Health Consultation

IOWA CITY FORMER MANUFACTURED GAS PLANT SITE
505 BURLINGTON STREET
IOWA CITY, JOHNSON COUNTY, IOWA

EPA FACILITY ID: IAD984591172

SEPTEMEBER 14, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR Toll Free at
1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

IOWA CITY FORMER MANUFACTURED GAS PLANT SITE
505 BURLINGTON STREET
IOWA CITY, JOHNSON COUNTY, IOWA

EPA FACILITY ID: IAD984591172

Prepared by:

Iowa Department of Public Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Table of Contents

Purpose

The United States Environmental Protection Agency (EPA) has requested the Iowa Department of Public Health (IDPH) Hazardous Waste Site Health Assessment Program to evaluate the health impacts of the proposed remedial strategy to be implemented at the Iowa City Former Manufactured Gas Plant Site (FMGP). The proposed remedial strategy to be implemented incorporates the following: 1) access restrictions through the continued operation of the Iowa-Illinois Manor and restriction on any future water well installation through continued implementation of a local environmental covenant; 2) previous site decommissioning activities that have restricted access to site contaminants; and 3) continued monitoring of the groundwater to ensure that contaminant levels in groundwater remain the same or are declining in concentration. This health consultation addresses potential health risks to people from exposure to the soil and vapors within the property. The information in this health consultation was current at the time of writing. Data that emerges later could alter this document's conclusions and recommendations.

Background

Site History

The Iowa City FMGP site is located at 505 Burlington Street, in Iowa City, Johnson County, Iowa. A coal gas production facility occupied the site from the mid-nineteenth century until the 1930's. In subsequent years, all coal gas production equipment was removed, and later the site was put to varied uses, including a utility company storage area and a bus garage (1). The FMGP site lies in an extensively developed, mixed commercial and residential area. It is bounded on the north and east by single and multi-family residences, and on the south and west by small commercial firms. The 2004 population estimate for Iowa City, Iowa is 63,027 (2). About 2700 people live within one square mile of the FMGP site (2).

In 1983, a three-story 54-unit apartment building, known as the Iowa-Illinois Manor, was constructed on land where the FMGP once stood. Prior to construction of the building, a passive venting system was installed beneath a portion of the building to vent any vapors from coal tar residuals at the site. The apartment building occupies about half of the 1.6 acre site; the remaining area is a concrete parking lot used by the approximately 150 tenants. Only small areas of landscaping and grass exist on-site. Figure 1, included on page 12 of this health consultation, shows the location of the Iowa-Illinois Manor and the location of the historic FMGP structures. Tenants of the Iowa-Illinois Manor are almost exclusively university students, from 19-21 years of age, with an average tenancy of 1-2 years. The owner of the Iowa-Illinois Manor has indicated that, according to his knowledge, no children have ever lived at the Iowa-Illinois Manor (personal communication with owner's legal counsel on June 14, 2006).

Site Characterization and Evaluation

A site characterization was initiated by MidAmerican Energy Company in 1999 and completed in 2004. Site characterization activities included surface and subsurface soil sampling and

analysis, groundwater sampling and analysis, indoor air sampling and analysis, and surface water and sediment sampling and analysis (3).

Composite surface soil samples were collected at 0 to 6 inches below ground surface at various locations around the Iowa-Illinois Manor building. Composite soil samples were also collected at 0 to 6 feet below ground surface. In addition, composite soil samples were also collected from a depth of 6 feet to the water table (10 to 12 feet below ground surface). The following table includes the average concentration of chemicals detected in each of the soil horizons.

Table 1 – Average Concentration of Chemicals in Soil

Chemical	Concentration Units	Surface Soil	Soil (0 to 6 ft)	Soil (6 ft to water table)
Cyanide	mg/kg	0.805	10.3	NA
Ammonium Nitrate	mg/kg	ND	195	NA
Nitrate Nitrogen	mg/kg	6.88	172	NA
Sulfate	mg/kg	50.9	204	NA
Sulfide	mg/kg	24	42.6	NA
Mercury	mg/kg	0.118	0.0858	NA
Aluminum	mg/kg	4730	5180	NA
Arsenic	mg/kg	8.47	7.92	NA
Barium	mg/kg	86	102	NA
Cadmium	mg/kg	1.5	1.41	NA
Chromium	mg/kg	10.8	6.73	NA
Copper	mg/kg	16.3	12.7	NA
Iron	mg/kg	9050	12200	NA
Lead	mg/kg	86.8	49.42	NA
Manganese	mg/kg	489	708	NA
Nickel	mg/kg	10.7	10.7	NA
Vanadium	mg/kg	12.6	15.2	NA
Zinc	mg/kg	140	69.4	NA
Thiocyanates	mg/kg	12.5	43	NA
Benzene	µg/kg	7.8	NA	NA
Ethylbenzene	µg/kg	5.7	NA	NA
Toluene	µg/kg	14.7	NA	NA
Xylenes, Total	µg/kg	9.15	NA	NA
Cresols, Total	mg/kg	ND	5.76	22.7
2,4-Dimethylphenol	mg/kg	ND	8.24	12.2
4-Methylphenol	mg/kg	ND	6.94	22.7
Acenaphthene	µg/kg	49.2	7090	1530
Acenaphthylene	µg/kg	ND	6290	99800
Anthracene	µg/kg	82.9	7250	39600
Benzo(a)anthracene	µg/kg	220	3890	30700
Benzo(a)pyrene	µg/kg	174	3260	22600
Benzo(b)fluoranthene	µg/kg	176	1880	9610
Benzo(ghi)perylene	µg/kg	197	2790	3430
Benzo(k)fluoranthene	µg/kg	109	566	7110
Chrysene	µg/kg	156	209	18300
Dibenzo(ah)anthracene	µg/kg	248	229	140
Fluoranthene	µg/kg	315	4270	55400
Fluorene	µg/kg	ND	7810	71400

Table 1 (Cont.) – Average Concentration of Chemicals in Soil

Chemical	Concentration Units	Surface Soil	Soil (0 to 6 ft)	Soil (6 ft to water table)
Indeno(1,2,3-dc)pyrene	µg/kg	124	2740	16700
Naphthalene	µg/kg	257	25800	110000
Phenanthrene	µg/kg	326	7240	63600
Pyrene	µg/kg	415	4040	43500
2-Methlynaphthalene	µg/kg	163	8570	70100

ND – means analyzed but not detected
NA – means not analyzed

The average concentration of chemicals in the soil has been calculated and will be used as an approximation of the concentration of chemicals that individuals would be exposed to living and working at the Iowa-Illinois Manor.

In addition to soil samples collected at various soil horizon intervals and locations, indoor air samples were collected within the building's crawlspace. The crawlspace samples were utilized since these samples of air would have less interference from chemicals within the apartments and would have minimal dilution from outside air. The air samples were analyzed for volatile and semi-volatile organic chemicals. The following table is the average detected concentration of chemicals that were detected in the air samples from within the crawlspace.

Table 2 – Average Concentration of Chemicals Detected in Crawlspace

Chemical	Concentration ($\mu g/m^3$)
Toluene	18.2
Naphthalene	0.16
2-Methlynaphthalene	0.13

A total of 55 groundwater monitoring wells have been installed in the vicinity of the site to determine the extent of the presence of contaminants. Although contaminants of potential concern were detected at elevated concentrations, the exposure to groundwater in the vicinity of the site is non-existent since there are no private or city water wells supplying water for human consumption within the area affected by the FMGP. Public water is supplied to all areas in the vicinity of the site through the City of Iowa City public water supply. The closest public water supply well is located approximately 3000 feet to the northwest of the FMGP, beyond the influence of the FMGP. In addition, the existing City Code and County Ordinance prohibit future well installation within the site vicinity. As a result, it is expected the contaminated groundwater from the FMGP site will not cause any negative health impacts to people living in Iowa City.

Contaminant of Potential Concern

The concentration of chemicals in the soil and air has been compared to comparison values. Comparison values are calculated concentrations of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in the most sensitive portions of the population. Comparison values are developed through human or animal health studies and have safety factors included in their calculation. Tables of the comparison values for soil and air are included in Appendix A. The concentration of chemicals in the soil or air above comparison values will be selected for further review in this health consultation. It is important to note that just because contaminants may be found above comparison values; it does not necessarily mean that adverse health effects will occur, but only that exposure to chemicals at these levels requires further evaluation.

The following contaminants in soil samples collected in the vicinity of the site are present at concentrations above comparison values – arsenic, vanadium, acenaphthene, anthracene, benzo(a)pyrene, fluoranthene, fluorine, naphthalene, pyrene, and 2-methylnaphthalene. Exposure to these chemicals of concern will be further discussed in this health consultation.

Contaminants detected in air samples within the crawlspace beneath the Iowa-Illinois Manor were all below comparison values. Since the contaminant levels are below comparison values, it is concluded that exposure to indoor air within the Iowa-Illinois Manor will not adversely affect the health of residents of the Iowa-Illinois Manor.

Discussion

Comparison to Background Levels of Contaminants in Soil

The levels of contaminants in the soil in the vicinity of the Iowa-Illinois Manor can be compared to background levels found in soils due to naturally occurring conditions. In 2004 the Iowa Geological Survey collected 532 samples of shallow soil throughout the state in an effort to determine background levels of contaminants. The mean value plus three standard deviations were calculated for several metals detected in the soil samples and are assumed to be representative of an average background or naturally occurring concentration. The background concentration for arsenic was determined to be 17 mg/kg, and the background concentration for vanadium was determined to be 133 mg/kg (4). Both of these background concentrations are above the concentration of these chemicals found at the site. As a result, it is assumed that exposure to arsenic or vanadium in the site soils will not pose any greater adverse health impact to the residents of the Iowa-Illinois Manor than living at any other site in Iowa. Exposure to arsenic and vanadium will not be discussed further in this health consultation.

Exposure to Site Contaminants

Exposure to site contaminants will most likely occur as a result of incidental ingestion of soil due to everyday exposure to surface soil by residents of the Iowa-Illinois Manor and incidental ingestion of soil by construction workers completing excavation activities during repair of site

utilities. Since no children are currently living or have ever lived at the Iowa-Illinois Manor, only exposure scenarios applicable to adults will be considered in this consultation.

The amount of soil ingested by an adult living at the Iowa-Illinois Manor can be estimated. The EPA has completed research on many exposure scenarios and has included this information in the Exposure Factors Handbook (5). Within this handbook is a section on incidental ingestion of soil. According to this handbook, the mean value for incidental ingestion of soil by an adult is 50 mg/day.

The amount of soil a construction worker may incidentally ingest is also included in this EPA handbook. Construction work is not specifically listed in the handbook. However, it is estimated that an adult participating in gardening and other soil intensive activities will incidentally ingest about 20 mg/hour of soil. Assuming a 10-hour work day, a construction worker may ingest up to 200 mg/day of soil.

Toxicological Evaluation

The following information has been prepared as a toxicological evaluation of 1) exposure of residents of the Iowa-Illinois Manor to surface soil, and 2) exposure of construction workers to soil during work on utilities in the vicinity of the Iowa-Illinois Manor. Using the assumption of the incidental ingestion rate discussed above for residents of the Iowa-Illinois Manor and the concentration of the chemicals of concern found in the site soils the following table can be prepared calculating an average rate of ingestion. The soil concentration and average rate of ingestion are only shown for the chemicals of concern that were above comparison values.

Table 3 – Soil Concentration and Average Rate of Ingestion

Chemical of Concern	Surface Soil Conc. mg/kg	Rate of Ingestion mg/kg/day	Deep Soil Conc. mg/kg	Rate of Ingestion mg/kg/day
Acenaphthene	-	-	7.09	2.03×10^{-5}
Anthracene	-	-	39.6	1.13×10^{-4}
Benzo(a)pyrene	1.74×10^{-1}	1.24×10^{-7}	22.6	6.46×10^{-5}
Fluoranthene	-	-	55.4	1.58×10^{-4}
Fluorene	-	-	71.4	2.04×10^{-4}
Naphthalene	-	-	110	3.14×10^{-4}
Pyrene	-	-	43.5	1.24×10^{-4}
2-Methlynaphthalene	-	-	70.1	2.00×10^{-4}

"-" means concentration of contaminant was not above comparison value, and rate of ingestion was not calculated

An example of the calculation of the rate of ingestion for exposure to deep soil shown in the table above for acenaphthene is shown below:

$$\frac{200 \text{ mg soil}}{\text{day}} \times \frac{\text{kg soil}}{10^6 \text{ mg soil}} \times \frac{7.09 \text{ mg Acenaphthene}}{\text{kg soil}} \times \frac{1}{70 \text{ kg}}{}^{a} = 2.03 \times 10^{-5} \text{ mg/kg/day}$$

[a] 70 kg body weight is assumed to be an average body weight for an adult.

This toxicological evaluation will compare the estimated daily ingestion amounts to the following health comparison values: Agency for Toxic Substances and Disease Registry (ATSDR) Oral Minimum Risk Levels (MRLs), the U.S. Environmental Protection Agency (EPA) Chronic Reference Dose (RfD), and the level of exposure that translates to a one-in-ten-thousand (10^{-4}) increased risk of cancer utilizing an EPA oral slope factor.

Minimum Risk Levels

Minimum Risk Levels (MRLs) are established by the Agency for Toxic Substances and Disease Registry (ATSDR). The MRL is defined as, "an estimate of daily exposure to a human being to a chemical that is likely to be without an appreciable risk of deleterious effects (non-carcinogenic) over a specified period of time (6)." MRLs are based upon human and animal studies, include several safety factors, and are reported for acute exposure ($\leq$ 14 days), intermediate exposure (15 – 364 days), and chronic exposure ($\geq$ 365 days).

Chronic Oral Reference Dose

The EPA chronic oral RfD is defined as "an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime (7)." The chronic oral RfDs are based upon human and animal studies, include safety factors, and are reported for lifetime exposures.

Cancer Risk

The EPA has developed oral slope factors for evaluating increased risk of cancer from a lifetime of exposure to certain chemicals. The slope factor is defined as "an upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, usually expressed in units of proportion (of a population) affected per mg/kg/day (8)." The interpretation of slope factor would be as follows: if slope factor = 1.5×10^{-2} $(mg/kg/day)^{-1}$, 1.5 excess cancer incidences are expected to develop per 100 people if exposed daily for a lifetime to 1 mg of the chemical per kg of body weight.

This slope factor can be converted to a daily ingestion rate that would equate to an excess cancer incidence risk of one-in-ten-thousand as shown below:

Ingestion Rate = $1 \times 10^{-4} / 1.5 \times 10^{-2}$ $(mg/kg/day)^{-1}$ (slope factor) = 6.7×10^{-3} mg/kg/day

Evaluation of Oral Exposure Levels

The table on the following page includes all published health effect levels for the selected chemicals of concern. All health effect levels are expressed as mg/kg/day.

Table 4 – Published Health Effect Levels of Chemicals of Concern

Chemical of Concern	Acute Oral MRL	Inter. Oral MRL	Chronic Oral MRL	Chronic RfD	Increased Cancer
Acenaphthene	-	6×10^{-1}	-	-	-
Anthracene	-	10	-	3×10^{-1}	-
Benzo(a)pyrene	-	-	-	-	1.37×10^{-5}
Fluoranthene	-	4×10^{-1}	-	4×10^{-2}	-
Fluorene	-	0.4	-	4×10^{-2}	-
Naphthalene	6×10^{-1}	4×10^{-1}	-	2×10^{-2}	-
Pyrene	-	-		3×10^{-2}	-
2-Methlynaphthalene	-	-	4×10^{-2}	4×10^{-3}	-

"-" means that particular health effect level is not currently established or available.

The level of the estimated amount ingested daily for all contaminants of concern is below all health effect levels with the exception of the rate of ingestion of benzo(a)pyrene for a construction worker exposed to soil during completion of an excavation project at the site. The estimated incidental ingestion of benzo(a)pyrene of a construction worker is estimated to be a level of exposure that would equate to a greater than one-in-ten-thousand risk of developing cancer. Although it may be theoretically possible to develop cancer from limited exposure to carcinogenic chemicals, the development of cancer normally occurs from long-term or chronic exposure to carcinogenic chemicals. An on-site construction worker will most likely be exposed to contaminated soil for only a few days or for several weeks. Given this limited exposure, it is felt that exposure to elevated levels of benzo(a)pyrene in the site soil would not cause a risk of developing cancer or other adverse health effects.

The conclusion of the toxicological evaluation is that adult residents of the Iowa-Illinois Manor exposed to surface soil on a daily basis and construction workers involved in soil intensive site work will not experience adverse health effects from exposure to site contaminants.

Children's Health Concerns

Children have unique vulnerabilities to some environmental chemicals, and IDPH's Hazardous Waste Site Health Assessment Program evaluated the potential impact of the presence of the chemical of concern detected in the soil samples in the vicinity of the Iowa-Illinois Manor on children's health. Since it is believed that no children have lived at the Iowa-Illinois Manor in the past and no children are expected to live in the Iowa-Illinois Manor in the future, exposure of site soils to children will be very small or negligible. It is concluded that children's health would not be negatively impacted by the presence of the various chemicals of concern detected within the site soil samples.

Community Health Concerns

The IDPH attended a public meeting in Iowa City on August 10, 2006. This meeting was convened by the EPA to receive public input on the proposed remedial strategy for the site. Concerned citizens from the community were given the opportunity to comment on the proposed

remedial strategy. EPA indicated that they would be responding to all comments received at this public meeting

One of the concerns discussed at the meeting was exposure to people not living in the Iowa-Illinois Manor, but living or working within buildings in the vicinity of the site. There is a possibility that children may be living within buildings in the vicinity of the site and that they could be exposed to surface soils. Also, individuals in nearby buildings do not have the benefit of a passive venting system installed beneath the building that they are living or working within – as in the case of the Iowa-Illinois Manor. This creates a potential for exposure to chemical vapors from contamination beneath the building in which they live or work. During the meeting on August 10, 2006, the IDPH indicated that this health consultation would address the potential health risks the site poses to nearby residents or occupants of nearby buildings.

Exposure to Off-Site Surface Soil

Soil and groundwater samples have been collected in areas outside of the Iowa-Illinois Manor property in areas where soil and groundwater contamination has migrated, mainly to the southwest of the Iowa-Illinois Manor property. Several surface soil samples were collected in areas immediately to the west of the Iowa-Illinois Manor property. The average concentrations of chemicals within the surface soil samples were compared to comparison values. The following table includes the average concentration of chemicals in off-site surface soil above comparison values.

Table 5 – Average Concentration of Chemicals in Off-Site Surface Soil

Chemical	Concentration
Arsenic	12.8 mg/kg
Vanadium	13 mg/kg
Benzo(a)pyrene	179 µg/kg

As previously discussed in this health consultation, the background concentrations for arsenic and vanadium are 17 mg/kg and 133 mg/kg, respectively. These background concentrations are above the average off-site concentration of these chemicals; therefore, it can be concluded that exposure to arsenic or vanadium in off-site soils will not pose any greater adverse health impact to people than living at any other site in Iowa.

The average concentration of benzo(a)pyrene in the off-site soils immediately to the west of the Iowa-Illinois Manor are just slightly lower than the average value of on-site concentrations of benzo(a)pyrene. We can determine the potential risk to children from exposure to these off-site soils by knowing an average soil ingestion rate for a child. The Exposure Factors Handbook (4) indicates that children, on average, incidentally ingest 100 mg per day of soil. Using an average body weight of a young child of 16 kg, the rate of ingestion of benzo(a)pyrene can be calculated as shown on the following page.

$$\frac{100 \text{ mg soil}}{\text{day}} \times \frac{\text{kg soil}}{10^6 \text{ mg soil}} \times \frac{174 \text{ µg benzo(a)pyrene}}{\text{kg soil}} \times \frac{1}{16 \text{ kg}} = 1.1 \times 10^{-4} \text{ µg/kg/day}$$

1.1×10^{-4} µg/kg/day = 1.1×10^{-7} mg/kg/day

This rate of ingestion can be compared to the health effect level for and increased incident of cancer from exposure to benzo(a)pyrene of 1.37×10^{-5} mg/kg/day, as shown in the table on page 6 of this consultation. The rate of ingestion is lower than the health effect level for increased cancer (the only published health effect level for benzo(a)pyrene); therefore, it is concluded that exposure to off-site surface soils at the levels detected in the site characterization will not cause adverse health effects.

Exposure to Indoor Vapors from Off-Site Groundwater Contamination

The water table has been sampled in a few groundwater monitoring wells in the vicinity of the site. The concentration of several volatile organic chemicals has been measured in these wells. Although direct exposure to groundwater in the vicinity of the site has been eliminated by restricting the installation of any private wells in the area, there is a potential for vapor intrusion of volatile chemicals found in the groundwater into basements or into homes or multi-family residential units through cracks in the foundation. A vapor transport model was developed by P. Johnson and R. Ettinger in 1991 and subsequently modified by EPA in 1998, 2001, and 2002 (J&E Model) (9). The J&E Model enables the potential concentration of volatile chemicals inside a home or multi-family residential unit to be estimated from known concentrations of volatile chemicals found in soil and groundwater. This model has been determined to be in qualitative agreement with case studies. Spreadsheets have been developed that calculate an estimated indoor air concentration of volatile chemicals from know concentrations of chemicals in soil and groundwater.

The model spreadsheets can be downloaded from the following web address:

http://www.epa.gov/oswer/riskassessment/airmodel/zip/excel.zip

The highest levels of benzene and ethylbenzene found at the water table during the site characterization were input into the model spreadsheets (97.2 µg/L benzene and 68.9 µg/L ethylbenzene). The site characterization indicated that site soils from the surface to groundwater consisted of mainly loam. Default values for loam soil were input into the J&E Model. It was also assumed that nearby homes were constructed with basements and that the water table was located 10 feet below ground surface.

Copies of the input and output of the spreadsheets are included in Appendix B. The J&E Model predicted the following indoor concentrations of benzene and ethylbenzene:

Benzene –1.70 µg/m^3 Ethylbenzene – 1.69 µg/m^3

(µg/m^3 – microgram per cubic meter)

An evaluation can be made by comparing the predicted indoor air concentrations of benzene and ethylbenzene to the ATSDR Inhalation MRLs, the EPA Reference Concentration (RfC), and the level of exposure that translates to a one-in-ten-thousand (10^{-4}) increased risk of cancer utilizing the EPA air unit risk. The following table includes these published health effect levels for benzene and ethylbenzene. All health effect levels are expressed as $\mu g/m^3$.

Table 6 – Published Health Effect Levels of Benzene and Ethylbenzene

Chemical	Acute Inhalation MRL	Intermediate Inhalation MRL	Chronic Inhalation MRL	Chronic RfC	Increased Cancer
Benzene	30	20	10	30	10
Ethylbenzene	-	4,000	-	1,000	-

"-" means that particular health effect level is not currently established or available.

The predicted air concentrations of benzene and ethylbenzene in a home or multi-family residential unit at the off-site locations (1.70 and 1.69 $\mu g/m^3$) are at least one order of magnitude lower than published health effect levels. It can be concluded that exposure to benzene and ethylbenzene vapors migrating into a home or multi-family residential unit at off-site locations from groundwater contamination emanating from the Iowa City FMGP site will not cause any adverse health effects, even during a lifetime of exposure.

Conclusions

From the soil sampling and analytical data collected in the vicinity of the site from 1999 to 2004, it is concluded that:

- The Iowa City FMGP is categorized as posing "No Apparent Public Health Hazard".
- Residents of the Iowa-Illinois Manor; and residents or workers in nearby homes, apartments or businesses; would not be expected to experience adverse health effects from exposure to air within the Iowa-Illinois Manor, or other apartments, homes, or businesses.
- Residents of the Iowa-Illinois Manor exposed to surface soil on a daily basis and construction workers completing soil intensive work would not be expected to experience any adverse health effects from exposure to site soils.
- Nearby residents or individuals working within nearby buildings would not be expected to experience adverse health effects from exposure to any contaminants in the soils or indoor air that may be exist due to the presence of the Iowa City FMGP.
- Since children will not be routinely exposed to soils at the site, the site will not pose any adverse health effects for children. Even if children were routinely exposed to soil and air at the site, adverse health effects would not be anticipated.

Recommendations

- Although construction workers involved in repair or installation of utilities will be exposed to contaminated soil for only several days or weeks at a time, these individuals would be exposed to the highest concentration of contaminants. Although it is not expected that this acute exposure to soil will cause adverse health effect, it is recommended that construction workers utilize protective clothing (such as Tyvek® protective overalls) while working on-site, and that these construction workers properly engage in decontamination procedures prior to leaving the site as part of prudent public health practice.

- If construction activities are conducted on-site, care should be taken to utilize caution tape and other measures to control access into construction areas.

- Consideration should be given to air monitoring during site construction activities to provide assurance for on-site construction workers and residents of the Iowa-Illinois Manor of no health hazards.

- A revised health consultation should be completed if the use of the site changes from an apartment complex utilized by adult students living on-site on average from one to two years.

Public Health Action Plan

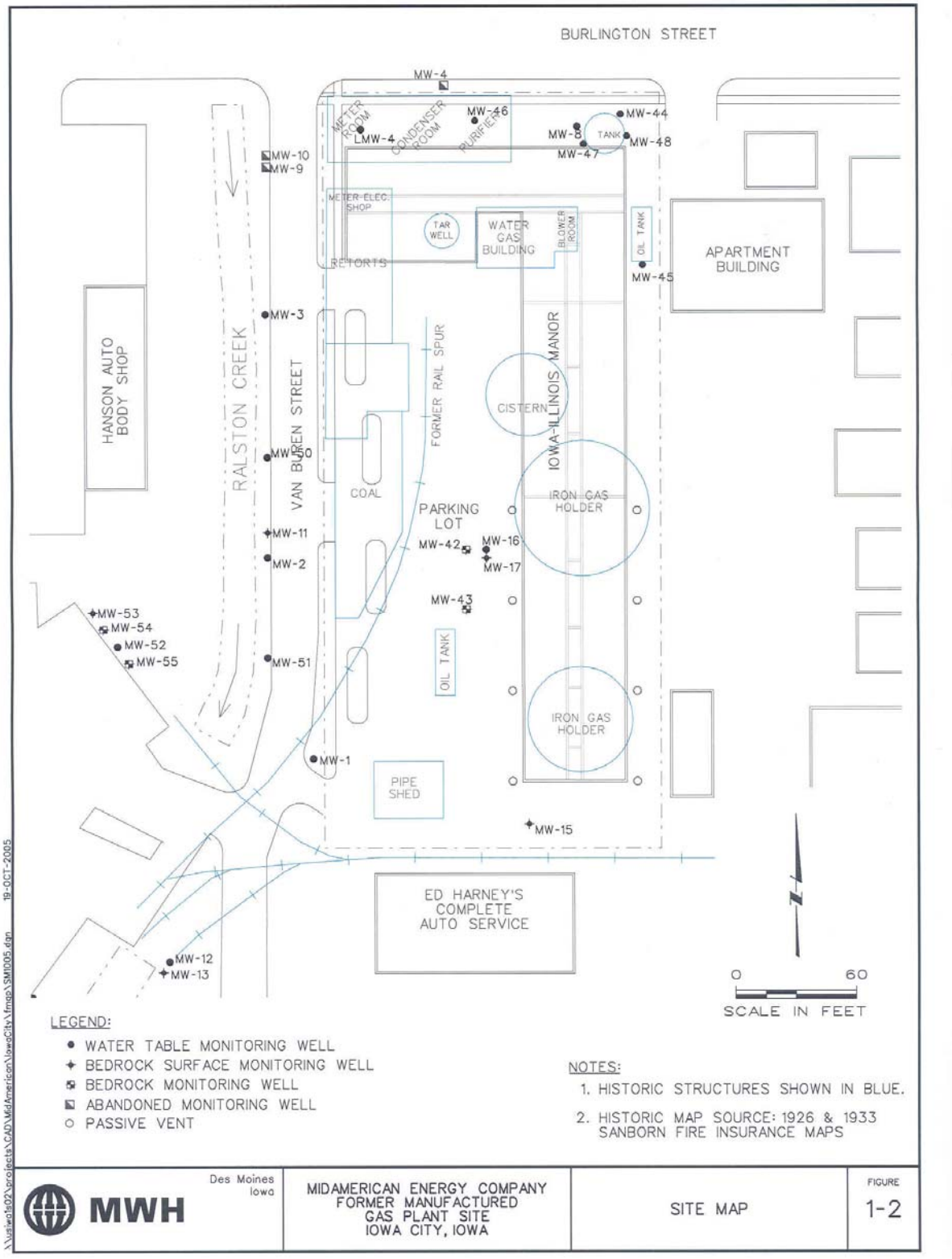
- IDPH will provide assistance with community health education as needed and requested.

- IDPH will review any additional sampling data and update health recommendations as necessary.

- IDPH will complete a revised health consultation if the proposed use of the site changes from that of an apartment complex.

- IDPH will continue to address and evaluate community concerns.

Figure 1 – Iowa-Illinois Manor and FMGP Structures



References

1. Site Characterization Report for the Iowa City Former Manufactured Gas Plant Site. Prepared for Mid-American Energy Company, by Montgomery Watson Harza, Des Moines Iowa. Project No. 1911345.051801. Nov 2001.

2. Data provided by US Census Bureau: http://www.census.gov

3. Feasibility Study Report for the Iowa City, Iowa Former Manufactured Gas Plant Site. Prepared MidAmerican Energy Company, by MWH, Des Moines, Iowa. Project No. 1913418.1803. March 2006.

4. On-Line Cumulative Risk Calculator, Supporting Information. IDNR Web Link: http://programs.iowadnr.com/riskcalc/pages/calculator.aspx

5. Exposure Factors Handbook: US Environmental Protection Agency; August 1997. EPA Web Link: http://www.epa.gov/ncea/pdfs/efh/front.pdf

6. Agency for Toxic Substances and Disease Registry. ATSDR Web Site Link: http://www.atsdr.cdc.gov/glossary.html

7. United States Environmental Protection Agency, Integrated Risk Information System. EPA Web Site Link: http://www.epa.gov/iris/gloss8.htm#r

8. United States Environmental Protection Agency, Integrated Risk Information System. EPA Web Site Link: http://www.epa.gov/iris/gloss8.htm#s

9. Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings. EPA Web Link: http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm

Preparers of the Report

Stuart Schmitz, P.E., Sara Colboth, and Charles Barton, Ph.D., DABT
Hazardous Waste Site Health Assessment Program
Iowa Department of Public Health

CERTIFICATION

The Iowa Department of Public Health, Hazardous Waste Site Health Assessment Program, has prepared this health consultation evaluating contamination in soil, groundwater, and indoor air in the vicinity of a 54-unit apartment building located in Iowa City, Iowa due to the Iowa City former manufactured gas plant under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). The document is in accordance with approved methodology and procedures existing when the health consultation was being prepared. Editorial review was completed by the cooperative agreement partner.

Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with its findings.

Chief, CAT, CAPEB, DHAC, ATSDR

Appendix A – Comparison Values

Soil Comparison Values

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
Acenaphthene	000083-32-9					3		30,000	400,000	3,000	40,000		1000	
Acephate	030560-19-1			80	C	3				200	3,000			
Acetaldehyde	000075-07-0				B2	2	2B							EPA tox review (external review draft 9/00) proposes the following changes: RfD: 0.04 mg/kg/day; RfC: 5.0 ug/m3; IUR: 0.000013 (ug/m3)-1
Acetamide	000060-35-5					3	2B							
Acetone	000067-64-1				IN	3		100,000	1,000,000	50,000	600,000		4,000	
Acetonitrile	000075-05-8					3								As of March 99, EPA has withdrawn the oral RfD
Acetophenone	000098-86-2				D	3				5,000	70,000			
2-Acetylaminofluorene	000053-96-3					2								
Acrolein	000107-02-8	30	400		IN	3	3			30	400			
Acrylamide	000079-06-1			0.2	B2	2	2A			10	100			
Acrylic Acid	000079-10-7					3	3			30,000	400,000			
Acrylonitrile	000107-13-1	2000	30,000	1	B1	2	2B	500	7,000			200	20	
Alachlor	015972-60-8				B2	3				500	7,000			
Aldicarb	000116-06-3				D	3	3			50	700			
Aldrin	000309-00-2	2	20	0.04	B2	3	3			2	20	4		
Allyl Alcohol	000107-18-6					3				300	4,000			
Alpha Radiation	012587-46-1					3	1							
Aluminum	007429-90-5					3		100,000	1,000,000				4,000	
Aluminum Phosphide	020859-73-8					3				20	300			
Ametryn	000834-12-8				D					500	6,000			
4-Amino-3,5,6-trichloropicolinic Acid	001918-02-1				D	3	3			4,000	50,000			
4-Aminobiphenyl	000092-67-1					1	1							
Aminotriazole	000061-82-5					2	3							
Ammonia	007664-41-7				D	3								
Aniline	000062-53-3			100	B2	3	3							
Anthracene	000120-12-7				D	3	3	500,000	1,000,000	20,000	200,000		20,000	
Antimony	007440-36-0				D	3				20	300			
Antimony Trioxide	001309-64-4					3	2B							
Aramite	000140-57-8			30	B2	3	2B							
Aroclor 1016	012674-11-2					3				4	50			
Aroclor 1221	011104-28-2					3								
Aroclor 1232	011141-16-5					3								
Aroclor 1240	071328-89-7					3								
Aroclor 1242	053469-21-9					3								
Aroclor 1248	012672-29-6					3								
Aroclor 1254	011097-69-1	1	10			2		2	20	1	10		0.06	
Aroclor 1260	011096-82-5					2								

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		Comments/Notes
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
		Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	
Aroclor 1262	037324-23-5					3								
Aroclor 1268	011100-14-4					3								
Aroclor 5432	063496-31-1					3								
Arsenic	007440-38-2	20	200	0.5	A	1	1			20	200	10		The acute oral MRL is considered a provisional MRL because it is based on a serious LOAEL.
Arsine	007784-42-1					3								
Asbestos	001332-21-4				A	1	1							
Atrazine	001912-24-9					3	3	200	2,000	2,000	20,000	20	6	
Automotive Gasoline	008006-61-9					3	2B							
Azobenzene	000103-33-3			6	B2	3	3							
Barium	007440-39-3				D	3				4,000	50,000			
Benomyl	017804-35-2					3				3,000	40,000			
Benfluralin	001861-40-1					3				20,000	200,000			
Benzaldehyde	000100-52-7					3				5,000	70,000			
Benzene	000071-43-2			10	A	1	1			200	3,000			Oral slope factor ranges from 0.015 - 0.055 $(mg/kg/day)^{-1}$.
Benzidine	000092-87-5			0.003	A	1	1			200	2,000			
Benzo(A)Anthracene	000056-55-3				B2	2	2A							
Benzo(A)Pyrene	000050-32-8			0.1	B2	2	2A							
Benzo(B)Fluoranthene	000205-99-2				B2	2	2B							
Benzo(Ghi)Perylene	000191-24-2				D	3	3							
Benzo(J)Fluoranthene	000205-82-3					2	2B							
Benzo(K)Fluoranthene	000207-08-9				B2	2	2B							
2,3-Benzofuran	000271-89-6					3	2B							
Benzoic Acid	000065-85-0				D	3				200,000	1,000,000			
Benzyl Chloride	000100-44-7			4	B2	3	2A							
Beryllium	007440-41-7	100	1,000		B1	1	1			100	1,000			EPA cancer class based on inhalation exposures. No cancer class has been assigned for oral exposure.
Beta Radiation	012587-47-2					3								
Beta-Naphthylamine	000091-59-8					1	1							
Biphenyl	000092-52-4				D	3				3,000	40,000			
Bis(2-Chloroethyl) Ether	000111-44-4			0.6	B2	3	3							
Bis(2-Chloroisopropyl) Ether	039638-32-9				D	3				2,000	30,000			
Bis(2-Ethylhexyl)Adipate	000103-23-1			600	C	3	3			30,000	400,000			
Bis(Chloromethyl) Ether	000542-88-1			0.003	A	1	1							
Boron	007440-42-8				IN	3		500	7,000	10,000	100,000		20	
Bromacil	000314-40-9				C	3								
Bromate	015541-45-4			1	B2	3				200	3,000			
Bromic Acid, Potassium Salt	007758-01-2					3	2B							
Bromochloromethane	000074-97-5				D	3								

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
Bromodichloromethane	000075-27-4	1,000	10,000	10	B2	2	2B			1,000	10,000	80		
Bromoform	000075-25-2	10,000	100,000	90	B2	3	3	10,000	100,000	1,000	10,000	1,000	400	
Bromomethane	000074-83-9				D	3	3	200	2,000	70	1,000		6	
1,3-Butadiene	000106-99-0				CA	1	2A							EPA's cancer class is "carcinogenic to humans by inhalation" under revised (1999) guidelines.
1-Butanol	000071-36-3				D	3				5,000	70,000			
2-Butanone	000078-93-3				IN	3				30,000	400,000			
2-Butoxyethanol	000111-76-2				C	3	3	4,000	50,000	30,000	400,000	800	100	
2-Butoxyethanol Acetate	000112-07-2				C	3								
Butyl Benzyl Phthalate	000085-68-7				C	3	3			10,000	100,000			
Butylate	002008-41-5				D	3				3,000	40,000			
Cadmium	007440-43-9	10	100		B1	1	1			50	700			Oral RfD shows value for water-- value for food is 0.001 mg/kg-day
Calcium Cyanide	000592-01-8					3				2,000	30,000			
Caprolactam	000105-60-2					3	4			30,000	400,000			
Captan	000133-06-2					3	3			7,000	90,000			
Carbaryl	000063-25-2				D	3	3			5,000	70,000			
Carbazole	000086-74-8					3	3							
Carbofuran	001563-66-2				E	3				300	4,000			
Carbon Disulfide	000075-15-0					3				5,000	70,000	20		
Carbon Tetrachloride	000056-23-5			5	B2	2	2B	1,000	10,000	40	500	100	40	
Carbosulfan	055285-14-8									500	7,000			
Carboxin	005234-68-4				D	3				5,000	70,000			
Cellosolve	000110-80-5					3								
Chloral Hydrate	000302-17-0				C	3	3			5,000	70,000			
Chloramben	000133-90-4				D	3				800	10,000			
Chlordane	000057-74-9	30	400	2	B2	3	2B	30	400	30	400	2	1	
Chlordecone	000143-50-0	30	400			2	2B	30	400			20	1	
Chlorendic Acid	000115-28-6					2	2B							
Chlorfenvinphos	000470-90-6	40	500			3		100	1000			4	4	
Chlorine	007782-50-5				D	3				5,000	70,000			
Chlorine Dioxide	010049-04-4				D	3				2,000	20,000			
Chlorite, Sodium	007758-19-2				D	3	3	5,000	70,000	2,000	20,000		200	
Chloroacetic Acid	000079-11-8					3								
2-Chloroacetophenone	000532-27-4					3								
4-Chloroaniline	000106-47-8					3	2B			200	3,000			
Chlorobenzene	000108-90-7				D	3		20,000	300,000	1,000	10,000		800	
Chlorobenzilate	000510-15-6					3	3			1,000	10,000			
Chlorodibromomethane	000124-48-1	5,000	60,000	8	C	3	3			1,000	10,000	200		Previously listed as dibromochloromethane
Chlorodifluoromethane	000075-45-6					3	3							
Chloroethane	000075-00-3					3	3							

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		Comments/Notes
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
		Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	
Chloroform	000067-66-3	500	7,000		LI	2	2B	5,000	70,000	500	7,000	600	200	
Chloromethane	000074-87-3				D	3	3							
2-Chloronaphthalene	000091-58-7					3				4,000	60,000			
2-Chlorophenol	000095-57-8				D	3				300	4,000			
4-Chlorophenol	000106-48-9					3						20		
3-Chloropropene	000107-05-1				C	3	3							
Chlorothalonil	001897-45-6				B2	3	2B			800	10,000			
2-Chlorotoluene	000095-49-8				D	3				1,000	10,000			
p-Chlorotoluene	000106-43-4				D	3								
Chlorpyrifos	002921-88-2	50	700		D	3		200	2,000	200	2,000	6	6	
Chromium	007440-47-3					3	3							
Chromium (VI), aerosol mists	007738-94-5					3								Previously listed as "Chromium Trioxide"
Chromium (VI), particulates	018540-29-9				A	1	1			200	2,000			Previously listed as "Chromium, hexavalent". EPA cancer class: A for inhalation exposure; D for oral exposure.
Chromium(VI) Oxide	001333-82-0					1								
Chromium, Trivalent	016065-83-1				D	3	3			80,000	1,000,000			
Chrysene	000218-01-9				B2	3	3							
Chlorpropham	000101-21-3					3	3			10,000	100,000			
Coal Tars	008007-45-2				A	1	1							
Cobalt	007440-48-4					3	2B	500	7,000				20	
Copper	007440-50-8				D	3		500	7,000			20	20	
Copper Cyanide	000544-92-3					3				300	4,000			
Coumarin	000091-64-5						3							
Coal Tar Creosote	008001-58-9				B1	1	2A							
Cresol, meta-	000108-39-4				C	3				3,000	40,000	100		
Cresol, ortho-	000095-48-7				C	3				3,000	40,000	100		
Cresol, para-	000106-44-5				C	3						100		
Cumene	000098-82-8				D	3				5,000	70,000			
Cyanazine	021725-46-2					3								
Cyanide	000057-12-5				D	3				1,000	10,000			
Cyanide, Sodium	000143-33-9					3		3,000	40,000	2,000	30,000		100	
Cyanogen	000460-19-5					3				2,000	30,000			
Cyanogen Chloride	000506-77-4				D	3				3,000	40,000			
Cyclohexane	000110-82-7				IN	3								
Cyclohexanone	000108-94-1					3	3			300,000	1,000,000			
Cyclotetramethylene Tetranitramine (HMX)	002691-41-0				D	3		3,000	40,000	3,000	40,000	200	100	
Cyclotrimethylenetrinitramine (RDX)	000121-82-4			6	C	3		2,000	20,000	200	2,000	100	60	
Cyfluthrin	068359-37-5					3				1,000	20,000			a.k.a. Baythroid
Cyhalothrin	068085-85-8					3		500	7,000	300	4,000	20	20	

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
Cypermethrin	052315-07-8					3				500	7,000	40		
2,4-D Acid	000094-75-7				D	3				500	7,000			
Dacthal	001861-32-1				D	3				500	7,000			
DDD, p, p'-	000072-54-8			3	B2	3	2B							
DDE, p,p'-	000072-55-9			2	B2	3	2B							
DDT, p,p'-	000050-29-3			2	B2	2	2B	30	400	30	400	1	1	
Demeton	008065-48-3									2	30			
Di-n-Butyl Phthalate	000084-74-2				D	3				5,000	70,000	1,000		
Di-n-Octyl Phthalate	000117-84-0					3		20,000	300,000			6,000	800	
Di(2-Ethylhexyl)Phthalate	000117-81-7	3,000	40,000	50	B2	2	3	5,000	70,000	1,000	10,000		200	
2,4-Diaminotoluene	000095-80-7					2	2B							
Diazinon	000333-41-5				E	3		10	100				0.4	
Dibenzo(A,E)Pyrene	000192-65-4					2	2B							
Dibenzo(A,H)Anthracene	000053-70-3				B2	2	2A							
Dibenzo(A,L)Pyrene	000191-30-0					2	2B							
1,2-Dibromo-3-Chloropropane	000096-12-8				B2	2	2B	100	1000				4	
1,2-Dibromoethane	000106-93-4			0.4	LI	2	2A			500	6,000			
Dibutyl Sebacate	000109-43-3					3								
Dicamba	001918-00-9				D	3				2,000	20,000			
Dichloroacetic Acid	000079-43-6			10	LI	3	2B			200	3,000			
1,2-Dichlorobenzene	000095-50-1	20,000	300,000		D	3	3	20,000	300,000	5,000	60,000	2,000	800	2/2/04: external review draft of IRIS: proposed RfD = 0.14 mg/kg/day cancer class = IN
1,4-Dichlorobenzene	000106-46-7				C	2	2B	4,000	50,000				100	2/2/04 external review draft of IRIS: proposed RfD = 0.0024 mg/kg/day; CSF = 0.013 (mg/kg/day) $^{-1}$; IUR = na; cancer class = LI
1,3-Dichlorobenzene	000541-73-1				D	3	3	2,000	20,000			800	60	2/2/04 external review draft of IRIS: proposed RfD = 0.001 mg/kg/day; cancer class = IN
3,3'-Dichlorobenzidine	000091-94-1			2	B2	2	2B							
Dichlorodifluoromethane	000075-71-8				D	3				10,000	100,000			
1,1-Dichloroethane	000075-34-3				C	3								
1,2-Dichloroethane	000107-06-2			8	B2	2	2B	10,000	100,000				400	
1,1-Dichloroethene	000075-35-4	500	6,000		SU	3				3,000	40,000			
1,2-Dichloroethene, cis-	000156-59-2				D	3		20,000	200,000			2,000	600	
1,2-Dichloroethene, trans-	000156-60-5				D	3		10,000	100,000	1,000	10,000		400	
2,4-Dichlorophenol	000120-83-2				E	3		200	2,000	200	2,000		6	
4-(2,4-Dichlorophenoxy)butyric acid	000094-82-6					3				400	6,000			
1,2-Dichloropropane	000078-87-5	5,000	60,000			3	3	4,000	50,000			200	100	
2,3-Dichloropropanol	000616-23-9					3				200	2,000			
1,3-Dichloropropene	000542-75-6			7	B2	2	2B			2,000	20,000			

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
2,2-Dichloropropionic acid	000075-99-0				D	3				2,000	20,000			
Dichlorvos	000062-73-7	30	400	2	B2	3	2B	200	2,000	30	400	8	6	
Dicofol	000115-32-2					3	3							
Dicrotophos	000141-66-2					3				5	70			
Dieldrin	000060-57-1	3	40	0.04	B2	3	3	5	70	3	40		0.2	
Diethanolamine	000111-42-2					3	3							
Diethyl Phthalate	000084-66-2				D	3		300,000	1,000,000	40,000	600,000	10,000	10,000	
Diflubenzuron	035367-38-5					3				1,000	10,000			
Diisopropyl Methylphosphonate	001445-75-6	30,000	400,000		D	3		40,000	600,000	4,000	60,000		2,000	
Dimethoate	000060-51-5					3				10	100			
3,3'-Dimethoxybenzidine	000119-90-4					2	2B							
Dimethyl Carbamyl Chloride	000079-44-7					2	2A							
Dimethyl Formamide	000068-12-2					3	3							
Dimethyl Methylphosphonate	000756-79-6				C	3								
1,4-Dimethyl Phthalate	000120-61-6					3				5,000	70,000			
Dimethyl Phthalate	000131-11-3				D	3								
Dimethyl Sulfate	000077-78-1				B2	2	2A							
Dimethylaniline	000121-69-7					3	3			100	1,000			
1,1-Dimethylhydrazine	000057-14-7					2	2B							
1,2-Dimethylhydrazine	000540-73-8					3	2A	40	600				2	
2,4-Dimethylphenol	000105-67-9					3				1,000	10,000			
2,6-Dimethylphenol	000576-26-1									30	400			
4,6-Dinitro-O-Cresol	000534-52-1					3		200	3,000			8	8	
1,3-Dinitrobenzene	000099-65-0				D	3		30	400	5	70	20	1	
2,4-Dinitrophenol	000051-28-5					3				100	1,000	20		
2,4-Dinitrotoluene	000121-14-2	100	1,000		B2	3	2B			100	1,000	100		
2,6-Dinitrotoluene	000606-20-2				B2	3	2B	200	3,000				8	
Dinitrotoluene	025321-14-6			1	B2	3								
Dinoseb	000088-85-7				D	3				50	700			
1,4-Dioxane	000123-91-1	5,000	70,000	60	B2	2	2B	30,000	400,000			8,000	1,000	
Diphenamid	000957-51-7				D	3				2,000	20,000			
Diphenylamine	000122-39-4					3				1,000	20,000			
1,2-Diphenylhydrazine	000122-66-7			0.9	B2	2								
Diphenylmethane Diisocyanate	000101-68-8				D		3							
Diquat	002764-72-9													
Disodium Arsenate	007778-43-0					1	1							
Disulfoton	000298-04-4	3	40		E	3		5	60	2	30	2	0.2	
1,4-Dithiane	000505-29-3				D	3				500	7,000			
Diuron	000330-54-1				D	3				100	1,000			
Endosulfan	000115-29-7	100	1,000			3		300	4,000	300	4,000		10	
Endothall	000145-73-3				D					1,000	10,000			
Endrin	000072-20-8	20	200		D	3	3	100	1,000	20	200		4	

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
Epichlorohydrin	000106-89-8			70	B2	2	2A							Oral RfD withdrawn by EPA (1992) & is under review.
EPN	002104-64-5					3				0.5	7			
EPTC	000759-94-4					3				1,000	20,000			
Ethephon	016672-87-0					3				300	4,000			
Ethion	000563-12-2	20	300			3		100	1,000	30	400	4	4	
Ethyl Acetate	000141-78-6					3				50,000	600,000			
Ethyl Acrylate	000140-88-5					3	2B							
Ethylbenzene	000100-41-4				D	3	2B			5,000	70,000			
Ethyl Ether	000060-29-7					3				10,000	100,000			
Ethylene Glycol	000107-21-1	100,000	1,000,000		D	3				100,000	1,000,000	4,000		
Ethylene Oxide	000075-21-8					1	1							
Fenvalerate	051630-58-1					3	3			1,000	20,000			
Fluoranthene	000206-44-0				D	3	3	20,000	300,000	2,000	30,000		800	
Fluorene	000086-73-7				D	3	3	20,000	300,000	2,000	30,000		800	
Fluoride, Sodium	007681-49-4	3,000	40,000			3								
Fluorine	007782-41-4					3				3,000	40,000			
Folpet	000133-07-3			200	B2	3				5,000	70,000			
Fonophos	000944-22-9				D	3				100	1,000			
Formaldehyde	000050-00-0	10,000	100,000		B1	2	1	20,000	200,000	10,000	100,000		600	
Fuel Oil No. 2	068476-30-2					3								
Furan	000110-00-9					2	2B			50	700			
Furfural	000098-01-1					3	3			200	2,000			
Gamma Radiation	HZ1800-03-T					3	1							
Glycidylaldehyde	000765-34-4				B2	3	2B			20	300			
Glyphosate	001071-83-6				D	3				5,000	70,000			
Heptachlor	000076-44-8			0.2	B2	3	2B			30	400			
Heptachlor Epoxide	001024-57-3			0.08	B2	3				1	9			
Hexabromobenzene	000087-82-1					3				100	1,000			
Hexachlorobenzene	000118-74-1	3	40	0.4	B2	2	2B	5	70	40	600	20	0.2	
Hexachlorobutadiene	000087-68-3			9	C	3	3	10	100				0.4	
Hexachlorocyclohexane, Technical Grade	000608-73-1			0.4	B2	2	2B							
Hexachlorocyclohexane, Alpha-	000319-84-6	400	6,000	0.1	B2	2	2B							
Hexachlorocyclohexane, Beta-	000319-85-7			0.4	C	2	2B	30	400			400	1	
Hexachlorocyclohexane, Gamma-	000058-89-9				C	2	2B	0.5	7	20	200	6	0.02	
Hexachlorocyclopentadiene	000077-47-4				E	3		5,000	70,000	300	4,000		200	
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	019408-74-3			0.0001	B2	3	3							
Hexachloroethane	000067-72-1			50	C	2	2B	500	7,000	50	700	2,000	20	
Hexachlorophene	000070-30-4					3	3			20	200			

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
Hexamethyl Phosphoramide	000680-31-9					2	2B							
Hexamethylene Diisocyanate	000822-06-0					3								
Hexane, N-	000110-54-3				D	3								
Hydrazine	000302-01-2			0.2	B2	2	2B							
Hydrochloric Acid	007647-01-0					3	3							
Hydrogen Cyanide	000074-90-8					3				1,000	10,000			
Hydrogen Fluoride	007664-39-3					3								
Hydrogen Sulfide	007783-06-4				IN	3								RfD withdrawn July 2003.
Hypochlorite	014380-61-1					3	3							
Indeno(1,2,3-CD)Pyrene	000193-39-5				B2	2	2B							
Iodine	007553-56-2	500	7,000			3						20		
Iodine-131	010043-66-0					3	1							
Isobutyl Alcohol	000078-83-1					3				20,000	200,000			
Isophorone	000078-59-1	10,000	100,000	700	C	3		200,000	1,000,000	10,000	100,000		6,000	
Isopropyl Methyl Phosphonate	005514-35-2					3								
Isopropyl Phenylcarbamate	000122-42-9				D	3	3			1,000	10,000			
JP-4	050815-00-4					3								
JP-5/JP-8	HZ0600-26-T					3								
JP-7	HZ0600-22-T					3	3							
Kerosene	008008-20-6					3								
Lead	007439-92-1				B2	3	2B							
Lead Acetate	000301-04-2				B2	2	2B							
Lead Phosphate	007446-27-7				B2	2	2B							
Malathion	000121-75-5	1,000	10,000		D	3	3	1,000	10,000	1,000	10,000		40	
Maleic Anhydride	000108-31-6					3				5,000	70,000			
Maneb	012427-38-2					3	3			300	4,000			
Manganese	007439-96-5				D	3				3,000	40,000			RfD reflects environmental screening level (0.05) the RfD for food is higher (0.14 mg/kg/day).
Mercuric Chloride	007487-94-7				C	3	3	100	1,000	20	200	10	4	
Mercury, Inorganic	HZ0900-19-T				D	3	3							
Mercury	007439-97-6				D	3	3							
Merphos	000150-50-5					3				2	20			
Methacrylonitrile	000126-98-7					3				5	70			
Methamidophos	010265-92-6									3	40			
Methanol	000067-56-1					3				30,000	400,000			
Methidathion	000950-37-8				C	3				50	700			
Methomyl	016752-77-5				E	3				1,000	20,000			
1-Methoxy-2-Propanol	000107-98-2					3								
Methoxychlor	000072-43-5				D	3	3	300	4,000	300	4,000		10	
Methoxyethanol	000109-86-4					3								
Methyl Isobutyl Ketone	000108-10-1				IN	3								

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
Methyl Parathion	000298-00-0	20	200		D	3	3	40	500	10	200		1	
2-Methyl-4-Chlorophenoxyacetic Acid	000094-74-6				D	3				30	400			
Methyl-T-Butyl Ether	001634-04-4					3	3	20,000	200,000			800	600	Cancer classification under review.
2-Methylaziridine	000075-55-8					2	2B							
5-Methylchrysene	003697-24-3					2	2B							
Methylene Chloride	000075-09-2	3,000	40,000	90	B2	2	2B			3,000	40,000	400		
4,4'-Methylenebis(2-Chloroaniline)	000101-14-4	200	2,000			2	2A							
4,4'-Methylenedianiline	000101-77-9					2	2B	4,000	60,000			400	200	
4,4'-(1-Methylethylidene)bis-Phenol	000080-05-7					3				3,000	40,000			
Methylmercuric Chloride	000115-09-3				C	3								
Methylmercury	022967-92-6	20	200		C	3				5	70			
1-Methylnaphthalene	000090-12-0	4,000	50,000			3								
2-Methylnaphthalene	000091-57-6	3,000	40,000		IN	3				200	3,000			
Metolachlor	051218-45-2				C	3				8,000	100,000			
Metribuzin	021087-64-9				D	3				1,000	20,000			
Mirex	002385-85-5	40	600			2	2B			10	100			
Molinate	002212-67-1					3				100	1,000			
Molybdenum	007439-98-7				D	3				300	4,000			
Naled	000300-76-5					3				100	1,000			
Naphthalene	000091-20-3				C	3	2B	30,000	400,000	1,000	10,000	1,000	1,000	
Nickel	007440-02-0					2	2B			1,000	10,000			
Nickel Subsulfide	012035-72-2				A	1								
Nitrate	014797-55-8					3				80,000	1,000,000			
Nitrate and Nitrite	HZ2100-10-T													
Nitrilotriacetic Acid	000139-13-9					2	2B							
Nitrite	014797-65-0					3				5,000	70,000			
Nitrobenzene	000098-95-3				D	3	2B			30	400			
Nitroglycerine	000055-63-0					3								
Nitroguanidine	000556-88-7				D	3				5,000	70,000			
2-Nitrophenol	000088-75-5					3								
4-Nitrophenol	000100-02-7				D	3								
N-Nitroso-N-Methylurethane	000615-53-2					3	2B							
N-Nitrosodi-N-Propylamine	000621-64-7			0.1	B2	2	2B					200		
N-Nitrosodiethylamine	000055-18-5			0.005	B2	2	2A							
N-Nitrosodimethylamine	000062-75-9			0.01	B2	2	2A							
N-Nitrosodiphenylamine	000086-30-6			100	B2	3	3							
Nitrosomorpholine	000059-89-2					2	2B							
Oxadiazon	019666-30-9					3				300	4,000			
Oxamyl	023135-22-0				E	3				1,000	20,000			

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
Oxyfluorfen	042874-03-3					3				200	2,000			
Paraquat Dichloride	001910-42-5				C	3				200	3,000			
Parathion	000056-38-2				C	3	3							
Pentachlorobenzene	000608-93-5				D	3				40	600			
2,3,4,7,8-Pentachlorodibenzofuran	057117-31-4					3		0.002	0.02			2.E-03	6.E-05	
Pentachloronitrobenzene	000082-68-8					3	3			200	2,000			
Pentachlorophenol	000087-86-5	50	700	6	B2	3		50	700	2,000	20,000	10	2	EPA tox review (draft 3/01) proposes the following changes: RfD: 0.005 mg/kg/day; CSF: 0.18 (mg/kg/day)$^{-1}$.
Perchlorate and Perchlorate Salts	**007790-98-9**				*	3				**40**	**500**			*EPA IRIS 2005: "not likely to pose a risk of thyroid cancer in humans, at least at doses below those necessary to alter thyroid hormone homeostasis."
Permethrin	052645-53-1					3	3	10,000	100,000	3,000	40,000	600	400	
Phenanthrene	000085-01-8				D	3	3							
Phenol	000108-95-2				D	3	3			20,000	200,000			
Phenylmercuric Acetate	000062-38-4					3				4	60			
Phosgene	000075-44-5					3								EPA tox review (external draft review 4/16/2004) proposes the following changes: RfC = 0.2 ug/m3; cancer class = IN.
Phosphine	007803-51-2				D	3				20	200			
Phosphoric Acid	007664-38-2					3								
Phosphorus, White	007723-14-0				D	3		10	100	1	10		0.4	
Phosphorus-32	014596-37-3					3	1							IARC group 1 as phosphate
Phthalic Anhydride	000085-44-9					3				100,000	1,000,000			
Plutonium	007440-07-5					3								
Plutonium-239	015117-48-3					3	1							
Polybrominated Biphenyls (PBB)	067774-32-7					2	2B					20		
Polybrominated Diphenyl Ethers (PBDE), lower brominated	032534-81-9 032536-52-0					2		400	5,000			60	10	
Polybrominated Diphenyl Ethers (PBDE), decabrominated	001163-19-5							500,000	1,000,000				20,000	
Polychlorinated Biphenyls (PCBs)	001336-36-3			0.4	B2	2	2A							Refer to comparison values for aroclor, which are commercial mixtures of PCBs.
Potassium Cyanide	000151-50-8					3				3,000	40,000			
Potassium Silver Cyanide	000506-61-6					3				10,000	100,000			
Prometon	001610-18-0				D	3				800	10,000			
Prometryn	007287-19-6					3				200	3,000			
Pronamide	023950-58-5				C					4,000	50,000			
Propachlor	001918-16-7				D	3				700	9,000			
Propanil	000709-98-8					3				300	4,000			
Propazine	000139-40-2				C	3				1,000	10,000			

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		Comments/Notes
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
		Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	
Propoxur	000114-26-1				C	3				200	3,000			
Propylene Glycol	000057-55-6					3								
Propylene Glycol Dinitrate	006423-43-4					3								
Propylene Oxide	000075-56-9			3	B2	2	2B							
Pendimethalin	040487-42-1					3				2,000	30,000			
Pyrene	000129-00-0				D	3	3			2,000	20,000			
Pyridine	000110-86-1					3	3			50	700			
Radium	007440-14-4					3	1							
Radium-224 and Daughters	HZ1800-60-T						1							
Radium-226 and Daughters	HZ1800-61-T						2							
Radium-226/228	HZ1800-20-T													
Radium-228 and Daughters	HZ1800-62-T						1							
Radon	010043-92-2					1	1							
Selenious Acid	007783-00-8				D	3				300	4,000			
Selenium	007782-49-2	300	4,000		D	3	3			300	4,000			
Selenium Sulfide	007446-34-6				B2	2	3							
Silica, amorphous	007631-86-9					1	3							
Silver	007440-22-4				D	3				300	4,000			
Simazine	000122-34-9				C	3	3			300	4,000			
Sodium	007440-23-5					3								
Sodium Azide	026628-22-8					3				200	3,000			
Sodium Bromate	007789-38-0					3								
Sodium Fluoroacetate	000062-74-8					3				1	10			
Urethane, Solidified	000051-79-6					2	2B							
Strontium	007440-24-6				D	3		100,000	1,000,000	30,000	400,000		4,000	
Strontium Chromate(VI)	007789-06-2					1	1							
Strychnine	000057-24-9					3				20	200			
Styrene	000100-42-5				C	3	2B	10,000	100,000	10,000	100,000		400	
Sulfate	014808-79-8					3								
Sulfotep	003689-24-5					3				30	400			
Sulfur Dioxide	007446-09-5					3	3							
Sulfur Mustard	000505-60-2					1	1	4	50			1	0.1	
2,4,5-T	000093-76-5				D	3				500	7,000			
TCDD Equivalents	HZ0400-03-T													
Tebuthiuron	034014-18-1				D					4,000	50,000			
Terbacil	005902-51-2					3				700	9,000			
Terbufos	013071-79-9				D									
Terbutryn	000886-50-0					3				50	700			
1,2,4,5-Tetrachlorobenzene	000095-94-3					3				20	200			
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	001746-01-6	0.00005	7.E-04		B2	1	1	0.001	0.01			4.E-04	4.E-05	

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		Comments/Notes
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
		Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	
1,2,3,4-Tetrachlorodibenzo-p-Dioxin	030746-58-8					3	3							
1,1,2,2-Tetrachloroethane	000079-34-5	2,000	30,000	4	C	3	3	30,000	400,000				1,000	
1,1,1,2-Tetrachloroethane	000630-20-6			30	C	3	3			2,000	20,000			
Tetrachloroethylene	000127-18-4				UR	2	2A			500	7,000	100		
2,3,4,6-Tetrachlorophenol	000058-90-2					3				2,000	20,000			
Tetraethyl Lead	000078-00-2					3	3			0.005	0.07			
Thallium	007440-28-0					3								
Thallium Acetate	000563-68-8				D	3				5	60			
Thallium Carbonate	006533-73-9				D	3				4	60			
Thallium Nitrate	010102-45-1				D	3				5	60			
Thallium Sulfate	007446-18-6				D	3				4	60			
Thioacetamide	000062-55-5					2	2B							
Thiobencarb	028249-77-6					3				500	7,000			
Thiourea	000062-56-6					2	3							
Thiram	000137-26-8					3	3			300	4,000			
Thorium	007440-29-1					3	1							
Tin, dibutyl	000683-18-1					3		300	4,000				10	
Tin, inorganic	007440-31-5					3		20,000	200,000				600	
Tin, tributyl	000056-35-9	20	200		D	3		20	200	20	200		0.6	
Titanium Tetrachloride	007550-45-0					3								
Toluene	000108-88-3				D	3	3	1,000	10,000	10,000	100,000	2,000	40	EPA tox profile (draft 1/15/04) proposes the following: RfC: 10,000 ug/m^3; cancer class: IN
Toluene Diisocyanate (N.O.S)	026471-62-5					2	2B							
Toxaphene	008001-35-2			0.6	B2	2	2B	50	700			10	2	
2,4,5-TP Acid	000093-72-1				D	3				400	6,000			
Trifluralin	001582-09-8			90	C	3	3			400	5,000			
s,s,s-Tributyl Phosphorotrithioate	000078-48-8					3				2	20			
1,1,2-Trichloro-1,2,2-Trifluoroethane	000076-13-1					3				1,000,000	1,000,000			
Trichloroacetaldehyde	000075-87-6					3	3			100	1,000			
Trichloroacetic Acid	000076-03-9				C		3							
1,3,5-Trichlorobenzene	000108-70-3					3								
1,2,4-Trichlorobenzene	000120-82-1				D	3				500	7,000			
1,1,1-Trichloroethane	000071-55-6				D	3	3	1,000,000	1,000,000				40,000	
1,1,2-Trichloroethane	000079-00-5			10	C	3	3	2,000	30,000	200	3,000	600	80	
Trichloroethylene	000079-01-6				B2	2	2A					400		EPA tox profile (draft 11/28/01) proposes: CSF: range from 0.02-0.4 (mg/kg/day) $^{-1}$; RfD: 0.0003 mg/kg/day; RfC: 40 ug/m3.
Trichlorofluoromethane	000075-69-4				D	3				20,000	200,000			
(Trichloromethyl)Benzene	000098-07-7			0.05	B2	2	2A							

		Hierarchy Level 1						Hierarchy Level 2				Additional Guidelines		
		Chronic EMEG		CREG	Cancer Class			Intermediate EMEG		RMEG		Acute EMEG	Inter. EMEG	
Name	CAS Number	Child ppm	Adult ppm	ppm	EPA	DHHS (NTP)	IARC	Child ppm	Adult ppm	Child ppm	Adult ppm	Pica Child ppm	Pica Child ppm	Comments/Notes
2,4,6-Trichlorophenol	000088-06-2			60	B2	2								
2,4,5-Trichlorophenol	000095-95-4					3				5,000	70,000			
1,2,3-Trichloropropane	000096-18-4					2	2A	3,000	40,000	300	4,000		100	
Triethanolamine	000102-71-6					3	3							
Triethylamine	000121-44-8					3								
1,3,5-Trinitrobenzene	000099-35-4					3				2,000	20,000			
2,4,6-Trinitrotoluene	000118-96-7			20	C	3	3	30	400	30	400		1	
Tris(2,3-Dibromopropyl)Phosphate	000126-72-7					2	2A							
Uranium	007440-61-1					3								
Uranium, Highly Soluble Salts	HZ1800-90-T					3		100	1,000				4	
Uranium, Insoluble Compounds	HZ1800-92-T					3								
Uranium, Soluble Salts	HZ1800-91-T					3				200	2,000			
Vanadium	007440-62-2					3		200	2,000				6	
Vanadium Pentoxide	001314-62-1					3	2B			500	6,000			
Vernolate	001929-77-7					3				50	700			
Vinyl Acetate	000108-05-4					3	2B							
Vinyl Chloride	000075-01-4	200	2,000	0.5	A	1	1			200	2,000			Health CV table shows cancer slope factors for exposures since birth. For adult-only exposure: oral CSF= 0.72 $(mg/kg/day)^{-1}$; inhalation IUR: 4.4x10-6 $(ug/m^3)^{-1}$.
Warfarin	000081-81-2					3				20	200			
p-Xylene	000106-42-3					3						2,000		
m-Xylene	000108-38-3					3		30,000	400,000				1,000	
Xylenes, Total	001330-20-7				IN	3	3	10,000	100,000	10,000	100,000		400	
3,4-Xylenol	000095-65-8									50	700			
Zinc	007440-66-6	20,000	200,000		D	3		20,000	200,000	20,000	200,000		600	
Zinc Cyanide	000557-21-1					3				3,000	40,000			

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
Acenaphthene	000083-32-9					3								
Acephate	030560-19-1				C	3								
Acetaldehyde	000075-07-0			0.5	B2	2	2B			9			2.2E-06	EPA external tox review (draft 9/00) proposes the following changes:RfC: 5.0 ug/m^3; IUR: 0.000013 (ug/m^3)$^{-1}$
Acetamide	000060-35-5					3	2B							
Acetone	000067-64-1	13,000			IN	3		13,000			26,000			
Acetonitrile	000075-05-8					3				60				
Acetophenone	000098-86-2				D	3								
2-Acetylaminofluorene	000053-96-3					2								
Acrolein	000107-02-8				IN	3	3	0.009		0.02	0.05			
Acrylamide	000079-06-1			0.0008	B2	2	2A						0.0013	
Acrylic Acid	000079-10-7					3	3			1				
Acrylonitrile	000107-13-1			0.01	B1	2	2B			2	100		6.8E-05	
Alachlor	015972-60-8				B2	3								
Aldicarb	000116-06-3				D	3	3							
Aldrin	000309-00-2			0.0002	B2	3	3						0.0049	
Allyl Alcohol	000107-18-6					3								
Alpha Radiation	012587-46-1					3	1							
Aluminum	007429-90-5					3								
Aluminum Phosphide	020859-73-8					3								
Ametryn	000834-12-8				D									
4-Amino-3,5,6-Trichloropicolinic Acid	001918-02-1				D	3	3							
4-Aminobiphenyl	000092-67-1					1	1							
Aminotriazole	000061-82-5					2	3							
Ammonia	007664-41-7	100			D	3				100	1,700			
Aniline	000062-53-3				B2	3	3			1				
Anthracene	000120-12-7				D	3	3							
Antimony	007440-36-0				D	3								
Antimony Trioxide	001309-64-4					3	2B			0.2				
Aramite	000140-57-8			0.1	B2	3	2B						7.1E-06	
Aroclor 1016	012674-11-2					3								
Aroclor 1221	011104-28-2					3								
Aroclor 1232	011141-16-5					3								
Aroclor 1240	071328-89-7					3								
Aroclor 1242	053469-21-9					3								
Aroclor 1248	012672-29-6					3								
Aroclor 1254	011097-69-1					2								

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
Aroclor 1260	011096-82-5					2								
Aroclor 1262	037324-23-5					3								
Aroclor 1268	011100-14-4					3								
Aroclor 5432	063496-31-1					3								
Arsenic	007440-38-2			0.0002	A	1	1						0.0043	
Arsine	007784-42-1					3				0.05				
Asbestos	001332-21-4			0.000004	A	1	1						0.23	The units for asbestos are maximum number of fibers/mL in air. The units on the inhalation unit risk are (fibers/mL)$^{-1}$.
Atrazine	001912-24-9					3	3							
Automotive Gasoline	008006-61-9					3	2B							
Azobenzene	000103-33-3			0.03	B2	3	3						3.1E-05	
Barium	007440-39-3				D	3								
Benomyl	017804-35-2					3								
Benfluralin	001861-40-1					3								
Benzaldehyde	000100-52-7					3								
Benzene	000071-43-2			0.1	A	1	1	4		30	50		7.8E-06	Inhal Unit Risk ranges from 2.2x10^{-6} to 7.8x10^{-6} (ug/m^3)$^{-1}$.
Benzidine	000092-87-5			1.0E-05	A	1	1						0.067	
Benzo(A)Anthracene	000056-55-3				B2	2	2A							
Benzo(A)Pyrene	000050-32-8				B2	2	2A							
Benzo(B)Fluoranthene	000205-99-2				B2	2	2B							
Benzo(GHI)Perylene	000191-24-2				D	3	3							
Benzo(J)Fluoranthene	000205-82-3					2	2B							
Benzo(K)Fluoranthene	000207-08-9				B2	2	2B							
2,3-Benzofuran	000271-89-6					3	2B							
Benzoic Acid	000065-85-0				D	3								
Benzyl Chloride	000100-44-7				B2	3	2A							
Beryllium	007440-41-7			0.0004	B1	1	1			0.02			0.0024	EPA cancer class based on inhalation exposures. No cancer class has been assigned for oral exposure.
Beta Radiation	012587-47-2					3								
Beta-Naphthylamine	000091-59-8					1	1							
Biphenyl	000092-52-4				D	3								
Bis(2-Chloroethyl) Ether	000111-44-4			0.003	B2	3	3	20					0.00033	
Bis(2-Chloroisopropyl) Ether	039638-32-9				D	3								
Bis(2-Ethylhexyl)Adipate	000103-23-1				C	3	3							
Bis(Chloromethyl) Ether	000542-88-1			2.0E-05	A	1	1	0.3					0.062	
Boron	007440-42-8				IN	3								

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			Comments/Notes
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
		ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	
Bromacil	000314-40-9				C	3								
Bromate	015541-45-4				B2	3								
Bromic Acid, Potassium Salt	007758-01-2					3	2B							
Bromochloromethane	000074-97-5				D	3								
Bromodichloromethane	000075-27-4				B2	2	2B							
Bromoform	000075-25-2			0.9	B2	3	3						1.1E-06	
Bromomethane	000074-83-9	5			D	3	3	50		5	50			
1,3-Butadiene	000106-99-0			0.03	CA	1	2A			2			3.0E-05	EPA's cancer class is "carcinogenic to humans by inhalation" under revised (1999) guidelines.
1-Butanol	000071-36-3				D	3								
2-Butanone	000078-93-3				IN	3				5,000				
2-Butoxyethanol	000111-76-2	200			C	3	3	3,000		13,000	6,000			
2-Butoxyethanol Acetate	000112-07-2				C	3								
Butyl Benzyl Phthalate	000085-68-7				C	3	3							
Butylate	002008-41-5				D	3								
Cadmium	007440-43-9			0.0006	B1	1	1						0.0018	
Calcium Cyanide	000592-01-8					3								
Caprolactam	000105-60-2					3	4							
Captan	000133-06-2					3	3							
Carbaryl	000063-25-2				D	3	3							
Carbazole	000086-74-8					3	3							
Carbofuran	001563-66-2				E	3								
Carbon Disulfide	000075-15-0	300				3				700				
Carbon Tetrachloride	000056-23-5	30		0.07	B2	2	2B	30					1.5E-05	
Carbosulfan	055285-14-8													
Carboxin	005234-68-4				D	3								
Cellosolve	000110-80-5					3				200				
Chloral Hydrate	000302-17-0				C	3	3							
Chloramben	000133-90-4				D	3								
Chlordane	000057-74-9		0.02	0.01	B2	3	2B		0.2	0.7			0.0001	
Chlordecone	000143-50-0					2	2B							
Chlorendic Acid	000115-28-6					2	2B							
Chlorfenvinphos	000470-90-6					3								
Chlorine	007782-50-5				D	3								
Chlorine Dioxide	010049-04-4				D	3		1		0.2				
Chlorite, Sodium	007758-19-2				D	3	3							
Chloroacetic Acid	000079-11-8					3								
2-Chloroacetophenone	000532-27-4					3				0.03				

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
4-Chloroaniline	000106-47-8					3	2B							
Chlorobenzene	000108-90-7				D	3								
Chlorobenzilate	000510-15-6					3	3							
Chlorodibromomethane	000124-48-1				C	3	3							Previously listed as dibromochloromethane
Chlorodifluoromethane	000075-45-6					3	3			50,000				
Chloroethane	000075-00-3					3	3			10,000	15,000			
Chloroform	000067-66-3	20		0.04	LI	2	2B	50			100		2.3E-05	
Chloromethane	000074-87-3	50			D	3	3	200		90	500			
2-Chloronaphthalene	000091-58-7					3								
2-Chlorophenol	000095-57-8				D	3								
4-Chlorophenol	000106-48-9					3								
3-Chloropropene	000107-05-1				C	3	3			1				
Chlorothalonil	001897-45-6				B2	3	2B							
2-Chlorotoluene	000095-49-8				D	3								
P-Chlorotoluene	000106-43-4				D	3								
Chlorpropham	000101-21-3					3	3							
Chlorpyrifos	002921-88-2				D	3								
Chromium	007440-47-3					3	3							
Chromium (VI), aerosol mists	007738-94-5					3			0.005	0.008				Previously listed as "Chromium Trioxide"
Chromium (VI), particulates	018540-29-9			8.0E-05	A	1	1		1	0.1			0.012	Previously listed as "Chromium, Hexavalent". EPA cancer class: A for inhalation exposure; D for oral exposure.
Chromium(VI) Oxide	001333-82-0					1				0.008				
Chromium, Trivalent	016065-83-1				D	3	3							
Chrysene	000218-01-9				B2	3	3							
Coal Tar Creosote	008001-58-9				B1	1	2A							
Coal Tars	008007-45-2			0.002	A	1	1						0.00062	
Cobalt	007440-48-4		0.1			3	2B							
Copper	007440-50-8				D	3								
Copper Cyanide	000544-92-3					3								
Coumarin	000091-64-5						3							
Cresol, Meta-	000108-39-4				C	3								
Cresol, Ortho-	000095-48-7				C	3								
Cresol, Para-	000106-44-5				C	3								
Cumene	000098-82-8				D	3				400				
Cyanazine	021725-46-2					3								
Cyanide	000057-12-5				D	3								
Cyanide, Sodium	000143-33-9					3								
Cyanogen	000460-19-5					3								

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
Cyanogen Chloride	000506-77-4				D	3								
Cyclohexane	000110-82-7				IN	3				6,000				
Cyclohexanone	000108-94-1					3	3							
Cyclotetramethylene Tetranitramine (HMX)	002691-41-0				D	3								
Cyclotrimethylenetrinitramine (RDX)	000121-82-4				C	3								
Cyfluthrin	068359-37-5					3								a.k.a. Baythroid
Cyhalothrin	068085-85-8					3								
Cypermethrin	052315-07-8					3								
2,4-D Acid	000094-75-7				D	3								
Dacthal	001861-32-1				D	3								
DDD, p,p'-	000072-54-8				B2	3	2B							
DDE, p,p'-	000072-55-9				B2	3	2B							
DDT, p,p'-	000050-29-3			0.01	B2	2	2B						9.7E-05	
Demeton	008065-48-3													
Di-n-Butyl Phthalate	000084-74-2				D	3								
Di-n-Octyl Phthalate	000117-84-0					3								
Di(2-Ethylhexyl)Phthalate	000117-81-7				B2	2	3							
2,4-Diaminotoluene	000095-80-7					2	2B							
Diazinon	000333-41-5				E	3			9					
Dibenzo(A,E)Pyrene	000192-65-4					2	2B							
Dibenzo(A,H)Anthracene	000053-70-3				B2	2	2A							
Dibenzo(A,L)Pyrene	000191-30-0					2	2B							
1,2-Dibromo-3-Chloropropane	000096-12-8				B2	2	2B	0.2		0.2				
1,2-Dibromoethane	000106-93-4			0.002	LI	2	2A			9			0.0006	
Dibutyl Sebacate	000109-43-3					3								
Dicamba	001918-00-9				D	3								
Dichloroacetic Acid	000079-43-6				LI	3	2B							
1,2-Dichlorobenzene	000095-50-1				D	3	3							2/2/04: external review draft of IRIS: proposed RfD = 0.14 mg/kg/day cancer class = IN
1,4-Dichlorobenzene	000106-46-7	20			C	2	2B	100		800	2,000			2/2/04 external review draft of IRIS: proposed RfD = 0.0024 mg/kg/day, RfC = 1,000 ug/m3 (1 mg/m3); CSF = 0.013 (mg/kg/day)-1; IUR = na; cancer class = LI
1,3-Dichlorobenzene	000541-73-1				D	3	3							2/2/04 external review draft of IRIS: proposed RfD = 0.001 mg/kg/day; cancer class = IN
3,3'-Dichlorobenzidine	000091-94-1				B2	2	2B							
Dichlorodifluoromethane	000075-71-8				D	3								
1,1-Dichloroethane	000075-34-3				C	3								

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
1,2-Dichloroethane	000107-06-2	600		0.04	B2	2	2B						2.6E-05	
1,1-Dichloroethene	000075-35-4				SU	3		20		200				
1,2-Dichloroethene, cis-	000156-59-2				D	3								
1,2-Dichloroethene, trans-	000156-60-5				D	3		200			200			
2,4-Dichlorophenol	000120-83-2				E	3								
4-(2,4-Dichlorophenoxy)butyric Acid	000094-82-6					3								
1,2-Dichloropropane	000078-87-5					3	3	7		4	50			
2,3-Dichloropropanol	000616-23-9					3								
1,3-Dichloropropene	000542-75-6	2		0.3	B2	2	2B	3		20			4.0E-06	
2,2-Dichloropropionic Acid	000075-99-0				D	3								
Dichlorvos	000062-73-7	0.06			B2	3	2B	0.3		0.5	2			
Dicofol	000115-32-2					3	3							
Dicrotophos	000141-66-2					3								
Dieldrin	000060-57-1			0.0002	B2	3	3						0.0046	
Diethanolamine	000111-42-2					3	3							
Diethyl Phthalate	000084-66-2				D	3								
Diflubenzuron	035367-38-5					3								
Diisopropyl Methylphosphonate	001445-75-6				D	3								
Dimethoate	000060-51-5					3								
3,3'-Dimethoxybenzidine	000119-90-4					2	2B							
Dimethyl Carbamyl Chloride	000079-44-7					2	2A							
Dimethyl Formamide	000068-12-2					3	3			30				
Dimethyl Methylphosphonate	000756-79-6				C	3								
1,4-Dimethyl Phthalate	000120-61-6					3								
Dimethyl Phthalate	000131-11-3				D	3								
Dimethyl Sulfate	000077-78-1				B2	2	2A							
Dimethylaniline	000121-69-7					3	3							
1,1-Dimethylhydrazine	000057-14-7					2	2B	0.2						
1,2-Dimethylhydrazine	000540-73-8					3	2A							
2,4-Dimethylphenol	000105-67-9					3								
2,6-Dimethylphenol	000576-26-1													
4,6-Dinitro-o-Cresol	000534-52-1					3								
1,3-Dinitrobenzene	000099-65-0				D	3								
2,4-Dinitrophenol	000051-28-5					3								
2,4-Dinitrotoluene	000121-14-2				B2	3	2B							
2,6-Dinitrotoluene	000606-20-2				B2	3	2B							
Dinitrotoluene	025321-14-6				B2	3								
Dinoseb	000088-85-7				D	3								

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			Comments/Notes
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
		ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	
1,4-Dioxane	000123-91-1	1,000			B2	2	2B				2,000			
Diphenamid	000957-51-7				D	3								
Diphenylamine	000122-39-4					3								
1,2-Diphenylhydrazine	000122-66-7			0.005	B2	2							0.00022	
Diphenylmethane Diisocyanate	000101-68-8				D		3			0.6				
Diquat	002764-72-9													
Disodium Arsenate	007778-43-0					1	1							
Disulfoton	000298-04-4				E	3			0.2			6		
1,4-Dithiane	000505-29-3				D	3								
Diuron	000330-54-1				D	3								
Endosulfan	000115-29-7					3								
Endothall	000145-73-3				D									
Endrin	000072-20-8				D	3	3							
Epichlorohydrin	000106-89-8			0.8	B2	2	2A			1			1.2E-06	
EPN	002104-64-5					3								
EPTC	000759-94-4					3								
Ethephon	016672-87-0					3								
Ethion	000563-12-2					3								
Ethyl Acetate	000141-78-6					3								
Ethyl Acrylate	000140-88-5					3	2B							
Ethylbenzene	000100-41-4				D	3	2B	1,000		1,000				
Ethyl Ether	000060-29-7					3								
Ethylene Glycol	000107-21-1				D	3					500			
Ethylene Oxide	000075-21-8					1	1	90						
Fenvalerate	051630-58-1					3	3							
Fluoranthene	000206-44-0				D	3	3							
Fluorene	000086-73-7				D	3	3							
Fluoride, Sodium	007681-49-4					3								
Fluorine	007782-41-4					3					10			
Folpet	000133-07-3				B2	3								
Fonophos	000944-22-9				D	3								
Formaldehyde	000050-00-0	8		0.08	B1	2	1	30			40		1.3E-05	
Fuel Oil No. 2	068476-30-2					3						20		
Furan	000110-00-9					2	2B							
Furfural	000098-01-1					3	3							
Gamma Radiation	HZ1800-03-T					3	1							
Glycidylaldehyde	000765-34-4				B2	3	2B							
Glyphosate	001071-83-6				D	3								

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
Heptachlor	000076-44-8			0.0008	B2	3	2B						0.0013	
Heptachlor Epoxide	001024-57-3			0.0004	B2	3							0.0026	
Hexabromobenzene	000087-82-1					3								
Hexachlorobenzene	000118-74-1			0.002	B2	2	2B						0.00046	
Hexachlorobutadiene	000087-68-3			0.05	C	3	3						2.2E-05	
Hexachlorocyclohexane, Technical Grade	000608-73-1			0.002	B2	2	2B						0.00051	
Hexachlorocyclohexane, Alpha-	000319-84-6			0.0006	B2	2	2B						0.0018	
Hexachlorocyclohexane, Beta-	000319-85-7			0.002	C	2	2B						5.3E-04	
Hexachlorocyclohexane, Gamma-	000058-89-9				C	2	2B							
Hexachlorocyclopentadiene	000077-47-4	0.2			E	3		10		0.2				
1,2,3,7,8,9-Hexachlorodibenzo-P-Dioxin	019408-74-3			8E-07	B2	3	3						1.3	
Hexachloroethane	000067-72-1			0.3	C	2	2B	6,000			6,000		4.0E-06	
Hexachlorophene	000070-30-4					3	3							
Hexamethyl Phosphoramide	000680-31-9					2	2B							
Hexamethylene Diisocyanate	000822-06-0	0.01				3		0.03		0.01				
Hexane, n-	000110-54-3	600			D	3				200				
Hydrazine	000302-01-2			0.0002	B2	2	2B	4					0.0049	
Hydrochloric Acid	007647-01-0					3	3			20				
Hydrogen Cyanide	000074-90-8					3				3				
Hydrogen Fluoride	007664-39-3					3					20			
Hydrogen Sulfide	007783-06-4				IN	3		20		2	200			
Hypochlorite	014380-61-1					3	3							
Indeno(1,2,3-cd)Pyrene	000193-39-5				B2	2	2B							
Iodine	007553-56-2					3								
Iodine-131	010043-66-0					3	1							
Isobutyl Alcohol	000078-83-1					3								
Isophorone	000078-59-1				C	3								
Isopropyl Methyl Phosphonate	005514-35-2					3								
Isopropyl Phenylcarbamate	000122-42-9				D	3	3							
JP-4	050815-00-4					3			9,000					
JP-5/JP-8	HZ0600-26-T					3			3,000					
JP-7	HZ0600-22-T		300			3	3							
Kerosene	008008-20-6					3			10					
Lead	007439-92-1				B2	3	2B							
Lead Acetate	000301-04-2				B2	2	2B							
Lead Phosphate	007446-27-7				B2	2	2B							
Malathion	000121-75-5				D	3	3		20			200		

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
Maleic Anhydride	000108-31-6					3								
Maneb	012427-38-2					3	3							
Manganese	007439-96-5		0.04		D	3				0.05				
Mercuric Chloride	007487-94-7				C	3	3							
Mercury, Inorganic	HZ0900-19-T				D	3	3							
Mercury	007439-97-6		0.2		D	3	3			0.3				
Merphos	000150-50-5					3								
Methacrylonitrile	000126-98-7					3								
Methamidophos	010265-92-6													
Methanol	000067-56-1					3								
Methidathion	000950-37-8				C	3								
Methomyl	016752-77-5				E	3								
1-Methoxy-2-Propanol	000107-98-2					3				2,000				
Methoxychlor	000072-43-5				D	3	3							
Methoxyethanol	000109-86-4					3				20				
Methyl Isobutyl Ketone	000108-10-1				IN	3				3,000				
Methyl Parathion	000298-00-0				D	3	3							
2-Methyl-4-Chlorophenoxyacetic Acid	000094-74-6				D	3								
Methyl-T-Butyl Ether	001634-04-4	700				3	3	700		3,000	2,000			Cancer classification under review.
2-Methylaziridine	000075-55-8					2	2B							
5-Methylchrysene	003697-24-3					2	2B							
Methylene Chloride	000075-09-2	300		3	B2	2	2B	300			600		4.0E-07	
4,4'-Methylenebis(2-Chloroaniline)	000101-14-4					2	2A							
4,4'-Methylenedianiline	000101-77-9					2	2B							
4,4'-(1-Methylethylidene)Bis-Phenol	000080-05-7					3								
Methylmercuric Chloride	000115-09-3				C	3								
Methylmercury	022967-92-6				C	3								
1-Methylnaphthalene	000090-12-0					3								
2-Methylnaphthalene	000091-57-6				IN	3								
Metolachlor	051218-45-2				C	3								
Metribuzin	021087-64-9				D	3								
Mirex	002385-85-5					2	2B							
Molinate	002212-67-1					3								
Molybdenum	007439-98-7				D	3								
Naled	000300-76-5					3								
Naphthalene	000091-20-3	0.7			C	3	2B			3				
Nickel	007440-02-0		0.09			2	2B		0.2					
Nickel Subsulfide	012035-72-2			0.002	A	1							0.00048	

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
Nitrate	014797-55-8					3								
Nitrate and Nitrite	HZ2100-10-T													
Nitrilotriacetic Acid	000139-13-9					2	2B							
Nitrite	014797-65-0					3								
Nitrobenzene	000098-95-3				D	3	2B							
Nitroglycerine	000055-63-0					3								
Nitroguanidine	000556-88-7				D	3								
2-Nitrophenol	000088-75-5					3								
4-Nitrophenol	000100-02-7				D	3								
N-Nitroso-N-Methylurethane	000615-53-2					3	2B							
N-Nitrosodi-N-Propylamine	000621-64-7				B2	2	2B							
N-Nitrosodiethylamine	000055-18-5			2.0E-05	B2	2	2A						0.043	
N-Nitrosodimethylamine	000062-75-9			7.0E-05	B2	2	2A						0.014	
N-Nitrosodiphenylamine	000086-30-6				B2	3	3							
Nitrosomorpholine	000059-89-2					2	2B							
Oxadiazon	019666-30-9					3								
Oxamyl	023135-22-0				E	3								
Oxyfluorfen	042874-03-3					3								
Paraquat Dichloride	001910-42-5				C	3								
Parathion	000056-38-2				C	3	3							
Pentachlorobenzene	000608-93-5				D	3								
2,3,4,7,8-Pentachlorodibenzofuran	057117-31-4					3								
Pentachloronitrobenzene	000082-68-8					3	3							
Pentachlorophenol	000087-86-5				B2	3								EPA tox review (draft 3/01) proposes the following change:CSF: 0.18 (mg/kg/day)$^{-1}$.
Perchlorate and Perchlorate Salts	007790-98-9				*	3								*EPA IRIS 2005: "not likely to pose a risk of thyroid cancer in humans, at least at doses below those necessary to alter thyroid hormone homeostasis."
Permethrin	052645-53-1					3	3							
Phenanthrene	000085-01-8				D	3	3							
Phenol	000108-95-2				D	3	3							
Phenylmercuric Acetate	000062-38-4					3								
Phosgene	000075-44-5					3								EPA tox review (external draft review 4/16/2004) proposes the following changes: RfC = 0.2 ug/m3; cancer class = IN.
Phosphine	007803-51-2				D	3				0.3				
Phosphoric Acid	007664-38-2					3				10				
Phosphorus,white	007723-14-0				D	3						20		

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			Comments/Notes
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
		ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	
Phosphorus-32	014596-37-3					3	1							IARC group 1 as phosphate
Phthalic Anhydride	000085-44-9					3								
Plutonium	007440-07-5					3								
Plutonium-239	015117-48-3					3	1							
Polybrominated Biphenyls (PBBs)	067774-32-7					2	2B							
Polybrominated Diphenyl Ethers (PBDE), lower brominated	032534-81-9 032536-52-0					2			6					
Polychlorinated Biphenyls (PCBs)	001336-36-3			0.01	B2	2	2A						0.0001	Refer to comparison values for aroclor, which are commercial mixtures of PCBs.
Potassium Cyanide	000151-50-8					3								
Potassium Silver Cyanide	000506-61-6					3								
Prometon	001610-18-0				D	3								
Prometryn	007287-19-6					3								
Pronamide	023950-58-5				C									
Propachlor	001918-16-7				D	3								
Propanil	000709-98-8					3								
Propazine	000139-40-2				C	3								
Propoxur	000114-26-1				C	3								
Propylene Glycol	000057-55-6					3		9						
Propylene Glycol Dinitrate	006423-43-4	0.04				3		0.04			3			
Propylene Oxide	000075-56-9			0.3	B2	2	2B			30			3.7E-06	
Pendimethalin	040487-42-1					3								
Pyrene	000129-00-0				D	3	3							
Pyridine	000110-86-1					3	3							
Radium	007440-14-4					3	1							
Radium-224 and Daughters	HZ1800-60-T						1							
Radium-226 and Daughters	HZ1800-61-T						2							
Radium-226/228	HZ1800-20-T													
Radium-228 and Daughters	HZ1800-62-T						1							
Radon	010043-92-2					1	1							
Refractory ceramic fibers		0.03*												* units are fibers/cc. See Synthetic Vitreous Fibers tox profile
Selenious Acid	007783-00-8				D	3								
Selenium	007782-49-2				D	3	3							
Selenium Sulfide	007446-34-6				B2	2	3							
Silica, Amorphous	007631-86-9					1	3							
Silver	007440-22-4				D	3								
Simazine	000122-34-9				C	3	3							
Sodium	007440-23-5					3								

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			Comments/Notes
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
		ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	
Sodium Azide	026628-22-8					3								
Sodium Bromate	007789-38-0					3								
Sodium Fluoroacetate	000062-74-8					3								
Urethane, Solidified	000051-79-6					2	2B							
Strontium	007440-24-6				D	3								
Strontium Chromate(VI)	007789-06-2					1	1							
Strychnine	000057-24-9					3								
Styrene	000100-42-5	60			C	3	2B			1,000				
Sulfate	014808-79-8					3								
Sulfotep	003689-24-5					3								
Sulfur Dioxide	007446-09-5					3	3				10			
Sulfur Mustard	000505-60-2					1	1		0.02			0.7		
2,4,5-T	000093-76-5				D	3								
TCDD Equivalents	HZ0400-03-T													
Tebuthiuron	034014-18-1				D									
Terbacil	005902-51-2					3								
Terbufos	013071-79-9				D									
Terbutryn	000886-50-0					3								
1,2,4,5-Tetrachlorobenzene	000095-94-3					3								
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	001746-01-6				B2	1	1							
1,2,3,4-Tetrachlorodibenzo-p-Dioxin	030746-58-8					3	3							
1,1,2,2-Tetrachloroethane	000079-34-5			0.02	C	3	3	400					5.8E-05	
1,1,1,2-Tetrachloroethane	000630-20-6			0.1	C	3	3						7.4E-06	
Tetrachloroethylene	000127-18-4	40			UR	2	2A				200			
2,3,4,6-Tetrachlorophenol	000058-90-2					3								
Tetraethyl Lead	000078-00-2					3	3							
Thallium	007440-28-0					3								
Thallium Acetate	000563-68-8				D	3								
Thallium Carbonate	006533-73-9				D	3								
Thallium Nitrate	010102-45-1				D	3								
Thallium Sulfate	007446-18-6				D	3								
Thioacetamide	000062-55-5					2	2B							
Thiobencarb	028249-77-6					3								
Thiourea	000062-56-6					2	3							
Thiram	000137-26-8					3	3							
Thorium	007440-29-1					3	1							
Tin, dibutyl	000683-18-1					3								Previously listed as "Dibutyltin Dichloride"
Tin, inorganic	007440-31-5					3								

		Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
Name	CAS Number	ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	Comments/Notes
Tin, tributyl	000056-35-9				D	3								Previously listed as "Tributyltin Oxide"
Titanium Tetrachloride	007550-45-0		0.1			3			10					
Toluene	000108-88-3	80			D	3	3			400	1,000			EPA toxicological profile (external review draft 1/15/04) proposes the following: RfC: 10,000 ug/m3; cancer class: IN
Toluene Diisocyanate (N.O.S)	026471-62-5					2	2B			0.07				
Toxaphene	008001-35-2			0.003	B2	2	2B						3.2E-04	
2,4,5-TP Acid	000093-72-1				D	3								
Trifluralin	001582-09-8				C	3	3							
s,s,s-Tributyl Phosphorotrithioate	000078-48-8					3								
1,1,2-Trichloro-1,2,2-Trifluoroethane	000076-13-1					3								
Trichloroacetaldehyde	000075-87-6					3	3							
Trichloroacetic Acid	000076-03-9				C		3							
1,3,5-Trichlorobenzene	000108-70-3					3								
1,2,4-Trichlorobenzene	000120-82-1				D	3								
1,1,1-Trichloroethane	000071-55-6				D	3	3	700			2,000			
1,1,2-Trichloroethane	000079-00-5			0.06	C	3	3						1.6E-05	
Trichloroethylene	000079-01-6				B2	2	2A	100			2,000			EPA tox profile (ext review draft 11/28/01) proposes: CSF: range from 0.02-0.4 (mg/kg/day)-1; RfC: 40 ug/m3.
Trichlorofluoromethane	000075-69-4				D	3								
(Trichloromethyl)benzene	000098-07-7				B2	2	2A							
2,4,6-Trichlorophenol	000088-06-2			0.3	B2	2							3.1E-06	
2,4,5-Trichlorophenol	000095-95-4					3								
1,2,3-Trichloropropane	000096-18-4					2	2A				0.3			
Triethanolamine	000102-71-6					3	3							
Triethylamine	000121-44-8					3				7				
1,3,5-Trinitrobenzene	000099-35-4					3								
2,4,6-Trinitrotoluene	000118-96-7				C	3	3							
Tris(2,3-Dibromopropyl)phosphate	000126-72-7					2	2A							
Uranium	007440-61-1					3								
Uranium, Highly Soluble Salts	HZ1800-90-T		0.3			3			0.4					
Uranium, Insoluble Compounds	HZ1800-92-T					3			8					
Uranium, Soluble Salts	HZ1800-91-T					3								
Vanadium	007440-62-2					3						0.2		
Vanadium Pentoxide	001314-62-1					3	2B							
Vernolate	001929-77-7					3								
Vinyl Acetate	000108-05-4					3	2B	10		200				

Name	CAS Number	Hierarchy Level 1						Hierarchy Level 2			Additional Health Guidelines			Comments/Notes
		Chronic EMEG/MRL		CREG	Cancer Class			Intermediate EMEG/MRL		RfC	Acute EMEG/MRL		EPA's Inhalation Unit Risk	
		ppb	µg/m^3	µg/m^3	EPA	DHHS (NTP)	IARC	ppb	µg/m^3	µg/m^3	ppb	µg/m^3	1/(µg/m^3)	
Vinyl Chloride	000075-01-4			0.1	A	1	1	30		100	500		8.8E-06	Health CV table shows cancer slope factors for exposures since birth. For adult-only exposure:oral CSF= 0.72 (mg/kg/day)$^{-1}$; inhal IUR: 4.4x10^{-6} (ug/m^3)$^{-1}$.
Warfarin	000081-81-2					3								
p-Xylene	000106-42-3					3								
m-Xylene	000108-38-3					3								
Xylenes, Total	001330-20-7	100			IN	3	3	700		0.1	1,000			
3,4-Xylenol	000095-65-8													
Zinc	007440-66-6				D	3								
Zinc Cyanide	000557-21-1					3								

Appendix B – Johnson & Ettinger Model Input and Output

DATA ENTRY SHEET

GW-SCREEN
Version 3.1; 02/04

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
71432	9.72E+01	Benzene

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	305	L	11	5

MORE

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
L			L	1.59	0.399	0.148

MORE

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
105	0.251	0.257	1.86E-09	0.854	1.58E-09	37.50	0.399	0.067	0.332	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.54E+04	1.80E+06	2.22E-04	200	8,112	2.82E-03	1.21E-01	1.76E-04	5.54E-03	8.23E-05	2.24E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
105	200	1.18E+04	0.10	8.33E+01	5.54E-03	4.00E+02	2.06E+163	1.45E-04	1.70E+00	7.8E-06	3.0E-02

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.79E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.5E-06	5.4E-02

MESSAGE SUMMARY BELOW:

END

]

DATA ENTRY SHEET

GW-SCREEN
Version 3.1; 02/04

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES X

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414	9.72E+01	Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
200	305	L	11	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
	OR		Lookup Soil Parameters			
L			L	1.59	0.399	0.148

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
105	0.251	0.257	1.86E-09	0.854	1.58E-09	37.50	0.399	0.067	0.332	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
2.54E+04	1.80E+06	2.22E-04	200	10,144	3.38E-03	1.45E-01	1.76E-04	4.72E-03	6.77E-05	1.85E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
105	200	1.41E+04	0.10	8.33E+01	4.72E-03	4.00E+02	4.25E+191	1.20E-04	1.69E+00	NA	1.0E+00

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.69E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.6E-03

MESSAGE SUMMARY BELOW:

END

]