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SUBJECT: Residual Risk Assessment for the Industrial Process Cooling Towers Source Category

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Introduction

Section 112(f)(2)(A) of the Clean Air Act directs EPA to assess the risk remaining (residual risk) after the implementation of maximum achievable control technology (MACT) standards under section 112(d) of the Act. Under these requirements, EPA will promulgate additional emission standards for a source category if existing MACT standards do not provide an "ample margin of safety" for human health or are not sufficient to prevent adverse environmental impacts. The residual risk assessment is performed by EPA as part of the residual risk rule development process, which is generally completed within eight years of the promulgation of MACT standards.

The purpose of this memorandum is to describe the methodology and results of the residual risk assessment performed for the Industrial Process Cooling Towers (IPCT) source category. The results of this analysis will assist EPA in determining whether a residual risk rule for this source category is appropriate.

Methods

Scope

The residual risk assessment for the IPCT source category focused on human health, evaluating the potential of emissions to cause cancer and noncancer risks associated with a lifetime of continuous exposure via the inhalation pathway. An assessment of the potential for public health impacts associated with acute inhalation exposures to peak hourly emissions was also performed using a hypothetical one-hour exposure scenario.

In air toxics risk assessment, the inhalation pathway is commonly assessed. However, multipathway exposures (human contact with the chemical in soil, water, sediment, or food) and ecological exposure pathways may also be assessed for a limited set of chemicals released to the air. The EPA has identified a set of persistent and bioaccumulative (PB) hazardous air pollutant(s) (HAP) for which multipathway health and ecological exposure analyses should generally be conducted. This list of PB HAP is based on information from the Pollution Prevention Program, the Great Waters program, and the Toxics Release Inventory. Refer to Volume I, Section 4.2.5, of the Air Toxics Risk Assessment Reference Library (available at: http://www.epa.gov/ttn/fera/risk_atoxic.html) for more information on the list of PB HAP.

Since there are no emissions of PB HAP from IPCTs, we believe the potential for adverse ecological impacts and the potential for risks from exposure pathways other than air are insignificant for this source category.

Source Category Characterization

The IPCT NESHAP banned the use of chromium water treatment chemicals in IPCT systems. When the NESHAP was promulgated in September 1994, six industries used chromium water treatment chemicals: petroleum refining, chemical manufacturing, primary metals processing, tobacco products manufacturing, tire and rubber products manufacturing, textiles finishing, and glass manufacturing. At that time, most facilities in these industries operated between two and six IPCTs, and EPA estimated that these six industries operated approximately 8,100 IPCTs in total. The industries with the greatest demands for industrial cooling are the petroleum refining and chemical manufacturing industries. Some petroleum refineries operate 20 to 25 IPCTs. The largest chemical manufacturing plants operate an even larger number of IPCTs.

While chromium water treatment chemicals are no longer used, other chemicals which either contain or form HAP are often added to industrial water cooling systems to prevent corrosion, scaling, fouling, and to limit the growth of microorganisms.[1] These HAP may be emitted from any IPCT that serves the cooling water system. Based on a literature review and information from water treatment chemical suppliers, three HAP, methanol, ethylene thiourea, and chloroform, can be emitted depending on the types of water treatment chemicals uses. However, it is unlikely that more than one of these HAP would be emitted from a cooling water system at a time, since each is the product of a different water treatment chemical, and these chemicals are not likely to be used together.[2] Chlorine emissions from IPCTs would only be expected to occur under relatively acidic conditions (i.e., cooling water pH of 4.0 or less). Because current cooling water treatment programs operate under alkaline conditions, chlorine emissions from IPCTs are unlikely. For this reason, emissions of chlorine are not evaluated in this assessment.

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[1] *Estimated Worst-Case HAP Emissions for IPCTs*. Memorandum to Phil Mulrine,EPA/OAQPS/ESD/MG, from Richard Marinshaw, RTI. August 20, 2004, revised November 8, 2004.

Gulf Oil Products Company, in Port Arthur, Texas, was identified as the highest-emitting facility for the IPCT source category, based on total IPCT recirculation flow, which is directly proportional to emission rates. This facility has 19 IPCTs and the highest total emissions for the source category.[2] The facility with the second highest emissions is Dow Chemical Company in Freeport, Texas.[3] Since more information was available for the Dow facility, including the location coordinates for all 56 of the facility's IPCTs, it was chosen for modeling in this residual risk assessment. The impact of this facility selection on the assessment results is further discussed in the uncertainty section of this document.

Emissions Data

Worst-case emissions were calculated for the IPCTs at Dow by assuming that all three HAP are emitted from each IPCT, an unlikely occurrence. Individual IPCT recirculation rates from information collection request (ICR) responses were received during development of the MACT. Estimated HAP concentrations in cooling water were obtained from a review of the literature and conversations with water treatment chemical suppliers. The estimated HAP emissions can be found in Appendix A. More information about the method used to estimate the HAP emissions can be found in references 1, 2, and 3. A total of 0.321 Mg/yr (0.01 g/s) of methanol, 0.803 Mg/yr (0.03 g/s) of ethylene thiourea, and 2.36 Mg/yr (0.07 g/s) of chloroform was estimated to be emitted from all the IPCTs at Dow.

IPCT heights were also obtained from the ICR responses. Emissions exit velocities, exit temperatures, and stack diameters were not provided in the ICR responses. However, a model plant was created during the development of the IPCT MACT which did contain an exit velocity (8.83 m/s) and exit temperature (305.37 K).[4] These parameters were used for all the IPCTs at Dow for this analysis. No diameter was provided in the ICR data or developed for the model plant IPCTs, so a default was created using the average of reported values for IPCTs at petroleum refineries in the final 1999 National Emissions Inventory (NEI), (3.261 m). The IPCT-specific emissions and modeling parameters used for this assessment are summarized in Appendix A.

Selection of HAP and Dose-Response Information

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[2] Letter and attachments from W.E. Dunn, Gulf Oil Products Company, to J.Farmer, EPA/ESD. May 21, 1985. Response to Section 114 Information Collection Request for the Port Arthur, Texas facility.

[3] Letter and attachment from R.S. Rose, Dow Chemical U.S.A., to B.Nicholson, Midwest Research Institute. May 6, 1988. Recirculation rates and locations for IPCTs at the Freeport, Texas facility.

[4] Chromium Emissions from Industrial Process Cooling Towers - Background Information for Proposed Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC. September 1992.

The list of HAP emitted from IPCTs and considered in this assessment, along with their respective cancer and chronic non-cancer dose-response values, are presented in Table 1. The dose-response values used for this assessment of risks from chronic exposure are available on EPA's air toxics website at http://www.epa.gov/ttn/atw/toxsource/summary.html . Toxicity profiles for the three HAP were obtained from EPA's air toxics website at http://www.epa.gov/ttn/atw/hapindex.html and are provided in Appendix B.

Acute non-cancer dose-response assessment values from several sources are presented in Table 2. Because EPA has not defined a prioritization scheme for the use of these acute dose-response values in the assessment of air toxics (due largely to the differing contexts of their development), the predicted short-term exposure concentrations are compared to all of the available values for the HAP of interest. Further information on the acute reference values presented in Table 2 can be found on the EPA's air toxics website cited above.

Table 1. Chronic Cancer and Non-cancer Dose Response Values Used in This Assessment

HAP	WOE for Cancer [a]	URE[b] (1/(µg/m^3))	Source of URE Toxicity Value	RfC or similar value[c] (mg/m^3)	Source of RfC Toxicity Value
Chloroform [d]	B2	2.3x10^{-5}	IRIS	0.098	Agency for Toxic Substances and Disease Registry
Ethylene thiourea	B2	1.3x10^{-5}	California Environmental Protection Agency	0.003	California Environmental Protection Agency
Methanol	--	--	NA	4	California Environmental Protection Agency

Notes:

Source: EPA's air toxics website at http://www.epa.gov/ttn/atw/toxsource/summary.html . Accessed October 2004. A dash (–) indicates either no available weight-of-evidence conclusion on potential human carcinogenicity, or there was no adequate quantitative potency estimate for a particular HAP; thus, the HAP was not considered in the quantitative risk analysis for carcinogenic effects.

[a] Weight of evidence (WOE). B2 = Probable human carcinogen based on sufficient evidence in animals and inadequate or no evidence in humans.

[b] Unit risk estimate (URE): The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 µg/m^3 in air. The interpretation of unit risk would be as follows: if URE = 1.5x10^{-6} µg/m^3, up to 1.5 additional people are expected to develop cancer in their lifetime per 1,000,000 people exposed continuously for a lifetime to 1 µg of the chemical per 1 m^3 of air. "Upper-bound" in this context is defined as a plausible upper limit to the true probability. An appropriate interpretation of upper-bound unit risk estimates is that the true value is probably less, and probably not greater.

[c] Reference Concentration (RfC): An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

[d] Even though the OAQPS website does not include a cancer URE for chloroform, we used the current IRIS value for this assessment as a health-protective screen, since the IRIS value is, in the judgment of OAPQS, an extremely conservative value which likely overestimates cancer risks by a significant amount.

Table 2. Acute Non-cancer Dose-Response Values Used in This Assessment

HAP	Acute Dose-Response Values (mg/m^3)						
	AEGL-1[a]	AEGL-2[a]	ERPG-1[b]	ERPG-2[b]	IDLH/10[c]	MRL[d]	REL[e]
Chloroform	--	430		240	240	4.9e-01	1.5e-01
Ethylene thiourea	--	--	--	--	--	--	--
Methanol	690	2,700	260	1,300	790	--	28

Notes: **Source:** EPA's air toxics website at http://www.epa.gov/ttn/atw/toxsource/summary.html . Accessed October 2004. A dash (–) indicates that no acute dose-response value of that type was defined for that HAP. No acute dose-response values were identified for ethylene thiourea; therefore, this HAP was not included in the acute exposure and risk assessment.

[a] Acute Exposure Guideline Levels (AEGL), developed by EPA's National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances. The values are available through EPA's Office of Pollution Prevention and Pesticides and Toxic Substances website at http://www.epa.gov/oppt/aegl/chemlist.htm. The AEGL values shown in Table 2 are per a 60 minute exposure time and were converted from ppm to mg/m^3. AEGL-1 is the airborne concentration of a substance at or above which it is predicted that the general population, including ``susceptible" but excluding ``hypersusceptible" individuals, could experience notable discomfort. Airborne concentrations below AEGL-1 represent exposure levels that could produce mild odor, taste, or other sensory irritations. An AEGL-2 value is the airborne concentration of a substance at or above which it is predicted that the general population, including ``susceptible" but excluding ``hypersusceptible" individuals, could experience irreversible or other serious, long-lasting effects or impaired ability to escape. Airborne concentrations below the AEGL-2 but at or above AEGL-1 represent exposure levels that may cause notable discomfort.

[b] Emergency Response Planning Guidelines (ERPGs) have been developed by the American Industrial Hygiene Association. ERPG–1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor. An ERPG-2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action.

[c] Immediately Dangerous to Life or Health air concentration values (IDLHs) have been developed by the National Institute for Occupational Safety and Health (NIOSH). IDLHs are exposure concentrations that are likely to cause death or immediate or delayed permanent adverse health effects or that may prevent escape from such an environment. The IDLH values in Table 2 have been divided by a factor of 10, making them roughly comparable to mild-effect level benchmarks.

[d] Minimum Risk Levels (MRLs) have been developed by the Agency for Toxic Substances and Disease Registry (ATSDR) and the EPA for substances likely to be found at facilities on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List. MRLs are exposure concentrations set below levels that, based on current information, might cause adverse health effects in the people most sensitive to such substance-induced effects.

[e] Reference Exposure Levels (RELs) have been developed by California's Office of Environmental Health Hazard Assessment. RELs represent the concentration level at or below which no adverse health effects are anticipated for a specified exposure duration and are designed to protect the most sensitive individuals in the population by the inclusion of margins of safety.

Dispersion Modeling for Human Inhalation Exposures

Modeling was performed for both chronic and acute exposures. The methodology for each exposure scenario is explained in the sections below.

Chronic exposure modeling

The EPA's Industrial Source Complex - Short Term Version 3 (ISCST3) model was used for the assessment of chronic exposures. Information about ISCST3 is available from EPA at http://www.epa.gov/scram001/tt22.htm#isc .

The ISCST3 air dispersion model is a steady-state Gaussian plume model that can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. For this assessment, ISCST3 was used to estimate the average annual ambient concentration at locations near the facility specified by the use of a polar grid. The location with the highest annual average concentration of HAP was used to estimate the maximum lifetime individual cancer risk and chronic non-cancer hazard index (HI) for the facility.

Necessary source-related inputs for ISCST3 included emission rate, release point location coordinates, height of emissions release, emissions exit velocity, stack inside diameter, and emissions exit temperature. These inputs can be found in Appendix A. Other parameters and settings (e.g., urban or rural setting, downwash-related parameters) must also be specified for the modeled source. The land use surrounding the facility was assumed to be rural, and the terrain was assumed to be flat. Building downwash, particle deposition, and plume depletion were not considered. In this assessment, the regulatory default options were selected, as defined in the *User's Guide for the Industrial Source Complex Models*.[5] ISCST3 also requires the input of meteorological data for the area and information specifying receptor location. Five years of meteorological data were used, 1991-1995, with surface meteorological data from Galveston, Texas and upper air meteorological data from Corpus Christi, Texas. The polar grid receptor option was chosen, with receptors placed every 10° at 100, 200, 400, 800, 1,500, 2,500, 5,000, 10,000, 25,000 and 50,000 meters. ISCST3 uses all of this information to determine HAP concentrations at the specified receptors.

Because ISCST3 is designed to model one pollutant at a time, and there are multiple HAP emitted from IPCTs, a unit emission rate of 1 g/s was input to the ISCST3 model. Since the relationship between the emission rate and the resulting ground-level concentration is linear, the unit emission rate results could be applied to all three HAP. Risks were estimated by determining the location with the overall highest concentration (maximally impacted receptor) in the model output, and protectively assuming that the receptor population resided there. The

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[5] *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models*. U.S. EPA, OAQPS/EMAD, Research Triangle Park, NC 27711. EPA-454/B-95-003a. September 1995. Available on-line at: http://www.epa.gov/scram001/userg/regmod/isc3v1.pdf.

contribution from each IPCT to the concentration at the maximally impacted receptor was determined from the ISCST3 output. These unit-emission-rate concentrations were multiplied by the HAP-specific emission rates for each IPCT to obtain HAP-specific concentrations per cooling tower at the maximally impacted receptor. These concentrations were then multiplied by the URE or divided by the RfC (see table 1) for each HAP to arrive at noncancer hazard quotient and cancer risk estimates per chemical per cooling tower. The hazard quotients and cancer risks were summed across cooling towers and across HAP to arrive at the total cancer risk and noncancer hazard index from the facility. This calculation of risk is presented in Table C-1 of Appendix C.

Dispersion Modeling for Acute Exposures

The EPA's SCREEN3 model was used for the assessment of acute exposures. Information about SCREEN3 is available from EPA at http://www.epa.gov/scram001/tt22.htm#screen3.

SCREEN3 is a screening-level, Gaussian dispersion model that can estimate the 1-hour maximum ground-level concentration and the distance to that maximum concentration.[6] The model contains a set of wind speed and atmospheric stability values that are used in combination with facility-specific release parameters to predict the maximum ambient concentration along the centerline of a plume in the downwind direction.[7] SCREEN3 calculates ambient concentrations assuming worst-case meteorological conditions , no deposition or atmospheric reactions, and flat terrain. SCREEN3 does not incorporate population data, facility coordinates, or actual facility boundaries. By using SCREEN3, a relatively large degree of conservatism is incorporated in the modeling procedure to provide reasonable assurance that maximum concentrations will not be underestimated.[8]

Inputs to the SCREEN 3 model include source-related inputs, including the emission rate, height of emissions release, emissions exit velocity, stack inside diameter, and emissions exit temperature. Other parameters include terrain height, building downwash, meteorology options, rural or urban setting, and receptor distances. Of these options, the flat terrain option was selected because it was assumed that the terrain height did not exceed the stack-base height, building downwash was not considered, and the full meteorology option was selected, which directs SCREEN3 to examine all stability classes and wind speeds to identify the worst-case meteorological conditions. The rural setting was chosen, and receptor distances were selected

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[6] SCREEN3 Model User's Guide. U.S. EPA, OAQPS/EMAD, Research Triangle Park, NC 27711. EPA-454/B-95-004. September 1995. Available on-line at: http://www.epa.gov/scram001/userg/screen/screen3d.pdf

[7] SCREEN3 Model User's Guide. U.S. EPA, OAQPS/EMAD, Research Triangle Park, NC 27711. EPA-454/B-95-004. September 1995. Available on-line at: http://www.epa.gov/scram001/userg/screen/screen3d.pdf

[8] *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources*, U.S. EPA, OAQPS/EMAD, Research Triangle Park, NC 27711. EPA-454/R-92-019. 1992.

using the automated distance array option, with a minimum distance for the array of 100 meters and maximum of 50,000 meters. In addition, the default ambient temperature (293 K) was used, no flagpole receptor was used, and fumigation calculations were not performed.

The final risk estimates due to acute exposures were determined using the model outputs and several calculations. Because SCREEN3 is designed to model one pollutant at a time, and there are multiple HAP emitted from IPCTs, a theoretical unit emission rate of 1 g/s was input to the model. Since the relationship between the emission rate and the resulting receptor concentration is linear, the unit-emission-rate concentrations were multiplied by the HAP-specific emissions for each IPCT to obtain HAP-specific concentrations from each. Based on the desire to develop a conservative assessment of acute exposures, the HAP-specific hourly emission rates used for the acute assessment were chosen to be 10 times the average hourly emission rates used for the chronic assessment. The resultant predicted maximum concentrations of each HAP were divided by the acute dose response values in table 2 (AEGL, ERPG, IDLH/10, MRL and REL) to arrive at acute hazard quotient values per chemical per IPCT. The acute hazard quotients were summed per chemical. This calculation of acute hazard quotient is presented in Table C-2 of Appendix C.

Testing the new HEM-3 model for chronic and acute exposures

The EPA has developed a new version of the Human Exposure Model (HEM-3), which incorporates the ISCST3 dispersion model and also includes HAP dose response values, meteorological data, population data, and exposure algorithms to estimate risk from both chronic and acute exposures all in one package. As this model may be used by EPA in the future to perform risk assessments similar to this one for the IPCT source category, HEM-3 was tested in this assessment for its ease of use and the similarity of risk results as compared with those derived from ISCST3, combined with the necessary post-modeling calculations. For more information about this model, the draft HEM-3 model and a User's Guide are available through the Fate, Exposure and Risk Analysis website of EPA's Technology Transfer Network at http://www.epa.gov/ttn/fera/human_hem.html. The same inputs described for the chronic and acute scenarios above were used in the execution of HEM-3.

The concentration and risk outputs from the HEM-3 runs are displayed in Tables C-3 and C-4 of Appendix C.

Results and Discussion

Summary of Chronic Risk Assessment Results

The upper-bound lifetime cancer risk and chronic hazard index (HI) associated with the maximally exposed receptor are summarized in Table 3. The cancer risks and chronic hazard indices presented in Table 3 represent the cumulative across all chemicals and all emission release points. The upper-bound cancer risk estimated with ISCST3 was 4×10^{-7} and the hazard index was 2×10^{-3}. Table 3 also presents the risk results from HEM-3, which are identical.

Table 3. Summary of Estimated Cancer and Chronic Hazard Values				
Facility	**ISCST3**		**HEM3**	
	Maximum Cancer Risk[a]	**Maximum Hazard Index**	**Maximum Cancer Risk[b]**	**Maximum Hazard Index**
Dow Chemical	4×10^{-7}	2×10^{-3}	4×10^{-7}	2×10^{-3}

[a] This value includes cancer risks from chloroform. Chloroform does not have a URE in the EPA's air toxics website summary table; however, the IRIS URE of 2.3×10^{-5} was considered in this estimate.
[b] This value also includes cancer risks from chloroform. The HEM3 model includes dose response values; however, these dose-response values are based on the EPA air toxics website summary table, which does not include chloroform. Chloroform risks were calculated using the IRIS URE and included in this estimate for easy comparison with the ISCST3 results.

The values in Table 3, as well as the risks presented by individual IPCTs to the maximally exposed receptor are included in Tables C-1 and C-3 of Appendix C.

Summary of Acute Risk Assessment Results

The one-hour ambient concentrations estimated by SCREEN3 were compared to acute non-cancer dose-response values (presented in Table 2) for each of the HAP (with the exception of ethylene thiourea for which no acute dose-response values are available). The maximum exposure concentrations for chloroform and methanol were 4×10^{-3} mg/m^3 and 5×10^{-4} mg/m^3 respectively. Charts were generated plotting the maximum exposure concentrations against available acute dose-response concentration values (Figures 1 and 2). Note that the concentration (on the y-axis) is plotted on a logarithmic scale to accommodate the wide range of exposure concentrations and acute reference values. Table C-2 of Appendix C contains the acute risk calculations from SCREEN3.

As shown in Figures 1 and 2, the maximum estimated one-hour HAP exposure concentrations from SCREEN3 were below all available acute dose-response reference levels.

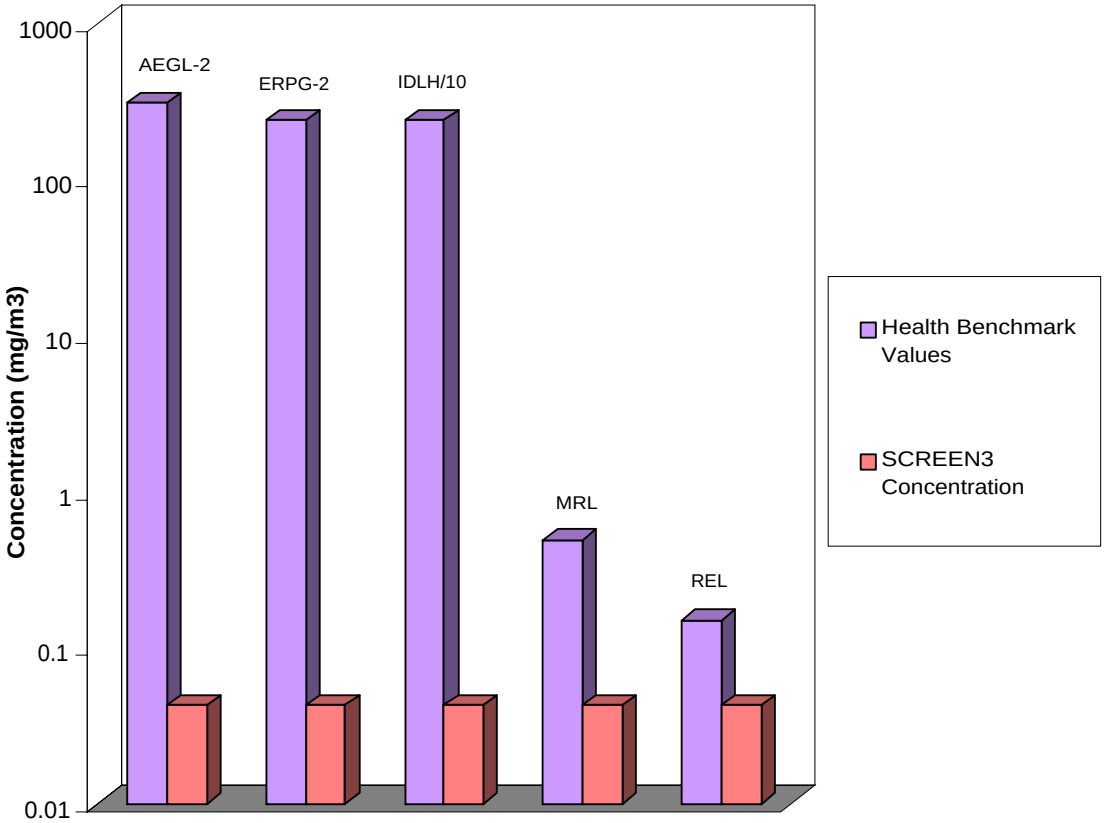

Figure 1. Chloroform Acute Exposure Reference Levels and Exposure Concentrations

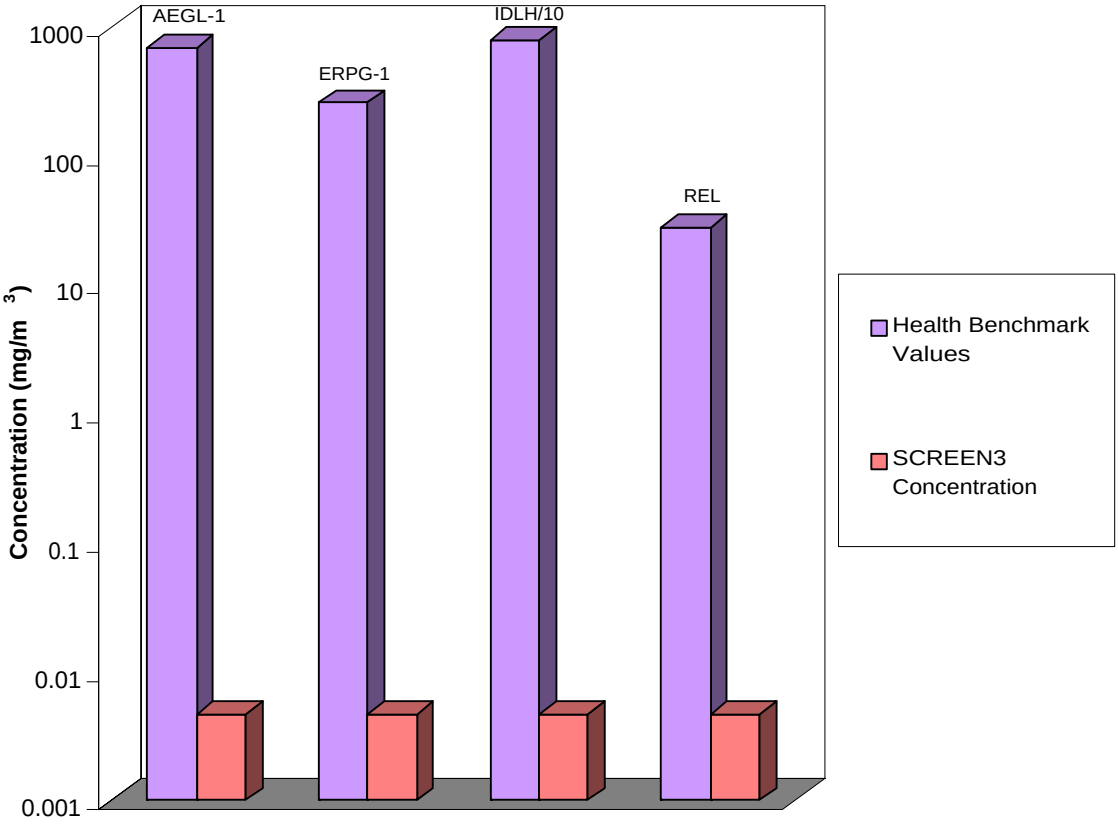

Figure 2. Methanol Acute Exposure Reference Levels and Exposure Concentrations

Summary of Human Health Multipathway and Ecological Assessment Results

As explained earlier in this document, due to their gaseous nature, lack of persistence in the environment, and lack of tendency to bioaccumulate the, the HAP emitted from IPCTs are not believed to pose any significant human multipathway or ecological risk.

Qualitative Uncertainty Analysis

This section summarizes some of the primary uncertainties associated with various components of this analysis, including the modeling data, the dispersion models as applied in this assessment, and toxicity information.

Emissions Data Uncertainties

Although the use of emission factors to estimate emissions from IPCT may overestimate or underestimate emissions at a specific facility, the emissions data used in this analysis were likely overstated. This is because chloroform, methanol, and ethylene thiourea were all assumed to be emitted from each IPCT while only one of these three HAP would be expected to be emitted from an actual IPCT.

The emissions for the IPCTs at Dow were calculated based on the recirculation rate and the application of an emission factor. The use of an emission factor introduces uncertainty to the modeling exercise, since certain assumptions must be made in the development of the emission factor that may not accurately depict the volatilization of these chemicals from the IPCT in every instance. However, in the absence of monitored or measured emission values, this method is deemed to provide a reasonable estimate.

The source for the recirculation rate data was a 1988 letter from Dow to an EPA contractor. Changes may have been made to the IPCTs or to the plant that have affected the recirculation rate, and IPCTs could have been added or taken off-line since then. However, IPCT technology has not changed greatly in this time, and it is estimated that current recirculation rates should remain similar to the rates from 1988. In addition, while the number of IPCTs in operation may be changed, it is unlikely that the resulting change in emissions would significantly impact the risk estimates, given the low level of emissions from any individual IPCT.

Model Plant Uncertainties

The use of a model plant approach in this assessment introduces uncertainty, in that each facility is not examined on a site-specific basis. The modeling parameters for the model plant, including emissions, emission release parameters, meteorology, and the locations of emission points relative to the location of receptors, are presumed to represent the conditions at all facilities in the IPCT source category. This may or may not be the case and, therefore, represents a source of uncertainty. However, this uncertainty in our ability to extrapolate from the model plant to other IPCTs was reduced, to the extent possible, by focusing on a very large facility in an area with resident populations nearby. Emissions were also increased to account for the differences in emission rates between the model plant and the highest emitting facility, as explained further below. One facility was chosen to represent the IPCT source category in this assessment. While the Dow Chemical Company facility in Freeport, Texas had the second highest emission rate from IPCTs, it was chosen over the highest emitting facility (Gulf Oil Products Company in Port Arthur, Texas). This selection was made based on the availability of

emission point latitude/longitude coordinates, which were available for the Dow but not the Gulf facility. This left some uncertainty that the risks presented by the Dow facility were the highest that would be expected from any source in the source category.

To address this uncertainty, a maximum emission scenario was developed. In this scenario, the Dow facility was treated as a "model plant" where the emission point locations and the other emissions release characteristics were retained, but the emissions were increased across the IPCTs proportionately to the level emitted overall by the Gulf facility. This amounted to increasing the emissions of methanol, ethylene thiourea, and chloroform from each IPCT by approximately 17 percent, and also increased the maximum lifetime individual cancer risk and the maximum hazard index by approximately 17 percent, to values of 5×10^{-7}, and 3×10^{-3} respectively. The maximum acute exposure concentration for chloroform is 5×10^{-3} mg/m^3 and the concentration for methanol is 5×10^{-4} mg/m^3. Tables C-5 and C-6 of Appendix C contain the chronic and acute risk calculations used for this maximum emission scenario.

The results of this maximum emission scenario indicate that it is unlikely that significant risks were missed using the chosen facility.

Parameter Uncertainties

Actual parameter data from the ICR response for Dow were used where available, and model IPCT parameters were used for those not reported in the ICR. The IPCTs at Dow are spread over a large area (see map in Appendix D), which leads to uncertainty that the coordinates are all correct. Stack diameter information was missing from both data sources. A default value was developed based on the average reported (not including any default values EPA used to fill in the data) stack diameter in the NEI for IPCTs at petroleum refineries. The use of the general values from the model IPCT exercise and defaults introduces uncertainties into modeling and calculating risks, as these values may not best represent conditions at a facility. However, in the absence of site-specific data, every effort was made to provide reasonable values (i.e., values that would not result in a gross over- or under-estimate of risks).

No building or cooling tower dimensions data were provided in the ICR to use in an analysis of building downwash effects. This type of information is not included in the NEI, nor was it available from the model IPCT exercise conducted during MACT development. Due to the lack of this parameter data, building downwash effects were not characterized. This adds uncertainty to the assessment.

Modeling Uncertainties

Three models, SCREEN3, ISCST3 and HEM-3 were chosen for use in this assessment. Other models, such as the Seasonal and Annual Cooling Tower Impact (SACTI) model, have been developed that consider more precisely the effects of moisture content on plume behavior and droplet deposition. While differences may be observed between the results of different models, EPA considers SCREEN3, ISCST3, and HEM-3 to be appropriate models for the scope of this analysis.

There are aspects of the application of SCREEN3, ISCST3, and HEM-3 that can introduce uncertainty to the final results. For example, these models require the use of assumptions associated with model algorithms, meteorology, geography, deposition, chemical fate and transport, terrain and building downwash effects. Although there are uncertainties inherent in these assumptions, none would be expected to result in a systematic over- or under-estimation of risks.

For each model, fate and transport characteristics were assumed to be the same for all HAP (e.g., no chemical transformation to more or less toxic substances was modeled; all chemicals were assumed to disperse in the same way). EPA considers this approach to be appropriate for assessments focused on the point of maximum impact because these locations tend to be near the sources, leaving little time for deposition or atmospheric chemistry to impact exposures. In addition, the modeling terrain was assumed to be flat, which could misrepresent conditions for releases in complex terrains.

Exposure Uncertainties

For the assessment of chronic risks, it was conservatively assumed that individuals may be exposed to air toxics 24 hours/day, 7 days/week over a lifetime of 70 years. These assumptions were used in order to capture the maximum possible exposure and provide the most health-protective results. In addition, it was assumed, in modeling with ISCST3, that these individuals live as close to the facility as 100 meters from the facility center, based on the locations of the cooling towers emission points. This assumption may overstate the proximity of residents to the facility, as the emission points are very widely distributed, and a 100 meter distance from the center of those points may still be on the property of the facility. Using these conservative, health-protective exposure assumptions likely results in an overestimate of actual risks.

Toxicological Uncertainties

Toxicity values used in this assessment were based on values compiled by EPA for air risk assessment in October 2004. These values are continuously under review and may be subject to change as new health studies become available.

As noted earlier, the values summarized on EPA's air toxics website do not contain a cancer dose-response value for chloroform. This is because chloroform has already been determined to have a non-linear dose-response mechanism via the ingestion exposure route, and EPA considers this mechanism likely to apply to inhalation also when the IRIS assessment for inhalation is updated. However, because the IRIS assessment has not yet been completed and chloroform continues to be classified as a probable human carcinogen (B2), we protectively used the existing IRIS URE, which is based on linear low-dose extrapolation, to perform this screening assessment. Since this purposely provides an upward bias to the risk assessment, and since the resultant risks were below 1 in a million, we are confident that actual risks are well below any level of concern.

Source Category Conclusions

This residual risk assessment may be summarized as follows:

- This facility, Dow Chemical in Freeport, TX, has the second highest emission rate for IPCTs in the source category, only slightly below the facility with the highest emission rate, Gulf Oil Products, Port Arthur, TX. The Dow facility was modeled instead of the Gulf Oil facility because location coordinates were available for all IPCTs at Dow but not for Gulf Oil. Worst-case emissions (i.e., assuming all three HAP are emitted from the same IPCTs) were estimated based on the known recirculation rates and emission factors. The ISCST3 model was utilized for chronic exposure, and SCREEN3 was used to model an acute exposure scenario.

- The IPCTs at Dow were assessed for potential cancer risks due emissions of ethylene thiourea and chloroform using ISCST3. The estimated maximum lifetime individual cancer risk from IPCT HAP was $4 \times 10^{-7.}$

- The IPCTs at Dow were assessed for potential chronic non-cancer hazards due to emissions of chloroform, ethylene thiourea, and methanol using ISCST3. The estimated maximum chronic non-cancer hazard index was 2×10^{-3}.

- There are no PB HAP known to be emitted from IPCTs, thus no human health multipathway or ecological risks are expected.

- The IPCTs at Dow were assessed for potential acute non-cancer hazards due to emissions of chloroform, ethylene thiourea, and methanol using SCREEN3. All maximum one-hour exposure concentrations were below available acute dose-response thresholds.

- A model plant scenario was undertaken to reduce the uncertainty that other plants would pose risks higher than those presented by the Dow facility. This analysis increased the emission rate to that of the highest emitting facility, while keeping all other modeling parameters constant. Using this model plant scenario, the maximum lifetime individual

cancer risk associated with the maximally exposed receptor is 5×10^{-7}, and the maximum hazard index is 3×10^{-3}.

- A new model prototype, HEM3 was tested in this analysis. The results proved to identical to those produced by ISCST3 for the chronic exposure scenario.

This analysis is not exhaustive and is not intended to be. We have used (1) the best emissions data currently available to us and (2) reasonable dispersion models. Additionally, we applied several health-protective assumptions, biasing our risk projections on the high side. On balance, using our scientific judgment and risk assessment experience, we believe the results are protective, meaning the predicted risk estimates are likely higher than would be expected to actually occur in the exposed population.

Given these results, the potential for unacceptable chronic or acute human health effects and ecological effects appears to be low for this source category.

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APPENDICES

Contents

APPENDIX A

Estimated Emissions and Model Inputs for IPCTs at Dow Chemical Company, Freeport, Texas

Table A-1. Estimated HAP Emissions from IPCTS for Dow Chemical Company, Freeport, Texas

IPCT No.	Recirculation rate, L/min	Model IPCT Size	Methanol		Ethylene thiourea		Chloroform	
			g/sec	Mg/yr	g/sec	Mg/yr	g/sec	Mg/yr
A-1800	181,694	E	7.2e-04	2.0e-02	3.3e-03	8.9e-02	6.7e-03	1.8e-01
A-1920	6,056	B	2.4e-05	6.6e-04	1.1e-04	3.0e-03	2.2e-04	6.1e-03
A-2622	18,169	C	7.2e-05	2.0e-03	3.3e-04	8.9e-03	6.7e-04	1.8e-02
A-2820	6,056	B	2.4e-05	6.6e-04	1.1e-04	3.0e-03	2.2e-04	6.1e-03
A-3204	10,220	B	4.0e-05	1.1e-03	1.8e-04	5.0e-03	3.8e-04	1.0e-02
A-3206	17,034	C	6.7e-05	1.9e-03	3.0e-04	8.4e-03	6.3e-04	1.7e-02
A-3665	76,463	D	3.0e-04	8.3e-03	1.4e-03	3.8e-02	2.8e-03	7.7e-02
A-3850	62,457	D	2.5e-04	6.8e-03	1.1e-03	3.1e-02	2.3e-03	6.3e-02
A-5070	158,983	E	6.3e-04	1.7e-02	2.8e-03	7.8e-02	5.8e-03	1.6e-01
A-808	56,780	D	2.2e-04	6.2e-03	1.0e-03	2.8e-02	2.1e-03	5.7e-02
A-808a	94,633	D	3.7e-04	1.0e-02	1.7e-03	4.7e-02	3.5e-03	9.6e-02
B-115	1,893	A	7.5e-06	2.1e-04	3.4e-05	9.3e-04	6.9e-05	1.9e-03
B-1202	17,034	C	6.7e-05	1.9e-03	3.0e-04	8.4e-03	6.3e-04	1.7e-02
B-1217	6,056	B	2.4e-05	6.6e-04	1.1e-04	3.0e-03	2.2e-04	6.1e-03
B-1350	757	A	3.0e-06	8.2e-05	1.4e-05	3.7e-04	2.8e-05	7.6e-04
B-1476	3,785	A	1.5e-05	4.1e-04	6.8e-05	1.9e-03	1.4e-04	3.8e-03
B-1700	2,460	A	9.7e-06	2.7e-04	4.4e-05	1.2e-03	9.0e-05	2.5e-03
B-2004	18,927	C	7.5e-05	2.1e-03	3.4e-04	9.3e-03	6.9e-04	1.9e-02
B-2224	24,604	C	9.7e-05	2.7e-03	4.4e-04	1.2e-02	9.0e-04	2.5e-02
B-2301	52,994	D	2.1e-04	5.8e-03	9.5e-04	2.6e-02	1.9e-03	5.4e-02
B-2401	757	A	3.0e-06	8.2e-05	1.4e-05	3.7e-04	2.8e-05	7.6e-04
B-2401	379	A	1.5e-06	4.1e-05	6.8e-06	1.9e-04	1.4e-05	3.8e-04
B-2403	1,136	A	4.5e-06	1.2e-04	2.0e-05	5.6e-04	4.2e-05	1.2e-03
B-2707	23,734	C	9.4e-05	2.6e-03	4.2e-04	1.2e-02	8.7e-04	2.4e-02
B-2707	38,497	D	1.5e-04	4.2e-03	6.9e-04	1.9e-02	1.4e-03	3.9e-02
B-3051	3,028	A	1.2e-05	3.3e-04	5.4e-05	1.5e-03	1.1e-04	3.1e-03
B-3235	59,528	D	2.4e-04	6.5e-03	1.1e-03	2.9e-02	2.2e-03	6.0e-02

Table A-1. Estimated HAP Emissions from IPCTS for Dow Chemical Company, Freeport, Texas

IPCT No.	Recirculation rate, L/min	Model IPCT Size	Methanol		Ethylene thiourea		Chloroform	
			g/sec	Mg/yr	g/sec	Mg/yr	g/sec	Mg/yr
B-3803	2,271	A	9.0e-06	2.5e-04	4.1e-05	1.1e-03	8.3e-05	2.3e-03
B-3803	2,271	A	9.0e-06	2.5e-04	4.1e-05	1.1e-03	8.3e-05	2.3e-03
B-3806	1,136	A	4.5e-06	1.2e-04	2.0e-05	5.6e-04	4.2e-05	1.2e-03
B-3809	3,785	A	1.5e-05	4.1e-04	6.8e-05	1.9e-03	1.4e-04	3.8e-03
B-3815	2,271	A	9.0e-06	2.5e-04	4.1e-05	1.1e-03	8.3e-05	2.3e-03
B-3920	16,277	C	6.4e-05	1.8e-03	2.9e-04	8.0e-03	6.0e-04	1.6e-02
B-4101	70,028	D	2.8e-04	7.6e-03	1.3e-03	3.5e-02	2.6e-03	7.1e-02
B-4400	1,136	A	4.5e-06	1.2e-04	2.0e-05	5.6e-04	4.2e-05	1.2e-03
B-4600	5,299	B	2.1e-05	5.8e-04	9.5e-05	2.6e-03	1.9e-04	5.4e-03
B-4601	3,028	A	1.2e-05	3.3e-04	5.4e-05	1.5e-03	1.1e-04	3.1e-03
B-4808	1,136	A	4.5e-06	1.2e-04	2.0e-05	5.6e-04	4.2e-05	1.2e-03
B-5006	1,136	A	4.5e-06	1.2e-04	2.0e-05	5.6e-04	4.2e-05	1.2e-03
B-5010	2,271	A	9.0e-06	2.5e-04	4.1e-05	1.1e-03	8.3e-05	2.3e-03
B-5010	2,271	A	9.0e-06	2.5e-04	4.1e-05	1.1e-03	8.3e-05	2.3e-03
B-5213	34,635	C	1.4e-04	3.8e-03	6.2e-04	1.7e-02	1.3e-03	3.5e-02
B-5601	75,706	D	3.0e-04	8.2e-03	1.4e-03	3.7e-02	2.8e-03	7.6e-02
B-6201	43,531	D	1.7e-04	4.7e-03	7.8e-04	2.1e-02	1.6e-03	4.4e-02
B-624	26,497	C	1.1e-04	2.9e-03	4.7e-04	1.3e-02	9.7e-04	2.7e-02
B-6403	1,457	A	5.8e-06	1.6e-04	2.6e-05	7.2e-04	5.3e-05	1.5e-03
B-6610	3,785	A	1.5e-05	4.1e-04	6.8e-05	1.9e-03	1.4e-04	3.8e-03
B-7101	2,460	A	9.7e-06	2.7e-04	4.4e-05	1.2e-03	9.0e-05	2.5e-03
B-7201	366,039	F	1.5e-03	4.0e-02	6.5e-03	1.8e-01	1.3e-02	3.7e-01
B-7501	151,412	E	6.0e-04	1.7e-02	2.7e-03	7.5e-02	5.6e-03	1.5e-01
B-7701	37,853	D	1.5e-04	4.1e-03	6.8e-04	1.9e-02	1.4e-03	3.8e-02
B-8401	29,828	C	1.2e-04	3.2e-03	5.3e-04	1.5e-02	1.1e-03	3.0e-02
OC-U1	73,518	D	2.9e-04	8.0e-03	1.3e-03	3.6e-02	2.7e-03	7.4e-02
OC-U2	134,692	E	5.3e-04	1.5e-02	2.4e-03	6.6e-02	4.9e-03	1.4e-01

Table A-1. Estimated HAP Emissions from IPCTS for Dow Chemical Company, Freeport, Texas

IPCT No.	Recirculation rate, L/min	Model IPCT Size	Methanol		Ethylene thiourea		Chloroform	
			g/sec	Mg/yr	g/sec	Mg/yr	g/sec	Mg/yr
OC-U2	158,839	E	6.3e-04	1.7e-02	2.8e-03	7.8e-02	5.8e-03	1.6e-01
OC-U3	134,261	E	5.3e-04	1.5e-02	2.4e-03	6.6e-02	4.9e-03	1.4e-01
Total	**2,332,945**		**9.2e-03**	**2.5e-01**	**4.2e-02**	**1.2e+00**	**8.6e-02**	**2.4e+00**

Source for recirculation rates: Letter from R. S. Rose, Dow Chemical Company, to Bruce Nicholson, MRI, May 6, 1988.

Table A-2. SCREEN3 and ISCST3 Model Inputs for IPCTs at the Dow Chemical Company, Freeport, Texas

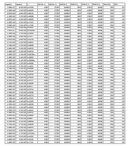
Cooling Tower ID	Stack Height	Temp.	Velocity	Diameter	Latitude			Longitude			Emissions (g/s)		
	Meters	Kelvin	(Meters/ second)	Meters	Deg	Min	Sec	Deg	Min	Sec	Methanol	Ethylene thiourea	Chloroform
a-1800	15.2	305.4	8.8	3.26	28	56	48	95	19	2	7.2e-04	3.3e-03	6.7e-03
a-1920	6.4	305.4	8.8	3.26	28	57	8	95	19	24	2.4e-05	1.1e-04	2.2e-04
a-2622	9.1	305.4	8.8	3.26	28	56	46	95	18	49	7.2e-05	3.3e-04	6.7e-04
a-2820	6.4	305.4	8.8	3.26	28	59	29	95	23	45	2.4e-05	1.1e-04	2.2e-04
a-3204	6.4	305.4	8.8	3.26	28	57	7	95	19	0	4.0e-05	1.8e-04	3.8e-04
a-3206	9.1	305.4	8.8	3.26	28	57	2	95	18	58	6.7e-05	3.0e-04	6.3e-04
a-3665	12.2	305.4	8.8	3.26	28	56	57	95	18	57	3.0e-04	1.4e-03	2.8e-03
a-3850	12.2	305.4	8.8	3.26	28	57	7	95	18	41	2.5e-04	1.1e-03	2.3e-03
a-5070	15.2	305.4	8.8	3.26	28	57	39	95	18	52	6.3e-04	2.8e-03	5.8e-03
a-808	12.2	305.4	8.8	3.26	28	56	38	95	19	17	2.2e-04	1.0e-03	2.1e-03
 a-808a	12.2	305.4	8.8	3.26	28	56	38	95	19	49	3.7e-04	1.7e-03	3.5e-03
b-115	4.9	305.4	8.8	3.26	28	59	18	95	22	57	7.5e-06	3.4e-05	6.9e-05
b-1202	9.1	305.4	8.8	3.26	28	59	7	95	22	47	6.7e-05	3.0e-04	6.3e-04
b-1217	6.4	305.4	8.8	3.26	28	59	7	95	22	53	2.4e-05	1.1e-04	2.2e-04
b-1350	4.9	305.4	8.8	3.26	28	59	31	95	23	40	3.0e-06	1.4e-05	2.8e-05
b-1476	4.9	305.4	8.8	3.26	28	59	3	95	22	47	1.5e-05	6.8e-05	1.4e-04
b-1700	4.9	305.4	8.8	3.26	28	59	38	95	23	45	9.7e-06	4.4e-05	9.0e-05
b-2004	9.1	305.4	8.8	3.26	28	59	17	95	22	21	7.5e-05	3.4e-04	6.9e-04
b-2224	9.1	305.4	8.8	3.26	28	59	26	95	23	38	9.7e-05	4.4e-04	9.0e-04
b-2301	12.2	305.4	8.8	3.26	28	59	43	95	23	48	2.1e-04	9.5e-04	1.9e-03
b-2401	4.9	305.4	8.8	3.26	28	59	16	95	23	45	3.0e-06	1.4e-05	2.8e-05
b-2401a	4.9	305.4	8.8	3.26	28	59	16	95	23	46	1.5e-06	6.8e-06	1.4e-05

Table A-2. SCREEN3 and ISCST3 Model Inputs for IPCTs at the Dow Chemical Company, Freeport, Texas

Cooling Tower ID	Stack Height	Temp.	Velocity	Diameter	Latitude			Longitude			Emissions (g/s)		
	Meters	Kelvin	(Meters/ second)	Meters	Deg	Min	Sec	Deg	Min	Sec	Methanol	Ethylene thiourea	Chloroform
b-2403	4.9	305.4	8.8	3.26	28	59	15	95	23	41	4.5e-06	2.0e-05	4.2e-05
b-2707	9.1	305.4	8.8	3.26	28	59	45	95	23	56	9.4e-05	4.2e-04	8.7e-04
b-2707a	12.2	305.4	8.8	3.26	28	59	46	95	23	57	1.5e-04	6.9e-04	1.4e-03
b-3051	4.9	305.4	8.8	3.26	28	59	20	95	23	51	1.2e-05	5.4e-05	1.1e-04
b-3235	12.2	305.4	8.8	3.26	28	59	15	95	24	3	2.4e-04	1.1e-03	2.2e-03
b-3803	4.9	305.4	8.8	3.26	28	59	29	95	23	55	9.0e-06	4.1e-05	8.3e-05
b-3803a	4.9	305.4	8.8	3.26	28	59	31	95	23	56	9.0e-06	4.1e-05	8.3e-05
b-3806	4.9	305.4	8.8	3.26	28	59	31	95	23	55	4.5e-06	2.0e-05	4.2e-05
b-3809	4.9	305.4	8.8	3.26	28	59	33	95	23	52	1.5e-05	6.8e-05	1.4e-04
b-3815	4.9	305.4	8.8	3.26	28	59	34	95	23	54	9.0e-06	4.1e-05	8.3e-05
b-3920	9.1	305.4	8.8	3.26	28	59	46	95	24	13	6.4e-05	2.9e-04	6.0e-04
b-4101	12.2	305.4	8.8	3.26	28	59	57	95	24	9	2.8e-04	1.3e-03	2.6e-03
b-4400	4.9	305.4	8.8	3.26	28	59	3	95	24	2	4.5e-06	2.0e-05	4.2e-05
b-4600	6.4	305.4	8.8	3.26	28	59	27	95	24	6	2.1e-05	9.5e-05	1.9e-04
b-4601	4.9	305.4	8.8	3.26	28	59	31	95	24	9	1.2e-05	5.4e-05	1.1e-04
b-4808	4.9	305.4	8.8	3.26	28	59	8	95	24	11	4.5e-06	2.0e-05	4.2e-05
b-5006	4.9	305.4	8.8	3.26	28	59	30	95	23	12	4.5e-06	2.0e-05	4.2e-05
b-5010	4.9	305.4	8.8	3.26	28	59	33	95	24	11	9.0e-06	4.1e-05	8.3e-05
b-5010a	4.9	305.4	8.8	3.26	28	59	32	95	24	11	9.0e-06	4.1e-05	8.3e-05
b-5213	9.1	305.4	8.8	3.26	28	59	43	95	24	15	1.4e-04	6.2e-04	1.3e-03
b-5601	12.2	305.4	8.8	3.26	28	59	26	95	24	29	3.0e-04	1.4e-03	2.8e-03
b-6201	12.2	305.4	8.8	3.26	28	59	46	95	24	22	1.7e-04	7.8e-04	1.6e-03
b-624	9.1	305.4	8.8	3.26	28	59	20	95	23	22	1.1e-04	4.7e-04	9.7e-04
b-6403	4.9	305.4	8.8	3.26	28	59	37	95	24	28	5.8e-06	2.6e-05	5.3e-05
b-6610	4.9	305.4	8.8	3.26	28	59	26	95	24	40	1.5e-05	6.8e-05	1.4e-04
b-7101	4.9	305.4	8.8	3.26	28	59	57	95	24	30	9.7e-06	4.4e-05	9.0e-05

Table A-2. SCREEN3 and ISCST3 Model Inputs for IPCTs at the Dow Chemical Company, Freeport, Texas

Cooling Tower ID	Stack Height	Temp.	Velocity	Diameter	Latitude			Longitude			Emissions (g/s)		
	Meters	Kelvin	(Meters/ second)	Meters	Deg	Min	Sec	Deg	Min	Sec	Methanol	Ethylene thiourea	Chloroform
b-7201	19.8	305.4	8.8	3.26	28	59	24	95	24	46	1.5e-03	6.5e-03	1.3e-02
b-7501	15.2	305.4	8.8	3.26	28	59	41	95	24	41	6.0e-04	2.7e-03	5.6e-03
b-7701	12.2	305.4	8.8	3.26	28	59	58	95	24	31	1.5e-04	6.8e-04	1.4e-03
b-8401	9.1	305.4	8.8	3.26	28	59	40	95	24	55	1.2e-04	5.3e-04	1.1e-03
oc-u1	12.2	305.4	8.8	3.26	28	58	29	95	20	50	2.9e-04	1.3e-03	2.7e-03
oc-u2	15.2	305.4	8.8	3.26	28	58	39	95	20	59	5.3e-04	2.4e-03	4.9e-03
oc-u2	15.2	305.4	8.8	3.26	28	58	35	95	20	58	6.3e-04	2.8e-03	5.8e-03
oc-u3	15.2	305.4	8.8	3.26	28	58	33	95	20	39	5.3e-04	2.4e-03	4.9e-03

APPENDIX B

Toxicity Profiles for Chloroform, Ethylene thiourea, and Methanol

Chloroform Hazard Summary

Chloroform may be released to the air as a result of its formation in the chlorination of drinking water, wastewater and swimming pools. Other sources include pulp and paper mills, hazardous waste sites, and sanitary landfills. The major effect from acute (short-term) inhalation exposure to chloroform is central nervous system depression. Chronic (long-term) exposure to chloroform by inhalation in humans has resulted in effects on the liver, including hepatitis and jaundice, and central nervous system effects, such as depression and irritability. Chloroform has been shown to be carcinogenic in animals after oral exposure, resulting in an increase in kidney and liver tumors. EPA has classified chloroform as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS), which contains information on oral chronic toxicity and the RfD, and the carcinogenic effects of chloroform including the unit cancer risk for inhalation exposure, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Chloroform.

Uses

- The vast majority of the chloroform produced in the United States is used to make HCFC-22. The rest is produced for export and for miscellaneous uses. (1)
- Chloroform was used in the past as an extraction solvent for fats, oils, greases, and other products; as a dry cleaning spot remover; in fire extinguishers; as a fumigant; and as an anesthetic. However, chloroform is no longer used in these products. (1)

Sources and Potential Exposure

- Chloroform may be released to the air from a large number of sources related to its manufacture and use, as well as its formation in the chlorination of drinking water, wastewater, and swimming pools. Pulp and paper mills, hazardous waste sites, and sanitary landfills are also sources of air emissions. The background level of chloroform in ambient air in the early 1990s was estimated at 0.00004 parts per million (ppm). (1)
- Human exposure to chloroform may occur through drinking water, where chloroform is formed as a result of the chlorination of naturally occurring organic materials found in raw water supplies. Measurements of chloroform in drinking water during the 1970s and 1980s ranged from 0.022 to 0.068 ppm. (1)
- Chloroform may also be found in some foods and beverages, largely from the use of tap water during production processes. (1)

Assessing Personal Exposure

- Chloroform can be detected in blood, urine, and body tissues. However, these methods are not very reliable because chloroform is rapidly eliminated from the body, and the tests are not specific for chloroform. (1)

Health Hazard Information

Acute Effects:

- The major effect from acute inhalation exposure to chloroform in humans is central nervous system depression. At very high levels (40,000 ppm), chloroform exposure may result in death, with concentrations in the range of 1,500 to 30,000 ppm producing anesthesia, and lower concentrations (<1,500 ppm) resulting in dizziness, headache, tiredness, and other effects. (1,2)
- Effects noted in humans exposed to chloroform via anesthesia include changes in respiratory rate, cardiac effects, gastrointestinal effects, such as nausea and vomiting, and effects on the liver and kidney. Chloroform is not currently used as a surgical anesthetic. (1,2)
- In humans, a fatal oral dose of chloroform may be as low as 10 mL (14.8 g), with death due to respiratory or cardiac arrest. (1,2)
- Tests involving acute exposure of animals have shown chloroform to have low acute toxicity from inhalation exposure and moderate acute toxicity from oral exposure. (3)

Chronic Effects (Noncancer):

- Chronic exposure to chloroform by inhalation in humans is associated with effects on the liver, including hepatitis and jaundice, and central nervous system effects, such as depression and irritability. Inhalation exposures of animals have also resulted in effects on the kidney. (1,2)
- Chronic oral exposure to chloroform in humans has resulted in effects on the blood, liver, and kidney. (1,2)
- EPA has not established a Reference Concentration (RfC) for chloroform. (4)
- The California Environmental Protection Agency (CalEPA) has established a chronic reference exposure level of 0.3 milligrams per cubic meter (mg/m3) for chloroform based on exposures resulting in kidney and liver effects in rats. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. It is not a direct estimator of risk, but rather a reference point to gauge the potential effects. At lifetime exposures increasingly greater than the reference exposure level, the potential for adverse health effects increases. (5)
- ATSDR has established an acute inhalation minimal risk level (MRL) of 0.5 mg/m3 (0.1 ppm) based on exposures resulting in liver effects in mice, an intermediate inhalation MRL of 0.2 mg/m3 (0.05 ppm) based on worker exposures resulting in liver effects in humans, and a chronic inhalation MRL of 0.1 mg/m3 (0.02 ppm) also based on liver effects in humans. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. (1)

- The Reference Dose (RfD) for chloroform is 0.01 milligrams per kilogram per day (mg/kg/d) based on exposures resulting in fatty cyst formation in the livers of dogs. The RfD is 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 appreciable risk of deleterious noncancer effects during a lifetime. (4)
- EPA has medium to low confidence in the RfD due to: medium confidence in the critical study on which the RfD was based because only two treatment doses were used, and a no-observed-effect level (NOEL) was not determined; and medium to low confidence in the database because several studies support the choice of a lowest-observed-adverse-effect level (LOAEL), but a NOEL was not found. (4)

Reproductive/Developmental Effects:

- Little information is available on the reproductive or developmental effects of chloroform in humans, via any route of exposure. A possible association between certain birth outcomes (e.g., low birth weight, cleft palate) and consumption of contaminated drinking water was reported. However, because multiple contaminants were present, the role of chloroform is unclear. (1)
- Animal studies have demonstrated developmental effects, such as decreased fetal body weight, fetal resorptions, and malformations in the offspring of animals exposed to chloroform via inhalation. (1)
- Reproductive effects, such as decreased conception rates, decreased ability to maintain pregnancy, and an increase in the percentage of abnormal sperm were observed in animals exposed to chloroform through inhalation. (1)
- Animal studies have noted decreased fetal weight, increased fetal resorptions, but no evidence of birth defects, in animals orally exposed to chloroform. (1)

Cancer Risk:

- No information is available regarding cancer in humans or animals after inhalation exposure to chloroform. (1)
- Epidemiologic studies suggest an association between cancer of the large intestine, rectum, and/or bladder and the constituents of chlorinated drinking water, including chloroform. However, there are no epidemiologic studies of water containing only chloroform. (1)
- Chloroform has been shown to be carcinogenic in animals after oral exposure, resulting in an increase in kidney and liver tumors. (1)
- EPA considers chloroform to be a probable human carcinogen and has ranked it in EPA's Group B2. (4)
- EPA has determined that although chloroform is likely to be carcinogenic to humans by all routes of exposure under high-exposure conditions that lead to cell death and regrowth in susceptible tissues, chloroform is not likely to cause cancer in humans by any route of exposure under exposure conditions that do not cause cell death and regrowth. Therefore, EPA has not derived either an oral carcinogenic potency slope or an inhalation unit risk for chloroform.

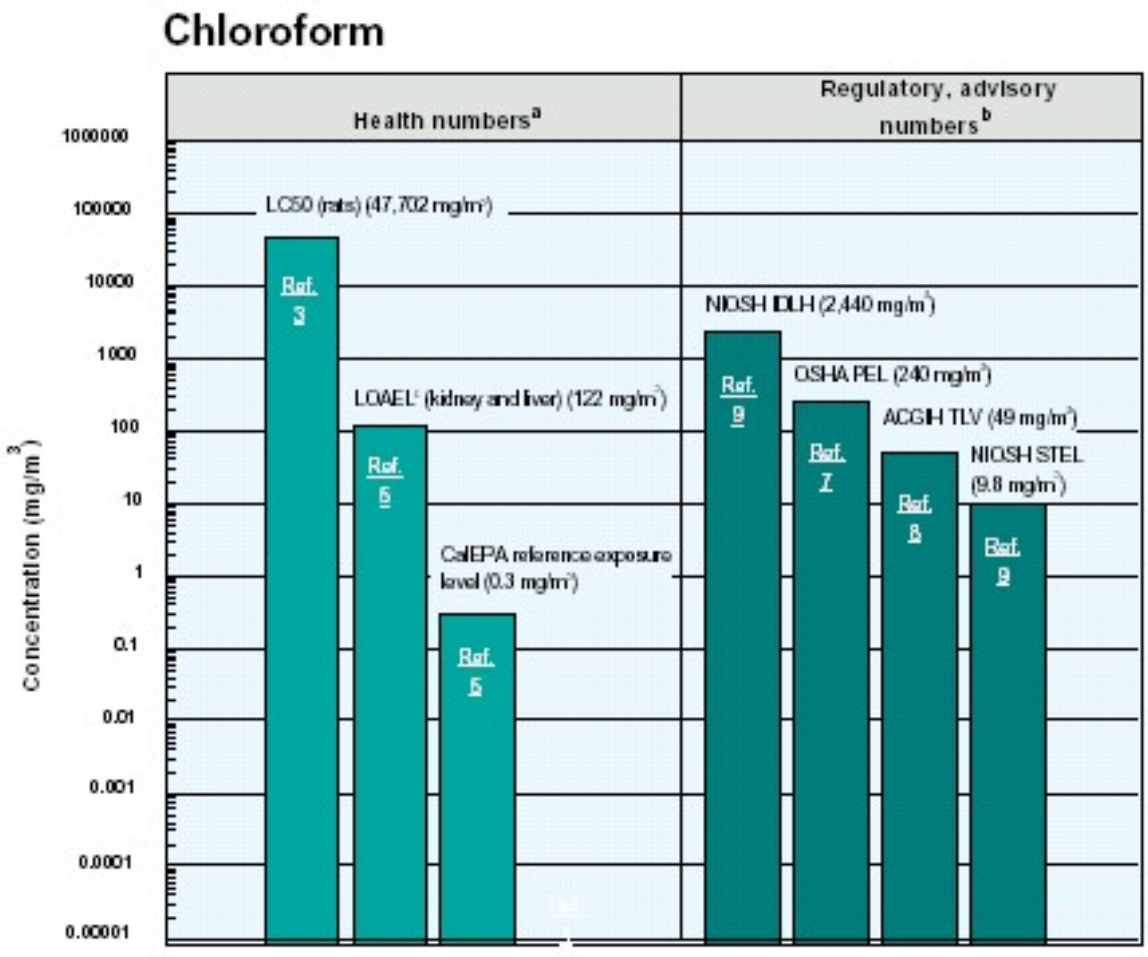
Physical Properties

- Chloroform is a colorless liquid that is not very soluble in water and is very volatile. (1,6)
- Chloroform has a pleasant, nonirritating odor; the odor threshold is 85 ppm. (1)
- The chemical formula for chloroform is CHCl3, and it has a molecular weight of 119.38 g/mol. (1)
- The vapor pressure for chloroform is 159 mm Hg at 20 °C, and it has a log octanol/water partition coefficient (log Kow) of 1.97. (1)

Conversion Factors:

- To convert concentrations in air (at 25°C) from ppm to mg/m3: mg/m3 = (ppm) × (molecular weight of the compound)/(24.45). For chloroform: 1 ppm = 4.88 mg/m3.
- To convert concentrations in air from μg/m3 to mg/m3: mg/m3 = (μg/m3) × (1 mg/1,000 μg).

Health Data from Inhalation Exposure



ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.
LC50 (Lethal Concentration50)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.
NIOSH REL--National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.
OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.
[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.
[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.
[c] These cancer risk estimates were derived from oral data and converted to provide the estimated inhalation risk.
[d] The LOAEL is from the critical study used as the basis for the CalEPA chronic reference exposure level.

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Ethylene Thiourea Hazard Summary

Ethylene thiourea is used in the rubber industry and in the production of some fungicides. No information is available on the acute (short-term) or chronic (long-term) effects of ethylene thiourea in humans. In rodents chronically exposed to ethylene thiourea in their diet, effects on the thyroid have been observed. Ethylene thiourea has been shown to be a potent teratogen (causes birth defects) in rats orally or dermally exposed. A study of female workers occupationally exposed to ethylene thiourea did not report an increased incidence of thyroid cancer. In a study by the National Toxicology Program (NTP), an increased incidence of thyroid tumors in rats, and thyroid, liver, and pituitary gland tumors in mice exposed to ethylene thiourea were noted. EPA has classified ethylene thiourea as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS), which contains information on oral chronic toxicity of ethylene thiourea and the RfD and EPA's Health and Environmental Effects Profile for Ethylene Thiourea. Other secondary sources include the Hazardous Substances Data Bank (HSDB), a database of summaries of peer-reviewed literature, and the Registry of Toxic Effects of Chemical Substances (RTECS), a database of toxic effects that are not peer reviewed.

Uses

- Ethylene thiourea is used as an accelerator in synthetic rubber production and as a curing agent for epichlorohydrin elastomers. (3,9)
- Ethylene thiourea is also a component of ethylenebisdithiocarbamate fungicides. (1)

Sources and Potential Exposure

- Occupational exposure by dermal and inhalation routes may occur in the rubber and plastics industry and where ethylenebisdithiocarbamate fungicides are used. (1,2,3)
- Individuals may be exposed to ethylene thiourea through consumption of food contaminated with fungicides (released during cooking). (1,2)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to ethylene thiourea.

Health Hazard Information

Acute Effects:

- No information is available on the acute effects of ethylene thiourea in humans.
- Tests involving acute exposure of rats and mice have demonstrated ethylene thiourea to have moderate acute toxicity by oral exposure. (4)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of ethylene thiourea in humans.
- In rodents chronically exposed to ethylene thiourea in their diet, increased incidences of thyroid hyperplasia and thyroid follicular cell hyperplasia and increased liver weights have been observed. (3,5)
- The EPA has not established a Reference Concentration (RfC) for ethylene thiourea. (5)
- The Reference Dose (RfD) for ethylene thiourea is 0.00008 milligrams per kilogram body weight per day (mg/kg/d) based on increased incidence of thyroid hyperplasia in rats. The RfD is 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 appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (5)
- EPA has medium confidence in the study on which the RfD was based since the chronic rat study provides sufficient data with multiple appropriate endpoints; medium confidence in the database because there were adequate group sizes with many test dose groups as well as additional supporting data from other chronic studies; and, consequently, medium confidence in the RfD.
- The California Environmental Protection Agency (CalEPA) has calculated a chronic reference exposure level of 0.003 milligrams per cubic meter (mg/m3) based on thyroid effects in rats. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. (10)

Reproductive/Developmental Effects:

- In an occupational study, reproductive or developmental effects were not observed in humans. (1,6)
- Ethylene thiourea has been shown to be a potent teratogen in rats orally or dermally exposed, causing CNS and skeletal abnormalities. (3)

Cancer Risk:

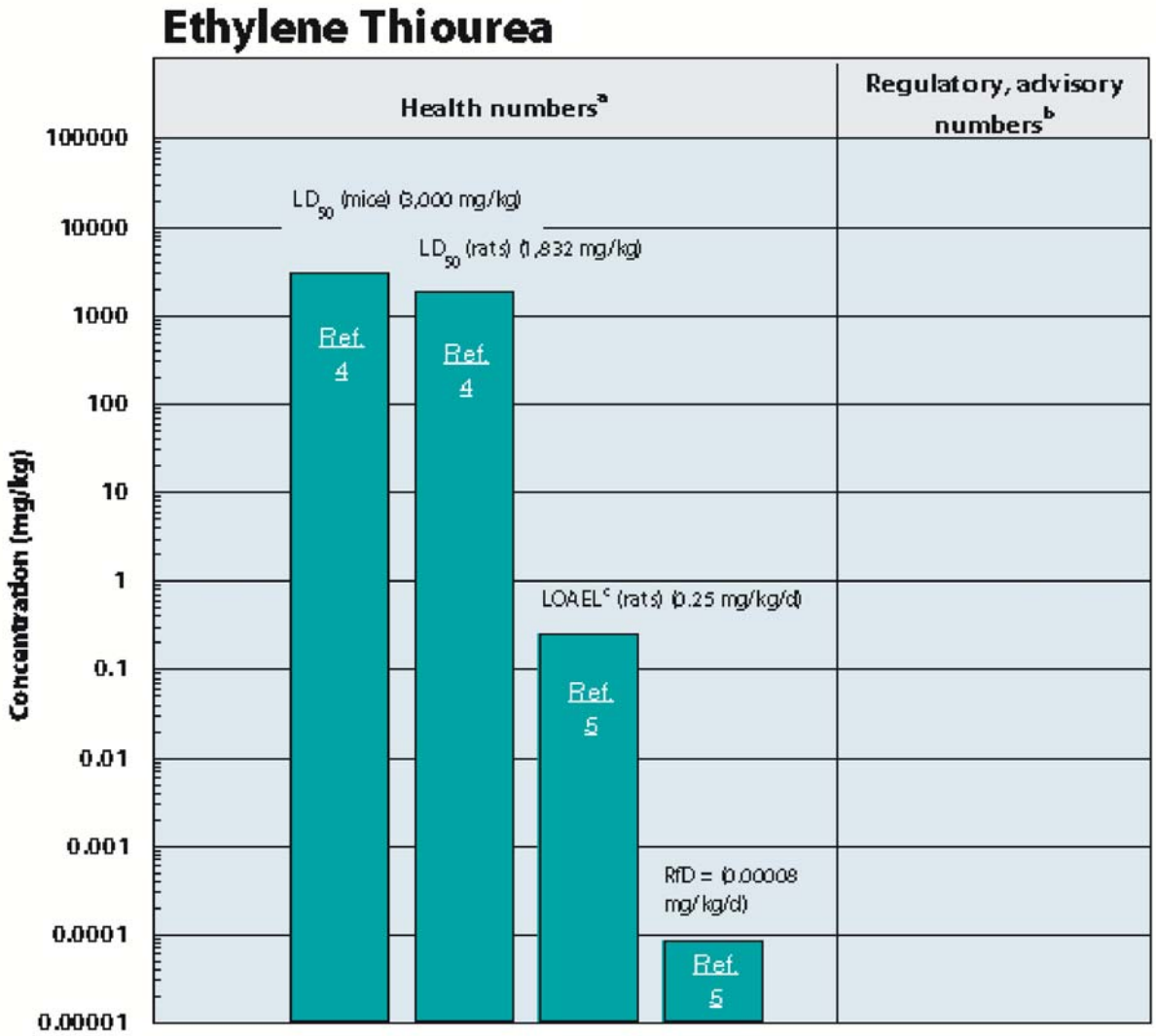
- A study of female workers occupationally exposed to ethylene thiourea did not report an increased incidence of thyroid cancer. (3,6,7)
- Increased incidences of thyroid carcinomas and hepatomas (liver tumors) have been observed in rats and mice orally exposed to ethylene thiourea. (3,6,7)
- In a study by the NTP, an increased incidence of thyroid tumors in rats, and thyroid, liver, and pituitary gland tumors in mice exposed to ethylene thiourea were noted. (11)
- EPA has classified ethylene thiourea as a Group B2, probable human carcinogen. (8)
- EPA has calculated an oral cancer slope factor of 0.11 (mg/kg/d)-1 for ethylene thiourea. (8)

Physical Properties

- The chemical formula for ethylene thiourea is C3H6N2S, and it has a molecular weight of 102.2 g/mol. (3,9)
- Ethylene thiourea occurs as white to pale green crystals or crystalline solid that is highly soluble in water. (1,3,9)
- The odor threshold for ethylene thiourea has not been established.
- The log octanol/water partition coefficient (log Kow) of ethylene thiourea is -0.66. (3)

Conversion Factors:

- To convert concentrations in air (at 25°C) from ppm to mg/m3: mg/m3 = (ppm) × (molecular weight of the compound)/(24.45). For ethylene thiourea: 1 ppm = 4.18 mg/m3.



Health Data from Oral Exposure

LD50 (Lethal Dose50)--A calculated dose of a chemical in water to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.
LOAEL--Lowest-observed-adverse-effect level.
The health values cited in this factsheet were obtained in December 1999.
[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.
[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice.
[c] This LOAEL is from the critical study used as the basis for EPA's RfD.
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Methanol Hazard Summary

Methanol is released to the environment during industrial uses and naturally from volcanic gases, vegetation, and microbes. Exposure may occur from ambient air and during the use of solvents. Acute (short-term) or chronic (long-term) exposure of humans to methanol by inhalation or ingestion may result in blurred vision, headache, dizziness, and nausea. No information is available on the reproductive, developmental, or carcinogenic effects of methanol in humans. Birth defects have been observed in the offspring of rats and mice exposed to methanol by inhalation. EPA has not classified methanol with respect to carcinogenicity.

Please Note: The main sources of information for this fact sheet are the Hazardous Substances Data Bank (HSDB), a database of summaries of peer-reviewed literature, and EPA's Integrated Risk Information System (IRIS), which contains information on oral chronic toxicity and the RfD. Other secondary sources include the Handbook of Toxic and Hazardous Chemicals and Carcinogens and the Registry of Toxic Effects of Chemical Substances (RTECS), a database of toxic effects that are not peer reviewed.

Uses

- Methanol is primarily used as an industrial solvent for inks, resins, adhesives, and dyes. It is also used as a solvent in the manufacture of cholesterol, streptomycin, vitamins, hormones, and other pharmaceuticals. (1-3)
- Methanol is also used as an antifreeze for automotive radiators, an ingredient of gasoline (as an antifreezing agent and octane booster), and as fuel for picnic stoves. Methanol is also an ingredient in paint and varnish removers. (1-3)
- Methanol is also used as an alternative motor fuel. (6)

Sources and Potential Exposure

- Occupational exposure to methanol through inhalation and dermal contact is widespread. (1,2)
- Individuals may be exposed to methanol in the ambient air from its evaporation during solvent uses or from automobile exhaust, through the consumption of various foods, and through dermal contact with various consumer products such as paint thinners and strippers, adhesives, cleaners, and inks. (1)
- Natural emission sources of methanol include volcanic gases, vegetation, microbes, and insects; methanol is also formed during biological decomposition of biological wastes, sewage, and sludge. (1)

Assessing Personal Exposure

- Personal exposure to methanol may be monitored through the measurement of methanol in the blood and measurement of methanol and formic acid in urine. (2)

Health Hazard Information

Acute Effects:

- Acute exposure of humans to methanol by inhalation or ingestion may result in visual disturbances, such as blurred or dimness of vision, leading to blindness. Neurological damage, specifically permanent motor dysfunction, may also result. (1,2,3)
- Contact of skin with methanol can produce mild dermatitis in humans. (2)
- Tests involving acute exposure of rats, mice, and rabbits have demonstrated methanol to have low acute toxicity from oral or inhalation exposure, and moderate acute toxicity from dermal exposure. (4)

Chronic Effects (Noncancer):

- Chronic inhalation or oral exposure to methanol may result in headache, dizziness, giddiness, insomnia, nausea, gastric disturbances, conjunctivitis, visual disturbances (blurred vision), and blindness in humans. (1,6)
- Elevated levels of liver enzymes and decreased brain weight were observed in rats chronically exposed to methanol via gavage (experimentally placing the chemical in the stomach). (5)
- EPA has not established a Reference Concentration (RfC) for methanol. (5)
- The Reference Dose (RfD) for methanol is 0.5 milligrams per kilogram body weight per day (mg/kg/d) based on increased liver enzymes (SAP and SGPT) and decreased brain weight in rats. The RfD is 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 appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (5)
- EPA has medium confidence in the principal study on which the RfD was based because it was well-designed and provided adequate toxicological endpoints, but the method of administration was not ideal; low confidence in the database because it is weak, lacking data on reproductive, developmental, or other toxicological endpoints; and, consequently, medium confidence in the RfD.
- The California Environmental Protection Agency (CalEPA) has calculated a chronic inhalation reference exposure level of 10 milligrams per cubic meter (mg/m3) based on developmental effects in mice. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. (6)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of methanol in humans.
- Developmental effects have been observed in the offspring of rats and mice exposed to methanol by inhalation. These included skeletal, cardiovascular, urinary system, and central nervous system (CNS) malformations in rats and increased resorptions and skeletal and CNS malformations in mice. (1,7)

Cancer Risk:

- No information is available on the carcinogenic effects of methanol in humans or animals.
- EPA has not classified methanol with respect to carcinogenicity. (5)

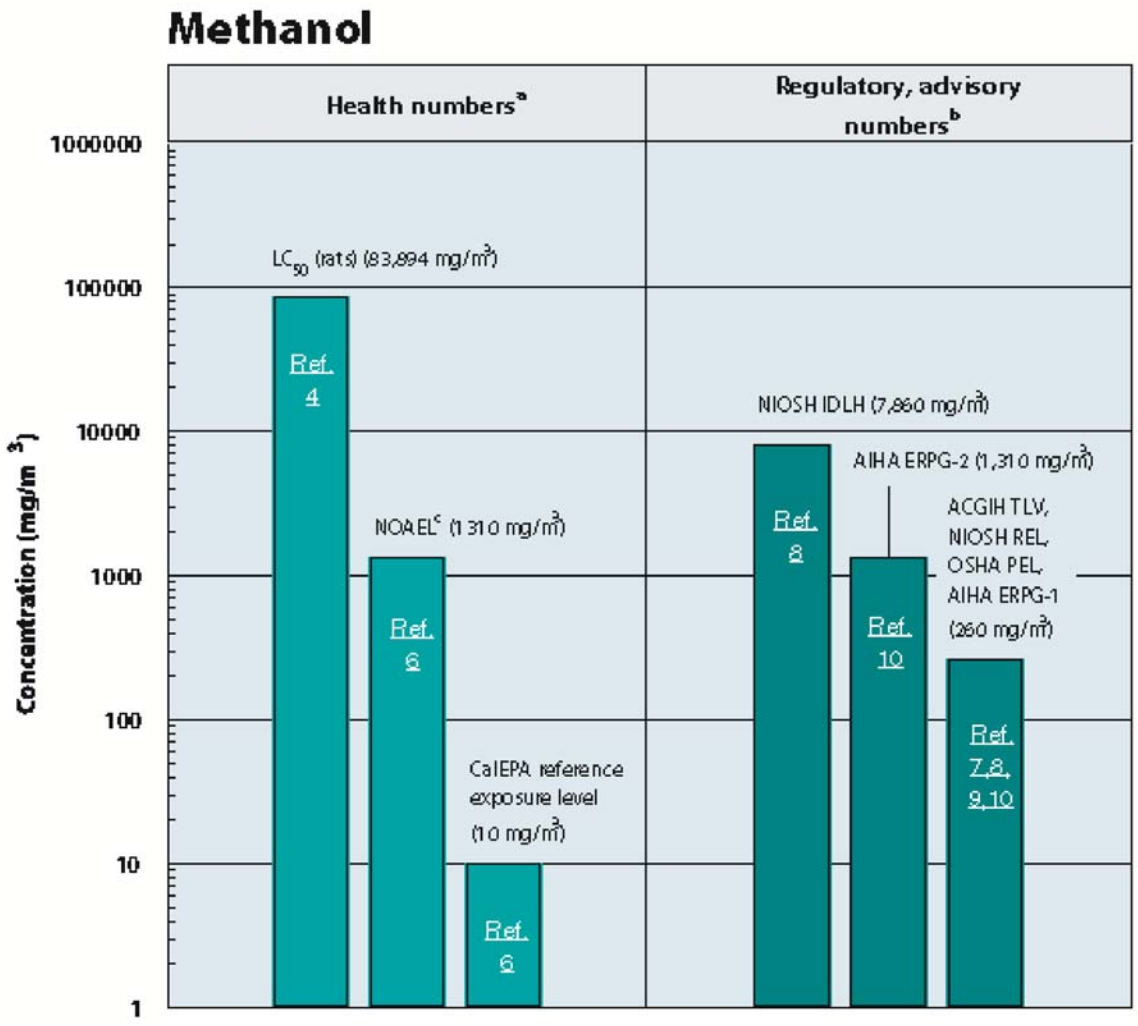
Physical Properties

- The chemical formula for methanol is CH3OH, and its molecular weight is 32.04 g/mol. (3)
- Methanol occurs as a flammable, mobile, colorless liquid that is miscible with water. (3)
- Methanol has a slightly alcoholic odor when pure and a repulsive, pungent odor when in its crude form; it is difficult to smell methanol in the air at less than 2,000 parts per million (ppm) (2,622 mg/m3). (1,2)
- The vapor pressure for methanol is 92 torr at 20 °C. (6)
- The log octanol/water partition coefficient (log Kow) is -0.77. (1)

Conversion Factors:

- To convert concentrations in air (at 25 °C) from ppm to mg/m3: mg/m3 = (ppm) × (molecular weight of the compound)/(24.45). For methanol: 1 ppm = 1.31 mg/m3.

Health Data from Inhalation Exposure



AIH A ERPG--American Industrial Hygiene Association's emergency response planning guidelines. ERPG 1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor; ERPG 2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing or developing irreversible or other serious health effects that could impair their abilities to take protective action.

ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

LC50 (Lethal Concentration50)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.
NIOSH REL--National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.
NIOSH IDLH -- NIOSH's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.
NOAEL--No observed adverse effect level.
OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.
[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.
[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH, ACGIH, and AIHA numbers are advisory.
[c] The NOAEL is from the critical study used as the basis for the CalEPA chronic reference exposure level.

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Appendix C

SCREEN3 and ISCST3 Outputs and Risk Calculations

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a-1800	3.0e-02	8.4e-04	3.8e-03	7.8e-03	2.2e-05	9.8e-05	2.0e-04	NA	1.3e-09	4.6e-09	5.4e-09	3.3e-05	2.0e-06
a-1920	4.0e-02	2.8e-05	1.3e-04	2.6e-04	9.5e-07	4.3e-06	8.8e-06	NA	5.6e-11	2.0e-10	2.4e-10	1.4e-06	9.0e-08
a-2622	3.3e-02	8.4e-05	3.8e-04	7.8e-04	2.4e-06	1.1e-05	2.2e-05	NA	1.4e-10	5.1e-10	5.9e-10	3.6e-06	2.2e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a-2820	7.5e-01	2.8e-05	1.3e-04	2.6e-04	1.8e-05	8.1e-05	1.7e-04	NA	1.1e-09	3.8e-09	4.5e-09	2.7e-05	1.7e-06
a-3204	3.7e-02	4.7e-05	2.2e-04	4.4e-04	1.5e-06	6.8e-06	1.4e-05	NA	8.8e-11	3.2e-10	3.8e-10	2.3e-06	1.4e-07
a-3206	3.6e-02	7.9e-05	3.6e-04	7.3e-04	2.4e-06	1.1e-05	2.2e-05	NA	1.4e-10	5.1e-10	6.0e-10	3.6e-06	2.3e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a-3665	3.2e-02	3.5e-04	1.6e-03	3.3e-03	9.8e-06	4.4e-05	9.1e-05	NA	5.8e-10	2.1e-09	2.4e-09	1.5e-05	9.2e-07
a-3850	3.1e-02	2.9e-04	1.3e-03	2.7e-03	7.7e-06	3.5e-05	7.2e-05	NA	4.5e-10	1.6e-09	1.9e-09	1.2e-05	7.3e-07
a-5070	2.7e-02	7.4e-04	3.3e-03	6.8e-03	1.7e-05	7.7e-05	1.6e-04	NA	1.0e-09	3.6e-09	4.2e-09	2.6e-05	1.6e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a-808	3.6e-02	2.6e-04	1.2e-03	2.4e-03	8.0e-06	3.6e-05	7.4e-05	NA	4.7e-10	1.7e-09	2.0e-09	1.2e-05	7.6e-07
a-808a	3.7e-02	4.4e-04	2.0e-03	4.1e-03	1.4e-05	6.2e-05	1.3e-04	NA	8.0e-10	2.9e-09	3.4e-09	2.1e-05	1.3e-06
b-115	2.1e-01	8.8e-06	4.0e-05	8.1e-05	1.5e-06	6.9e-06	1.4e-05	NA	9.0e-11	3.3e-10	3.8e-10	2.3e-06	1.5e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-1202	1.7e-01	7.9e-05	3.6e-04	7.3e-04	1.2e-05	5.3e-05	1.1e-04	NA	6.9e-10	2.5e-09	2.9e-09	1.8e-05	1.1e-06
b-1217	2.1e-01	2.8e-05	1.3e-04	2.6e-04	5.1e-06	2.3e-05	4.7e-05	NA	3.0e-10	1.1e-09	1.3e-09	7.6e-06	4.8e-07
b-1350	5.9e-01	3.5e-06	1.6e-05	3.3e-05	1.8e-06	8.0e-06	1.7e-05	NA	1.0e-10	3.8e-10	4.4e-10	2.7e-06	1.7e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-1476	2.0e-01	1.8e-05	7.9e-05	1.6e-04	3.0e-06	1.4e-05	2.8e-05	NA	1.8e-10	6.5e-10	7.6e-10	4.6e-06	2.9e-07
b-1700	6.3e-01	1.1e-05	5.2e-05	1.1e-04	6.1e-06	2.8e-05	5.7e-05	NA	3.6e-10	1.3e-09	1.5e-09	9.2e-06	5.8e-07
b-2004	1.1e-01	8.8e-05	4.0e-04	8.1e-04	8.1e-06	3.6e-05	7.5e-05	NA	4.7e-10	1.7e-09	2.0e-09	1.2e-05	7.6e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-2224	5.4e-01	1.1e-04	5.2e-04	1.1e-03	5.2e-05	2.4e-04	4.9e-04	NA	3.1e-09	1.1e-08	1.3e-08	7.9e-05	5.0e-06
b-2301	3.9e-01	2.5e-04	1.1e-03	2.3e-03	8.2e-05	3.7e-04	7.6e-04	NA	4.8e-09	1.7e-08	2.0e-08	1.2e-04	7.7e-06
b-2401	7.8e-01	1.8e-06	7.9e-06	1.6e-05	1.2e-06	5.3e-06	1.1e-05	NA	6.9e-11	2.5e-10	2.9e-10	1.8e-06	1.1e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-2401a	8.2e-01	3.5e-06	1.6e-05	3.3e-05	2.5e-06	1.1e-05	2.3e-05	NA	1.4e-10	5.3e-10	6.2e-10	3.7e-06	2.3e-07
b-2403	6.5e-01	5.3e-06	2.4e-05	4.9e-05	2.9e-06	1.3e-05	2.7e-05	NA	1.7e-10	6.2e-10	7.2e-10	4.4e-06	2.7e-07
b-2707	6.5e-01	1.1e-04	5.0e-04	1.0e-03	6.1e-05	2.8e-04	5.7e-04	NA	3.6e-09	1.3e-08	1.5e-08	9.2e-05	5.8e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-2707a	5.5e-01	1.8e-04	8.1e-04	1.6e-03	8.4e-05	3.8e-04	7.8e-04	NA	4.9e-09	1.8e-08	2.1e-08	1.3e-04	7.9e-06
b-3051	1.1e+00	1.4e-05	6.3e-05	1.3e-04	1.3e-05	5.9e-05	1.2e-04	NA	7.7e-10	2.8e-09	3.3e-09	2.0e-05	1.2e-06
b-3235	1.2e+00	2.8e-04	1.2e-03	2.6e-03	2.8e-04	1.3e-03	2.6e-03	NA	1.6e-08	6.0e-08	7.0e-08	4.2e-04	2.7e-05

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-3803	1.5e+00	1.1e-05	4.8e-05	9.7e-05	1.4e-05	6.1e-05	1.2e-04	NA	7.9e-10	2.9e-09	3.4e-09	2.0e-05	1.3e-06
b-3803a	1.6e+00	1.1e-05	4.8e-05	9.7e-05	1.4e-05	6.4e-05	1.3e-04	NA	8.4e-10	3.0e-09	3.6e-09	2.1e-05	1.3e-06
b-3806	1.5e+00	5.3e-06	2.4e-05	4.9e-05	6.6e-06	3.0e-05	6.1e-05	NA	3.9e-10	1.4e-09	1.6e-09	9.9e-06	6.2e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-3809	1.0e+00	1.8e-05	7.9e-05	1.6e-04	1.6e-05	7.1e-05	1.5e-04	NA	9.2e-10	3.4e-09	3.9e-09	2.4e-05	1.5e-06
b-3815	1.1e+00	1.1e-05	4.8e-05	9.7e-05	1.0e-05	4.6e-05	9.4e-05	NA	5.9e-10	2.2e-09	2.5e-09	1.5e-05	9.6e-07
b-3920	4.1e-01	7.5e-05	3.4e-04	7.0e-04	2.6e-05	1.2e-04	2.4e-04	NA	1.5e-09	5.6e-09	6.5e-09	3.9e-05	2.5e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-4101	4.3e-01	3.2e-04	1.5e-03	3.0e-03	1.2e-04	5.4e-04	1.1e-03	NA	7.0e-09	2.5e-08	3.0e-08	1.8e-04	1.1e-05
b-4400	9.8e-01	5.3e-06	2.4e-05	4.9e-05	4.4e-06	2.0e-05	4.1e-05	NA	2.6e-10	9.4e-10	1.1e-09	6.6e-06	4.2e-07
b-4600	2.7e+00	2.5e-05	1.1e-04	2.3e-04	5.7e-05	2.6e-04	5.3e-04	NA	3.4e-09	1.2e-08	1.4e-08	8.6e-05	5.4e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-4601	3.9e+00	1.4e-05	6.3e-05	1.3e-04	4.7e-05	2.1e-04	4.3e-04	NA	2.7e-09	9.9e-09	1.2e-08	7.0e-05	4.4e-06
b-4808	1.1e+00	5.3e-06	2.4e-05	4.9e-05	5.0e-06	2.3e-05	4.6e-05	NA	2.9e-10	1.1e-09	1.3e-09	7.5e-06	4.7e-07
b-5006	2.4e-01	5.3e-06	2.4e-05	4.9e-05	1.1e-06	4.9e-06	1.0e-05	NA	6.4e-11	2.3e-10	2.7e-10	1.6e-06	1.0e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-5010	2.9e+00	1.1e-05	4.8e-05	9.7e-05	2.6e-05	1.2e-04	2.4e-04	NA	1.5e-09	5.5e-09	6.4e-09	3.9e-05	2.4e-06
b-5010a	3.3e+00	1.1e-05	4.8e-05	9.7e-05	2.9e-05	1.3e-04	2.7e-04	NA	1.7e-09	6.3e-09	7.3e-09	4.4e-05	2.8e-06
b-5213	1.5e-01	1.6e-04	7.3e-04	1.5e-03	2.1e-05	9.4e-05	1.9e-04	NA	1.2e-09	4.4e-09	5.2e-09	3.1e-05	2.0e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-5601	1.4e-01	3.5e-04	1.6e-03	3.3e-03	4.1e-05	1.8e-04	3.8e-04	NA	2.4e-09	8.7e-09	1.0e-08	6.1e-05	3.8e-06
b-6201	2.0e-01	2.0e-04	9.1e-04	1.9e-03	3.4e-05	1.6e-04	3.2e-04	NA	2.0e-09	7.3e-09	8.6e-09	5.2e-05	3.3e-06
b-624	3.4e-01	1.2e-04	5.6e-04	1.1e-03	3.6e-05	1.6e-04	3.3e-04	NA	2.1e-09	7.6e-09	8.9e-09	5.4e-05	3.4e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-6403	1.8e-01	6.8e-06	3.1e-05	6.3e-05	1.0e-06	4.6e-06	9.4e-06	NA	6.0e-11	2.2e-10	2.5e-10	1.5e-06	9.6e-08
b-6610	1.2e-01	1.8e-05	7.9e-05	1.6e-04	1.8e-06	7.9e-06	1.6e-05	NA	1.0e-10	3.7e-10	4.4e-10	2.6e-06	1.7e-07
b-7101	1.7e-01	1.1e-05	5.2e-05	1.1e-04	1.7e-06	7.5e-06	1.5e-05	NA	9.8e-11	3.5e-10	4.2e-10	2.5e-06	1.6e-07

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-7201	5.4e-02	1.7e-03	7.7e-03	1.6e-02	7.8e-05	3.5e-04	7.2e-04	NA	4.6e-09	1.7e-08	1.9e-08	1.2e-04	7.3e-06
b-7501	7.6e-02	7.0e-04	3.2e-03	6.5e-03	4.5e-05	2.1e-04	4.2e-04	NA	2.7e-09	9.7e-09	1.1e-08	6.8e-05	4.3e-06
b-7701	1.2e-01	1.8e-04	7.9e-04	1.6e-03	1.9e-05	8.4e-05	1.7e-04	NA	1.1e-09	4.0e-09	4.7e-09	2.8e-05	1.8e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b-8401	7.2e-02	1.4e-04	6.3e-04	1.3e-03	8.5e-06	3.8e-05	7.8e-05	NA	5.0e-10	1.8e-09	2.1e-09	1.3e-05	8.0e-07
oc-u1	5.0e-02	3.4e-04	1.5e-03	3.2e-03	1.4e-05	6.5e-05	1.3e-04	NA	8.5e-10	3.1e-09	3.6e-09	2.2e-05	1.4e-06
oc-u2	4.8e-02	7.3e-04	3.3e-03	6.8e-03	3.0e-05	1.4e-04	2.8e-04	NA	1.8e-09	6.4e-09	7.5e-09	4.6e-05	2.9e-06
oc-u2a	4.8e-02	6.2e-04	2.8e-03[35.8e-03		2.6e-05	1.2e-04	2.4e-04	NA	1.5e-09	5.5e-09	6.4e-09	3.9e-05	2.4e-06

Table C-1. ISCST3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum annual concentration ($\mu g/m^3$) (Max receptor unit rate conc * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
oc-u3	4.2e-02	6.2e-04	2.8e-03	5.8e-03	2.2e-05	1.0e-04	2.1e-04	NA	1.3e-09	4.8e-09	5.6e-09	3.4e-05	2.1e-06
Total	3.4e+01				1.5e-03	6.7e-03	1.4e-02	NA	8.7e-08	3.1e-07	3.7e-07	2.2e-03	1.4e-04
Grand Total	3.4e+01				2.2e-02			4.0e-07			2.4e-03		

Table C-2. Screen3 Output and Risk Calculations for Acute Exposure Assessment																
IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum 1-hour concentration (μg/m3) (max receptor unit rate conc * HAP-specific emission rate)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
a-1800	32.93	7.2e-04	3.3e-03	6.7e-03	2.4e-02	1.1e-01	2.2e-01	3.4e-08	9.1e-08	3.0e-08	8.4e-07	7.0e-07	9.1e-07	9.1e-07	4.5e-04	1.5e-03
a-1920	196.8	2.4e-05	1.1e-04	2.2e-04	4.7e-03	2.1e-02	4.4e-02	6.8e-09	1.8e-08	6.0e-09	1.7e-07	1.4e-07	1.8e-07	1.8e-07	8.9e-05	2.9e-04
a-2622	105.5	7.2e-05	3.3e-04	6.7e-04	7.6e-03	3.4e-02	7.0e-02	1.1e-08	2.9e-08	9.6e-09	2.7e-07	2.2e-07	2.9e-07	2.9e-07	1.4e-04	4.7e-04
a-2820	196.8	2.4e-05	1.1e-04	2.2e-04	4.7e-03	2.1e-02	4.4e-02	6.8e-09	1.8e-08	6.0e-09	1.7e-07	1.4e-07	1.8e-07	1.8e-07	8.9e-05	2.9e-04
a-3204	196.8	4.0e-05	1.8e-04	3.8e-04	8.0e-03	3.6e-02	7.4e-02	1.1e-08	3.1e-08	1.0e-08	2.8e-07	2.4e-07	3.1e-07	3.1e-07	1.5e-04	4.9e-04
a-3206	105.5	6.7e-05	3.0e-04	6.3e-04	7.1e-03	3.2e-02	6.6e-02	1.0e-08	2.7e-08	9.0e-09	2.5e-07	2.1e-07	2.7e-07	2.7e-07	1.3e-04	4.4e-04
a-3665	54.84	3.0e-04	1.4e-03	2.8e-03	1.7e-02	7.5e-02	1.5e-01	2.4e-08	6.4e-08	2.1e-08	5.9e-07	4.9e-07	6.4e-07	6.4e-07	3.1e-04	1.0e-03
a-3850	54.84	2.5e-04	1.1e-03	2.3e-03	1.4e-02	6.1e-02	1.3e-01	1.9e-08	5.2e-08	1.7e-08	4.8e-07	4.0e-07	5.2e-07	5.2e-07	2.6e-04	8.4e-04
a-5070	32.93	6.3e-04	2.8e-03	5.8e-03	2.1e-02	9.4e-02	1.9e-01	3.0e-08	8.0e-08	2.6e-08	7.4e-07	6.1e-07	8.0e-07	8.0e-07	3.9e-04	1.3e-03
a-808	54.84	2.2e-04	1.0e-03	2.1e-03	1.2e-02	5.5e-02	1.1e-01	1.8e-08	4.7e-08	1.6e-08	4.4e-07	3.7e-07	4.8e-07	4.8e-07	2.3e-04	7.6e-04
a-808a	54.84	3.7e-04	1.7e-03	3.5e-03	2.1e-02	9.3e-02	1.9e-01	3.0e-08	7.9e-08	2.6e-08	7.3e-07	6.1e-07	7.9e-07	7.9e-07	3.9e-04	1.3e-03
b-115	196.8	7.5e-06	3.4e-05	6.9e-05	1.5e-03	6.7e-03	1.4e-02	2.1e-09	5.7e-09	1.9e-09	5.3e-08	4.4e-08	5.7e-08	5.7e-08	2.8e-05	9.1e-05
b-1202	105.5	6.7e-05	3.0e-04	6.3e-04	7.1e-03	3.2e-02	6.6e-02	1.0e-08	2.7e-08	9.0e-09	2.5e-07	2.1e-07	2.7e-07	2.7e-07	1.3e-04	4.4e-04
b-1217	196.8	2.4e-05	1.1e-04	2.2e-04	4.7e-03	2.1e-02	4.4e-02	6.8e-09	1.8e-08	6.0e-09	1.7e-07	1.4e-07	1.8e-07	1.8e-07	8.9e-05	2.9e-04
b-1350	196.8	3.0e-06	1.4e-05	2.8e-05	5.9e-04	2.7e-03	5.5e-03	8.5e-10	2.3e-09	7.4e-10	2.1e-08	1.8e-08	2.3e-08	2.3e-08	1.1e-05	3.6e-05
b-1476	196.8	1.5e-05	6.8e-05	1.4e-04	3.0e-03	1.3e-02	2.7e-02	4.2e-09	1.1e-08	3.7e-09	1.1e-07	8.8e-08	1.1e-07	1.1e-07	5.6e-05	1.8e-04
b-1700	196.8	9.7e-06	4.4e-05	9.0e-05	1.9e-03	8.7e-03	1.8e-02	2.8e-09	7.4e-09	2.4e-09	6.8e-08	5.7e-08	7.4e-08	7.4e-08	3.6e-05	1.2e-04
b-2004	105.5	7.5e-05	3.4e-04	6.9e-04	7.9e-03	3.6e-02	7.3e-02	1.1e-08	3.0e-08	1.0e-08	2.8e-07	2.3e-07	3.1e-07	3.1e-07	1.5e-04	4.9e-04
b-2224	105.5	9.7e-05	4.4e-04	9.0e-04	1.0e-02	4.6e-02	9.5e-02	1.5e-08	3.9e-08	1.3e-08	3.7e-07	3.0e-07	4.0e-07	4.0e-07	1.9e-04	6.3e-04
b-2301	54.84	2.1e-04	9.5e-04	1.9e-03	1.1e-02	5.2e-02	1.1e-01	1.6e-08	4.4e-08	1.5e-08	4.1e-07	3.4e-07	4.4e-07	4.4e-07	2.2e-04	7.1e-04
b-2401	196.8	1.5e-06	6.8e-06	1.4e-05	3.0e-04	1.3e-03	2.7e-03	4.2e-10	1.1e-09	3.7e-10	1.1e-08	8.8e-09	1.1e-08	1.1e-08	5.6e-06	1.8e-05
b-2401a	196.8	3.0e-06	1.4e-05	2.8e-05	5.9e-04	2.7e-03	5.5e-03	8.5e-10	2.3e-09	7.4e-10	2.1e-08	1.8e-08	2.3e-08	2.3e-08	1.1e-05	3.6e-05
b-2403	196.8	4.5e-06	2.0e-05	4.2e-05	8.8e-04	4.0e-03	8.2e-03	1.3e-09	3.4e-09	1.1e-09	3.2e-08	2.6e-08	3.4e-08	3.4e-08	1.7e-05	5.5e-05
b-2707	105.5	9.4e-05	4.2e-04	8.7e-04	9.9e-03	4.5e-02	9.2e-02	1.4e-08	3.8e-08	1.3e-08	3.5e-07	2.9e-07	3.8e-07	3.8e-07	1.9e-04	6.1e-04

Table C-2. Screen3 Output and Risk Calculations for Acute Exposure Assessment																
IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum 1-hour concentration (μg/m3) (max receptor unit rate conc * HAP-specific emission rate)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b-2707a	54.84	1.5e-04	6.9e-04	1.4e-03	8.3e-03	3.8e-02	7.7e-02	1.2e-08	3.2e-08	1.1e-08	3.0e-07	2.5e-07	3.2e-07	3.2e-07	1.6e-04	5.2e-04
b-3051	196.8	1.2e-05	5.4e-05	1.1e-04	2.4e-03	1.1e-02	2.2e-02	3.4e-09	9.1e-09	3.0e-09	8.4e-08	7.0e-08	9.1e-08	9.1e-08	4.5e-05	1.5e-04
b-3235	54.84	2.4e-04	1.1e-03	2.2e-03	1.3e-02	5.8e-02	1.2e-01	1.9e-08	5.0e-08	1.6e-08	4.6e-07	3.8e-07	5.0e-07	5.0e-07	2.4e-04	8.0e-04
b-3803	196.8	9.0e-06	4.1e-05	8.3e-05	1.8e-03	8.0e-03	1.6e-02	2.5e-09	6.8e-09	2.2e-09	6.3e-08	5.2e-08	6.8e-08	6.8e-08	3.3e-05	1.1e-04
b-3803a	196.8	9.0e-06	4.1e-05	8.3e-05	1.8e-03	8.0e-03	1.6e-02	2.5e-09	6.8e-09	2.2e-09	6.3e-08	5.2e-08	6.8e-08	6.8e-08	3.3e-05	1.1e-04
b-3806	196.8	4.5e-06	2.0e-05	4.2e-05	8.8e-04	4.0e-03	8.2e-03	1.3e-09	3.4e-09	1.1e-09	3.2e-08	2.6e-08	3.4e-08	3.4e-08	1.7e-05	5.5e-05
b-3809	196.8	1.5e-05	6.8e-05	1.4e-04	3.0e-03	1.3e-02	2.7e-02	4.2e-09	1.1e-08	3.7e-09	1.1e-07	8.8e-08	1.1e-07	1.1e-07	5.6e-05	1.8e-04
b-3815	196.8	9.0e-06	4.1e-05	8.3e-05	1.8e-03	8.0e-03	1.6e-02	2.5e-09	6.8e-09	2.2e-09	6.3e-08	5.2e-08	6.8e-08	6.8e-08	3.3e-05	1.1e-04
b-3920	105.5	6.4e-05	2.9e-04	6.0e-04	6.8e-03	3.1e-02	6.3e-02	9.8e-09	2.6e-08	8.6e-09	2.4e-07	2.0e-07	2.6e-07	2.6e-07	1.3e-04	4.2e-04
b-4101	54.84	2.8e-04	1.3e-03	2.6e-03	1.5e-02	6.9e-02	1.4e-01	2.2e-08	5.8e-08	1.9e-08	5.4e-07	4.5e-07	5.9e-07	5.9e-07	2.9e-04	9.4e-04
b-4400	196.8	4.5e-06	2.0e-05	4.2e-05	8.8e-04	4.0e-03	8.2e-03	1.3e-09	3.4e-09	1.1e-09	3.2e-08	2.6e-08	3.4e-08	3.4e-08	1.7e-05	5.5e-05
b-4600	196.8	2.1e-05	9.5e-05	1.9e-04	4.1e-03	1.9e-02	3.8e-02	5.9e-09	1.6e-08	5.2e-09	1.5e-07	1.2e-07	1.6e-07	1.6e-07	7.8e-05	2.5e-04
b-4601	196.8	1.2e-05	5.4e-05	1.1e-04	2.4e-03	1.1e-02	2.2e-02	3.4e-09	9.1e-09	3.0e-09	8.4e-08	7.0e-08	9.1e-08	9.1e-08	4.5e-05	1.5e-04
b-4808	196.8	4.5e-06	2.0e-05	4.2e-05	8.8e-04	4.0e-03	8.2e-03	1.3e-09	3.4e-09	1.1e-09	3.2e-08	2.6e-08	3.4e-08	3.4e-08	1.7e-05	5.5e-05
b-5006	196.8	4.5e-06	2.0e-05	4.2e-05	8.8e-04	4.0e-03	8.2e-03	1.3e-09	3.4e-09	1.1e-09	3.2e-08	2.6e-08	3.4e-08	3.4e-08	1.7e-05	5.5e-05
b-5010	196.8	9.0e-06	4.1e-05	8.3e-05	1.8e-03	8.0e-03	1.6e-02	2.5e-09	6.8e-09	2.2e-09	6.3e-08	5.2e-08	6.8e-08	6.8e-08	3.3e-05	1.1e-04
b-5010a	196.8	9.0e-06	4.1e-05	8.3e-05	1.8e-03	8.0e-03	1.6e-02	2.5e-09	6.8e-09	2.2e-09	6.3e-08	5.2e-08	6.8e-08	6.8e-08	3.3e-05	1.1e-04
b-5213	105.5	1.4e-04	6.2e-04	1.3e-03	1.4e-02	6.5e-02	1.3e-01	2.1e-08	5.6e-08	1.8e-08	5.2e-07	4.3e-07	5.6e-07	5.6e-07	2.7e-04	8.9e-04
b-5601	54.84	3.0e-04	1.4e-03	2.8e-03	1.6e-02	7.4e-02	1.5e-01	2.4e-08	6.3e-08	2.1e-08	5.9e-07	4.9e-07	6.4e-07	6.4e-07	3.1e-04	1.0e-03
b-6201	54.84	1.7e-04	7.8e-04	1.6e-03	9.4e-03	4.3e-02	8.8e-02	1.4e-08	3.6e-08	1.2e-08	3.4e-07	2.8e-07	3.7e-07	3.7e-07	1.8e-04	5.8e-04
b-624	105.5	1.1e-04	4.7e-04	9.7e-04	1.1e-02	5.0e-02	1.0e-01	1.6e-08	4.3e-08	1.4e-08	4.0e-07	3.3e-07	4.3e-07	4.3e-07	2.1e-04	6.8e-04
b-6403	196.8	5.8e-06	2.6e-05	5.3e-05	1.1e-03	5.1e-03	1.1e-02	1.6e-09	4.4e-09	1.4e-09	4.0e-08	3.4e-08	4.4e-08	4.4e-08	2.1e-05	7.0e-05
b-6610	196.8	1.5e-05	6.8e-05	1.4e-04	3.0e-03	1.3e-02	2.7e-02	4.2e-09	1.1e-08	3.7e-09	1.1e-07	8.8e-08	1.1e-07	1.1e-07	5.6e-05	1.8e-04
b-7101	196.8	9.7e-06	4.4e-05	9.0e-05	1.9e-03	8.7e-03	1.8e-02	2.8e-09	7.4e-09	2.4e-09	6.8e-08	5.7e-08	7.4e-08	7.4e-08	3.6e-05	1.2e-04

Table C-2. Screen3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Max receptor unit rate conc (ug/m^3)	HAP-specific emission rate (g/s)			Maximum 1-hour concentration (μg/m3) (max receptor unit rate conc * HAP-specific emission rate)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
		Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b-7201	19.24	1.5e-03	6.5e-03	1.3e-02	2.8e-02	1.3e-01	2.6e-01	4.0e-08	1.1e-07	3.5e-08	1.0e-06	8.3e-07	1.1e-06	1.1e-06	5.3e-04	1.7e-03
b-7501	32.93	6.0e-04	2.7e-03	5.6e-03	2.0e-02	8.9e-02	1.8e-01	2.8e-08	7.6e-08	2.5e-08	7.0e-07	5.8e-07	7.6e-07	7.6e-07	3.7e-04	1.2e-03
b-7701	54.84	1.5e-04	6.8e-04	1.4e-03	8.2e-03	3.7e-02	7.6e-02	1.2e-08	3.2e-08	1.0e-08	2.9e-07	2.4e-07	3.2e-07	3.2e-07	1.6e-04	5.1e-04
b-8401	105.5	1.2e-04	5.3e-04	1.1e-03	1.2e-02	5.6e-02	1.2e-01	1.8e-08	4.8e-08	1.6e-08	4.4e-07	3.7e-07	4.8e-07	4.8e-07	2.3e-04	7.7e-04
oc-u1	54.84	2.9e-04	1.3e-03	2.7e-03	1.6e-02	7.2e-02	1.5e-01	2.3e-08	6.1e-08	2.0e-08	5.7e-07	4.7e-07	6.2e-07	6.2e-07	3.0e-04	9.9e-04
oc-u2	32.93	6.3e-04	2.8e-03	5.8e-03	2.1e-02	9.4e-02	1.9e-01	3.0e-08	7.9e-08	2.6e-08	7.4e-07	6.1e-07	8.0e-07	8.0e-07	3.9e-04	1.3e-03
oc-u2a	32.93	5.3e-04	2.4e-03	4.9e-03	1.8e-02	7.9e-02	1.6e-01	2.5e-08	6.7e-08	2.2e-08	6.3e-07	5.2e-07	6.8e-07	6.8e-07	3.3e-04	1.1e-03
oc-u3	32.93	5.3e-04	2.4e-03	4.9e-03	1.7e-02	7.9e-02	1.6e-01	2.5e-08	6.7e-08	2.2e-08	6.2e-07	5.2e-07	6.8e-07	6.8e-07	3.3e-04	1.1e-03
Total	7243.5	9.2e-03	4.2e-02	8.6e-02	4.6e-01	2.1e+00	4.3e+00	6.7e-07	1.8e-06	5.9e-07	1.7e-05	1.4e-05	1.8e-05	1.8e-05	8.8e-03	2.9e-02

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a1800	1.7e-05	7.8e-05	1.6e-04	NA	1.0E-09	3.7E-09	4.3E-09	2.6E-05	1.6E-06
a1920	7.6e-07	3.5e-06	7.1e-06	NA	4.5E-11	1.6E-10	1.9E-10	1.1E-06	7.2E-08
a2622	2.0e-06	9.0e-06	1.8e-05	NA	1.2E-10	4.2E-10	5.0E-10	3.0E-06	1.9E-07

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a2820	4.8e-06	2.2e-05	4.5e-05	NA	2.8E-10	1.0E-09	1.2E-09	7.2E-06	4.5E-07
a3204	1.2e-06	5.6e-06	1.2e-05	NA	7.3E-11	2.6E-10	3.1E-10	1.9E-06	1.2E-07
a3206	2.0e-06	9.0e-06	1.9e-05	NA	1.2E-10	4.3E-10	5.0E-10	3.0E-06	1.9E-07

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a3665	8.2e-06	3.7e-05	7.6e-05	NA	4.9E-10	1.8E-09	2.1E-09	1.2E-05	7.8E-07
a3850	6.3e-06	2.9e-05	5.9e-05	NA	3.7E-10	1.3E-09	1.6E-09	9.5E-06	6.0E-07
a5070	1.6e-05	7.2e-05	1.5e-04	NA	9.3E-10	3.4E-09	4.0E-09	2.4E-05	1.5E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
a808	5.5e-06	2.5e-05	5.1e-05	NA	3.2E-10	1.2E-09	1.4E-09	8.3E-06	5.2E-07
a808a	9.7e-06	4.4e-05	9.0e-05	NA	5.7E-10	2.1E-09	2.4E-09	1.5E-05	9.2E-07
b115	8.4e-07	3.8e-06	7.8e-06	NA	4.9E-11	1.8E-10	2.1E-10	1.3E-06	7.9E-08

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b1202	6.2e-06	2.8e-05	5.8e-05	NA	3.6E-10	1.3E-09	1.6E-09	9.3E-06	5.9E-07
b1217	2.3e-06	1.1e-05	2.2e-05	NA	1.4E-10	5.0E-10	5.8E-10	3.5E-06	2.2E-07
b1350	5.7e-07	2.6e-06	5.3e-06	NA	3.3E-11	1.2E-10	1.4E-10	8.5E-07	5.4E-08

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b1476	1.4e-06	6.3e-06	1.3e-05	NA	8.2E-11	3.0E-10	3.5E-10	2.1E-06	1.3E-07
b1700	2.0e-06	9.0e-06	1.9e-05	NA	1.2E-10	4.3E-10	5.0E-10	3.0E-06	1.9E-07
b2004	6.4e-06	2.9e-05	5.9e-05	NA	3.7E-10	1.4E-09	1.6E-09	9.6E-06	6.0E-07

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b2224	1.7e-05	7.7e-05	1.6e-04	NA	1.0E-09	3.6E-09	4.2E-09	2.6E-05	1.6E-06
b2301	3.9e-05	1.8e-04	3.6e-04	NA	2.3E-09	8.4E-09	9.8E-09	5.9E-05	3.7E-06
b2401	2.9e-07	1.3e-06	2.7e-06	NA	1.7E-11	6.1E-11	7.2E-11	4.3E-07	2.7E-08

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b2401a	5.9e-07	2.6e-06	5.4e-06	NA	3.4E-11	1.3E-10	1.5E-10	8.8E-07	5.6E-08
b2403	8.1e-07	3.6e-06	7.5e-06	NA	4.7E-11	1.7E-10	2.0E-10	1.2E-06	7.6E-08
b2707	2.3e-05	1.0e-04	2.1e-04	NA	1.3E-09	4.8E-09	5.6E-09	3.4E-05	2.1E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b2707a	3.5e-05	1.6e-04	3.2e-04	NA	2.0E-09	7.4E-09	8.6E-09	5.2E-05	3.3E-06
b3051	2.6e-06	1.2e-05	2.4e-05	NA	1.5E-10	5.5E-10	6.5E-10	3.9E-06	2.5E-07
b3235	5.0e-05	2.3e-04	4.7e-04	NA	2.9E-09	1.1E-08	1.3E-08	7.6E-05	4.8E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration (μg/m^3) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b3803	2.1e-06	9.5e-06	1.9e-05	NA	1.2E-10	4.5E-10	5.2E-10	3.2E-06	2.0E-07
b3803a	2.1e-06	9.7e-06	2.0e-05	NA	1.3E-10	4.6E-10	5.3E-10	3.2E-06	2.0E-07
b3806	1.1e-06	4.8e-06	9.7e-06	NA	6.2E-11	2.2E-10	2.6E-10	1.6E-06	9.9E-08

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b3809	3.4e-06	1.5e-05	3.2e-05	NA	2.0E-10	7.3E-10	8.5E-10	5.1E-06	3.2E-07
b3815	2.1e-06	9.6e-06	2.0e-05	NA	1.2E-10	4.5E-10	5.3E-10	3.2E-06	2.0E-07
b3920	2.2e-05	9.8e-05	2.0e-04	NA	1.3E-09	4.6E-09	5.4E-09	3.3E-05	2.1E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b4101	8.3e-05	3.7e-04	7.7e-04	NA	4.8E-09	1.8E-08	2.1E-08	1.2E-04	7.8E-06
b4400	1.0e-06	4.5e-06	9.3e-06	NA	5.9E-11	2.1E-10	2.5E-10	1.5E-06	9.5E-08
b4600	6.0e-06	2.7e-05	5.6e-05	NA	3.5E-10	1.3E-09	1.5E-09	9.0E-06	5.7E-07

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b4601	3.8e-06	1.7e-05	3.5e-05	NA	2.2E-10	8.0E-10	9.4E-10	5.7E-06	3.6E-07
b4808	1.1e-06	5.1e-06	1.1e-05	NA	6.7E-11	2.4E-10	2.8E-10	1.7E-06	1.1E-07
b5006	6.1e-07	2.8e-06	5.7e-06	NA	3.6E-11	1.3E-10	1.5E-10	9.2E-07	5.8E-08

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b5010	2.9e-06	1.3e-05	2.7e-05	NA	1.7E-10	6.3E-10	7.3E-10	4.4E-06	2.8E-07
b5010a	2.9e-06	1.3e-05	2.7e-05	NA	1.7E-10	6.2E-10	7.2E-10	4.4E-06	2.7E-07
b5213	4.8e-05	2.2e-04	4.5e-04	NA	2.8E-09	1.0E-08	1.2E-08	7.3E-05	4.6E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b5601	9.2e-05	4.2e-04	8.6e-04	NA	5.4E-09	2.0E-08	2.3E-08	1.4E-04	8.8E-06
b6201	6.2e-05	2.8e-04	5.8e-04	NA	3.7E-09	1.3E-08	1.6E-08	9.4E-05	5.9E-06
b624	1.4e-05	6.4e-05	1.3e-04	NA	8.3E-10	3.0E-09	3.5E-09	2.1E-05	1.3E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b6403	2.4e-06	1.1e-05	2.2e-05	NA	1.4E-10	5.1E-10	6.0E-10	3.6E-06	2.3E-07
b6610	5.7e-06	2.6e-05	5.3e-05	NA	3.4E-10	1.2E-09	1.4E-09	8.6E-06	5.4E-07
b7101	5.5e-06	2.5e-05	5.1e-05	NA	3.2E-10	1.2E-09	1.4E-09	8.3E-06	5.2E-07

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b7201	3.7e-04	1.7e-03	3.4e-03	NA	2.1E-08	7.8E-08	9.1E-08	5.5E-04	3.4E-05
b7501	2.3e-04	1.1e-03	2.2e-03	NA	1.4E-08	5.0E-08	5.9E-08	3.5E-04	2.2E-05
b7701	7.2e-05	3.3e-04	6.7e-04	NA	4.2E-09	1.5E-08	1.8E-08	1.1E-04	6.8E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration ($\mu g/m^3$) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
b8401	5.4e-05	2.4e-04	5.0e-04	NA	3.2E-09	1.1E-08	1.3E-08	8.1E-05	5.1E-06
ocu1	1.3e-05	5.7e-05	1.2e-04	NA	7.4E-10	2.7E-09	3.2E-09	1.9E-05	1.2E-06
ocu2	2.7e-05	1.2e-04	2.5e-04	NA	1.6E-09	5.7E-09	6.7E-09	4.0E-05	2.5E-06

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration (μg/m^3) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
ocu2a	2.3e-05	1.0e-04	2.1e-04	NA	1.4E-09	4.9E-09	5.8E-09	3.5E-05	2.2E-06
ocu3	2.1e-05	9.5e-05	2.0e-04	NA	1.2E-09	4.5E-09	5.2E-09	3.2E-05	2.0E-06
Total	1.4e-03	6.5e-03	1.3e-02	NA	8.43E-08	3.06E-07	3.59E-07	2.16E-03	1.36E-04

Table C-3. HEM3 Outputs and Risk Calculations for Chronic Exposure Assessment

IPCT ID	Maximum annual concentration (μg/m^3) (unit rate * HAP-specific emission rate)			Maximum annual cancer risks (max annual conc. * dose-response value)			Maximum annual non-cancer hazards (max annual conc. / dose-response value)		
	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform	Methanol	Ethylene thiourea	Chloroform
Grand Total	2.1e-02			3.9e-07			2.3e-03		

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
a1800	4.6e-02	2.1e-01	4.3e-01	6.7E-08	1.8E-07	5.9E-08	1.7E-06	1.4E-06	1.8E-06	1.8E-06	8.8E-04	2.9E-03
a1920	2.3e-03	1.1e-02	2.2e-02	3.4E-09	9.0E-09	2.9E-09	8.3E-08	6.9E-08	9.0E-08	9.0E-08	4.4E-05	1.4E-04
a2622	6.7e-03	3.0e-02	6.2e-02	9.6E-09	2.6E-08	8.5E-09	2.4E-07	2.0E-07	2.6E-07	2.6E-07	1.3E-04	4.1E-04

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
a2820	7.1e-03	3.2e-02	6.5e-02	1.0E-08	2.7E-08	8.9E-09	2.5E-07	2.1E-07	2.7E-07	2.7E-07	1.3E-04	4.4E-04
a3204	3.9e-03	1.8e-02	3.6e-02	5.6E-09	1.5E-08	5.0E-09	1.4E-07	1.2E-07	1.5E-07	1.5E-07	7.4E-05	2.4E-04
a3206	6.2e-03	2.8e-02	5.8e-02	8.9E-09	2.4E-08	7.9E-09	2.2E-07	1.8E-07	2.4E-07	2.4E-07	1.2E-04	3.8E-04

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
a3665	2.5e-02	1.1e-01	2.3e-01	3.6E-08	9.5E-08	3.1E-08	8.8E-07	7.3E-07	9.5E-07	9.5E-07	4.7E-04	1.5E-03
a3850	1.5e-02	6.6e-02	1.4e-01	2.1E-08	5.6E-08	1.8E-08	5.2E-07	4.3E-07	5.6E-07	5.6E-07	2.8E-04	9.0E-04
a5070	3.9e-02	1.8e-01	3.6e-01	5.6E-08	1.5E-07	5.0E-08	1.4E-06	1.2E-06	1.5E-06	1.5E-06	7.4E-04	2.4E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
a808	1.7e-02	7.6e-02	1.6e-01	2.4E-08	6.5E-08	2.1E-08	6.0E-07	5.0E-07	6.5E-07	6.5E-07	3.2E-04	1.0E-03
a808a	3.2e-02	1.5e-01	3.0e-01	4.6E-08	1.2E-07	4.1E-08	1.2E-06	9.6E-07	1.2E-06	1.2E-06	6.1E-04	2.0E-03
b115	2.1e-03	9.3e-03	1.9e-02	3.0E-09	7.9E-09	2.6E-09	7.4E-08	6.1E-08	8.0E-08	8.0E-08	3.9E-05	1.3E-04

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b1202	1.3e-02	5.8e-02	1.2e-01	1.9E-08	5.0E-08	1.6E-08	4.6E-07	3.8E-07	5.0E-07	5.0E-07	2.4E-04	8.0E-04
b1217	5.4e-03	2.4e-02	5.0e-02	7.7E-09	2.1E-08	6.8E-09	1.9E-07	1.6E-07	2.1E-07	2.1E-07	1.0E-04	3.3E-04
b1350	8.2e-04	3.7e-03	7.7e-03	1.2E-09	3.2E-09	1.0E-09	2.9E-08	2.4E-08	3.2E-08	3.2E-08	1.6E-05	5.1E-05

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b1476	3.7e-03	1.7e-02	3.5e-02	5.4E-09	1.4E-08	4.7E-09	1.3E-07	1.1E-07	1.4E-07	1.4E-07	7.1E-05	2.3E-04
b1700	2.8e-03	1.3e-02	2.6e-02	4.0E-09	1.1E-08	3.5E-09	1.0E-07	8.3E-08	1.1E-07	1.1E-07	5.3E-05	1.7E-04
b2004	1.5e-02	6.9e-02	1.4e-01	2.2E-08	5.9E-08	1.9E-08	5.5E-07	4.5E-07	5.9E-07	5.9E-07	2.9E-04	9.4E-04

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b2224	2.2e-02	1.0e-01	2.1e-01	3.2E-08	8.5E-08	2.8E-08	7.9E-07	6.6E-07	8.5E-07	8.5E-07	4.2E-04	1.4E-03
b2301	4.6e-02	2.1e-01	4.3e-01	6.6E-08	1.8E-07	5.8E-08	1.6E-06	1.4E-06	1.8E-06	1.8E-06	8.7E-04	2.9E-03
b2401	4.5e-04	2.0e-03	4.1e-03	6.4E-10	1.7E-09	5.6E-10	1.6E-08	1.3E-08	1.7E-08	1.7E-08	8.4E-06	2.8E-05

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b2401a	7.9e-04	3.6e-03	7.3e-03	1.1E-09	3.0E-09	1.0E-09	2.8E-08	2.3E-08	3.1E-08	3.1E-08	1.5E-05	4.9E-05
b2403	1.3e-03	5.9e-03	1.2e-02	1.9E-09	5.0E-09	1.6E-09	4.6E-08	3.9E-08	5.0E-08	5.0E-08	2.5E-05	8.0E-05
b2707	3.1e-02	1.4e-01	2.9e-01	4.5E-08	1.2E-07	3.9E-08	1.1E-06	9.2E-07	1.2E-06	1.2E-06	5.9E-04	1.9E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b2707a	4.5e-02	2.0e-01	4.2e-01	6.5E-08	1.7E-07	5.7E-08	1.6E-06	1.3E-06	1.7E-06	1.7E-06	8.5E-04	2.8E-03
b3051	3.7e-03	1.7e-02	3.4e-02	5.3E-09	1.4E-08	4.7E-09	1.3E-07	1.1E-07	1.4E-07	1.4E-07	6.9E-05	2.3E-04
b3235	5.2e-02	2.3e-01	4.8e-01	7.4E-08	2.0E-07	6.5E-08	1.8E-06	1.5E-06	2.0E-06	2.0E-06	9.8E-04	3.2E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b3803	3.6e-03	1.6e-02	3.4e-02	5.2E-09	1.4E-08	4.6E-09	1.3E-07	1.1E-07	1.4E-07	1.4E-07	6.9E-05	2.2E-04
b3803a	3.6e-03	1.6e-02	3.3e-02	5.2E-09	1.4E-08	4.6E-09	1.3E-07	1.1E-07	1.4E-07	1.4E-07	6.8E-05	2.2E-04
b3806	1.8e-03	8.3e-03	1.7e-02	2.6E-09	7.1E-09	2.3E-09	6.6E-08	5.4E-08	7.1E-08	7.1E-08	3.5E-05	1.1E-04

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b3809	4.9e-03	2.2e-02	4.5e-02	7.0E-09	1.9E-08	6.2E-09	1.7E-07	1.4E-07	1.9E-07	1.9E-07	9.2E-05	3.0E-04
b3815	3.3e-03	1.5e-02	3.1e-02	4.8E-09	1.3E-08	4.2E-09	1.2E-07	9.8E-08	1.3E-07	1.3E-07	6.3E-05	2.0E-04
b3920	1.6e-02	7.4e-02	1.5e-01	2.4E-08	6.3E-08	2.1E-08	5.8E-07	4.9E-07	6.3E-07	6.3E-07	3.1E-04	1.0E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b4101	9.2e-02	4.1e-01	8.5e-01	1.3E-07	3.5E-07	1.2E-07	3.3E-06	2.7E-06	3.5E-06	3.5E-06	1.7E-03	5.7E-03
b4400	1.3e-03	5.8e-03	1.2e-02	1.9E-09	5.0E-09	1.6E-09	4.6E-08	3.8E-08	5.0E-08	5.0E-08	2.4E-05	8.0E-05
b4600	9.0e-03	4.1e-02	8.4e-02	1.3E-08	3.5E-08	1.1E-08	3.2E-07	2.7E-07	3.5E-07	3.5E-07	1.7E-04	5.6E-04

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b4601	5.1e-03	2.3e-02	4.8e-02	7.4E-09	2.0E-08	6.5E-09	1.8E-07	1.5E-07	2.0E-07	2.0E-07	9.7E-05	3.2E-04
b4808	1.2e-03	5.6e-03	1.1e-02	1.8E-09	4.7E-09	1.6E-09	4.4E-08	3.6E-08	4.7E-08	4.7E-08	2.3E-05	7.6E-05
b5006	1.2e-03	5.5e-03	1.1e-02	1.7E-09	4.7E-09	1.5E-09	4.3E-08	3.6E-08	4.7E-08	4.7E-08	2.3E-05	7.5E-05

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b5010	2.8e-03	1.3e-02	2.6e-02	4.1E-09	1.1E-08	3.6E-09	1.0E-07	8.4E-08	1.1E-07	1.1E-07	5.4E-05	1.8E-04
b5010a	2.8e-03	1.3e-02	2.6e-02	4.0E-09	1.1E-08	3.6E-09	1.0E-07	8.4E-08	1.1E-07	1.1E-07	5.3E-05	1.7E-04
b5213	3.5e-02	1.6e-01	3.2e-01	5.0E-08	1.3E-07	4.4E-08	1.2E-06	1.0E-06	1.3E-06	1.3E-06	6.5E-04	2.1E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b5601	7.2e-02	3.2e-01	6.7e-01	1.0E-07	2.8E-07	9.1E-08	2.6E-06	2.1E-06	2.8E-06	2.8E-06	1.4E-03	4.4E-03
b6201	3.7e-02	1.7e-01	3.5e-01	5.4E-08	1.4E-07	4.7E-08	1.3E-06	1.1E-06	1.5E-06	1.5E-06	7.1E-04	2.3E-03
b624	2.1e-02	9.5e-02	1.9e-01	3.0E-08	8.1E-08	2.7E-08	7.5E-07	6.2E-07	8.1E-07	8.1E-07	4.0E-04	1.3E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b6403	1.9e-03	8.8e-03	1.8e-02	2.8E-09	7.5E-09	2.5E-09	6.9E-08	5.8E-08	7.5E-08	7.5E-08	3.7E-05	1.2E-04
b6610	4.7e-03	2.1e-02	4.3e-02	6.8E-09	1.8E-08	5.9E-09	1.7E-07	1.4E-07	1.8E-07	1.8E-07	8.9E-05	2.9E-04
b7101	4.0e-03	1.8e-02	3.7e-02	5.7E-09	1.5E-08	5.0E-09	1.4E-07	1.2E-07	1.5E-07	1.5E-07	7.6E-05	2.5E-04

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b7201	2.0e-01	9.2e-01	1.9e+00	2.9E-07	7.9E-07	2.6E-07	7.3E-06	6.1E-06	7.9E-06	7.9E-06	3.9E-03	1.3E-02
b7501	1.2e-01	5.4e-01	1.1e+00	1.7E-07	4.6E-07	1.5E-07	4.3E-06	3.6E-06	4.6E-06	4.6E-06	2.3E-03	7.4E-03
b7701	3.7e-02	1.7e-01	3.4e-01	5.3E-08	1.4E-07	4.6E-08	1.3E-06	1.1E-06	1.4E-06	1.4E-06	6.9E-04	2.3E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
b8401	2.5e-02	1.1e-01	2.3e-01	3.6E-08	9.6E-08	3.1E-08	8.9E-07	7.3E-07	9.6E-07	9.6E-07	4.7E-04	1.5E-03
ocu1	3.5e-02	1.6e-01	3.3e-01	5.1E-08	1.4E-07	4.5E-08	1.3E-06	1.1E-06	1.4E-06	1.4E-06	6.7E-04	2.2E-03
ocu2	6.8e-02	3.1e-01	6.3e-01	9.8E-08	2.6E-07	8.6E-08	2.4E-06	2.0E-06	2.6E-06	2.6E-06	1.3E-03	4.2E-03

Table C-4. HEM3 Output and Risk Calculations for Acute Exposure Assessment

IPCT ID	Maximum 1-hour concentration (μg/m3)			Methanol maximum acute hazards (max 1-hour conc. / dose-response value)				Chloroform maximum acute hazards (max 1-hour conc. / dose-response value)				
	methanol conc (ug/m^3)	ethylene thiourea conc (ug/m^3)	chloroform conc (ug/m^3)	AEGL-1	ERPG1	IDHL/10	REL	AEGL - 2	ERPG2	IDHL/10	MRL	REL
ocu2a	5.6e-02	2.5e-01	5.2e-01	8.1E-08	2.2E-07	7.1E-08	2.0E-06	1.7E-06	2.2E-06	2.2E-06	1.1E-03	3.5E-03
ocu3	4.1e-02	1.8e-01	3.8e-01	5.9E-08	1.6E-07	5.2E-08	1.5E-06	1.2E-06	1.6E-06	1.6E-06	7.7E-04	2.5E-03
Total	1.4e+00	6.1e+00	1.3e+01	2.0E-06	5.2E-06	1.7E-06	4.8E-05	4.0E-05	5.2E-05	5.2E-05	2.6E-02	8.4E-02