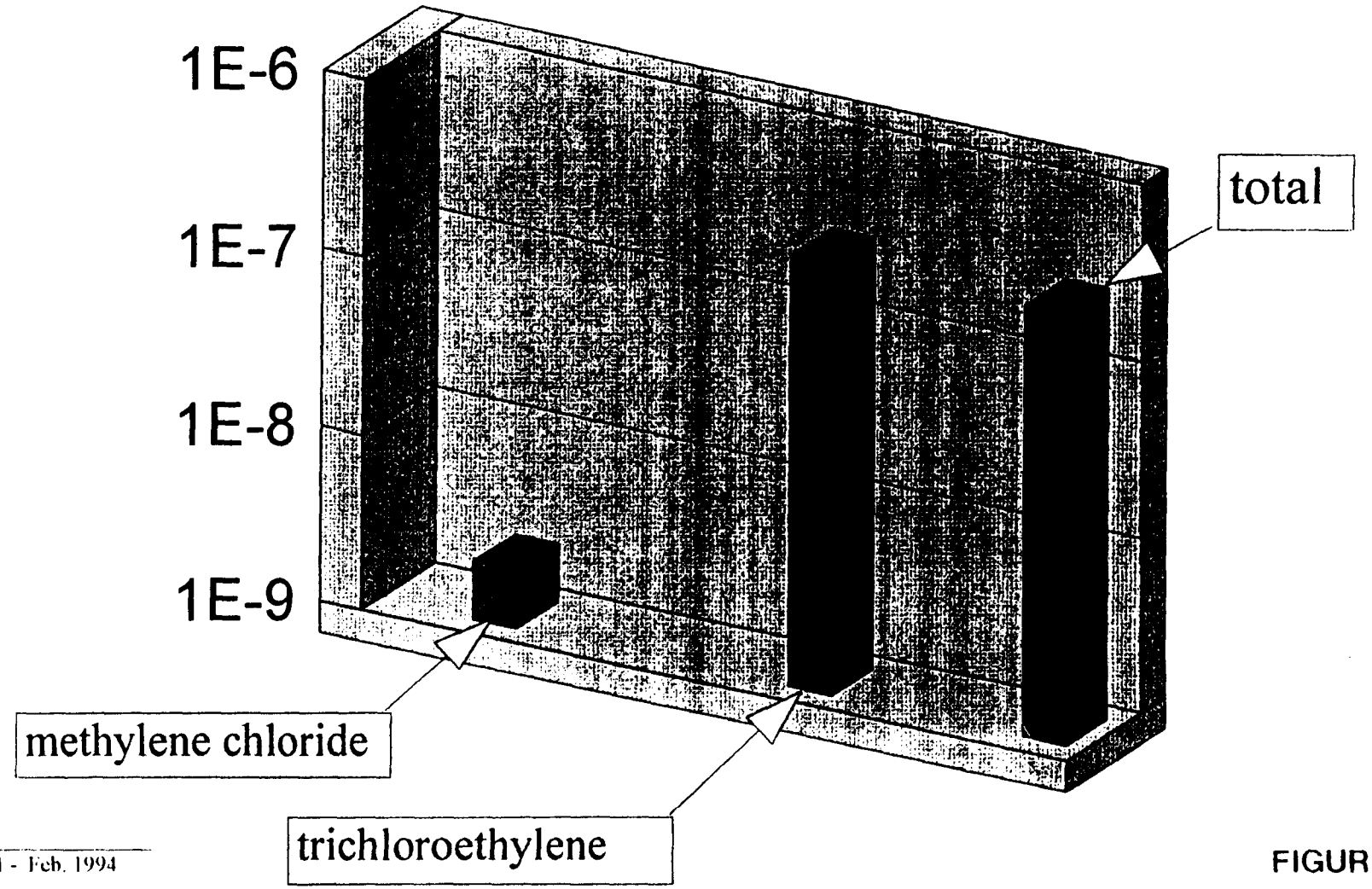

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FIGURE 9

COMPOSITE SUMMARY

Hazard Index - Child

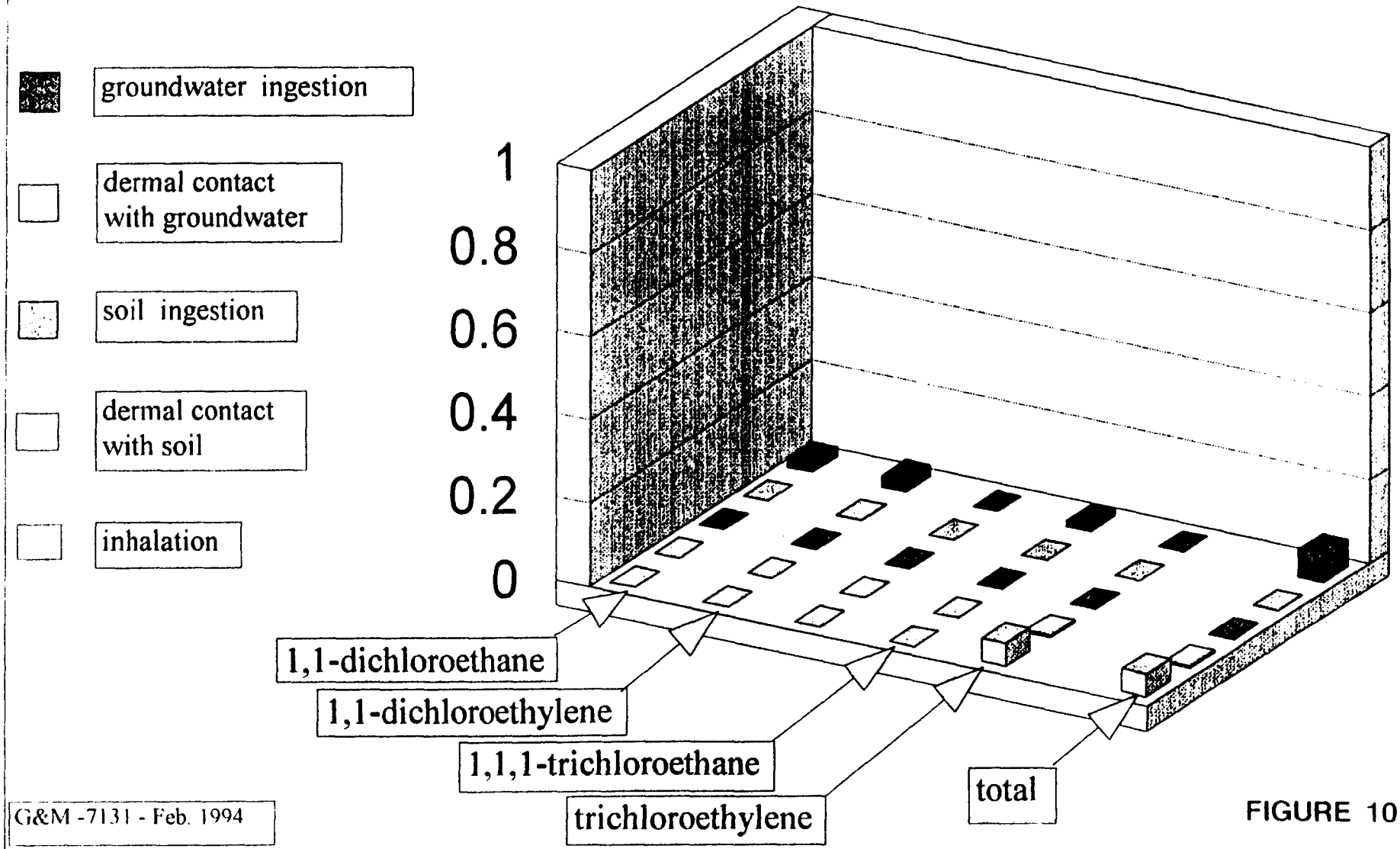

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FIGURE 10

COMPOSITE SUMMARY

Probability Index - Adult

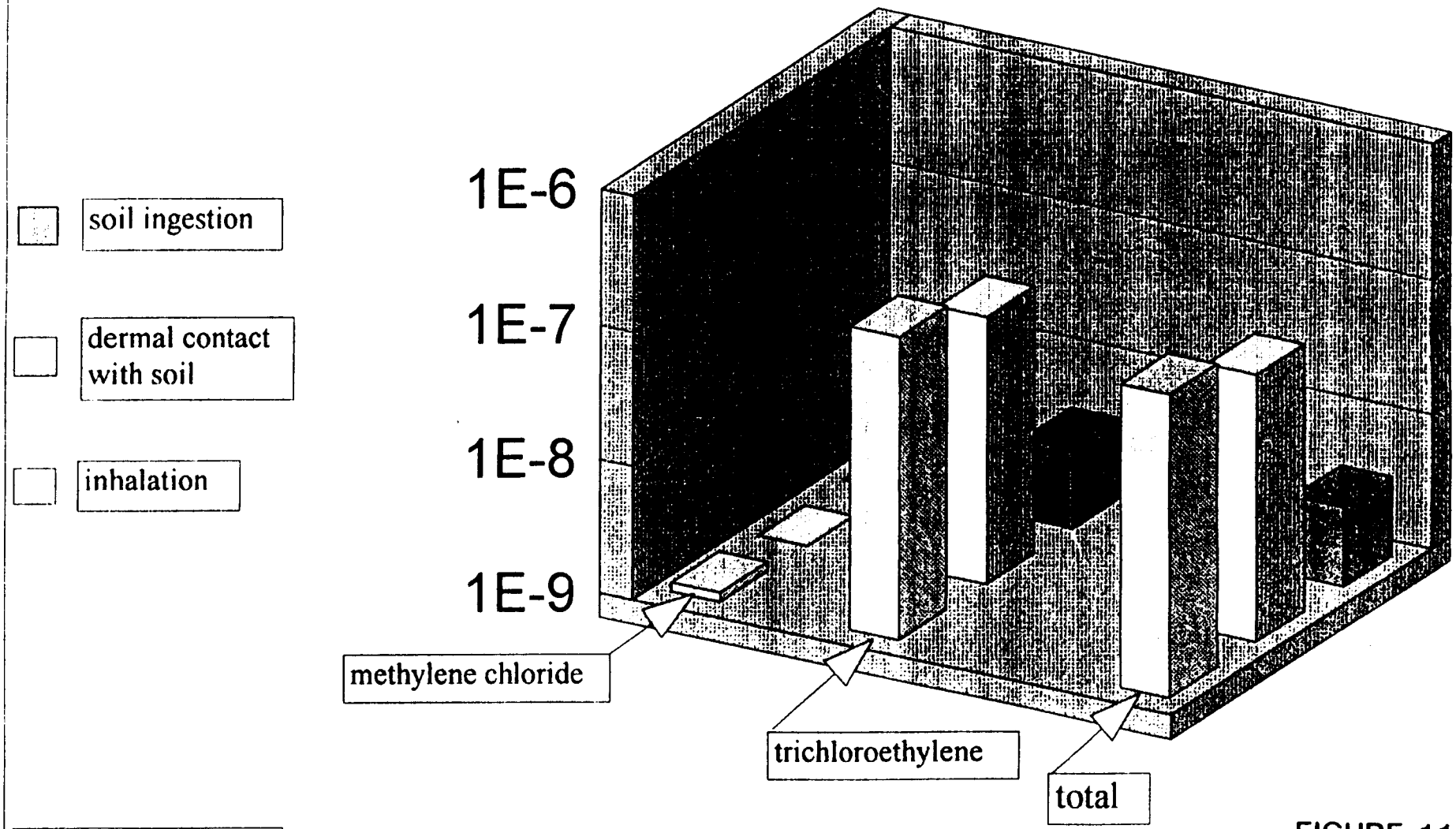

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FIGURE 11

Table 24 reveals that toxic risk is only 10% of the allowable level established in Ohio EPA's closure plan review guidance. Figure 6 reveals that toxic risk is due to the potential for ingestion of groundwater and inhalation of vapors and gasses. Figure 7 clarifies that trichloroethylene is the most significant contributor to toxic risk by a slight degree, while methylene chloride contributes least to toxic risk.

Table 22 indicates that carcinogen risk is well below the allowable level established by Ohio EPA. Figure 8 reveals that carcinogen risk is primarily impacted by the inhalation of vapors and gasses pathway and the dermal contact with soil and dust pathway. Figure 9 clarifies that trichloroethylene is the only significant contributor to carcinogen risk. Figures 10 and 11 provide other visual comparisons of the same data. Although the assessment of risk included 5 chemicals, this assessment is essentially impacted by only one chemical (trichloroethylene) due to the lack of significant contribution of the other chemicals.

CONCLUSIONS FOR THE BUILDING 7131 SITE

1. Existing levels of soil and groundwater contamination, as determined in the above noted reports, meet the criteria for clean closure established by Ohio EPA. One detail that deserves a special note is that the second report reveals methylene chloride at 100 ppb, acetone at 68 ppb, and carbon disulfide at 400 ppb in a soil sample collected at Building 7131, but indicates these values are due to laboratory contamination of the sample. These values were not utilized in the final risk assessment due to the laboratory contamination disclaimer. The basis of the determination that the sample was contaminated in the laboratory was not well documented in the report.

   Because of the lack of clarity regarding the basis of the laboratory contamination comment, an assessment which included these values was conducted in order to determine the potential impact should these values represent actual soil contamination conditions. This assessment revealed that inclusion of these values as actual contamination would increase the resulting hazard index (child) from 0.1 to 0.3 and the probability index (adult) would remain unchanged at 3E-7. These values are well within the criteria established by Ohio EPA for RCRA risk assessment closures.

2. Soil contamination levels appear to be adequately defined, but additional groundwater information may be needed to adequately support the findings of the Building 7131 risk assessment due to the limited number of wells at this site. The issue of adequacy of existing data to support the Building 7131 risk assessment should be addressed in the RCRA closure plan for the Garage and Maintenance Area.

3. Toxicity data (inhalation reference doses) were incomplete and had to be estimated for both 1,1-dichloroethylene and trichloroethylene. The assessment of risk should still be fairly reliable since carcinogenicity data is complete and the level of toxic risk is only 10% of the allowable levels established by Ohio EPA for RCRA risk assessment closure. However, it should be noted that Ohio EPA has a caveat within its closure manual which states that Ohio EPA may not accept risk assessments for chemicals having incomplete toxicity or carcinogenicity data. Ohio EPA maintains the option of requiring cleanup to analytical detection limits when such data are incomplete.

BUILDING 7121 TANK SITE

DESCRIPTION OF THE BUILDING 7121 TANK SITE

LOCATION, GEOLOGY AND HYDROGEOLOGY

The location of the Building 7121 tanks (28, 29, 30, and 31) are shown on the last page of Appendix A.[1] Local geologic and hydrogeologic conditions for this area are best described in the EBASCO Environmental report dated November 1991 (see Appendix B).[2]

EXISTING LEVELS OF SOIL CONTAMINATION

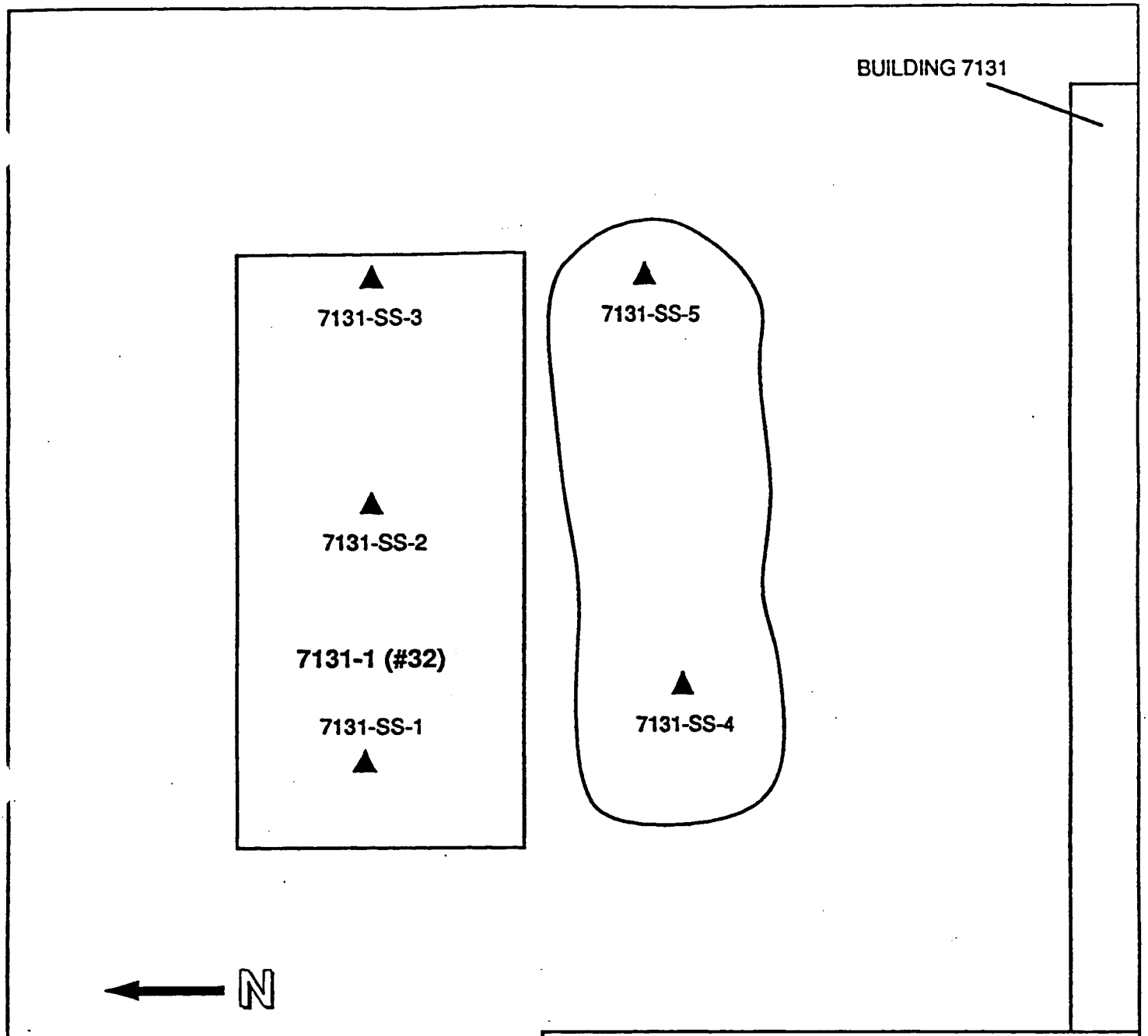
Existing soil contamination levels immediately adjacent to the tank boundaries at the Building 7121 site were determined at the time of the tank removals in December, 1989. The reports for this sampling provided the laboratory analytical reports, but failed to summarize the data in a manner that distinguished individual samples. Instead, the reports provided summaries of the highest values encountered at the site. Therefore, data summaries in the original reports do not distinguish between excavated soils which have been removed from the site and in-situ soils at the boundaries of the excavation.

A sketch of the sample locations is provided in Figure 12. A full description of the sampling activities, the tank removal process, and the laboratory analytical reports are provided in the Ebasco Services Site Assessment for Tanks 24, 25, 28, 29, 30, 31, 32, and 39 (Appendix C).[3] Sample numbers 7121-SS-1, 7121-SS-2, 7121-SS-5, 7121-SS-6, and 7121-SS-7 are samples of in-situ soil. Table 30 is a compilation of the results of this initial in-situ soil sampling.

The EBASCO Environmental report, dated November 1991, reported three additional soil samples (PBS-GM-SB05, PBS-GM-SB06, and PBS-GM-SB07). The locations of these samples are shown in Figure 2 and the laboratory results are included in Table 30.

The November 1991 report also provided the results of a sediment sample collected from a nearby ditch and a soil gas survey. The location of the sediment sample is shown in Figure 3. Although the laboratory reported values for methylene chloride and acetone, the report noted that these values were the result of laboratory contamination of the sample. The soil gas survey indicated failed to detect contamination within the immediate vicinity of the Building 7131 site. The locations of the soil gas sampling points are shown in Figure 4 and the analytical results are provided in Table 3-7 of Appendix B.

Six additional soil samples (B-1, B-2, B-6, B-31, B-32, and B-33) were collected during 1993. The locations of these samples are shown in Figure 5. The results of this sampling, as provided in the M.K. Ferguson report, dated January 28, 1993 , are included in Table 30.



NASA PLUM BROOK STATION
UNDERGROUND STORAGE TANK CORRECTIVE ACTIONS REMEDIAL INVESTIGATION/FEASIBILITY STUDY: PHASE I

LEGEND

▲ Soil Sample

Tank Pit

Excavated Soil Pile

Sampling Locations Associated With the Building 7131 UST

GARAGE AND MAINTENANCE AREA

EBASCO ENVIRONMENTAL | NOT TO SCALE

FIGURE [12]

GARAGE AND MAINTENANCE AREA - BUILDING 7121

SOIL SAMPLING RESULTS - DECEMBER 1989

	7121-SS1	7121-SS2	7121-SS5	7121-SS6	7121-SS7
Acetone	380 & 75	-	6j & 0 & 28j	-	-
carbon disulfide	1j	-	-	-	-
carbon tetrachloride	-	22	100 & 73 & 140	93	36
chloroethane	34 & 5j	-	-	-	-
1,1-dichloroethane	70 & 11	3j	35 & 47j & 27	12	20
1,2-dichloroethane	3j	-	-	3	-
1,1-dichloroethylene	2j	-	6j & 8j	-	-
cis-1,2-dichloroethylene	-	-	-	60 & 37	28
1,2-dichloroethylene	3j	-	19 & 19j & 11j	-	-
methylene chloride	4j & 1j	4j	6j & 0 & 45	5 & 231	19 & 249
methyl ethyl ketone	86	-	-	-	-
1,1,2,2-tetrachloroethane	-	-	1j	-	-
tetrachloroethylene	2j	6j	110 & 94 & 160	119 & 192	88 & 157
1,1,1-trichloroethane	12 & 3j	150	760 & 530 & 1100	442 & 496	177 & 203
1,1,2-trichloroethane	-	-	3j & 6j	4	4
trichloroethylene	36 & 55	200	850 & 880 & 1000	890 & 1605	851 & 1335
trichlorofluoromethane	4j	3j	7	3	13
vinyl chloride	3j	-	-	-	-
chlorobenzene	1j	-	-	-	-
bis(2-ethylhexyl)phthalate	-	-	-	-	-
dichlorobenzene	5j	-	-	-	-
ethylbenzene	1j	-	-	3	1j
naphthalene	-	-	-	4 & 20	1
1,2,3,-trichlorobenzene	-	-	-	-	-
1,2,4-trimethylbenzene	-	-	-	6	-
1,3,5-trimethylbenzene	-	-	-	5	-
toluene	2j	2j	19j & 15j & 25j	22 & 23	2
xylenes	3j		5j	4	-

TABLE 30

GARAGE AND MAINTENANCE AREA - BUILDING 7121

SOIL SAMPLING RESULTS - NOVEMBER 1991

	PBS-GM-SBO5	PBS-GM-SB06	PBS-GM-SBO7
Acetone	33	38 & 34	-
carbon disulfide	27	75	32
carbon tetrachloride	260	-	-
chloroethane	-	-	-
1,1-dichloroethane	50	12	-
1,2-dichloroethane	-	-	-
1,1-dichloroethylene	61	-	-
cis-1,2-dichloroethylene	-	-	-
1,2-dichloroethylene	-	-	-
methylene chloride	8	8	11 & 120
methyl ethyl ketone	6200	-	-
1,1,2,2-tetrachloroethane	18	-	-
tetrachloroethylene	24	-	-
1,1,1-trichloroethane	1100 & 2000	25 & 11	20
1,1,2-trichloroethane	-	-	-
trichloroethylene	55	-	-
trichlorofluoromethane	-	-	-
vinyl chloride	-	-	-
chlorobenzene	-	-	-
bis(2-ethylhexyl)phthalate	1500 & 360j	750	1300 & 470
ethylbenzene	-	-	-
naphthalene	-	-	-
1,2,3,-trichlorobenzene	-	-	-
1,2,4-trimethylbenzene	-	-	-
1,3,5-trimethylbenzene	-	-	-
toluene	-	-	-
xylenes	-	-	-

TABLE 30

GARAGE AND MAINTENANCE AREA - BUILDING 7121

SOIL SAMPLING RESULTS - JANUARY 1993

	B-1	B-2	B-6	B-31	B-32	B-33
Acetone	-	-	64.6 & 106	-	-	-
carbon disulfide	-	-	-	-	-	-
carbon tetrachloride	-	-	-	-	-	-
chloroethane	-	-	-	-	-	-
1,1-dichloroethane	-	-	-	-	-	-
1,2-dichloroethane	-	-	-	-	-	-
1,1-dichloroethylene	-	-	-	-	-	-
cis-1,2-dichloroethylene	-	-	-	-	-	-
1,2-dichloroethylene	-	-	-	-	-	-
methylene chloride	-	-	-	7.4	12.2 & 10.3	-
methyl ethyl ketone	-	-	(50)	-	-	-
1,1,2,2-tetrachloroethane	-	-	-	-	-	-
tetrachloroethylene	-	-	-	-	-	-
1,1,1-trichloroethane	-	-	65.2	17.8	82.2 & 43.3	8.9 & 7.5
1,1,2-trichloroethane	-	-	-	-	-	-
trichloroethylene	-	-	-	-	-	-
trichlorofluoromethane	-	-	-	-	-	-
vinyl chloride	-	-	-	-	-	-
chlorobenzene	-	-	-	-	-	-
bis(2-ethylhexyl)phthalate	-	-	-	-	-	-
dichlorobenzene	-	-	-	-	-	-
ethylbenzene	-	-	-	-	-	-
naphthalene	-	-	-	5.6	-	-
tetrahydrofuran	-	(243)	-	-	-	-
1,2,3,-trichlorobenzene	-	-	-	5.1	-	-
1,2,4-trimethylbenzene	-	-	-	-	-	-
1,3,5-trimethylbenzene	-	-	-	-	-	-
toluene	-	-	-	6.4	7.4	10.2
xylenes	-	-	-	-	-	-

GROUNDWATER CONTAMINATION

The first investigation did not evaluate groundwater contamination at the Building 7121 site. The second investigation, discussed in the November 1991 report, included the collection of one groundwater sample. The last investigation included sampling of five wells. The last two studies indicate a potentially complex groundwater flow pattern due to the influence of numerous structures in the area which may be transporting groundwater and contaminants along preferential pathways.

The results from both groundwater sampling events were used to evaluate the level of risk posed by contaminated groundwater. The January 28, 1993, study appears to provide sufficient sampling data to support the determination of risk levels, but does not provide a high level of certainty due to complex groundwater flow system at the Building 7121 site.

The report for the final investigation, conducted by the Morrison Knudsen Ferguson, is provided in Appendix A. Table 31 summarizes the findings of all of the well sampling at the Building 7121 site.

RISK ASSESSMENT MODELS UTILIZED

See previous discussion for the Building 7131 site.

SELECTION OF CHEMICAL SPECIFIC VALUES

CONTAMINANT CONCENTRATIONS IN SOIL

This risk assessment is designed to determine the impact of the contamination resulting from the hazardous waste management unit. Since the fuel tank was known to have leaked the assessment does not include fuels components. Detected chemicals that are considered to be fuel related are: toluene, ethylbenzene, xylene, trimethylbenzenes, and naphthalene. The assessment also does not include 1,2,3-trichlorobenzene, chlorobenzene, and Beta-BHC which are used as ingredients in insecticides and found only at very low concentrations. The reported methyl ethyl ketone value for the January 1993 sampling of soil boring B-6 is not included in the assessment because it was determined to be a laboratory contaminant. Plasticizers such as Bis(2-ethylhexyl)phthalate and butylbenzylphthalate were excluded from the assessment since they are common laboratory and field sampling contaminants resulting from the use of equipment which contains rubber or plastic. The selected chemicals are shown in Table 32.

The selected values representing soil contamination levels at the Building 7121 site are shown in the third column of Table 32. These values represent the highest concentration for each contaminant present in in-situ soils. Utilization of the 95% upper confidence limit (UCL) of the arithmetic mean of the sample population in lieu of maximum values to characterize site conditions was considered but not selected due to uncertainty that the previous sampling data may not conform to significant assumptions inherent to the 95% UCL method.

TABLE 31

GARAGE AND MAINTENANCE AREA - BUILDING 7121

GROUNDWATER SAMPLING RESULTS

VOLATILES	PBS-GM-GW06	MW-1	MW-2	EB-4	EB-5	EB-6
chloroethane	-	-	-	4.1	2.2	
cis-1,2-dichloroethylene	-	-	-	2.9	-	-
1,1-dichloroethane	24	-	-	48.5	112	-
1,1-dichlorothylene	20	-	-	51.6	52.9	-
tetrachloroethylene	-	-	-	5.7	-	-
1,1,1-trichloroethane	120	-	-	551	1130	-
1,1,2,-trichloroethane	-	-		2.1	1.3	-
SEMIVOLATILES						
Butylben-zylphthalate	6j	-	-	-	-	-
Bis(2-ethyl-hexyl)phthalate	7j	-	-	-	-	-
PESTISIDES						
Beta-BHC	0.19	-	-	-	-	-

j: below quantification limits

chemical	CW	CS	oral RfD	inhaled RfD	carcinogen class	oral slope factor	inhaled slope factor	oral absorption factor	Koc	H	Di
acetone	0.00E+00	3.80E-01	1.00E-01	1.00E-01	D			5.00E-01	2.20E+00	2.06E-05	1.22E-01
carbon disulfide	0.00E+00	7.50E-02	1.00E-01	2.86E-03				5.00E-01	5.40E+01	1.23E-02	1.16E-01
carbon tetrachloride	0.00E+00	2.60E-01	7.00E-04	5.71E-04	B2	1.30E-01	5.25E-02	5.00E-01	1.10E+02	2.41E-02	9.45E-02
chloroethane	4.00E-03	3.40E-02	2.00E-02	2.86E+00				5.00E-01	3.30E+01	8.48E-03	1.23E-01
1,1-dichloroethane	1.12E-01	7.00E-02	1.00E-01	1.43E-01	C			8.10E-01	3.00E+01	4.31E-03	1.08E-01
1,2-dichloroethane	0.00E+00	3.00E-03	2.86E-03	2.86E-03	B2	9.10E-02	9.10E-02	1.00E+00	1.40E+01	9.79E-04	1.08E-01
1,1-dichloroethylene	5.30E-02	8.00E-03	9.00E-03	9.00E-03	C			5.00E-01	6.50E+01	3.40E-02	9.38E-02
cis-1,2-dichloroethylene	3.00E-03	6.00E-02	1.00E-02	1.00E-02	D			9.00E-01	4.90E+01	7.58E-03	9.38E-02
1,2-dichloroethylene	0.00E+00	1.90E-02	9.00E-03	9.00E-03				5.00E-01	6.50E+01	3.40E-02	9.38E-02
methylene chloride	0.00E+00	2.49E-01	6.00E-02	8.57E-01	B2	7.50E-03	1.65E-03	4.00E-01	8.80E+00	2.03E-03	1.16E-01
methyl ethyl ketone	0.00E+00	6.20E+00	6.00E-01	2.86E-01	D			5.00E-01	4.50E+00	2.74E-05	1.06E-01
tetrachloroethylene	6.00E-03	1.92E-01	1.00E-02	1.00E-02	B2	5.20E-02	2.03E-03	1.00E+00	3.64E+02	2.59E-02	8.78E-02
1,1,2,2-tetrachloroethane	0.00E+00	1.80E-02	3.00E-02	3.00E-02	C			5.00E-01	1.18E+02	3.81E-04	8.64E-02
1,1,1-trichloroethane	1.13E+00	2.00E+00	9.00E-02	2.86E-01	D			1.00E+00	1.52E+02	1.44E-02	9.45E-02
1,1,2-trichloroethane	2.00E-03	6.00E-03	4.00E-03	4.00E-03	C			5.00E-01	5.60E+01	1.17E-03	9.45E-02
trichloroethylene	1.30E-02	1.61E+00	6.00E-03	6.00E-03	B2	1.10E-02	6.00E-03	5.00E-01	1.26E+02	9.10E-03	9.63E-02
trichlorofluoromethane	0.00E+00	1.30E-02	3.00E-01	2.00E-01				5.00E-01	1.59E+02	9.70E-02	9.31E-02
vinyl chloride	0.00E+00	3.00E-03			A	1.90E+00	3.00E-01	5.00E-01	5.70E+01	8.19E-02	1.27E-01

UNITS:

CW and CS = mg/l or mg/kg
oral absorption factor = % as decimal fraction
Koc = ml/g
H = atm-m3/mol
Di = cm2/sec

CONTAMINANT CONCENTRATIONS IN GROUNDWATER

The selected values representing groundwater contamination levels at the Building 7121 site are provided in the second column of Table 32. These values represent the highest concentration for each contaminant found in the groundwater wells. Utilization of the 95% upper confidence limit (UCL) of the arithmetic mean of the sample population in lieu of maximum values to characterize site conditions was considered but not selected for the same reasons noted above for soil contaminant levels.

TOXICITY VALUES

The selected toxicity values are provided in Table 32. Toxicity values were selected using the data source hierarchy system established by U.S. EPA and required by Ohio EPA. The Integrated Risk Information System (IRIS) was the primary source, and the Health Effects Assessment Summary Tables (HEAST) was the secondary source.[6, 7] Carcinogen risk was assessed for all class A and class B carcinogens as specified by Ohio EPA closure guidance. Oral slope factors and inhaled slope factors were available for all of the carcinogens present at the site. Therefore, the toxicity assessment for carcinogenicity has a relatively high degree of certainty.

The toxicity assessment for toxins has a lesser degree of certainty due to a lack of available data. The inhaled reference dose for acetone, 1,1-dichloroethylene, cis-1,2-dichloroethylene, 1,2-dichloroethylene (mixture) tetrachloroethylene, 1,1,2-trichloroethane, and trichloroethylene were estimated using each chemical's oral RfD value. The oral RfD for 1,2-dichloroethane was estimated using its inhaled RfD value. Both the oral RfD and inhaled RfD for 1,1,2,2-tetrachloroethane were estimated using the oral RfD value for 1,1,1,2-tetrachloroethane. A similar method of filling in partial data gaps was recently utilized by the U.S. EPA Region III Senior Toxicologist in a memo dated July 9, 1993.[8] Review of available literature and discussions with U.S. EPA personnel revealed that the toxicity assessment for vinyl chloride should be limited to carcinogenic properties.

Adjustment of toxicity values for dermal exposure was performed according to the methods presented in the U.S. EPA RAGS, volume 1, Part B, Appendix A.[5] This adjustment is necessary since the toxicity data is expressed as administered doses while exposure assessment values are expressed as absorbed doses. This adjustment was made using the following calculations:

Dermal RfD = administered RfD x oral absorption factor

Dermal slope factor = administered slope factor / oral absorption factor

Selected oral absorption values are shown in the ninth column of Table 32. Ohio EPA's closure guidance document was used as the source of oral absorption factors for 1,1-dichloroethane, cis-1,2-dichloroethylene, 1,2-dichloroethylene (mixture), methylene chloride, tetrachloroethylene, and 1,1,1-trichloroethane. Oral absorption factors for the remaining chemicals were estimated

conservatively at 0.5. Since all but one of the known values varied between 0.8 and 1.0, and all of these chemicals have fairly similar physical and chemical properties, these estimates are expected to be highly conservative.

OTHER CONSTANTS AND PROPERTIES

In order to determine air pathway contributions it is necessary to calculate the concentrations in air that can be expected. Such calculations are necessary since direct air monitoring using commonly employed methods is not likely to have sufficiently low method detection limits to be able to detect the chemicals of concern. The calculated values depend upon several chemical-specific physical constants. These are the organic carbon partitioning coefficient (Koc), Henry's Law coefficient (H), and molecular diffusivity (Di). The selected values for these constants are provided in Table 32.

Values for Koc and H were obtained from a table provided by Ohio EPA (appendix F) with the exception of the Henry's Law constant for trichlorofluoromethane and chloroethane which were obtained from the Handbook of Environmental Fate and Exposure Data, and the Koc for chloroethane which was calculated using the formula log Koc = (-0.55 x log S) + 3.64, where S equals solubility (mg/l).[10] Diffusion coefficients of contaminant in air (Di) were obtained from Table 2-3 of the Superfund Exposure Assessment Manual (SEAM) with the exception of methylene chloride which was calculated based upon equation 2-5 of the SEAM.[9] The reference chemical used in this equation was 1,1-dichloroethane.

RESULTS OF ASSESSMENT AT BUILDING 7121

Tables 33 through 44 present the calculations of hazard and probability indexes. Each pathway consists of two tables; one for toxins and one for carcinogens. The various factors used in the calculations are presented in columns. The far right column provides the calculated index. Each chemical comprises two rows. One row for the child population and one for the Adult population. In the lower right portion of each table the index is totaled for both the child and adult populations. The pathways assessed include ingestion of groundwater; dermal contact with groundwater; ingestion of soil and dust; dermal contact with soil; and inhalation of vapors, gasses, and dusts.

Tables 45 through 48 summarize these data in a manner that allows the chemical and pathway contributions to be compared. Table 45 presents all of the cumulative indexes per pathway and Table 46 presents all of the cumulative indexes per chemical. Comparison of the totals for each mode of sorting also provides a check for addition errors. Table 47 provides a sorting of the data according to both pathway and chemical for the hazard index for the child population, since this population was the most restrictive for the toxins. Table 48 provides a sorting of the data according to both pathway and chemical for the probability index for the adult population, since this population was the most restrictive for the carcinogens. Tables 49 and 50 present the calculations which were necessary to determine the air concentrations (CA) which were utilized in Tables 41 through 44.

GARAGE AND MAINTENANCE - BUILDING 7121 - TOXIC RISK ASSESSMENT
PATHWAY: INGESTION OF GROUND WATER

Table 33

chemical	Population	cw	IR	EF	ED	BW	AT	INTAKE	oral RfD	hazard index
acetone	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	1.00E-01	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	1.00E-01	0.0E+00
carbon disulfide	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	1.00E-01	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	1.00E-01	0.0E+00
carbon tetrachloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	7.00E-04	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	7.00E-04	0.0E+00
chloroethane	Child	4.00E-03	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	5.11E-04	2.00E-02	2.6E-02
	Adult	4.00E-03	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.10E-04	2.00E-02	5.5E-03
1,1-dichloroethane	Child	1.12E-01	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.43E-02	1.00E-01	1.4E-01
	Adult	1.12E-01	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.07E-03	1.00E-01	3.1E-02
1,2-dichloroethane	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	2.86E-03	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	2.86E-03	0.0E+00
1,1-dichloroethylene	Child	5.30E-02	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	6.78E-03	9.00E-03	7.5E-01
	Adult	5.30E-02	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.45E-03	9.00E-03	1.6E-01
cis-1,2-dichloroethylene	Child	3.00E-03	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.84E-04	1.00E-02	3.8E-02
	Adult	3.00E-03	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	8.22E-05	1.00E-02	8.2E-03
1,2-dichloroethylene	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	9.00E-03	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	9.00E-03	0.0E+00
methylene chloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	6.00E-02	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	6.00E-02	0.0E+00
methyl ethyl ketone	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	6.00E-01	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	6.00E-01	0.0E+00
tetrachloroethylene	Child	6.00E-03	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.67E-04	1.00E-02	7.7E-02
	Adult	6.00E-03	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.64E-04	1.00E-02	1.6E-02
1,1,2,2-tetrachloroethane	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	3.00E-02	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	3.00E-02	0.0E+00
1,1,1-trichloroethane	Child	1.13E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.44E-01	9.00E-02	1.6E+00
	Adult	1.13E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.10E-02	9.00E-02	3.4E-01
1,1,2-trichloroethane	Child	2.00E-03	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.56E-04	4.00E-03	6.4E-02
	Adult	2.00E-03	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.48E-05	4.00E-03	1.4E-02
trichloroethylene	Child	1.30E-02	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.66E-03	6.00E-03	2.8E-01
	Adult	1.30E-02	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.56E-04	6.00E-03	5.9E-02
trichlorofluoromethane	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	3.00E-01	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	3.00E-01	0.0E+00
vinyl chloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	0.00E+00	0.00E+00	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	0.00E+00	0.00E+00	0.0E+00

Child Hazard Index 3.0E+00
Adult Hazard Index 6.4E-01

GARAGE AND MAINTENANCE - BUILDING 7121 - CARCINOGEN RISK ASSESSMENT
PATHWAY: INGESTION OF GROUND WATER

Table 34

chemical	population	CW	IR	EF	ED	BW	AT	intake	oral slope	prob. indx
carbon tetrachloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	0.00E+00	1.30E-01	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	0.00E+00	1.30E-01	0.0E+00
1,2-dichloroethane	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	0.00E+00	9.10E-02	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	0.00E+00	9.10E-02	0.0E+00
methylene chloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	0.00E+00	7.50E-03	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	0.00E+00	7.50E-03	0.0E+00
tetrachloroethylene	Child	6.00E-03	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	6.58E-05	5.20E-02	3.4E-06
	Adult	6.00E-03	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	7.05E-05	5.20E-02	3.7E-06
trichloroethylene	Child	1.30E-02	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	1.42E-04	1.10E-02	1.6E-06
	Adult	1.30E-02	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.53E-04	1.10E-02	1.7E-06
vinyl chloride	Child	0.00E+00	2.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	0.00E+00	1.90E+00	0.0E+00
	Adult	0.00E+00	2.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	0.00E+00	1.90E+00	0.0E+00

Child Probability Index 5.0E-06
Adult Probability Index 5.3E-06

GARAGE AND MAINTENANCE - BUILDING 7121 - TOXIC RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH WATER

Table 35

chemical	population	CW	SA	PC	ET	EF	ED	CF	BW	AT	absorbed dose	oral RfD	oral absorption factor	dermal RfD	hazard index
acetone	Child	0.00E+00	7.00E+03	1.00E-01	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	1.00E-01	5.00E-01	5.00E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	1.00E-01	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	1.00E-01	5.00E-01	5.00E-02	0.0E+00
carbon disulfide	Child	0.00E+00	7.00E+03	2.40E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	1.00E-01	5.00E-01	5.00E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	2.40E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	1.00E-01	5.00E-01	5.00E-02	0.0E+00
carbon tetrachloride	Child	0.00E+00	7.00E+03	2.20E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	7.00E-04	5.00E-01	3.50E-04	0.0E+00
	Adult	0.00E+00	2.00E+04	2.20E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	7.00E-04	5.00E-01	3.50E-04	0.0E+00
chloroethane	Child	4.00E-03	7.00E+03	8.00E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	2.86E-06	2.00E-02	5.00E-01	1.00E-02	2.9E-04
	Adult	4.00E-03	2.00E+04	8.00E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	1.75E-06	2.00E-02	5.00E-01	1.00E-02	1.8E-04
1,1-dichloroethane	Child	1.12E-01	7.00E+03	8.90E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	8.92E-05	1.00E-01	8.10E-01	8.10E-02	1.1E-03
	Adult	1.12E-01	2.00E+04	8.90E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	5.46E-05	1.00E-01	8.10E-01	8.10E-02	6.7E-04
1,2-dichloroethane	Child	0.00E+00	7.00E+03	5.30E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	2.86E-03	1.00E+00	2.86E-03	0.0E+00
	Adult	0.00E+00	2.00E+04	5.30E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	2.86E-03	1.00E+00	2.86E-03	0.0E+00
1,1-dichloroethylene	Child	5.30E-02	7.00E+03	1.60E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	7.59E-05	9.00E-03	5.00E-01	4.50E-03	1.7E-02
	Adult	5.30E-02	2.00E+04	1.60E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	4.65E-05	9.00E-03	5.00E-01	4.50E-03	1.0E-02
cis-1,2-dichloroethylene	Child	3.00E-03	7.00E+03	1.00E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	2.68E-06	1.00E-02	9.00E-01	9.00E-03	3.0E-04
	Adult	3.00E-03	2.00E+04	1.00E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	1.64E-06	1.00E-02	9.00E-01	9.00E-03	1.8E-04
1,2-dichloroethylene	Child	0.00E+00	7.00E+03	1.00E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	9.00E-03	5.00E-01	4.50E-03	0.0E+00
	Adult	0.00E+00	2.00E+04	1.00E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	9.00E-03	5.00E-01	4.50E-03	0.0E+00
methylene chloride	Child	0.00E+00	7.00E+03	4.50E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	6.00E-02	4.00E-01	2.40E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	4.50E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	6.00E-02	4.00E-01	2.40E-02	0.0E+00
methyl ethyl ketone	Child	0.00E+00	7.00E+03	4.50E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	6.00E-01	5.00E-01	3.00E-01	0.0E+00
	Adult	0.00E+00	2.00E+04	4.50E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	6.00E-01	5.00E-01	3.00E-01	0.0E+00
tetrachloroethylene	Child	6.00E-03	7.00E+03	4.80E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	2.58E-05	1.00E-02	1.00E+00	1.00E-02	2.6E-03
	Adult	6.00E-03	2.00E+04	4.80E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	1.58E-05	1.00E-02	1.00E+00	1.00E-02	1.6E-03
1,1,2,2-tetrachloroethane	Child	0.00E+00	7.00E+03	9.00E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	3.00E-02	5.00E-01	1.50E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	9.00E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	3.00E-02	5.00E-01	1.50E-02	0.0E+00
1,1,1-trichloroethane	Child	1.13E+00	7.00E+03	1.70E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	1.72E-03	9.00E-02	1.00E+00	9.00E-02	1.9E-02
	Adult	1.13E+00	2.00E+04	1.70E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	1.05E-03	9.00E-02	1.00E+00	9.00E-02	1.2E-02
1,1,2-trichloroethane	Child	2.00E-03	7.00E+03	8.40E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	1.50E-06	4.00E-03	5.00E-01	2.00E-03	7.5E-04
	Adult	2.00E-03	2.00E+04	8.40E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	9.21E-07	4.00E-03	5.00E-01	2.00E-03	4.6E-04
trichloroethylene	Child	1.30E-02	7.00E+03	1.60E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	1.86E-05	6.00E-03	5.00E-01	3.00E-03	6.2E-03
	Adult	1.30E-02	2.00E+04	1.60E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	1.14E-05	6.00E-03	5.00E-01	3.00E-03	3.8E-03
trichlorofluoromethane	Child	0.00E+00	7.00E+03	1.70E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	3.00E-01	5.00E-01	1.50E-01	0.0E+00
	Adult	0.00E+00	2.00E+04	1.70E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	3.00E-01	5.00E-01	1.50E-01	0.0E+00
vinyl chloride	Child	0.00E+00	7.00E+03	7.30E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.19E+03	0.00E+00	0.00E+00	5.00E-01	0.00E+00	0.0E+00
	Adult	0.00E+00	2.00E+04	7.30E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	1.10E+04	0.00E+00	0.00E+00	5.00E-01	0.00E+00	0.0E+00

child Hazard Index	4.7E-02
Adult Hazard Index	2.9E-02

GARAGE AND MAINTENANCE - BUILDING 7121 - CARCINOGEN RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH WATER

Table 36

chemical	population	CW	SA	PC	ET	EF	ED	CF	BW	AT	absorbed dose	oral slope factor	oral absorption factor	dermal slope factor	probability index
carbon tetrachloride	Child	0.00E+00	7.00E+03	2.20E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	0.00E+00	1.30E-01	5.00E-01	2.60E-01	0.0E+00
	Adult	0.00E+00	2.00E+04	2.20E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	0.00E+00	1.30E-01	5.00E-01	2.60E-01	0.0E+00
1,2-dichloroethane	Child	0.00E+00	7.00E+03	5.30E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	0.00E+00	9.10E-02	1.00E+00	9.10E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	5.30E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	0.00E+00	9.10E-02	1.00E+00	9.10E-02	0.0E+00
methylene chloride	Child	0.00E+00	7.00E+03	4.50E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	0.00E+00	7.50E-03	4.00E-01	1.88E-02	0.0E+00
	Adult	0.00E+00	2.00E+04	4.50E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	0.00E+00	7.50E-03	4.00E-01	1.88E-02	0.0E+00
tetrachloroethylene	Child	6.00E-03	7.00E+03	4.80E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	2.21E-06	5.20E-02	1.00E+00	5.20E-02	1.1E-07
	Adult	6.00E-03	2.00E+04	4.80E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	6.76E-06	5.20E-02	1.00E+00	5.20E-02	3.5E-07
trichloroethylene	Child	1.30E-02	7.00E+03	1.60E-02	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	1.60E-06	1.10E-02	5.00E-01	2.20E-02	3.5E-08
	Adult	1.30E-02	2.00E+04	1.60E-02	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	4.88E-06	1.10E-02	5.00E-01	2.20E-02	1.1E-07
vinyl chloride	Child	0.00E+00	7.00E+03	7.30E-03	2.00E-01	3.50E+02	6.00E+00	1.00E-03	1.50E+01	2.56E+04	0.00E+00	1.90E+00	5.00E-01	3.80E+00	0.0E+00
	Adult	0.00E+00	2.00E+04	7.30E-03	2.00E-01	3.50E+02	3.00E+01	1.00E-03	7.00E+01	2.56E+04	0.00E+00	1.90E+00	5.00E-01	3.80E+00	0.0E+00

child probability index 1.6E-07
adult probability index 4.6E-07

GARAGE AND MAINTENANCE - BUILDING 7121 - TOXIC RISK ASSESSMENT
PATHWAY: INGESTION OF SOIL AND DUST

Table 37

chemical	population	CS	IR	CF	FI	EF	ED	BW	AT	INTAKE	ORAL RfD	hazard index
acetone	Child	3.80E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	4.86E-06	1.00E-01	4.9E-05
	Adult	3.80E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.21E-07	1.00E-01	5.2E-06
carbon disulfide	Child	7.50E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	9.59E-07	1.00E-01	9.6E-06
	Adult	7.50E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.03E-07	1.00E-01	1.0E-06
carbon tetrachloride	Child	2.60E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.32E-06	7.00E-04	4.7E-03
	Adult	2.60E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.56E-07	7.00E-04	5.1E-04
chloroethane	Child	3.40E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	4.35E-07	2.00E-02	2.2E-05
	Adult	3.40E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.66E-08	2.00E-02	2.3E-06
1,1-dichloroethane	Child	7.00E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.95E-07	1.00E-01	8.9E-06
	Adult	7.00E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	9.59E-08	1.00E-01	9.6E-07
1,2-dichloroethane	Child	3.00E-03	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.84E-08	2.86E-03	1.3E-05
	Adult	3.00E-03	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.11E-09	2.86E-03	1.4E-06
1,1-dichloroethylene	Child	8.00E-03	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.02E-07	9.00E-03	1.1E-05
	Adult	8.00E-03	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.10E-08	9.00E-03	1.2E-06
cis-1,2-dichloroethylene	Child	6.00E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.67E-07	1.00E-02	7.7E-05
	Adult	6.00E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	8.22E-08	1.00E-02	8.2E-06
1,2-dichloroethylene	Child	1.90E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.43E-07	9.00E-03	2.7E-05
	Adult	1.90E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.60E-08	9.00E-03	2.9E-06
methylene chloride	Child	2.49E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.18E-06	6.00E-02	5.3E-05
	Adult	2.49E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.41E-07	6.00E-02	5.7E-06
methyl ethyl ketone	Child	6.20E+00	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.93E-05	6.00E-01	1.3E-04
	Adult	6.20E+00	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	8.49E-06	6.00E-01	1.4E-05
tetrachloroethylene	Child	1.92E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.45E-06	1.00E-02	2.5E-04
	Adult	1.92E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.63E-07	1.00E-02	2.6E-05
1,1,2,2-tetrachloroethane	Child	1.80E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.30E-07	3.00E-02	7.7E-06
	Adult	1.80E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.47E-08	3.00E-02	8.2E-07
1,1,1-trichloroethane	Child	2.00E+00	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.56E-05	9.00E-02	2.8E-04
	Adult	2.00E+00	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.74E-06	9.00E-02	3.0E-05
1,1,2-trichloroethane	Child	6.00E-03	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.67E-08	4.00E-03	1.9E-05
	Adult	6.00E-03	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	8.22E-09	4.00E-03	2.1E-06
trichloroethylene	Child	1.61E+00	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.05E-05	6.00E-03	3.4E-03
	Adult	1.61E+00	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.20E-06	6.00E-03	3.7E-04
trichlorofluoromethane	Child	1.30E-02	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.66E-07	3.00E-01	5.5E-07
	Adult	1.30E-02	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.78E-08	3.00E-01	5.9E-08
vinyl chloride	Child	3.00E-03	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.84E-08	0.00E+00	0.0E+00
	Adult	3.00E-03	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.11E-09	0.00E+00	0.0E+00

child hazard index 9.1E-03
adult hazard index 9.8E-04

GARAGE AND MAINTENANCE - BUILDING 7121 - CARCINOGEN RISK ASSEMENT
PATHWAY: INGESTION OF SOIL AND DUST

TABLE 38

chemical	population	CS	IR	CF	FI	EF	ED	BW	AT	INTAKE	ORAL SLOPE	PROBABILITY INDEX
carbon tetrachloride	child	2.60E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.85E-07	1.30E-01	3.7E-08
	adult	2.60E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.53E-07	1.30E-01	2.0E-08
1,2-dichloroethane	child	3.00E-03	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	3.29E-09	9.10E-02	3.0E-10
	adult	3.00E-03	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.76E-09	9.10E-02	1.6E-10
methylene chloride	child	2.49E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.73E-07	7.50E-03	2.0E-09
	adult	2.49E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.46E-07	7.50E-03	1.1E-09
tetrachloroethylene	child	1.92E-01	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.10E-07	5.20E-02	1.1E-08
	adult	1.92E-01	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.13E-07	5.20E-02	5.9E-09
trichloroethylene	child	1.61E+00	2.00E+02	1.00E-06	1.00E+00	3.50E+02	6.00E+00	1.50E+01	2.56E+04	1.76E-06	1.10E-02	1.9E-08
	adult	1.61E+00	1.00E+02	1.00E-06	1.00E+00	3.50E+02	3.00E+01	7.00E+01	2.56E+04	9.42E-07	1.10E-02	1.0E-08
vinyl chloride	child	3.00E-03	2.000E+02	1.00E-06	1.000E+00	3.500E+02	6.000E+00	1.500E+01	2.56E+04	3.29E-09	1.90E+00	6.2E-09
	adult	3.00E-03	1.000E+02	1.00E-06	1.000E+00	3.500E+02	3.000E+01	7.000E+01	2.56E+04	1.76E-09	1.90E+00	3.3E-09

Child Hazard Index **7.6E-08**
Adult Hazard Index **4.1E-08**

GARAGE AND MAINTENANCE - BUILDING 7121 - TOXIC RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH SOIL

Table 39

chemical	population	CS	CF	SA	AF	ABS	EF	ED	BW	AT	absorbed dose	oral RfD	Oral Absorption factor	dermal RfD	hazard index
acetone	Child	3.80E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.21E-05	1.00E-01	5.00E-01	5.00E-02	2.4E-04
	Adult	3.80E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	6.51E-06	1.00E-01	5.00E-01	5.00E-02	1.3E-04
carbon disulfide	Child	7.50E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.40E-06	1.00E-01	5.00E-01	5.00E-02	4.8E-05
	Adult	7.50E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.28E-06	1.00E-01	5.00E-01	5.00E-02	2.6E-05
carbon tetrachloride	Child	2.60E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.31E-06	7.00E-04	5.00E-01	3.50E-04	2.4E-02
	Adult	2.60E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.45E-06	7.00E-04	5.00E-01	3.50E-04	1.3E-02
chloroethane	Child	3.40E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.09E-06	2.00E-02	5.00E-01	1.00E-02	1.1E-04
	Adult	3.40E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.82E-07	2.00E-02	5.00E-01	1.00E-02	5.8E-05
1,1-dichlorothane	Child	7.00E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.24E-06	1.00E-01	8.10E-01	8.10E-02	2.8E-05
	Adult	7.00E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.20E-06	1.00E-01	8.10E-01	8.10E-02	1.5E-05
1,2-dichloroethane	Child	3.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	9.59E-08	2.86E-03	1.00E+00	2.86E-03	3.4E-05
	Adult	3.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.14E-08	2.86E-03	1.00E+00	2.86E-03	1.8E-05
1,1-dichloroethylene	Child	8.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.56E-07	9.00E-03	5.00E-01	4.50E-03	5.7E-05
	Adult	8.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.37E-07	9.00E-03	5.00E-01	4.50E-03	3.0E-05
cis-1,2-dichloroethylene	Child	6.00E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.92E-06	1.00E-02	9.00E-01	9.00E-03	2.1E-04
	Adult	6.00E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.03E-06	1.00E-02	9.00E-01	9.00E-03	1.1E-04
1,2-dichloroethylene	Child	1.90E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	6.07E-07	9.00E-03	5.00E-01	4.50E-03	1.3E-04
	Adult	1.90E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.25E-07	9.00E-03	5.00E-01	4.50E-03	7.2E-05
methylene chloride	Child	2.49E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.96E-06	6.00E-02	4.00E-01	2.40E-02	3.3E-04
	Adult	2.49E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.26E-06	6.00E-02	4.00E-01	2.40E-02	1.8E-04
methyl ethyl ketone	Child	6.20E+00	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.98E-04	6.00E-01	5.00E-01	3.00E-01	6.6E-04
	Adult	6.20E+00	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.06E-04	6.00E-01	5.00E-01	3.00E-01	3.5E-04
tetrachloroethylene	Child	1.92E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	6.14E-06	1.00E-02	1.00E+00	1.00E-02	6.1E-04
	Adult	1.92E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.29E-06	1.00E-02	1.00E+00	1.00E-02	3.3E-04
1,1,2,2-tetrachloroethane	Child	1.80E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	5.75E-07	3.00E-02	5.00E-01	1.50E-02	3.8E-05
	Adult	1.80E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.08E-07	3.00E-02	5.00E-01	1.50E-02	2.1E-05
1,1,1-trichloroethane	Child	2.00E+00	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	6.39E-05	9.00E-02	1.00E+00	9.00E-02	7.1E-04
	Adult	2.00E+00	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.42E-05	9.00E-02	1.00E+00	9.00E-02	3.8E-04
1,1,2-trichloroethane	Child	6.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.92E-07	4.00E-03	5.00E-01	2.00E-03	9.6E-05
	Adult	6.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.03E-07	4.00E-03	5.00E-01	2.00E-03	5.1E-05
trichloroethylene	Child	1.61E+00	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	5.13E-05	6.00E-03	5.00E-01	3.00E-03	1.7E-02
	Adult	1.61E+00	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.75E-05	6.00E-03	5.00E-01	3.00E-03	9.2E-03
trichlorofluoromethane	Child	1.30E-02	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	4.16E-07	3.00E-01	5.00E-01	1.50E-01	2.8E-06
	Adult	1.30E-02	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.23E-07	3.00E-01	5.00E-01	1.50E-01	1.5E-06
vinyl chloride	Child	3.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	9.59E-08	0.00E+00	5.00E-01	0.00E+00	0.0E+00
	Adult	3.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.14E-08	0.00E+00	5.00E-01	0.00E+00	0.0E+00

child Hazard Index **4.4E-02**
adult hazard Index **2.4E-02**

GARAGE AND MAINTENANCE - BUILDING 7121 - CARCINOGEN RISK ASSESSMENT
PATHWAY: DERMAL CONTACT WITH SOIL

Table 40

Chemical	Population	CS	CF	SA	AF	ABS	EF	ED	BW	AT	absorbed dose	Oral Slope Factor	Oral Absorbtion factor	Dermal Slope Factor	probability index
carbon tetrachloride	Child	2.60E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	7.12E-07	1.30E-01	5.00E-01	2.60E-01	1.9E-07
	Adult	2.60E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.91E-06	1.30E-01	5.00E-01	2.60E-01	5.0E-07
1,2-dichloroethane	Child	3.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	8.22E-09	9.10E-02	1.00E+00	9.10E-02	7.5E-10
	Adult	3.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	2.20E-08	9.10E-02	1.00E+00	9.10E-02	2.0E-09
methylene chloride	Child	2.49E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	6.82E-07	7.50E-03	4.00E-01	1.88E-02	1.3E-08
	Adult	2.49E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.83E-06	7.50E-03	4.00E-01	1.88E-02	3.4E-08
tetrachloroethylene	Child	1.92E-01	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	5.26E-07	5.20E-02	1.00E+00	5.20E-02	2.7E-08
	Adult	1.92E-01	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.41E-06	5.20E-02	1.00E+00	5.20E-02	7.3E-08
trichloroethylene	Child	1.61E+00	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	4.40E-06	1.10E-02	5.00E-01	2.20E-02	9.7E-08
	Adult	1.61E+00	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.18E-05	1.10E-02	5.00E-01	2.20E-02	2.6E-07
vinyl chloride	Child	3.00E-03	1.00E-06	2.00E+03	1.00E+00	2.50E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	8.22E-09	1.90E+00	5.00E-01	3.80E+00	3.1E-08
	Adult	3.00E-03	1.00E-06	5.00E+03	1.00E+00	2.50E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	2.20E-08	1.90E+00	5.00E-01	3.80E+00	8.4E-08

Child Probability Index: 3.5E-07
Adult Probability Index: 9.5E-07

GARAGE AND MAINTENANCE - BUILDING 7121 - TOXIC RISK ASSESSMENT
PATHWAY: INHALATION OF VAPORS AND GASSES

Table 41

chemical	population	CA	outdoor IR	shower IR	outdoor ET	shower ET	EF	ED	BW	AT	INT AKE outdoor	INT AKE shower	inhaled RfD	hazard index outdoor	hazard index shower
acetone	Child	6.45E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.21E-05	4.95E-07	1.00E-01	8.2E-04	4.9E-06
	Adult	6.45E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.76E-05	1.06E-07	1.00E-01	1.8E-04	1.1E-06
carbon disulfide	Child	6.38E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.12E-05	4.89E-07	2.86E-03	2.8E-02	1.7E-04
	Adult	6.38E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.74E-05	1.05E-07	2.86E-03	6.1E-03	3.7E-05
carbon tetrachloride	Child	1.96E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.49E-04	1.50E-06	5.71E-04	4.4E-01	2.6E-03
	Adult	1.96E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.34E-05	3.22E-07	5.71E-04	9.3E-02	5.6E-04
chloroethane	Child	3.19E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	4.06E-05	2.45E-07	2.86E+00	1.4E-05	8.6E-08
	Adult	3.19E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	8.70E-06	5.24E-08	2.86E+00	3.0E-06	1.8E-08
1,1-dichloroethane	Child	4.49E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	5.72E-05	3.44E-07	1.43E-01	4.0E-04	2.4E-06
	Adult	4.49E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.23E-05	7.36E-08	1.43E-01	8.6E-05	5.2E-07
1,2-dichloroethane	Child	1.32E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.68E-06	1.01E-08	2.86E-03	5.9E-04	3.5E-06
	Adult	1.32E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.61E-07	2.17E-09	2.86E-03	1.3E-04	7.6E-07
1,1-dichloroethylene	Child	9.79E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.25E-05	7.51E-08	9.00E-03	1.4E-03	8.3E-06
	Adult	9.79E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.67E-06	1.61E-08	9.00E-03	3.0E-04	1.8E-06
cis-1,2-dichloroethylene	Child	3.73E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	4.75E-05	2.86E-07	1.00E-02	4.8E-03	2.9E-05
	Adult	3.73E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.02E-05	6.13E-08	1.00E-02	1.0E-03	6.1E-06
1,2-dichloroethylene	Child	2.32E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.96E-05	1.78E-07	9.00E-03	3.3E-03	2.0E-05
	Adult	2.32E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	6.34E-06	3.82E-08	9.00E-03	7.0E-04	4.2E-06
methylene chloride	Child	2.14E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.72E-04	1.64E-06	8.57E-01	3.2E-04	1.9E-06
	Adult	2.14E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.83E-05	3.51E-07	8.57E-01	6.8E-05	4.1E-07
methyl ethyl ketone	Child	7.90E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.01E-03	6.06E-06	2.86E-01	3.5E-03	2.1E-05
	Adult	7.90E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.15E-04	1.30E-06	2.86E-01	7.5E-04	4.5E-06
tetrachloroethylene	Child	7.71E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	9.82E-05	5.91E-07	1.00E-02	9.8E-03	5.9E-05
	Adult	7.71E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.10E-05	1.27E-07	1.00E-02	2.1E-03	1.3E-05
1,1,2,2-tetrachloroethane	Child	1.51E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.92E-06	1.16E-08	3.00E-02	6.4E-05	3.9E-07
	Adult	1.51E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.11E-07	2.48E-09	3.00E-02	1.4E-05	8.3E-08
1,1,1-trichloroethane	Child	9.66E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.23E-03	7.41E-06	2.86E-01	4.3E-03	2.6E-05
	Adult	9.66E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.63E-04	1.59E-06	2.86E-01	9.2E-04	5.5E-06
1,1,2-trichloroethane	Child	1.34E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.71E-06	1.03E-08	4.00E-03	4.3E-04	2.6E-06
	Adult	1.34E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.66E-07	2.20E-09	4.00E-03	9.1E-05	5.5E-07
trichloroethylene	Child	6.80E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.66E-04	5.22E-06	6.00E-03	1.4E-01	8.7E-04
	Adult	6.80E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.86E-04	1.12E-06	6.00E-03	3.1E-02	1.9E-04
trichlorofluoromethane	Child	1.74E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.21E-05	1.33E-07	2.00E-01	1.1E-04	6.7E-07
	Adult	1.74E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	4.74E-06	2.86E-08	2.00E-01	2.4E-05	1.4E-07
vinyl chloride	Child	8.12E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.03E-05	6.23E-08	0.00E+00	0.0E+00	0.0E+00
	Adult	8.12E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.21E-06	1.33E-08	0.00E+00	0.0E+00	0.0E+00

child hazard index	**6.4E-01**	**3.8E-03**
adult hazard index	**1.4E-01**	**8.2E-04**

GARAGE AND MAINTENANCE - BUILDING 7121 - CARCINOGEN RISK ASSESSMENT
PATHWAY: INHALATION OF VAPORS AND GASSES

Table 42

chemical	population	CA	outdoor IR	shower IR	outdoor ET	shower ET	EF	ED	BW	AT	INTAKE outdoor	INTAKE shower	inhaled slope factor	probability index outdoor	probability index shower
carbon tetrachloride	Child	1.96E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.14E-05	1.29E-07	5.25E-02	1.1E-06	6.8E-09
	Adult	1.96E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	2.29E-05	1.38E-07	5.25E-02	1.2E-06	7.2E-09
1,2-dichloroethane	Child	1.32E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	1.44E-07	8.70E-10	9.10E-02	1.3E-08	7.9E-11
	Adult	1.32E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.55E-07	9.32E-10	9.10E-02	1.4E-08	8.5E-11
methylene chloride	Child	2.14E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	2.33E-05	1.41E-07	1.65E-03	3.9E-08	2.3E-10
	Adult	2.14E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	2.50E-05	1.51E-07	1.65E-03	4.1E-08	2.5E-10
tetrachloroethylene	Child	7.71E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	8.41E-06	5.07E-08	2.03E-03	1.7E-08	1.0E-10
	Adult	7.71E-05	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	9.01E-06	5.43E-08	2.03E-03	1.8E-08	1.1E-10
trichloroethylene	Child	6.80E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	7.42E-05	4.47E-07	6.00E-03	4.5E-07	2.7E-09
	Adult	6.80E-04	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	7.95E-05	4.79E-07	6.00E-03	4.8E-07	2.9E-09
vinyl chloride	Child	8.12E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	8.86E-07	5.34E-09	3.00E-01	2.7E-07	1.6E-09
	Adult	8.12E-06	8.30E-01	6.00E-01	2.40E+01	2.00E-01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	9.49E-07	5.72E-09	3.00E-01	2.8E-07	1.7E-09

child probability index	**1.9E-06**	**1.1E-08**
adult probability index	**2.0E-06**	**1.2E-08**

GARAGE AND MAINTENANCE - BUILDING 7121 - TOXIC ASSESSMENT
PATHWAY: INHALATION OF DUSTS

TABLE 43

chemical	population	CA	IR	ET	EF	ED	BW	AT	INTAKE	INHALED RfD	hazard index
acetone	child	1.28E-10	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.63E-10	1.00E-01	1.6E-09
	adult	1.28E-10	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.49E-11	1.00E-01	3.5E-10
carbon disulfide	child	2.52E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.21E-11	2.86E-03	1.1E-08
	adult	2.52E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	6.89E-12	2.86E-03	2.4E-09
carbon tetrachloride	adult	8.75E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.11E-10	5.71E-04	2.0E-07
	child	8.75E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.39E-11	5.71E-04	4.2E-08
chloroethane	child	1.14E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.46E-11	2.86E+00	5.1E-12
	adult	1.14E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	3.12E-12	2.86E+00	1.1E-12
1,1-dichloroethane	child	2.36E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.00E-11	1.43E-01	2.1E-10
	adult	2.36E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	6.43E-12	1.43E-01	4.5E-11
1,2-dichloroethane	child	1.01E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.29E-12	2.86E-03	4.5E-10
	adult	1.01E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.75E-13	2.86E-03	9.6E-11
1,1-dichloroethylene	child	2.69E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	3.43E-12	9.00E-03	3.8E-10
	adult	2.69E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	7.35E-13	9.00E-03	8.2E-11
cis-1,2-dichloroethylene	child	2.02E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.57E-11	1.00E-02	2.6E-09
	adult	2.02E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.51E-12	1.00E-02	5.5E-10
1,2-dichloroethylene	child	6.39E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.14E-12	9.00E-03	9.0E-10
	adult	6.39E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.74E-12	9.00E-03	1.9E-10
methylene chloride	child	8.38E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.07E-10	8.57E-01	1.2E-10
	adult	8.38E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.29E-11	8.57E-01	2.7E-11
methyl ethyl ketone	child	2.09E-09	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.66E-09	2.86E-01	9.3E-09
	adult	2.09E-09	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.69E-10	2.86E-01	2.0E-09
tetrachloroethylene	child	6.46E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.23E-11	1.00E-02	8.2E-09
	adult	6.46E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.76E-11	1.00E-02	1.8E-09
1,1,2,2-tetrachloroethane	child	6.06E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	7.71E-12	3.00E-02	2.6E-10
	adult	6.06E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.65E-12	3.00E-02	5.5E-11
1,1,1-trichloroethane	child	6.73E-10	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	8.57E-10	2.86E-01	3.0E-09
	adult	6.73E-10	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.84E-10	2.86E-01	6.4E-10
1,1,2-trichloroethane	child	2.02E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	2.57E-12	4.00E-03	6.4E-10
	adult	2.02E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	5.51E-13	4.00E-03	1.4E-10
trichloroethylene	child	5.40E-10	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	6.88E-10	6.00E-03	1.1E-07
	adult	5.40E-10	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.47E-10	6.00E-03	2.5E-08
trichlorofluoromethane	child	4.37E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	5.57E-12	2.00E-01	2.8E-11
	adult	4.37E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	1.19E-12	2.00E-01	6.0E-12
vinyl chloride	child	1.01E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.19E+03	1.29E-12	0.00E+00	0.0E+00
	adult	1.01E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	1.10E+04	2.75E-13	0.00E+00	0.0E+00

child hazard index **3.5E-07**
adult hazard index **7.5E-08**

GARAGE AND MAINTENANCE - BUILDING 7121 - CARCINOGEN RISK ASSESSMENT TABLE 44
PATHWAY: INHALATION OF DUSTS

chemical	population	CA	IR	ET	EF	ED	BW	AT	INTAKE	INHALED SLOPE FACTOR	PROBABILITY INDEX
carbon tetrachloride	child	8.75E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	9.55E-12	5.25E-02	5.0E-13
	adult	8.75E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.02E-11	5.25E-02	5.4E-13
1,2-dichloroethane	child	1.01E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	1.10E-13	9.100E-02	1.0E-14
	adult	1.01E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.18E-13	9.100E-02	1.1E-14
methylene chloride	child	8.38E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	9.15E-12	1.650E-03	1.5E-14
	adult	8.38E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	9.80E-12	1.650E-03	1.6E-14
tetrachloroethylene	child	6.46E-11	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	7.05E-12	2.030E-03	1.4E-14
	adult	6.46E-11	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	7.56E-12	2.030E-03	1.5E-14
trichloroethylene	child	5.40E-10	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	5.90E-11	6.000E-03	3.5E-13
	adult	5.40E-10	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	6.32E-11	6.000E-03	3.8E-13
vinyl chloride	child	1.01E-12	8.30E-01	2.40E+01	3.50E+02	6.00E+00	1.50E+01	2.56E+04	1.10E-13	3.000E-01	3.3E-14
	adult	1.01E-12	8.30E-01	2.40E+01	3.50E+02	3.00E+01	7.00E+01	2.56E+04	1.18E-13	3.000E-01	3.5E-14

child probability index 9.3E-13
adult probability index 9.9E-13

TABLE 45

GARAGE AND MAINTENANCE - BUILDING 7121 - RISK ASSESSMENT
PATHWAY SUMMARY

Pathway	Hazard Index Child	Hazard Index Adult	Prob. Index Child	Prob. Index Adult
Ingestion of Ground Water	3.0E+00	6.4E-01	5.0E-06	5.3E-06
Dermal Contact With Ground Water	4.7E-02	2.9E-02	1.5E-07	4.6E-07
Ingestion of Soil & Dust	9.1E-03	9.8E-04	7.6E-08	4.1E-08
Dermal Contact With Soil	4.4E-02	2.4E-02	3.5E-07	9.5E-07
Inhalation of Vapor & Gas	6.4E-01	1.4E-01	1.9E-06	2.0E-06
Inhalation of Dust	3.5E-07	7.5E-08	9.3E-13	9.9E-13
Total	**4E+00**	**8E-01**	**7E-06**	**9E-06**

Table 46

GARAGE AND MAINTENANCE - BUILDING 7121 - RISK ASSESSMENT
CHEMICAL CONTRIBUTIONS SUMMARY

CHEMICAL	Haz. Index Child	Haz. Index Adult	Prob. Index Child	Prob. Index Adult
acetone	1.1E-03	3.1E-04		
carbon disulfide	2.9E-02	6.2E-03		
carbon tetrachloride	4.7E-01	1.1E-01	1.3E-06	1.7E-06
chloroethane	2.6E-02	5.7E-03		
1,1-dichloroethane	1.4E-01	3.1E-02		
1,2-dichloroethane	6.4E-04	1.5E-04	1.4E-08	1.6E-08
1,1-dichloroethylene	7.7E-01	1.7E-01		
cis-1,2-dichloroethylene	4.4E-02	9.5E-03		
1,2-dichloroethylene	3.5E-03	7.8E-04		
methylene chloride	7.0E-04	2.5E-04	5.4E-08	7.7E-08
methyl ethyl ketone	4.3E-03	1.1E-03		
tetrachloroethylene	9.0E-02	2.0E-02	3.6E-06	4.1E-06
1,1,2,2-tetrachloroethane	1.1E-04	3.5E-05		
1,1,1-trichloroethane	1.6E+00	3.6E-01		
1,1,2-trichloroethane	6.5E-02	1.4E-02		
trichloroethylene	4.5E-01	1.0E-01	2.2E-06	2.5E-06
trichlorofluoromethane	1.1E-04	2.5E-05		
vinyl chloride	0.0E+00	0.0E+00	3.0E-07	3.7E-07
Total	**4E+00**	**8E-01**	**7E-06**	**9E-06**

GARAGE AND MAINTENANCE - BUILDING 7121 - RISK ASS MENT
CHEMICAL AND PATHWAY SUMMARY OF HAZARD INDEX - CHILD

CHEMICAL	INGESTION OF GROUNDWATER	DERMAL CONTACT WITH GROUNDWATER	INGESTION OF SOIL	DERMAL CONTACT WITH SOIL	INHALATION OF GAS AND DUST
acetone	0.0E+00	0.0E+00	4.9E-05	2.4E-04	8.3E-04
carbon disulfide	0.0E+00	0.0E+00	9.6E-06	4.8E-05	2.9E-02
carbon tetrachloride	0.0E+00	0.0E+00	4.7E-03	2.4E-02	4.4E-01
chloroethane	2.6E-02	2.9E-04	2.2E-05	1.1E-04	1.4E-05
1,1-dichloroethane	1.4E-01	1.1E-03	8.9E-06	2.8E-05	4.0E-04
1,2-dichloroethane	0.0E+00	0.0E+00	1.3E-05	3.4E-05	5.9E-04
1,1-dichloroethylene	7.5E-01	1.7E-02	1.1E-05	5.7E-05	1.4E-03
cis-1,2-dichloroethylene	3.8E-02	3.0E-04	7.7E-05	2.1E-04	4.8E-03
1,2-dichloroethylene	0.0E+00	0.0E+00	2.7E-05	1.3E-04	3.3E-03
methylene chloride	0.0E+00	0.0E+00	5.3E-05	3.3E-04	3.2E-04
methyl ethyl ketone	0.0E+00	0.0E+00	1.3E-04	6.6E-04	3.5E-03
tetrachloroethylene	7.7E-02	2.6E-03	2.5E-04	6.1E-04	9.9E-03
1,1,2,2-tetrachloroethane	0.0E+00	0.0E+00	7.7E-06	3.8E-05	6.4E-05
1,1,1-trichloroethane	1.6E+00	1.9E-02	2.8E-04	7.1E-04	4.3E-03
1,1,2-trichloroethane	6.4E-02	7.5E-04	1.9E-05	9.6E-05	4.3E-04
trichloroethylene	2.8E-01	6.2E-03	3.4E-03	1.7E-02	1.5E-01
trichlorofluoromethane	0.0E+00	0.0E+00	5.5E-07	2.8E-06	1.1E-04
vinyl chloride	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
total	**3E+00**	**5E-02**	**9E-03**	**4E-02**	**6E-01**

GARAGE AND MAINTENANCE - BUILDING 7121 - RISK ASSESSMENT
CHEMICAL AND PATHWAY SUMMARY OF PROBABILITY INDEX - ADULT

Table 48

CHEMICAL	INGESTION OF GROUNDWATER	DERMAL CONTACT WITH GROUNDWATER	INGESTION OF SOIL	DERMAL CONTACT WITH SOIL	INHALATION OF GAS AND DUST
carbon tetrachloride	0.0E+00	0.0E+00	2.0E-08	5.0E-07	1.2E-06
1,2-dichloroethane	0.0E+00	0.0E+00	1.6E-10	2.0E-09	1.4E-08
methylene chloride	0.0E+00	0.0E+00	1.1E-09	3.4E-08	4.2E-08
tetrachloroethylene	3.7E-06	3.5E-07	5.9E-09	7.3E-08	1.8E-08
trichloroethylene	1.7E-06	1.1E-07	1.0E-08	2.6E-07	4.8E-07
vinyl chloride	0.0E+00	0.0E+00	3.3E-09	8.4E-08	2.9E-07
total	**5E-06**	**5E-07**	**4E-08**	**9E-07**	**2E-06**

CONCENTRATIONS IN AIR FROM GAS PHASE EMISSIONS

TABLE 49

chemical	Koc	OC	H	Kd	Kas	DI	E	Del	Ps	ALPHA	LS	V	DH	A	T	VF	CS	CA
acetone	2.20E+00	2.00E-02	2.06E-05	4.40E-02	1.92E-02	1.22E-01	3.50E-01	8.64E-02	2.65E+00	3.36E-04	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	5.89E+03	3.80E-01	6.45E-05
	2.20E+00	2.00E-02	2.06E-05	4.40E-02	1.92E-02	1.22E-01	3.50E-01	8.64E-02	2.65E+00	3.36E-04	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	5.89E+03	3.80E-01	6.45E-05
carbon disulfide	5.40E+01	2.00E-02	1.23E-02	1.08E+00	4.67E-01	1.16E-01	3.50E-01	8.19E-02	2.65E+00	7.10E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.18E+03	7.50E-02	6.38E-05
	5.40E+01	2.00E-02	1.23E-02	1.08E+00	4.67E-01	1.16E-01	3.50E-01	8.19E-02	2.65E+00	7.10E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.18E+03	7.50E-02	6.38E-05
carbon tetrachloride	1.10E+02	2.00E-02	2.41E-02	2.20E+00	4.49E-01	9.45E-02	3.50E-01	6.68E-02	2.65E+00	5.59E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.33E+03	2.60E-01	1.96E-04
	1.10E+02	2.00E-02	2.41E-02	2.20E+00	4.49E-01	9.45E-02	3.50E-01	6.68E-02	2.65E+00	5.59E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.33E+03	2.60E-01	1.96E-04
chloroethane	3.30E+01	2.00E-02	8.48E-03	6.60E-01	5.27E-01	1.23E-01	3.50E-01	8.72E-02	2.65E+00	8.44E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.07E+03	3.40E-02	3.19E-05
	3.30E+01	2.00E-02	8.48E-03	6.60E-01	5.27E-01	1.23E-01	3.50E-01	8.72E-02	2.65E+00	8.44E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.07E+03	3.40E-02	3.19E-05
1,1-dichloroethane	3.00E+01	2.00E-02	4.31E-03	6.00E-01	2.95E-01	1.08E-01	3.50E-01	7.63E-02	2.65E+00	4.31E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.56E+03	7.00E-02	4.49E-05
	3.00E+01	2.00E-02	4.31E-03	6.00E-01	2.95E-01	1.08E-01	3.50E-01	7.63E-02	2.65E+00	4.31E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.56E+03	7.00E-02	4.49E-05
1,2-dichloroethane	1.40E+01	2.00E-02	9.79E-04	2.80E-01	1.43E-01	1.08E-01	3.50E-01	7.63E-02	2.65E+00	2.16E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.27E+03	3.00E-03	1.32E-06
	1.40E+01	2.00E-02	9.79E-04	2.80E-01	1.43E-01	1.08E-01	3.50E-01	7.63E-02	2.65E+00	2.16E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.27E+03	3.00E-03	1.32E-06
1,1-dichloroethylene	6.50E+01	2.00E-02	3.40E-02	1.30E+00	1.07E+00	9.38E-02	3.50E-01	6.63E-02	2.65E+00	1.19E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	8.17E+02	8.00E-03	9.79E-06
	6.50E+01	2.00E-02	3.40E-02	1.30E+00	1.07E+00	9.38E-02	3.50E-01	6.63E-02	2.65E+00	1.19E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	8.17E+02	8.00E-03	9.79E-06
cis-1,2-dichloroethylene	4.90E+01	2.00E-02	7.58E-03	9.80E-01	3.17E-01	9.38E-02	3.50E-01	6.63E-02	2.65E+00	4.01E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.61E+03	6.00E-02	3.73E-05
	4.90E+01	2.00E-02	7.58E-03	9.80E-01	3.17E-01	9.38E-02	3.50E-01	6.63E-02	2.65E+00	4.01E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.61E+03	6.00E-02	3.73E-05
1,2-dichloroethylene	6.50E+01	2.00E-02	3.40E-02	1.30E+00	1.07E+00	9.38E-02	3.50E-01	6.63E-02	2.65E+00	1.19E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	8.17E+02	1.90E-02	2.32E-05
	6.50E+01	2.00E-02	3.40E-02	1.30E+00	1.07E+00	9.38E-02	3.50E-01	6.63E-02	2.65E+00	1.19E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	8.17E+02	1.90E-02	2.32E-05
methylene chloride	8.80E+00	2.00E-02	2.03E-03	1.76E-01	4.73E-01	1.16E-01	3.50E-01	8.23E-02	2.65E+00	7.22E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.16E+03	2.49E-01	2.14E-04
	8.80E+00	2.00E-02	2.03E-03	1.76E-01	4.73E-01	1.16E-01	3.50E-01	8.23E-02	2.65E+00	7.22E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.16E+03	2.49E-01	2.14E-04
methyl ethyl ketone	4.50E+00	2.00E-02	2.74E-05	9.00E-02	1.25E-02	1.06E-01	3.50E-01	7.50E-02	2.65E+00	1.90E-04	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	7.85E+03	6.20E+00	7.90E-04
	4.50E+00	2.00E-02	2.74E-05	9.00E-02	1.25E-02	1.06E-01	3.50E-01	7.50E-02	2.65E+00	1.90E-04	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	7.85E+03	6.20E+00	7.90E-04
tetrachloroethylene	3.64E+02	2.00E-02	2.59E-02	7.28E+00	1.46E-01	8.78E-02	3.50E-01	6.21E-02	2.65E+00	1.79E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.49E+03	1.92E-01	7.71E-05
	3.64E+02	2.00E-02	2.59E-02	7.28E+00	1.46E-01	8.78E-02	3.50E-01	6.21E-02	2.65E+00	1.79E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.49E+03	1.92E-01	7.71E-05
1,1,2,2-tetrachloroethane	1.18E+02	2.00E-02	3.81E-04	2.36E+00	6.62E-03	8.64E-02	3.50E-01	6.11E-02	2.65E+00	8.21E-05	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.20E+04	1.80E-02	1.51E-06
	1.18E+02	2.00E-02	3.81E-04	2.36E+00	6.62E-03	8.64E-02	3.50E-01	6.11E-02	2.65E+00	8.21E-05	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	1.20E+04	1.80E-02	1.51E-06
1,1,1-trichloroethane	1.52E+02	2.00E-02	1.44E-02	3.04E+00	1.94E-01	9.45E-02	3.50E-01	6.68E-02	2.65E+00	2.54E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.07E+03	2.00E+00	9.66E-04
	1.52E+02	2.00E-02	1.44E-02	3.04E+00	1.94E-01	9.45E-02	3.50E-01	6.68E-02	2.65E+00	2.54E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.07E+03	2.00E+00	9.66E-04
1,12-trichloroethane	5.60E+01	2.00E-02	1.17E-03	1.12E+00	4.28E-02	9.45E-02	3.50E-01	6.68E-02	2.65E+00	5.76E-04	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	4.48E+03	6.00E-03	1.34E-06
	5.60E+01	2.00E-02	1.17E-03	1.12E+00	4.28E-02	9.45E-02	3.50E-01	6.68E-02	2.65E+00	5.76E-04	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	4.48E+03	6.00E-03	1.34E-06
trichloroethylene	1.26E+02	2.00E-02	9.10E-03	2.52E+00	1.48E-01	9.63E-02	3.50E-01	6.81E-02	2.65E+00	1.99E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.36E+03	1.61E+00	6.80E-04
	1.26E+02	2.00E-02	9.10E-03	2.52E+00	1.48E-01	9.63E-02	3.50E-01	6.81E-02	2.65E+00	1.99E-03	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	2.36E+03	1.61E+00	6.80E-04
trichlorofluoromethane	1.59E+02	2.00E-02	9.70E-02	3.18E+00	1.25E+00	9.31E-02	3.50E-01	6.59E-02	2.65E+00	1.33E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	7.48E+02	1.30E-02	1.74E-05
	1.59E+02	2.00E-02	9.70E-02	3.18E+00	1.25E+00	9.31E-02	3.50E-01	6.59E-02	2.65E+00	1.33E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	7.48E+02	1.30E-02	1.74E-05
vinyl chloride	5.70E+01	2.00E-02	8.19E-02	1.14E+00	2.95E+00	1.27E-01	3.50E-01	9.00E-02	2.65E+00	3.37E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	3.70E+02	3.00E-03	8.12E-06
	5.70E+01	2.00E-02	8.19E-02	1.14E+00	2.95E+00	1.27E-01	3.50E-01	9.00E-02	2.65E+00	3.37E-02	1.00E+02	2.25E+00	2.00E+00	6.00E+07	7.90E+08	3.70E+02	3.00E-03	8.12E-06

CONCENTRATIONS IN AIR FROM PARTICULATE EMISSIONS

TABLE 50

chemical	LS	V	DH	A	G	Um	Ut	F(x)	PEF	CS	CA
acetone	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.80E-01	1.28E-10
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.80E-01	1.28E-10
carbon disulfide	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	7.50E-02	2.52E-11
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	7.50E-02	2.52E-11
carbon tetrachloride	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.60E-01	8.75E-11
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.60E-01	8.75E-11
chloroethane	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.40E-02	1.14E-11
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.40E-02	1.14E-11
1,1-dichloroethane	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	7.00E-02	2.36E-11
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	7.00E-02	2.36E-11
1,2-dichloroethane	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.00E-03	1.01E-12
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.00E-03	1.01E-12
1,1-dichloroethylene	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	8.00E-03	2.69E-12
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	8.00E-03	2.69E-12
cis-1,2-dichloroethylene	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.00E-02	2.02E-11
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.00E-02	2.02E-11
1,2-dichloroethylene	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.90E-02	6.39E-12
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.90E-02	6.39E-12
methylene chloride	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.49E-01	8.38E-11
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.49E-01	8.38E-11
methyl ethyl ketone	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.20E+00	2.09E-09
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.20E+00	2.09E-09
tetrachloroethylene	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.92E-01	6.46E-11
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.92E-01	6.46E-11
1,1,2,2-tetrachloroethane	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.80E-02	6.06E-12
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.80E-02	6.06E-12
1,1,1-trichloroethane	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.00E+00	6.73E-10
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	2.00E+00	6.73E-10
1,1,2-trichloroethane	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.00E-03	2.02E-12
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	6.00E-03	2.02E-12
trichloroethylene	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.61E+00	5.40E-10
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.61E+00	5.40E-10
trichlorofluoromethane	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.30E-02	4.37E-12
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	1.30E-02	4.37E-12
vinyl chloride	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.00E-03	1.01E-12
	1.00E+02	2.25E+00	2.00E+00	6.00E+03	0.00E+00	4.74E+00	1.28E+01	4.97E-02	2.97E+09	3.00E-03	1.01E-12

In order to more effectively analyze the resulting data, Tables 45 through 48 were graphed. These graphs, presented in Figures 13 through 18, provide an excellent way to rapidly evaluate and compare a large amount of information. However, care should be utilized in using these graphs. Due to minor limitations in the graphical software the bar heights can be slightly higher or lower than the scale indicates. These differences are minor and do not interfere with analysis of the data. Also, it is important to note that probability values are graphed using log scales.

Table 45 reveals that toxic risk is approximately four times the level established in Ohio EPA's closure plan review guidance. Figure 13 reveals that toxic risk is impacted primarily by the ingestion of groundwater pathway, while the inhalation of vapors and gasses pathway is a secondary contributor to toxic risk levels. Figure 14 clarifies that 1,1,1-trichloroethane is the primary contributor to toxic risk, 1,1-dichloroethylene is a secondary contributor, and carbon tetrachloride and trichloroethylene are minor contributors to toxic risk. The remaining chemicals do not contribute significantly to toxic risk levels.

Table 45 indicates that carcinogen risk is significantly above the level established by Ohio EPA. Figure 15 reveals that carcinogen risk is primarily impacted by the ingestion of groundwater pathway and secondarily impacted by the inhalation of vapors and gasses pathway. Figure 16 clarifies that tetrachloroethylene is the primary contributor to carcinogen risk while trichloroethylene and carbon tetrachloride are secondary contributors to carcinogen risk levels. Figures 17 and 18 provide other visual comparisons of the same data.

TARGET CLEAN UP LEVELS

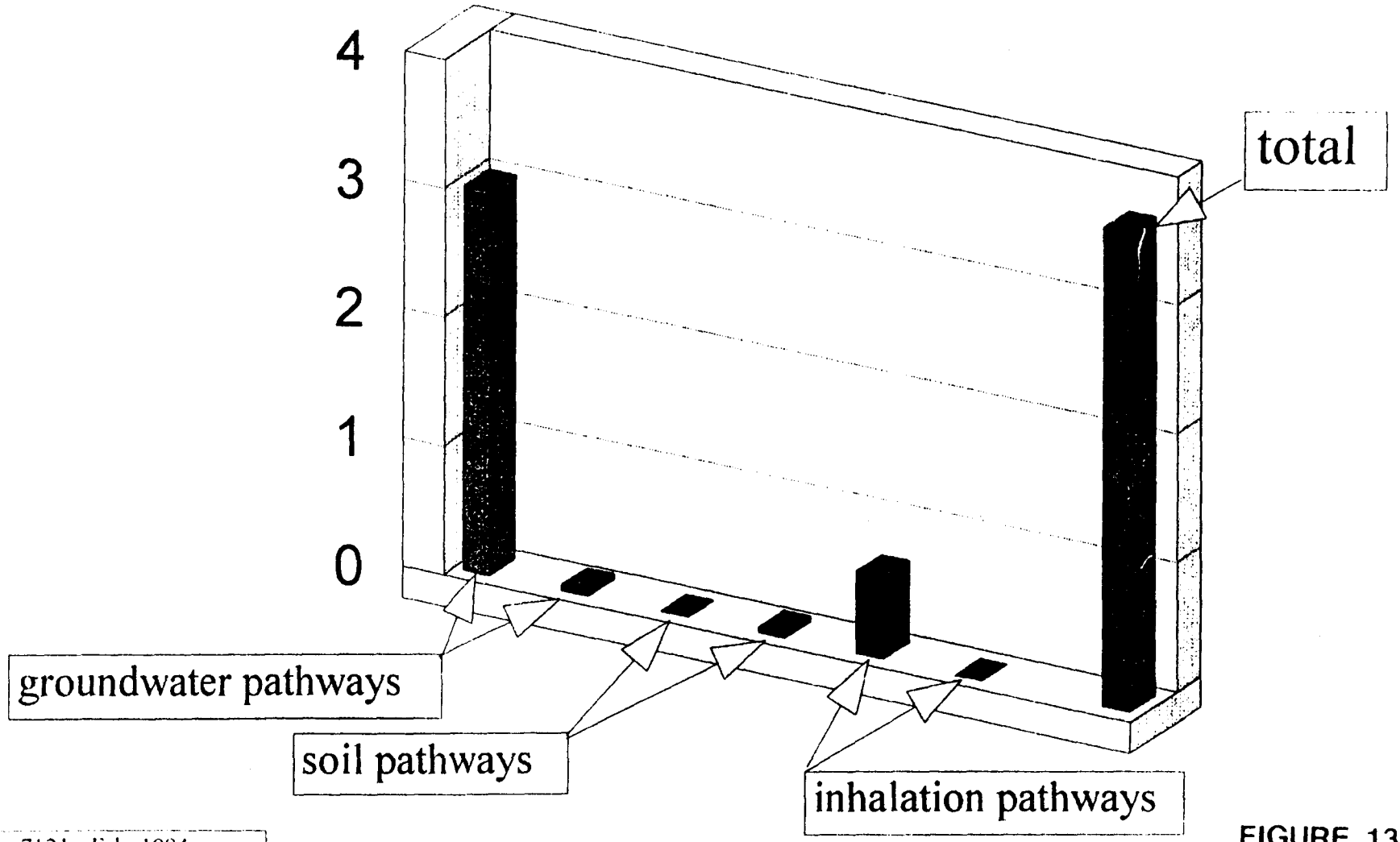
Target clean up levels for the Building 7121 site were determined using a scenario approach. Chemical concentration values were entered into the assessment model to determine the concentrations of contaminants which could remain at the site and still meet Ohio EPA's criteria for clean closure. The first scenario involved setting all soil contaminant concentrations to zero and leaving groundwater unremediated. The resulting assessment revealed that a complete removal of all soil contamination would yield a hazard index (child) of 3 and a probability index (adult) of 6E-6. Therefore, soil removal without groundwater remediation would not meet Ohio EPA standards.

The second scenario was the reverse of the first scenario. It involved setting groundwater contaminant concentrations to zero and leaving the soil unremediated. This produced a hazard index (child) of 0.7 and a probability index (adult) of 3E-6. This is not far outside of Ohio EPA's maximum limit, and suggests that limited soil remediation could be effective if 100% remediation of the groundwater were provided.

Although Ohio EPA policy does not allow use of controls to meet risk assessment clean closure criteria, a third scenario was conducted to assess the impact of vapor control. This scenario was identical to the second except that the inhalation pathways were removed from the model. This resulted in a hazard index (child) of 0.05 and a probability index (adult) of 1E-6, which is within Ohio EPA criteria for clean closure.

PATHWAY SUMMARY

Hazard Index - Child

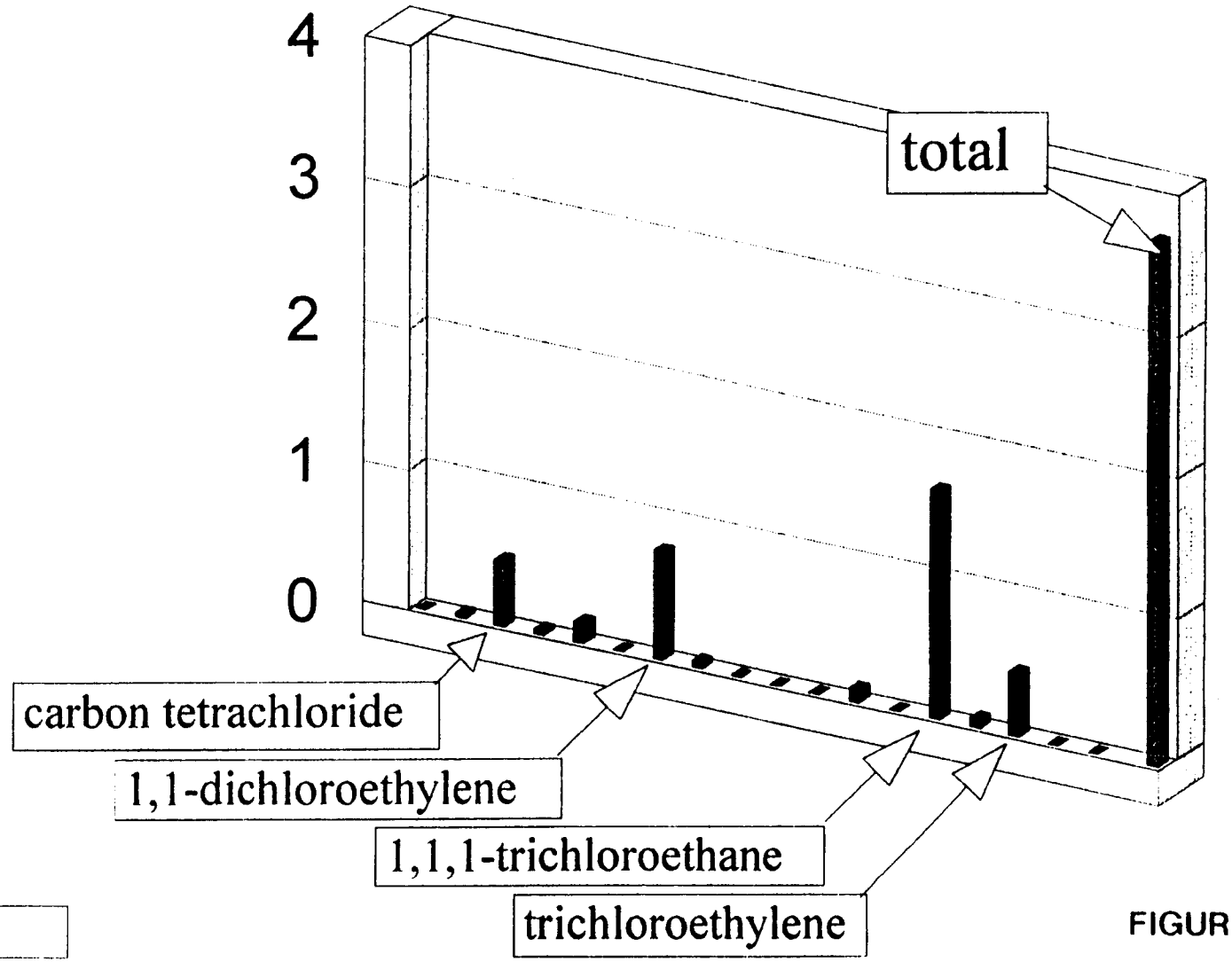


G&M - 7121 - Feb. 1994

FIGURE 13

CHEMICAL SUMMARY

Hazard Index - Child

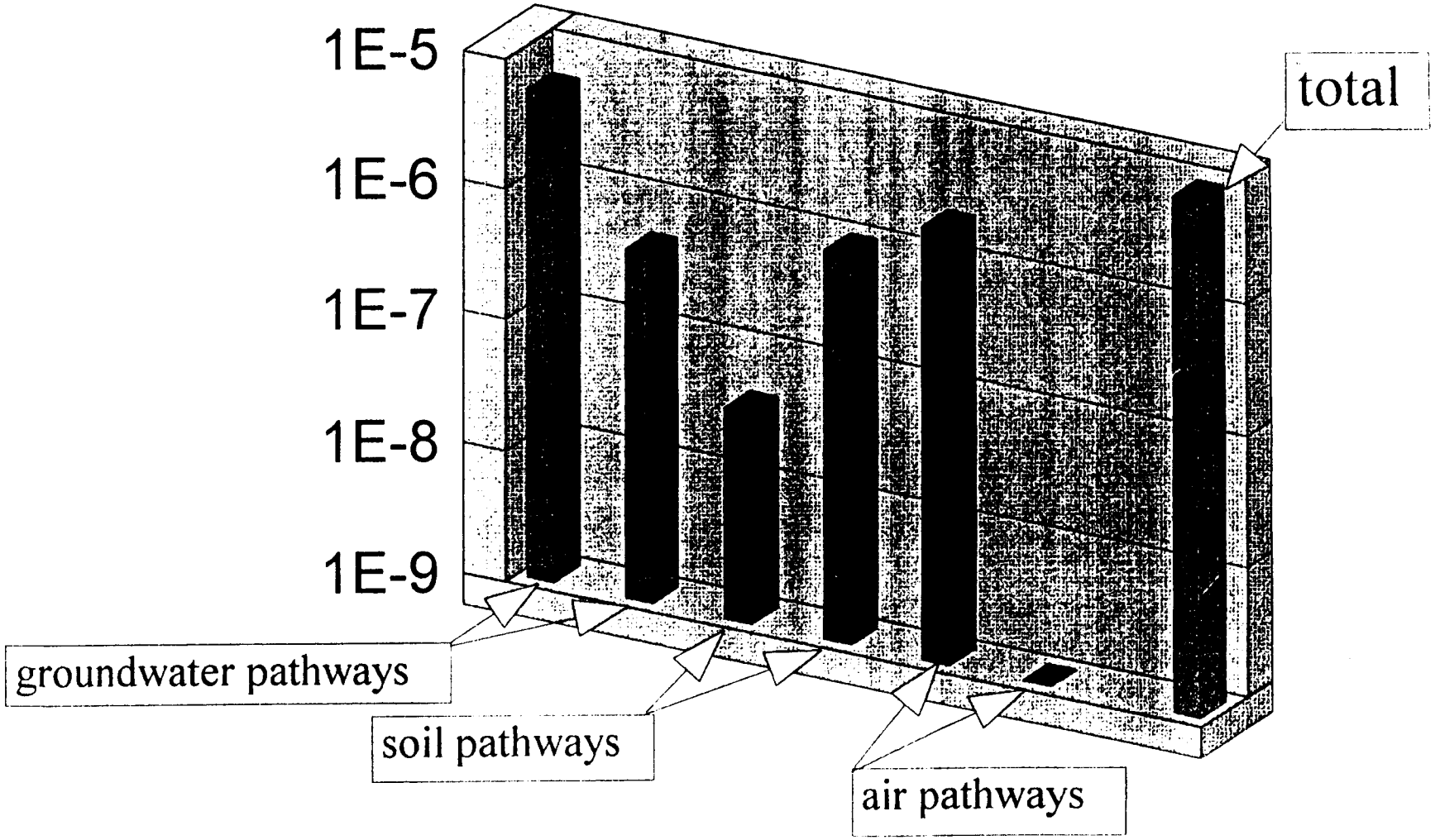


G&M - 7121 - Feb. 1994

FIGURE 14

PATHWAY SUMMARY

Probability Index - Adult

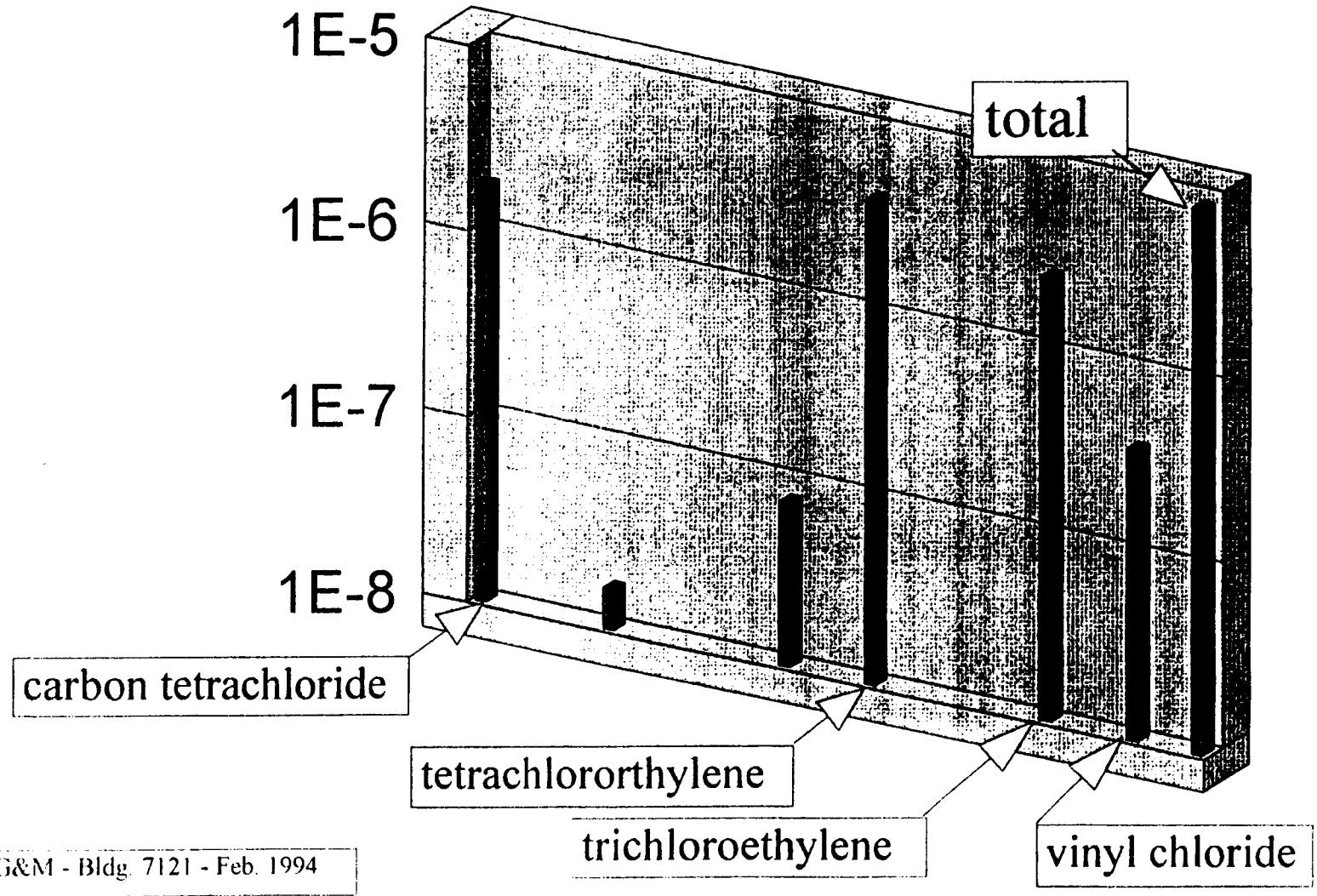


G&M - 7121 - Feb. 1994

FIGURE 15

CHEMICAL SUMMARY

Probability Index - Adult

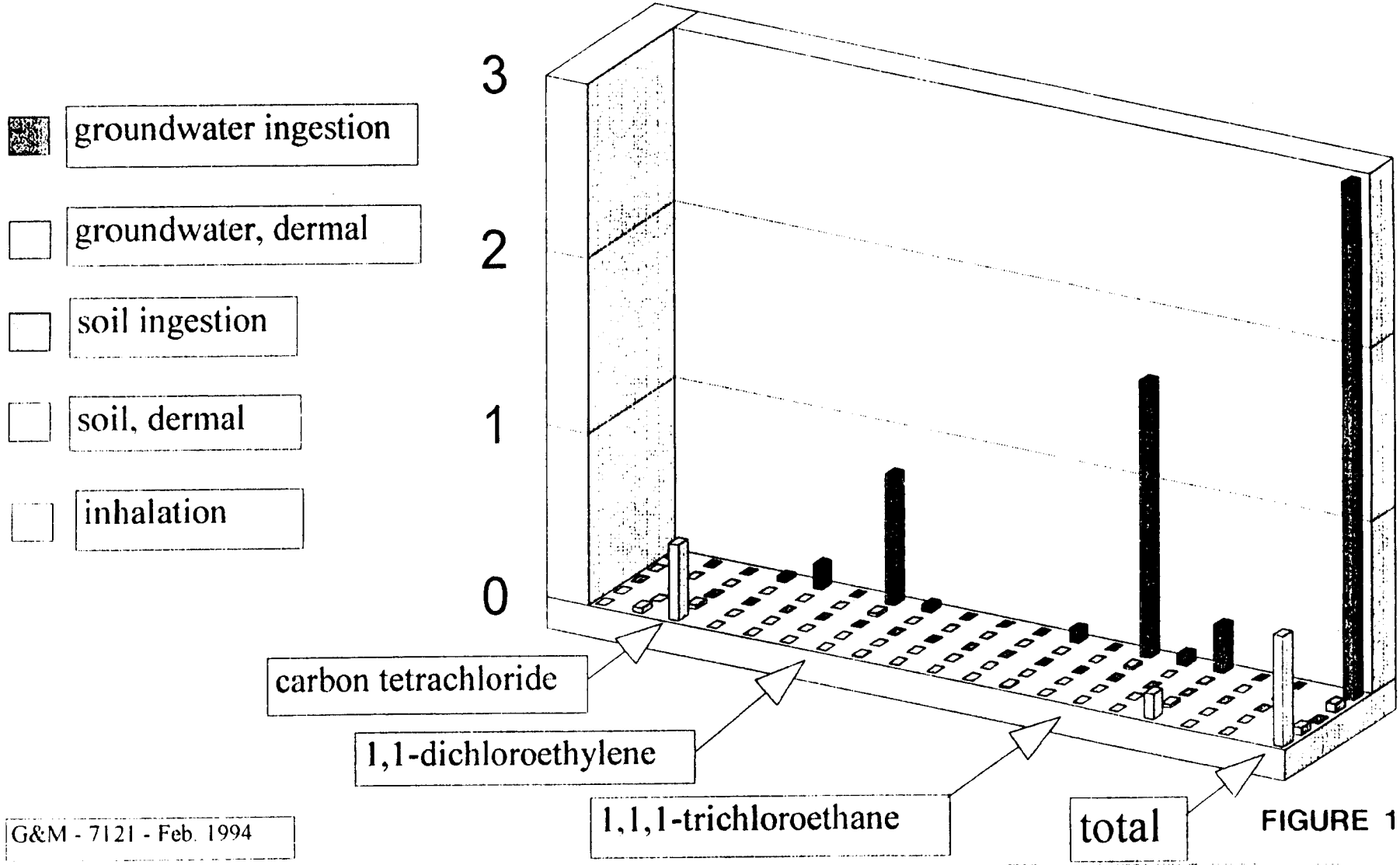


G&M - Bldg. 7121 - Feb. 1994

FIGURE 16

COMPOSITE SUMMARY

Hazard Index - Child



G&M - 7121 - Feb. 1994

FIGURE 17

COMPOSITE SUMMARY

Probability Index - Adult

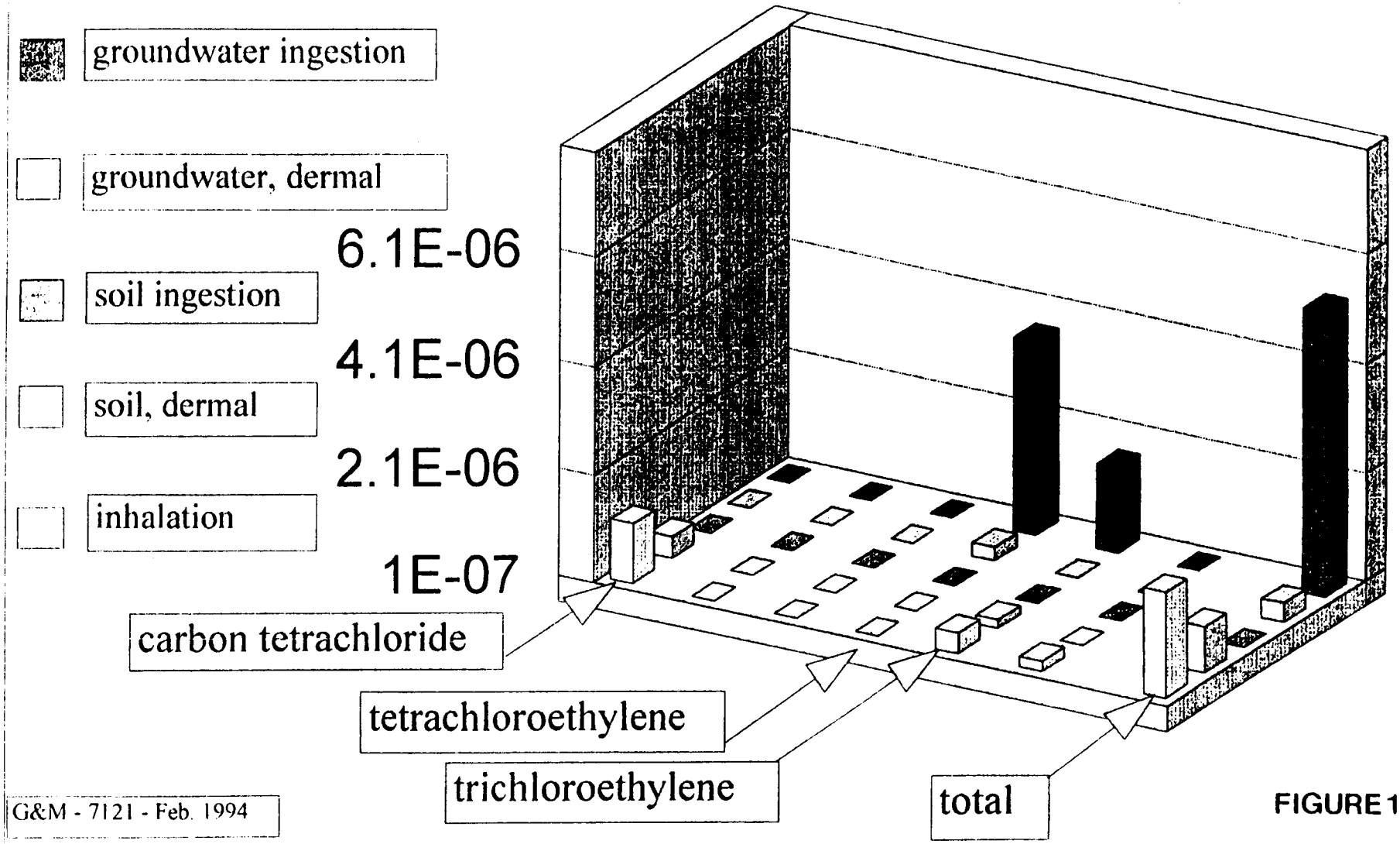


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FIGURE 18

The fourth scenario was a variation of the first in which soil contamination was set to zero and assorted percent removals of the four primary groundwater contaminants were placed into the model. This revealed that an 80% reduction of groundwater contaminant levels will produce a hazard index (child) of 0.8 and a probability index (adult) of 1E-6. Therefore, even with complete soil remediation, an 80% reduction in groundwater contaminant concentrations would be needed in order to meet Ohio EPA criteria. This suggested that it may be possible to select realistic soil remediation levels first and then determine the necessary groundwater remediation goals. This lead to scenario number five.

The fifth scenario utilized soil remediation goals which were assumed to be readily attainable. Various groundwater remediation goals were then inserted into the model. This information was combined with the results of the previous scenarios to construct a table of remedial goals (see Table 51). Each column represents a combination that meets Ohio EPA's guidelines for RCRA risk assessment clean closure.

CONCLUSIONS FOR THE BUILDING 7121 SITE

1. Existing levels of contamination, as determined in the above noted reports, do not meet the criteria for clean closure established by Ohio EPA.

2. The level of risk at Building 7121 is significantly impacted by six chemicals (1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene, carbon tetrachloride, 1,1-dichloroethylene, and vinyl chloride). Reduction of existing concentrations of these contaminants will be necessary in order to decrease risk to a level which meets Ohio EPA criteria for risk assessment closure. 1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene, and 1,1-dichloroethylene concentrations will need to be reduced in the groundwater. Carbon tetrachloride and trichloroethylene concentrations will need to be reduced in the air pathway. Vinyl chloride concentrations also may need to be reduced in the air pathway, depending upon the effectiveness of the previously noted required reductions. Since Ohio EPA policy does not allow use of controls in risk assessment closures, it will be necessary to reduce contaminant concentrations in the soil in order to reduce air pathway risk levels. Contaminant concentrations will need to be reduced more than 90 % in order to meet Ohio EPA criteria.

3. Target remedial goals are shown in Table 51. Since chemicals respond differently to differing treatment methodologies, and a treatment method has not been selected, this table of final acceptable contaminant concentrations has been constructed to provide a variety of combinations. Each column represents a combination that meets Ohio EPA's guidelines for RCRA risk assessment clean closure. In order to achieve these levels groundwater contaminant concentrations will need to be reduced by well in excess of 90 percent.

T LE 51

REMEDIAL GOALS - BUILDING 7121 SITE

	OPTION A		OPTION B		OPTION C		OPTION D		OPTION E	
Critical Contaminants	ground water	soil	ground water	soil	ground water	soil	ground water	soil	ground water	soil
1,1-dichloroethylene	10	0	5	-	5	-	20	-	20	-
tetrachloroethylene	1	0	0.6	-	1	-	1	-	1	-
1,1,1-trichloroethane	225	0	110	-	110	-	250	-	300	-
trichloroethylene	3	0	1	160	1	150	1	100	1	20
carbon tetrachloride	-	0	-	25	-	25	-	25	-	5
vinyl chloride	-	0	-	3	-	2	-	2	-	3
	See note 1 *		See note 2 **		See note 2		See note 2		See note 2	

Units = ppb or $\mu g/kg$

* = Based upon 80% reduction of critical contaminants in groundwater

** = Based upon 90% reduction of critical contaminants in groundwater

Note 1: Assumes all contaminant concentrations in soil equal zero.

Note 2: Assumes all contaminant concentrations in soil and groundwater remain at original concentrations, unless otherwise noted. See Table 32 for original concentrations.

4. Carcinogenic toxicity data were complete, but portions of noncarcinogen toxicity data were incomplete and had to be estimated for nine chemicals. This included three of the chemicals that require remediation (tetrachloroethylene, trichloroethylene, and 1,1-dichloroethylene). The maximum clean levels noted in Table 51 do not take into account a caveat within Ohio EPA's closure manual that states that Ohio EPA may not accept risk assessments for chemicals having incomplete toxicity or carcinogenicity data. Ohio EPA maintains the option of requiring cleanup to analytical detection limits when such data are incomplete.

Cited References

1. Morrison Knudsen Ferguson Group, Preliminary Site Investigation Report-Phase I, January 28, 1993.

2. EBASCO Environmental, Underground Storage Tank Corrective Actions Remedial Investigation/Feasibility Study - Phase 1 Report, November 1991.

3. EBASCO Environmental, Closure Assessment for Tanks 24, 25, 28, 29, 30, 31, 32, and 39, undated (1989).

4. Ohio EPA, Closure Plan Revision Guidance for RCRA Facilities Interim Final, September 1, 1993.

5. U.S. EPA, Risk Assessment Guidance for Superfund, Volume 1, Part B, December 1991.

6. U.S. EPA, Integrated Risk Information System (IRIS) Data Base, July 1993.

7. U.S. EPA, Health Effects Assessment Summary Tables (HEAST), March 1993.

8. Smith, Ray L., Senior Toxicologist, U.S. EPA, Memo Regarding Risk-Based Concentration Tables, July 9, 1993.

9. U.S. EPA, Superfund Exposure Assessment Manual, April 1988.

10. Howard, Philip H., Handbook of Fate and Exposure Data, 1991.