



1. AQ Facility ID No.:	14100003
2. AQ File No.:	
3. Facility Name:	Great River Energy - Elk River Station
4. Facility Address:	17845 Highway 10 East Elk River, MN 55330
5. Date:	June 13, 2007
6. Standard Industrial Classification (SIC):	4953 – Waste Combustor 4911 – Peaking Turbine

Maps

Maps provide a pictorial representation of information and allow for significant abbreviation of text submittals. Each map should be standard with a title, reference, date, legend, scale, north arrow, and occasionally a radius. Additional information can be added to clarify the maps or what surrounds the facility. It is recommended to verify information with a site visit. Example maps and data sources can be accessed on the AERA Qualitative webpage. There are instructions that accompany this form and have examples for each map question. The instructions provide sources for where to get the requested information.

7. Sensitive Receptors

Provide a map with appropriate radius (see instructions) around the facility and the surrounding area with the following features: facility, nearby residents, schools, daycares, public recreation areas (e.g., playgrounds, swimming pools, tennis courts, city parks, etc.), nursing homes, hospitals, and other locations where sensitive receptors congregate. **See AERA Figures 1, 2, and 3**

8. General Neighborhood Information

Provide census and demographic information such as population density. When input variability indicates that a map would provide more clarity, provide information with appropriate radius. General descriptions and lists may also be used. How close are the nearest residents? **See Table AERA-02-1**

9. Nearby permitted air emission facilities

Provide map and/or list of permitted air emission facilities and sources within proper radius of the facility. **See Table AERA-02-2**

10. Zoning

Provide map and/or description of zoning, when zoning information is available, within 10 kilometers of the facility. You may want to supplement maps with relevant ordinances that would inform potential exposures, (e.g. raising chickens in town or prohibitions of livestock, etc.). If you are unable to provide this information, MPCA cannot make assumptions regarding zoning restrictions. If land is not zoned and ordinances are not available, a detailed land use map is sufficient. **See AERA Figure 1**



11. Land Use

Provide map showing current land use within 10 kilometers of the facility. Land use maps include information such as areas of residential, commercial and industrial use, farms, forests and waterways. If no map is provided, we will assume the most restrictive land use. It is also helpful to know if the land is used for other purposes than what is designated on the land use maps. MPCA considers "reasonable potential future land use". According to EPA's Human Health Risk Assessment Protocol, three examples of reasonable potential future land use are:

1. Rural area characterized as undeveloped open fields could reasonably be expected to become farmland if it can support agricultural activities;
2. Rural area currently characterized by open fields and intermittent housing, could reasonably be expected to become a residential subdivision;
3. An area currently characterized as an industrial area would **not** reasonably be expected to become farmland. **See AERA Figure 1**

12. Facilities emitting PBTs should provide a map showing the following features:

a. Fishable water bodies

A water body may be considered "fishable" if it typically contains water year-round in a year that receives at least 75 percent of the normal annual precipitation for that area. Provide a map showing lakes, rivers and streams within the appropriate radius depending on stack height. Also show water bodies outside the specified area that may be fed by rivers and streams lying within the radius of interest. It is also useful to know if the waterbody is on private or public property and the general accessibility of the water. **See AERA Figure 1 for lakes within 10 km.**

b. Farming locations

While landuse maps provide the Agency with general information, it is recognized that agricultural landuse does not equate to actually having farms present. Provide a map showing the specific locations of farms within the specified area.

If no information is available regarding land use, the default assumption will be that a farmer could be impacted by facility emissions, and the farmer's risks will be used as a basis for decisions. If land use indicates that farms do not exist within the appropriate radius, only the indirect risks will be assessed. Resident exposures could include ingesting chickens, eggs, or other livestock that are raised on the property.

- When available, provide additional information about farms that surround the facility. For example:
 - What crops are grown on the farm?
 - What animals are raised?
 - Is it a small family farm?
 - Is it a large commercial farm?

A farm was assumed to be located at the property boundary but there is no actual farm currently located at the boundary. The incremental risk to a farmer receptor from the project is below MDH guideline values. Foreseeable future land use in the Elk River area likely prohibits a farmer from locating at the property boundary.



Exposure

1. Is there a fence surrounding the facility? **No**
2. Is access to the property restricted? Describe. **No**
3. Does the facility rent or lease portions of property for farming or other purposes that could provide exposure to public? If yes, describe. **No**
4. Is there a fishable water body on farming property? **Unknown**
5. Describe accessibility to water bodies. Are they on public or private property?
Public and private water bodies exist in the area.

Quick Reference Table

See AERA-02 Instructions for additional information

Qualitative Section	What to include	Resources
Receptors and Sensitive Populations	schools, daycares, recreation centers/playgrounds, nursing homes, hospitals, and residence locations	Aerial photos from sites referenced above or local records, databases.
General Neighborhood Information	Population and nearest residents if not addressed under Receptors and Sensitive Populations.	U.S. Census Bureau: http://www.census.gov/ MN Census Quick Facts: http://quickfacts.census.gov/qfd/maps/minnesota_map.html and http://www.census.gov/census2000/states/mn.html
Nearby Facilities	map and/or list of permitted facilities with air emissions; is not limited to facilities with air permits	MN Environmental Data Access: http://www.pca.state.mn.us/data/edaAir/ What's In My Neighborhood?: http://www.pca.state.mn.us/backyard/neighborhood.html
Zoning	Description of zoning where available	Zoning maps are searchable on the internet for most counties in Minnesota – use your preferred search engine to find “MN zoning maps”
Land Use	Provide map showing land use including farming, forests, residential and industrial areas. It is recommended to verify information with a site visit.	MN County Land Use Maps: http://www.mnplan.state.mn.us/maps/LandUse/ MN Land Use and Cover: http://mapserver.lmic.state.mn.us/landuse/ USGS: http://mapping.usgs.gov/index.html EPA: ftp://ftp.epa/pub
Fishable Water Bodies	Provide map with labels of fishable water bodies. Information on accessibility to water body should be provided when available.	Lake Finder: http://www.dnr.state.mn.us/lakefind/index.html
Farming Locations	Provide map showing farming locations surrounding facility. Additional information regarding crop types, animals raised, number of animals, farm size, and other qualitative information about the farm may be provided.	MN County Land Use Maps: http://www.mnplan.state.mn.us/maps/LandUse/



MINNESOTA POLLUTION CONTROL AGENCY
 AIR QUALITY
 520 LAFAYETTE ROAD
 ST. PAUL, MN 55155-4194

AERA-02
QUALITATIVE INFORMATION

AIR EMISSIONS RISK ANALYSIS
 Air Quality #9.02 February 2006

Table AERA-02-1. Neighborhood Information (Elk River)

	Number	Source
Population (estimate)	21,329	U.S. Census Bureau, 2005 Population Estimates
Population Density (persons per square mile)	591	U.S. Census Bureau, Census 2000 Summary

Table AERA-02-2. Nearby Permitted Facilities

EIS/Delta #	Facility Name	Original Permit Year	Permit Type ¹	City	Street Address
14100041	Waste Management Inc -Elk River Landfill	1998	IO	Elk River	22460 Highway 169 NW
14100010	Barton Sand & Gravel	1990	OT	Elk River	11560 205th Ave Nw
14100055	ABRA Auto Body & Glass - Elk River	1996	R	Elk River	275 Carson Ave
14100045	Aggregate Industries Inc - Elk River	1998	R	Elk River	21700 Highway 169
14100062	Alltool Pinnacle Design & Manufacturing	2002	R	Elk River	19175 Industrial Blvd
99000023	Commercial Asphalt Co - Plant 908	1996	R	Elk River	11560 205th Ave NW
14100052	Deano's Collision Specialists Inc	1996	R	Elk River	11063 173rd Ave NW
14100030	Elk River Bituminous	1996	R	Elk River	21591 Highway 169
14100049	Elk River Ford Inc	1995	R	Elk River	17219 Highway 10
14100042	Elk River Machine Co	1995	R	Elk River	828 4th St
14100047	Elk River Municipal Utilities	1995	R	Elk River	1705 Main St
14100022	Elk River Resource Recovery Facility	2002	R	Elk River	10700 165th Ave NW
14100008	ISD 728 - Elk River Area High School	1996	R	Elk River	900 School St
14100056	Saxon	1996	R	Elk River	17354 Zane St Highway 10
14100050	World Class Auto Body Inc	1996	R	Elk River	17375 Highway 10
14100046	Jim Ennis Cabinets	1995	R	Big Lake	17594 County Road 50
14100063	Whirl-Air-Flow Corp - Big Lake	2002	R	Big Lake	20055 177th St

¹Type of latest permit issued (I = installation, I/O = Installation/operation, O = Operation, OT = Total Facility, P = Pronto, G = General, MG or MGP = Mfg General, HM = Hot Mix General, NM = Non-Metallic General, R = Registration, ST = System, and VD = Void)



[This discussion is continued from the RISK ANALYSIS SUMMARY]

5.0 Qualitative Screening Analysis

5.1 Land Use and Receptors

The project site is located in Elk River, Minnesota. Lands immediately adjacent to the Elk River Station property are primarily residential and commercial.

5.1.1 Sensitive Receptors

Potentially sensitive receptors within 3 kilometers of the proposed project are primarily residential and urban in nature. Form AERA-02 includes the land use map for areas within 10 kilometers of the Elk River Station and identifies potentially sensitive receptors such as day cares/preschools, schools, civic and government centers, hospitals, and retirement home and communities.

5.1.2 Multimedia Receptors

Another type of "sensitive receptor" is the population surrounding a facility that could be exposed to the PBTs in a facility's emissions via the food pathway. The project operations are estimated to release only very small amounts of PBT chemicals.

The RASS evaluates two generic receptors: 1) a farmer who consumes homegrown vegetables and regularly eats home-grown meat and dairy products, and 2) a nearby resident who consumes vegetables grown in his/her garden. Because there are no farmers located at the property boundary, the farmer risks calculated for the Elk River Station are likely not applicable.

5.1.3 Farmers and Residents

Site information indicates that agricultural lands are present within 10 kilometers of the facility, although agriculture is not a predominant land use and no agriculture occurs at the Elk River Station property boundary.

The nearest residences are located to the north and the east of the Elk River Station.

Chemicals assessed for multimedia risks include selected particulate metals, PAHs (total) and dioxins/furans (as 2,3,7,8-TCDD equivalents). The estimated multimedia risks from the project are less than the MDH guideline values for cancer and noncancer chronic risks (Table 5). Therefore, potential long-term impacts via the food ingestion pathway are not expected from the proposed project emissions and further analysis for the food ingestion pathway is not warranted.

5.1.4 Fishers

Water bodies are located within 10 kilometers of the proposed facility (Form AERA-02). The RASS does not assess chemical deposition to water bodies or accumulation in fish or humans consuming the fish. This is because of the very large variability surrounding water bodies such as watershed size, water body turnover rate, flow rate, etc. makes it difficult to describe an appropriate assessment at this time (MPCA, 2004). However, emission estimates for PBTs (e.g., arsenic, PAHs, mercury, dioxins/furans) from the project are low. Small emissions, combined with the expectation that only a very small percent of the emissions would deposit locally near the facility, indicates that the potential deposition to surface waters (lakes and rivers) of PBTs is likely not significant.

5.2 Chemicals and Emissions

The discussions under this section of the AERA are to provide the reader with additional qualitative information and perspective on chemicals and emissions associated with the project.

5.2.1 Facility Specifics

Pollutants

Chemicals potentially emitted from the project are primarily associated with combustion of fuel; natural gas and fuel oil. The following conservative assumptions were used in assessing chemicals potentially emitted from the project, and thereby overestimating potential inhalation and multimedia risks:

- Arsenic is assessed as “total arsenic”, in the trioxide (+3; most toxic) state. This is conservative because available data indicates that arsenic is typically in the pentoxide (+5) state (Langmuir et al. 2004). Only a small percentage of the arsenic trioxide (+3) is considered to be bioavailable (Langmuir et al 2004; McGeer et al 2004).
- Metals are assumed to be 100% bioavailable. This is conservative because only a small amount of a metal is truly bioavailable (Drexler et al, 2003; Langmuir et al. 2004).
- Chromium emissions are speciated to +3 and +6 (hexavalent) forms. Data from waste combustors indicates that as little as 0.2% of the total chromium emissions may be chromium +6 (Bailiff 1991). No chromium +6 stack testing data are available for the existing facility. As a conservative measure, we have assumed that chromium +6 is 18% of total chromium.
- PAHs were evaluated as “total” PAHs. No speciation to individual species was conducted. The total PAHs were evaluated as benzo(a)pyrene and provides an overestimation of the potential impacts from PAHs. PAHs are only evaluated for the peaking plant. Emission factors for PAHs from RDF plants are not available in the EPA databases; therefore PAH emissions from the RDF plant could not be estimated.

5.2.2 Mixtures and Surrogate Toxicity Values

Calculating risks using surrogate toxicity values to represent chemical mixtures introduces a high level of uncertainty to the risk estimates. The use of surrogate toxicity values is not widely accepted in the scientific community. At best they can be used as a screening tool but not in a quantitative risk evaluation. The MPCA (2004) guidance states that: *“With a goal of not under-predicting risk, all available toxicity values for chemicals in a given mixture are considered, and a chemical is selected because its toxicity relative to the other chemicals in the mixture is greater. There may, however, be instances in which the mixture contains chemicals with higher toxicity than the surrogate, in which case the potential exists for risks from the mixture to be under-predicted.”* In this AERA, the use of surrogate toxicity values is assumed to provide a conservative estimate of potential inhalation risks.

5.2.3 Sensitizers

Chemical sensitizers are of particular concern because these chemicals can cause severe adverse reactions sometimes at minute concentrations for persons who have been previously sensitized to the chemical. A person’s initial exposure to a sensitizer may not result in an adverse response, yet that exposure may have resulted in a non-observable immune response. Subsequent exposures may then result in a much more severe response. A person’s sensitized response may be from an exposure to a chemical that is only structurally similar. Sensitization reactions are sometimes very severe and can be fatal.

Chemicals potentially emitted from the project that are identified as sensitizer chemicals include: Beryllium, Formaldehyde, Nickel compounds.

A reference toxicity concentration (USEPA RfC, MDH HRV, Cal EPA-OEHHA REL) is generally considered by the USEPA to be protective against asthma and other potential effects for non-sensitized individuals (USEPA, 1998). Therefore, the potential for sensitization of members of the general public is considered to be low.

5.2.4 Developmental Toxicants/Chemicals with Ceiling Values

Pregnant women are a sensitive subgroup who must be given special consideration in a risk analysis. Although many chemical exposures can have adverse effects to a pregnant woman and her fetus, chemicals that are developmental toxicants may directly harm a fetus. Unfortunately, most chemicals have not been tested for developmental effects; many chemicals have uncertainty regarding time of exposure and mass of a chemical necessary to generate developmental effects. Those chemicals for which sufficient scientific evidence was available to develop an IHB for developmental effects have been noted in the *RiskCalcs* worksheet of the MPCA’s RASS.

Of special importance are chemicals with HRVs and California Reference Exposure Levels (RELs) that are known to be developmental toxicants. Acute HRVs with developmental endpoints have been identified in the RASS as chemicals with “ceiling values” that should not be exceeded. The acute exposure, that is the resulting maximum estimated hourly concentration from a facility, is compared to the ceiling value to determine whether the ceiling value has been

exceeded. Like chronic chemicals and other exposure scenarios, ceiling value chemicals with ratios of 0.1 of the acute threshold can be excluded from further analysis. Ceiling values do not apply to surrogate values.

Risk results from the RASS indicate that no ceiling values were exceeded. Therefore, potential impacts to the general public from exposure to developmental toxicants associated with the project are not expected.

5.2.5 Criteria Pollutants

Criteria pollutant modeling conducted for the Elk River Station indicates that the high first high values for each pollutant are below the respective standards for the pre-and post-project facility. A ratio less than one indicates an acceptable relationship between the criteria pollutant concentration and the ambient air quality standard.

The ratios of the modeled air concentrations to ambient air quality standards for the criteria pollutants are not comparable to the quantitative HQs calculated in the RASS because those HQs are based on a dose-response relationship.

Criteria Pollutant Screen – Post Project Elk River Generating Station					
Chemical	Fraction of 1-hr std	Fraction of 3-hr std	Fraction of 24-hr std	Fraction of qtrly std	Fraction of annual std
SO2	0.017				0.010
PM10					0.004
PM2.5					0.013
NOx					0.030
CO	0.046				
Pb				0.022	

5.2.6 PM_{2.5}

The following discussion is adopted from MPCA Reports (MPCA 2003a,b; 2004b):

Particulate matter (PM) is a general term used for a complex mixture of solid and liquid particles in the air. “Coarse” particles, such as dust from roads and farm fields, have a diameter about a tenth the width of a human hair. “Fine” particles are even smaller, some so small that several thousand of them could fit on the period at the end of this sentence.

Fine particles can be directly released during combustion processes, for example, when coal, gasoline, diesel, other fossil fuels and wood are burned. Many fine particles are also formed secondarily in the atmosphere from chemical reactions involving gaseous pollutants such as nitrogen oxides, sulfur oxides, some volatile organic compounds and

ammonia. Major sources of fine particles are cars, trucks, buses, diesel construction equipment, coal-fired power plants, manufacturing, biomass (wood, vegetation, etc.) burning and agriculture.

Because they are tiny and light, fine particles can be carried by the wind for hundreds of miles, making exposure to these pollutants a regional problem. Unlike ozone, which is typically elevated in the hot summer months, fine particles can be a problem throughout the year. Evidence indicates more than half the particles in Minnesota's air come from out-of-state sources.

Fine particles can be inhaled deeply into the lung. These particles then accumulate in the respiratory system and are linked with a number of serious health effects such as increased cardiovascular and respiratory hospital admissions and deaths. Studies indicate that peaks in PM_{2.5} may aggravate respiratory conditions such as asthma and chronic bronchitis. In 1997, significant scientific advances in understanding the health effects of fine particles led to the adoption of new federal standards to protect public health.

Following MPCA's (2006a) guidance regarding assessing PM_{2.5} emissions in an AERA, the simplest and most conservative way to estimate direct PM_{2.5} emissions is to assume PM_{2.5} emissions are equal to PM₁₀ emissions. Because there is no approved regulatory dispersion model for PM_{2.5}, the most conservative way to estimate PM_{2.5} air concentrations from a proposed project is to use the modeled PM₁₀ air concentrations as surrogates for PM_{2.5} air concentrations. The modeled PM₁₀ air concentrations are then compared to the PM_{2.5} National Ambient Air Quality Standards (NAAQS) to provide an initial assessment of potential compliance with the PM_{2.5} NAAQS.

The criteria pollutant modeling results for the proposed project includes only annual modeled concentrations. This modeling included both stack and fugitive emission sources. The maximum modeled PM₁₀ annual air concentration is 0.13 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The PM_{2.5} NAAQS are 35 $\mu\text{g}/\text{m}^3$ for the 24-hour averaging period and 15 $\mu\text{g}/\text{m}^3$ for the annual averaging period. The ratio of the modeled PM₁₀ air concentrations to the PM_{2.5} NAAQS is as follows (modeled PM₁₀ air concentration divided by the corresponding PM_{2.5} NAAQS):

- 24-hour averaging period: Not assessed
- Annual averaging period: $0.13 \mu\text{g}/\text{m}^3 \div 15 \mu\text{g}/\text{m}^3 = 0.009$

This is not a rigorous comparison of potential PM_{2.5} emissions to potential PM₁₀ emissions for the post-project facility but it does suggest that direct PM_{2.5} emissions are likely not significant for the facility.

Secondary formation of PM_{2.5} potentially associated with the facility's SO₂ and NO_x emissions that may be transformed into sulfate and nitrate aerosol, typically as ammonium sulfate or ammonium nitrate, by atmospheric processes is not addressed in this evaluation. Fine particle pollution is recognized as being a long-range transport issue (USEPA 2004). For SO₂ conversion

to sulfate aerosol, the conversion typically occurs over several days and during that time the emissions from a facility may have moved several hundred miles. Research is ongoing with regard to the conversion of NO/NO₂ to nitrate aerosol. Due to this long range transport of fine particles associated with SO₂ and NO_x emissions, it is uncertain as to the extent the secondary formation of sulfate and nitrate aerosol affect air concentrations near an emission source but it is not expected to be a significant contribution with regard to health effects near the facility. The estimated emissions of SO₂ and NO_x from the post-project facility are small and below the PSD permitting thresholds. Therefore, it is unlikely that the post-project emissions would be a significant contributor to PM_{2.5} air concentrations.

The potential impact of PM_{2.5} direct emissions on the quantitative inhalation risk estimates is not known. Based on the low ratio of the estimated annual ambient air concentration to the PM_{2.5} standard, it is not likely to be a significant contribution to inhalation risks.

5.3 Multimedia Analysis

Chemicals emitted to the atmosphere may be deposited on soils and surface water and may subsequently enter the terrestrial and aquatic food chain that may lead to indirect human exposures. The purpose of the screening level multimedia analysis is to evaluate the potential for adverse human health effects associated indirect exposure to chemicals potentially emitted from the proposed facility. Multimedia factors are used to estimate noncancer and cancer risks from ingestion exposures. The multimedia factors have been developed by MPCA staff and are chemical-specific ratios of the maximum estimated risk from the ingestion exposure route to the maximum estimated risk from the inhalation exposure route (MPCA, 2004).

Multimedia factors are multiplied by the chronic screening inhalation HQs and the screening inhalation cancer risks to obtain screening level risks from ingestion exposure routes. The combined cancer risks and HQs for the multimedia (inhalation and ingestion) exposure routes are then calculated for individual chemicals (see the *RiskCalcs* worksheet in the RASS). The risks are summed across all chemicals (cancer risks and hazard indices).

The multimedia factors were derived by the MPCA from the IRAP model using generic input parameters to calculate inhalation and indirect exposure risk for specific chemicals (MPCA 2006b). The ratios of the calculated risks for these pathways were then used to derive chemical specific multimedia factors. The method developed by the MPCA has not undergone widespread scientific review. The reliability and applicability of the method is unknown. Therefore uncertainty is associated with the results of the multimedia analysis presented in this report. Based on the information available from the MPCA (2006b) regarding the multimedia factors, it is highly likely that potential risks are conservative and overestimate any potential risks.

5.3.1 Screening Results from the RASS

Potential multimedia risks estimated for the project are presented in Table 5 and indicate that farmer and resident risks are below the MPCA's guideline values of 1×10^{-5} for cancer and 1.0 for noncancer chronic risks. Given the conservatism in the multimedia factors, these risk results

indicate that no adverse health effects from the indirect pathway (food ingestion pathway) are expected to be associated with the project emissions.

As previously discussed, the RASS calculations employ conservative generic multimedia factors to convert an air concentration into a multimedia concentration. The technical and scientific basis for this approach has not been widely reviewed by technical and scientific experts, therefore, the reliability and applicability of the multimedia factor approach is not known.

5.3.2 PBTs Without Multimedia Factors

The version of RASS (version Unlocked Concentration_RASS-25 stacks-20060829) used in this AERA identifies the following CFE as PBTs not having a multimedia factor: Antimony, arsenic, manganese, mercury, naphthalene, and nickel. The overall effect of these pollutants on multimedia risk estimates for ingestion of home-grown vegetables and home-grown meat and dairy products is unknown. The CFEs identified as having a multimedia factor in MPCA's RASS ("MMFactor" tab) are identified in the electronic files and not shown here.

5.4 Conservatism of the Quantitative Assessment

The need to address uncertainty is discussed in the National Research Council (NRC, 1983) report *Risk Assessment in the Federal Government* which states that: *"The dominant analytical difficulty [in decision making based on risk assessment] is pervasive uncertainty....there is often great uncertainty in estimates of the types, probability, and magnitude of health effects associated with a chemical agent...."*

The risk assessment process is subject to uncertainty and variability from a variety of sources. These are inherent in the risk assessment process and are not unique to this AERA. Uncertainties represent incomplete knowledge about certain parameters, and the values of the parameters generally depend upon limited data and model predictions. Variability, on the other hand, represents true heterogeneity and inherent differences within a population, across geographic regions, and throughout a given time period (USEPA, 1997c).

Uncertainties in the AERA are related to measurement uncertainties, model uncertainty, and uncertainties that result from the lack of data.

- Measurement uncertainties result from inherent errors or systematic biases. Examples of parameters that are subject to measurement errors are chemical specific parameters such as vapor pressure, stack airflow and emission rates, and toxicity values.
- Model uncertainties are related to the use of simplistic assumptions in models to predict dispersion of chemicals in the atmosphere. Another source of uncertainty is due to the variability of important parameters and the subsequent effect on exposure and risk estimates. Variability is not related to data quality or knowledge of fundamental relationships in the risk assessment process, but refers to observed differences (i.e., residence time, exposure frequency, toxicity data etc.) attributable to true heterogeneity

(USEPA, 1997c). Variability occurs when a specific quantity is represented by a single value (i.e., body weight, exposure duration, toxicity value) that in reality may consist of a distribution of values.

- Uncertainty due to the lack of data (such as the absence of information on the effects of a chemical on humans, the lack of information on the biological mechanisms, etc.) is significant and is the greatest source of uncertainty in the risk estimate. Therefore, a simplified numerical representation of risk is incomplete and misleading (USEPA, 1992a). USEPA recommends that a multi-scenario approach be used as an indicator of the overall uncertainty in the risk assessment. In this approach, different single values (ranging from worst case to average) for key variables are used to develop point estimates of exposure and risk. The range of the risk estimates is used to describe the overall uncertainty of the risk characterization. However, in this AERA, only a single value is used to describe risk.

The major sources of uncertainty for this AERA are briefly discussed in the following sections.

5.4.1 Exposure Assessment

The Exposure Assessment identifies the means by which people can come into contact with chemicals in ambient air that are associated with emissions from the proposed project.

The exposure assessment was conducted for the MEI; i.e., near maximum risk estimate. This exposure concept employs maximum point estimates for ambient air concentration, exposure frequency and duration, and upper bound values for toxicity, and bioavailability, without direct consideration of the variability in exposure point concentrations, toxicity, chemical speciation, and in the study population. Three receptors for the MEI exposure concept were evaluated: maximum offsite, residential, farmer.

5.4.1.1 Exposure and Dose

The AERA used simple generic equations to calculate potential chemical exposure to a hypothetical receptor through inhalation. In these models, exposure is synonymous with dose. For example, for the inhalation exposure route, exposure conservatively signifies the introduction of the hypothetical receptor to the chemical through inhalation. In actuality, real exposure occurs during uptake of the chemical through the lung after inhalation.

The term dose should be differentiated into applied dose, internal dose, and delivered dose. An applied dose is the amount of a chemical inhaled. The internal dose is the amount of the chemical that has been absorbed and is available to interact with biological systems. The delivered dose is the amount of a chemical transported to tissue, fluid, or an organ. The biologically effective dose is the amount of the chemical that actually reaches target sites where adverse effects can occur. The exposure methodology used in the AERA implicitly assumes that the calculated exposure point concentration is equal to the biologically effective dose. This assumption results in a significant overestimation of risk.

5.4.1.2 Exposure Concept

To estimate exposure, the AERA used only the MEI exposure concept. For the MEI exposure concept, generic exposure assumptions represented by single values were used. The MEI exposure concept is not based on site-specific conditions regarding actual human activity patterns of the population in the vicinity of the facility.

The MEI exposure concept intentionally overestimates the exposure in an actual population for the purpose of developing a statement that the risk is not greater than the estimated value (USEPA, 1999a). Maximum estimates of emissions (annual, 1-hour) are used to derive high-end exposure conditions (maximum annual and 1-hour air concentrations, respectively). The high-end exposure conditions along with maximum values for exposure duration and exposure frequency (24 hours per day, 365 days per year, over a 70-year period) provide a very conservative estimate of exposure and hence risk estimate.

The maximum values for exposure duration and frequency are used to represent a “worst case” or upper bound exposure scenario. A worst-case scenario refers to a combination of events and conditions such that, when taken together, produce the highest conceivable risk. These upper bound exposure assumptions for the MEI concept result in a representation of maximum possible exposure that significantly overestimates exposure for any “real” receptor.

The Guidelines for Exposure Assessment (USEPA, 1992b) state that bounding estimates can be used for preliminary evaluations, or screening steps, to eliminate exposure pathways and exposure routes that do not significantly contribute to overall risk. The guidelines further caution that *“the only thing the bounding estimate can establish is a level to eliminate pathways from further consideration. It certainly cannot be used for an estimate of actual exposure”* (emphasis added). The “bounding” estimates (MEI) cannot be used for an estimate of actual exposure, because by definition it is clearly outside the actual distribution of exposure in a known population (USEPA, 1992b; 1999a,b). It has been estimated that standard MEI calculations overestimate the exposure to a true maximally exposed individual by a factor of 10 to 100, and are significantly higher than those expected for the average exposure case (Hawkins, 1991).

Important conservative assumptions included in the MEI exposure concept are discussed in the following paragraphs .

Maximum Off-property Receptor

Under the MEI exposure concept’s maximum off-property receptor for chronic risk (cancer, noncancer chronic) it was assumed that a hypothetical person lives at this location regardless of whether people actually live, or have the ability to live, at that location or in that general area. This assumption overestimates the potential risk to any “real” receptor.

Indoor Air versus Outdoor Air

For both receptors (maximum off-site receptor, farmer and resident) it was further assumed that the hypothetical individual is continuously exposed to outdoor air for a lifetime (24 hours per day, 365 days per year, over a 70-year period). In reality people spend a considerable amount of time indoors, where concentrations are most likely lower (USEPA, 1994). In Minnesota, the assumption that a person will be outside continuously for a lifetime is very conservative and likely does not occur.

Concentrations of metal particulate in air, associated with emissions from the proposed project, are different for indoor than outdoor environments. Indoor air concentrations for the metals associated with external sources are typically lower, often substantially, than outdoors (USEPA, 1994). Concentrations of organic compounds also differ between indoor and outdoor environments (USEPA assumed indoor concentrations were 60% of outdoor concentrations; USEPA, 1986c). However, for the MEI exposure concept, it was conservatively assumed that indoor air concentrations would be equal to outdoor air concentrations. In addition, it was assumed that all metals in ambient air would be in the respirable size range (less than or equal to 10 microns in diameter).

Locations of Maximum Modeled Air Concentrations

Typically adding to the conservatism in the MEI exposure concept is the assumption that all maximum air concentrations occur at the same receptor location when modeling shows that the maximum concentrations occur at different locations for different chemicals. In this AERA the maximum modeled air concentrations are assumed to occur in one location even though dispersion modeling results indicate they occur in different locations. This assumption adds to the overestimate of risks.

5.4.2 Exposure Point Concentrations

The exposure point concentrations developed in the AERA were based on emissions estimates and dispersion modeling and each is paragraphs discussed in the following.

5.4.2.1 Emission Estimates

The Potential to Emit (PTE) emission estimates were based on stack testing data and then a safety factor of one standard deviation was applied to the estimates. In all cases, PTE emission estimates are considered conservative (i.e., an overestimate of emissions) and are based on maximum permitted rates.

Emission factors provide information on the quantity of a chemical typically released to ambient air for a particular type or source operation, and are representative of an industry or emission type as a whole. Actual emissions from a specific source may be lower (or higher) depending on differences in process design, operation and maintenance practices, control equipment type and

efficiency, or other factors. The quality of the emission factors (EF) depends on the quality and quantity of the test data upon which the EF was based. AP-42 presents an EF quality rating system. The ratings range from “Excellent” to “Poor”. The AP-42 emission factor rating is an overall assessment of how good a factor is, based on both the quality of the tests or information that is the source of the factor, and on how well the factor represents the emission source (USEPA, 1996a). When more than one AP-42 emission factor for a specific source was available, to be conservative the higher value was selected for use in the AERA.

In summary, the emission inventory provides a conservative estimate of emissions.

5.4.2.2 Air Dispersion Modeling

Maximum potential emission rates were used in conjunction with AERMOD modeling to derive estimates of maximum air concentrations. Model uncertainty is related to the gaps in scientific knowledge and the simplifying assumptions used in air dispersion models to predict the behavior of volatile, semi-volatile organic chemicals, inorganic chemical agents and particulates. Uncertainty associated with air dispersion modeling is due to algorithm error (limitations of the model algorithms and assumptions) and input data limitations (such as wind speed, wind direction, horizontal and vertical dispersion, effective emission height and mixing height). Total model uncertainty has been represented by the assumption that 90 percent of the model predictions are within a factor of 2 of the true concentration. An accuracy factor of two is commonly regarded as typical of Gaussian model performance (Freeman, 1986; Irwin, 1987). The worst case meteorological conditions (from a dispersion standpoint) over the 5 year period of meteorological data were assumed to occur on a daily basis over the 70 year exposure period evaluated in this AERA. Because of the considerations discussed previously, the ambient air concentrations as used in the AERA are most likely overestimated, thereby resulting in an overestimation of risk.

5.4.3 Toxicity Assessment

A potential large source of uncertainty is inherent in the derivation of USEPA, MDH and Cal EPA-OEHHA toxicity values (i.e., RfCs and UR factors). Adequate data reflecting human exposure to low levels of environmental chemicals are generally not available. Data that are available for human exposures are usually based on exposures in the workplace, where concentrations are generally higher than those encountered in the environment. Because of the lack of human data, toxicity values are derived from studies with laboratory animals. To apply data derived from animal studies to humans, extrapolation factors are used. In developing these dose-response values, USEPA currently uses conservative assumptions to assure that the toxicity value is conservative and that the resultant risk estimate is more likely to overestimate risk than underestimate risk. USEPA applies these conservative assumptions for the development of both URs and RfCs.

The sources for the toxicity values used in MPCA’s RASS were the MDH list of HRVs, USEPA’s IRIS database, Cal EPA-OEHHA RELs, and USEPA’s HEAST database, as well as provisional values developed by the MDH and surrogate toxicity values for certain chemicals. The toxicity values presented in the IRIS database have undergone review by USEPA’s internal

peer review groups. Values presented in HEAST are provisional values and have not been subjected to the same level of peer review as the values listed in IRIS. The MDH essentially adopted the USEPA RfCs with at most an alteration of an uncertainty factor. Toxicity values (RELs) developed by Cal EPA-OEHHA were derived in essentially the same manner as those derived by the USEPA. Cal EPA-OEHHA internal and external experts have reviewed RELs adopted by that Agency. Cal EPA-OEHHA Draft RELs have not been subjected to this same level of review and should not be considered to be at the same level of confidence as the adopted RELs. Likewise, the provisional values derived by MDH and the surrogate toxicity values employed by MPCA in the RASS should not be considered to be at the same level of confidence as the adopted HRVs.

A significant uncertainty in the AERA is the numerical values representing toxicity of the chemicals evaluated. The uncertainty is biased towards conservatism, thereby providing health risk-based values that overestimate actual risk.

5.4.3.1 Noncarcinogenic Toxicity Values

Because appropriate human exposure data are rarely available, alternative methods are used to estimate dose-response values that are not likely to cause adverse health effects. The methods currently employed by the USEPA, Cal EPA-OEHHA, and the MDH to develop dose-response values do not allow for an assessment of the likelihood that effects will occur, nor allow an assessment of the severity of the effects in an exposed individual or population. Sources of uncertainty in the development of noncarcinogenic inhalation toxicity values (HRVs, RfCs, RELs) include:

- Extrapolation from high dose, short-term exposures in the experimental study to predict effects following longer-term exposure encountered in the environment. This assumes that a given exposure concentration results in an effect regardless of the exposure time.
- Use of adverse effects data available for the most sensitive laboratory animal species. For example, a chemical may have a statistically significant adverse health effect in female mice, but not in male mice or rats of both sexes.
- Extrapolation from animal studies to humans. It is assumed that humans are as sensitive as the most sensitive animal species, strain, or sex. Furthermore, the effects seen in the experimental animal study is taken as evidence that the chemical may cause adverse health effects in humans. However, the observed effects in the experimental animal study may not be relevant to humans due to differences in absorption, distribution, metabolism, excretion, target organs, and population variability.
- The use of dose-response data from one route of exposure to predict effects from exposure via different routes (e.g., ingestion effects used to predict inhalation effects) introduces a high level of uncertainty in the RfC. The primary difference in toxicity for different routes of exposure is most likely due to the pharmacokinetics absorption, distribution, metabolism, or excretion of the chemical. Factors that affect the absorption of a chemical through differing exposure routes (i.e., inhalation, ingestion) are properties such as the physical and chemical parameters of the chemical agent (i.e., solubility, dissociation, reactivity), the exposure conditions (concentration, duration, regimen), and the physiological characteristics of the exposed tissue (i.e., cell type, metabolic capability, pH). Distribution of the chemical in the body and elimination of the chemical

from the body (i.e. rate of clearance and site of excretion) may also be affected by these same parameters.

- The variability in the quality of the studies upon which the toxicity values are based. Toxicity values derived from IRIS vary significantly in the level of confidence assigned. Because a no observable adverse effects level (NOAEL) or a lowest observable adverse effects level (LOAEL) is most often based on a limited number of data, USEPA has developed policy positions expressed as uncertainty factors. The magnitude assigned to each uncertainty factor for a specific chemical is a subjective decision with little or no foundation in scientific data. Additional modifying factors (MF) ranging from 1 to 10 may be applied to reflect the qualitative judgments about limitations and uncertainties in the critical study or the database as a whole that are not explicitly addressed by the standard uncertainty factors (USEPA, 1989). Uncertainty factors greater than 1,000 reflect a great degree of uncertainty regarding a chemical's human health effects, and the magnitude of the uncertainty factor must be a key consideration when risk management decisions are made. USEPA cautions that the noncarcinogenic toxicity values are "*an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.*" (USEPA, 1989). The use of order of magnitude uncertainty factors, rounded to one significant figure, and the definition of the RfC as having "uncertainty, spanning perhaps an order of magnitude", are indications of the general lack of precision in the estimates (USEPA, 1989, 1999a). The uncertainty factors for the CFE quantitatively evaluated in the AERA for inhalation risks range from 10 to 3,000 (MPCA's RASS, version Unlocked Concentration_RASS-25 stacks-20060829). The relative precision and the magnitude of the composite UFs and MFs are important considerations in decisions involving comparisons of HQs for different chemicals and in assessing the HI for a mixture of chemicals (USEPA, 1999a).
- Synergism/Antagonism. Toxicological interactions between multiple chemical exposures can occur. These potential interactions were not specifically addressed in the AERA. These interactions may result in greater (synergistic) or lesser (antagonistic) effect than the effect of each individual chemical. Because very limited chemical specific toxicological information is available regarding these interactions at low doses, it was assumed that chemical actions in the mixture would be additive in accordance with USEPA guidance (USEPA, 1989).

5.4.3.2 Carcinogenic Toxicity Values

The toxicological database used for developing inhalation UR values is also a source of uncertainty. The USEPA outlined some of the sources of uncertainties in its *Guidelines for Carcinogen Risk Assessment* (USEPA, 1986b; 1999a) and they include extrapolation from high to low doses and from animals to humans and species, gender age, and strain differences in uptake, metabolism, organ distribution and target site susceptibility. Differences in the chemical species emitted from the proposed project, and the chemical species used in specific toxicity studies, also contributes to the uncertainty associated with the toxicological database.

USEPA (1986b) assumes that cancer induction is a “non-threshold” event because it is believed that any level of exposure, however small, poses a finite probability of generating a carcinogenic response. For those chemicals that do not act by directly inducing mutations in DNA, but disrupt hormonal balances that can cause cytotoxicity and compensatory cell proliferation, the linear dose response model is not appropriate. There is no reason to believe that these chemicals will exhibit low dose linearity proportional to the response at high doses. Risk estimates for these chemicals based on low dose linearity may overstate risks by a factor of 100, 1,000 or more. In some cases the overestimate is infinite because the best risk estimate is zero. In developing cancer slope factors and inhalation UR factors, USEPA, in general, uses the linear low dose response model. This model assumes that every incremental dose of a carcinogen produces a constant increment of risk. Or in other words, under the assumption of low dose linearity, the UR is a constant, and risk has a linear relationship to exposure, meaning that any increase in exposure results in a linear increase in risk. USEPA cautions, however, that, *“It should be emphasized that the linear multistage procedure leads to a plausible upper limit to the risk that is consistent with some mechanism of carcinogenesis. Such an estimate, however, does not necessarily give a realistic prediction of the risk. The true value of the risk is unknown and may be as low as zero. ...”* (USEPA, 1989; 1999a). Application of this model in the AERA results in an overestimation of potential inhalation cancer risk.

Chemicals can be included in either Group A or B (USEPA groups) even if there is just one positive finding of tumors in one laboratory experiment because this one finding is given more weight than any number of negative findings in studies of equal quality. It must further be emphasized that for many substances that have been found to be carcinogenic in some animal species, a great deal of uncertainty exists regarding their carcinogenic potential in humans. The Office of Science and Technology Policy has observed the following: *...known human carcinogens are carcinogenic in appropriately conducted studies in some animal system. This does not mean that all chemicals found to be carcinogenic in animals will turn out to be carcinogenic in humans. Because of the differences in the production of critical metabolites, and because of other differences between species, a given carcinogen may not produce cancer in all species or in all strains of rodents* (OSTP 1985).

The Cal EPA-OEHHA inhalation UR values for some chemicals (dibenzo(a,h)anthracene; lead) are based on data derived from oral studies. The derived oral slope factor (SF) was then converted to a UR by assuming a body weight of 70 kg and an inhalation rate of 20 m³ per day. For lead it was assumed that the absorption through inhalation was 50% compared to 10% through ingestion. Cal EPA-OEHHA assumed that URs for inhalation have the same relative activities as cancer potencies for oral intake (Cal EPA, 2002). This assumption introduces an additional level of uncertainty in the derived value because the route of administration may have an impact on the absorption, distribution, metabolism, excretion, and mode of action of the chemical.

Dioxins/Furans

A specific discussion on dioxins/furans is provided because they are a risk driver pollutant for the existing (pre-project) facility and the post-project facility.

The toxicity values for Dioxins and Furans provided by the MPCA in the RASS represent values developed by the California Office of Environmental Health Hazard Assessment (OEHHA) or the Minnesota Department of Health. The cancer slope factor of 1.4×10^{-3} (pg TCDD TEQ/kg body weight/day)⁻¹ recommended by the MDH is based on EPA's draft animal-based cancer slope factor. In its recently released *Evaluation of the EPA Reassessment*, the National Academy of Sciences (NAS, July, 2006) identified three areas that require substantial improvement in describing the scientific basis for EPA's dioxin risk assessment to support a sufficient risk characterization:

- Justification of approaches to dose-response modeling for cancer and noncancer end points.
- Transparency and clarity in selection of key data sets for analysis.
- Transparency, thoroughness, and clarity in quantitative uncertainty analysis.

The NAS presented the following summary recommendations to address the key concerns:

- Justification of approaches to dose-response modeling for cancer and noncancer end points.
- EPA should compare cancer risks by using nonlinear models consistent with a receptor-mediated mechanism of action and by using epidemiological data and the new NTP animal bioassay data. The comparison should include upper and lower bounds, as well as central estimates of risk. EPA should clearly communicate this information as part of its risk characterization.
- EPA should identify the most important data sets to be used for quantitative risk assessment for each of the four key end points (cancer, immunotoxicity, reproductive effects, and developmental effects). EPA should specify inclusion criteria for the studies (animal and human) used for derivation of the benchmark dose (BMD) for different noncancer effects and potentially for the development of RfD values and discuss the strengths and limitations of those key studies; describe and define (quantitatively to the extent possible) the variability and uncertainty for key assumptions used for each key end-point-specific risk assessment (choices of data set, POD, model, and dose metric); incorporate probabilistic models to the extent possible to represent the range of plausible values; and assess goodness-of-fit of dose-response models for data sets and provide both upper and lower bounds on central estimates for all statistical estimates. When quantitation is not possible, EPA should clearly state it and explain what would be required to achieve quantitation.
- When selecting a BMD as a POD, EPA should provide justification for selecting a response level (e.g., at the 10%, 5% or 1% level). In either case, the effects of this choice on the final risk assessment values should be illustrated by comparing point estimates and lower bounds derived from selected PODs.

- EPA should continue to use body burden as the preferred dose metric but should also consider physiologically based pharmacokinetic modeling as a means to adjust for differences in body fat composition and for other differences between rodents and humans.

A major factor contributing to the overall uncertainty associated with the cancer slope factor recommended by the MPCA is the assumption of low-dose linearity at exposure levels associated with potential emissions of dioxins from the proposed facility. The NAS committee concluded that EPA's decision to rely solely on a default linear model lacked adequate scientific support.

Because toxicological data from inhalation studies were not available the MPCA used route-to-route extrapolation based on the methodology developed by the MDH. The MDH states in its Risk Assessment Rules/Guidance that *“Another case where extrapolation would be inappropriate is when the target organ for the critical effect is the liver. The liver, because of its unique structure and circulation, is subjected to much higher concentrations of ingested chemicals than other organs. In addition, the unique biochemistry of the hepatocytes can result in the generation of very different metabolic products of a toxicant in the liver than would be produced in other organs. For these reasons an extrapolation approach will not be used if the liver is the target organ for a toxicant following oral exposure.”*

The oral cancer slope factor developed by the MDH is based on a rodent study where the target organ was determined to be the liver. The MDH calculated slope factor is based on the occurrence of liver tumors. However, the MDH modified the view that route-to-route extrapolation is not appropriate for chemicals where the target organ is the liver because *“dioxin-like compounds undergo limited metabolism and exhibit long half-lives in the body. As a result the liver would not be subjected to significant higher concentrations or significantly different metabolic products than other organs. Therefore, although the recommended oral slope factor is based on liver tumors, route-to-route extrapolation is acceptable.”* The MPCA used toxicity equivalency factors TEFs established by the WHO to calculate inhalation unit risks for all carcinogenic dioxin and furan congeners. By adopting the WHO TEFs, the MPCA assumes the same potency between inhalation and oral exposure. It is important to note that there is no basis for assuming that the relative order of potency for dioxins/furans is the same for inhalation and oral exposure.

The noncarcinogenic oral reference dose (RfD) developed by the Cal-OEHHA was based on the same study (Kociba et al., 1978) that was used by the MDH to develop the oral cancer slope factor. The Cal-OEHHA determined that the examination of markers of liver toxicity made the Kociba study an appropriate choice for developing an oral RfD. The Cal-OEHHA then used route-to-route extrapolation to calculate an inhalation reference concentration (RfC). The Cal-OEHHA notes that a major area of uncertainty with the RfC is the lack of adequate human exposure data and the lack of chronic inhalation studies. The Cal-OEHHA used TEFs from the EPA adopted in 1989 to calculate RfDs and RfC for all relevant dioxin/furan congeners. The RfDs and RfCs developed by the Cal- OEHHA were adjusted by the MPCA using WHO TEF values.

In summary, substantial uncertainty exists regarding the numerical values developed by the MDH, MPCA, and the OEHHA to represent the toxicity of dioxins and furans. The uncertainty tends to bias the resulting calculated risk high.

5.4.4 Risk Characterization

In the risk characterization step, exposure point concentrations are compared to health risk based values. Exposure point concentrations for the MEI concept are based on conservative assumptions. For the MEI exposure concept, maximum exposure assumptions were combined to quantify exposure and risk and bias the estimates toward the high end (near maximum risk estimate).

Conservative assumptions are those that tend to maximize estimates of exposure (USEPA, 1989; 1992b). As part of the risk assessment process, risks are estimated as a function of exposure and toxicity. The mathematical product of several conservative assumptions is more conservative than any single assumption alone. The combination of several conservative assumptions can lead to unrealistically conservative bounding estimates (USEPA, 1989; 1992b), with the result that the potential estimated risks are likely to be greatly overestimated. In this context, it is important to emphasize that the estimated risks presented in the AERA should not be interpreted as estimates of the probability that health risks will occur. The risk estimates presented in the AERA are conditional estimates of risk that depend on the conservative assumptions involved in the assessments of exposure to, and toxicity of, the chemicals for evaluation.

5.4.4.1 Potential Incremental Carcinogenic Inhalation Risk

To estimate chemical specific potential cancer risk under the MEI exposure concept, maximum values for exposure point concentrations and exposure conditions were used. A combination of these exposure events does not occur in an actual population. Use of these maximum values results in an estimated cancer risk that represents the maximum possible risk for that specific chemical.

The assumption of long-term (70 years) exposure to maximum ambient air concentrations is very conservative (USEPA, 1989). Combining maximum exposure point concentrations with maximum values for exposure frequency and duration in combination with upper bound toxicity values, results in a potential cancer risk estimate that may be thousands of times greater than those for the average exposed individual. While such maximum exposure conditions are individually possible when considered alone, a combination of these conditions is not likely to occur in an actual population. The estimated potential cancer risk for the MEI exposure conditions developed in the AERA represents a theoretical upper bound risk that does not occur in the actual population.

The upper bound exposure assumptions for the MEI exposure concept result in a significant overestimation of risk for any “real” receptor. These estimates of exposure may be thousands of times larger than those encountered by the average individual. The Guidelines for Exposure

Assessment (USEPA, 1992b) state that bounding estimates can be used for preliminary evaluations, or screening steps, to eliminate exposure pathways and exposure routes that do not significantly contribute to overall risk. The guidelines further caution that “*the only thing the bounding estimate can establish is a level to eliminate pathways from further consideration. It certainly cannot be used for an estimate of actual exposure*” (emphasis added).

Conservatism in Summing Individual Chemical Risk

To develop a cancer risk estimate associated with exposure to multiple chemicals identified by USEPA as carcinogens, the chemical specific cancer risk estimates were summed in accordance with MPCA and USEPA guidance. USEPA recognizes that there are several limitations associated with this approach. For chemicals where the UR is based on the upper 95th percentile of the probability distribution, addition of these percentiles may become progressively more conservative as risks from a number of carcinogens are summed (USEPA, 1989). In addition, the following procedures and assumptions result in an additional level of conservatism in the cancer risk estimates:

- In summing the cancer risk, equal weight was given to all chemicals regardless of their classification (class A = known human carcinogen, class B = probable human carcinogen, class C = possible human carcinogen).
- Cancer risk values derived from animal studies were given equal weight to values based on human data.
- Carcinogenic responses arising in the same tissue should, according to USEPA be considered additive, unless the mechanism of carcinogenicity is unrelated. The chemicals identified by USEPA as potential carcinogens varied in target tissue. In the AERA, cancer risks were summed regardless of the difference in their mode of action or target tissue. In general, the assumption of additivity is expected to be conservative (USEPA, 1999a).

5.4.4.2 Potential Incremental Noncancer Inhalation Risk

One conservative feature built into the RASS is that hazard indices for noncarcinogens are summed regardless of toxic endpoint. The RASS automatically adds all individual chemical HQs to determine one total HI when in reality, the individual chemicals in the sum likely impact several different organs or systems. A refined analysis would allow for summing the chemical HQs to several hazard indices, one for each organ or system. If a project proposer undergoes a reasonable amount of refinement focusing in other areas and is still unable to calculate a noncancer HI below the risk management threshold, chemicals may need to be broken into toxicity endpoints.

Quantitative risk results for noncancer chronic and noncancer acute are summed regardless of toxic endpoint. Typically this adds to the conservative estimate of potential risks.

5.5 Monitored Ambient Air Concentrations of Toxic Pollutants

The MPCA conducted a statewide air toxics monitoring study from 1996 through 2001 and measured ambient air concentrations of volatile organic compounds (VOCs), carbonyls, and metals associated with particulate matter at 35 sites in the state (MPCA 2005c). This study was designed to collect background air concentration data from rural, small town, small city, and metropolitan areas. The overall study design allows for data to be extrapolated to other areas of the state where monitoring has not been conducted.

Air monitoring was conducted in Elk River. The comparison of the background risks calculated by the MPCA for all monitoring sites included in the MPCA's Statewide Air Toxics Monitoring Study (MPCA 2005c) are presented below. The background risks are similar in many of the monitored locations, and Elk River is similar to other Twin Cities sites. As summarized by the MPCA (2005c), the pollutants found above health benchmarks at one site or more were benzene, formaldehyde, carbon tetrachloride and ethylene dibromide. Each of these pollutants posed greater than a 1 in a 100,000 excess cancer risk at one or more monitoring sites. Of these four, carbon tetrachloride and ethylene dibromide are below levels of concern based on current data (MPCA 2005c). Benzene is generally below health benchmarks at current monitors; however, since it is a known human carcinogen, it may still be of concern in areas with elevated concentrations such as near sources such as gas stations and busy roadways (MPCA 2005c). Formaldehyde continues to be found at levels of concern across the state (MPCA 2005c); however, the revised toxicity value for formaldehyde likely changes this MPCA (2005c) conclusion.

Site Name	Monitoring Year	2000 Population	Acute HI	Developmental	Eyes	Nervous	Reproductive	Respiratory System	10-5 Cancer Risk	Chronic Non-Cancer HI	Blood Cardiovascular	Developmental	Eyes	Hematopoietic	Kidney Urinary	Liver	Nervous	Reproductive	Upper Respiratory System	Lower Respiratory System	Respiratory System	Whole Body
Alexandria	1996-1997	8820	0.04	0.00	0.04	0.00	0.00	0.04	4.39	0.82	0.04	0.11	0.48	0.00	0.00	0.04	0.07	0.00	0.62	0.52	0.62	0.00
International Falls	1996-1997	6703	0.05	0.01	0.04	0.00	0.00	0.04	4.25	0.81	0.05	0.11	0.43	0.00	0.00	0.04	0.07	0.00	0.61	0.53	0.61	0.00
Leon Township	1996-1997	942	0.04	0.00	0.03	0.00	0.00	0.03	3.56	0.65	0.02	0.11	0.39	0.00	0.00	0.04	0.06	0.00	0.47	0.40	0.48	0.00
Little Falls	1996-1997	7719	0.03	0.00	0.03	0.00	0.00	0.03	3.69	0.70	0.03	0.14	0.38	0.00	0.00	0.04	0.07	0.00	0.47	0.40	0.47	0.00
Pipstone	1996-1997	4280	0.04	0.00	0.04	0.00	0.00	0.04	3.84	0.72	0.03	0.09	0.42	0.00	0.00	0.04	0.09	0.00	0.52	0.44	0.53	0.00
Plymouth	1996-1997	65894	0.07	0.01	0.06	0.00	0.00	0.06	4.22	0.89	0.04	0.10	0.41	0.00	0.00	0.04	0.08	0.00	0.68	0.57	0.69	0.00
Wagner Township	1996-1997	320	0.04	0.00	0.04	0.00	0.00	0.04	3.63	0.68	0.02	0.12	0.41	0.00	0.00	0.04	0.05	0.00	0.49	0.42	0.50	0.00
Elk River	1997-1998	16447	0.05	0.00	0.04	0.00	0.00	0.04	4.04	0.82	0.03	0.09	0.48	0.00	0.00	0.03	0.08	0.00	0.62	0.51	0.62	0.00
Fergus Falls	1997-1998	13471	0.04	0.00	0.04	0.00	0.00	0.04	4.65	1.06	0.04	0.11	0.55	0.00	0.00	0.03	0.10	0.00	0.82	0.62	0.82	0.00
Granite Falls	1997-1998	3070	0.22	0.01	0.22	0.00	0.00	0.22	4.69	1.00	0.03	0.08	0.66	0.00	0.00	0.03	0.07	0.00	0.83	0.72	0.83	0.00
Hibbing	1997-1998	17071	0.06	0.00	0.06	0.00	0.00	0.06	4.21	0.89	0.03	0.12	0.52	0.00	0.00	0.03	0.08	0.00	0.66	0.56	0.66	0.00
Minneapolis	1997-1998	382618	0.12	0.00	0.12	0.00	0.00	0.12	5.81	1.26	0.05	0.10	0.83	0.00	0.00	0.03	0.10	0.00	1.03	0.87	1.03	0.00
Rochester	1997-1998	85806	0.03	0.00	0.03	0.00	0.00	0.03	4.06	0.77	0.04	0.08	0.45	0.00	0.00	0.04	0.07	0.00	0.59	0.49	0.59	0.00
Warroad	1997-1998	1722	0.06	0.00	0.06	0.00	0.00	0.06	3.44	0.67	0.02	0.09	0.41	0.00	0.00	0.04	0.06	0.00	0.51	0.45	0.52	0.00
Bemidji	1998-1999	11917	0.04	0.01	0.03	0.00	0.00	0.03	3.83	0.84	0.04	0.10	0.46	0.00	0.00	0.03	0.07	0.00	0.63	0.52	0.63	0.00
Duluth 7550	1998-1999	86918	0.06	0.00	0.05	0.00	0.00	0.05	3.56	0.84	0.03	0.11	0.47	0.00	0.00	0.03	0.05	0.00	0.66	0.57	0.67	0.00
St. Paul	1998-1999	287151	0.10	0.01	0.09	0.00	0.00	0.09	5.45	1.24	0.06	0.10	0.74	0.00	0.00	0.03	0.09	0.00	1.00	0.84	1.01	0.00
Holloway	1998-1999	112	0.03	0.00	0.03	0.00	0.00	0.03	2.47	0.59	0.02	0.09	0.28	0.00	0.00	0.02	0.05	0.00	0.44	0.36	0.44	0.00
Moorhead	1998-1999	32177	0.06	0.00	0.06	0.00	0.00	0.06	4.17	1.05	0.03	0.12	0.57	0.00	0.00	0.03	0.08	0.00	0.81	0.64	0.81	0.00
St. Cloud	1998-1999	59107	0.14	0.00	0.14	0.00	0.00	0.14	3.95	0.86	0.04	0.10	0.50	0.00	0.00	0.03	0.06	0.00	0.67	0.54	0.67	0.00
Winona	1998-1999	27069	0.08	0.01	0.07	0.00	0.00	0.07	5.09	1.43	0.05	0.10	0.72	0.00	0.00	0.03	0.08	0.00	1.21	1.04	1.21	0.00
Albert Lea	1999-2000	18356	0.05	0.01	0.04	0.00	0.00	0.04	4.15	1.00	0.04	0.16	0.52	0.00	0.00	0.03	0.11	0.00	0.70	0.56	0.70	0.00
Hutchinson	1999-2000	13080	0.04	0.00	0.04	0.00	0.00	0.04	4.05	1.02	0.03	0.15	0.54	0.00	0.00	0.02	0.08	0.00	0.77	0.63	0.77	0.00
Perham	1999-2000	2559	0.03	0.00	0.03	0.00	0.00	0.03	3.20	0.79	0.02	0.17	0.39	0.00	0.00	0.03	0.09	0.00	0.52	0.42	0.52	0.00
Silver Bay	1999-2000	2068	0.04	0.00	0.03	0.00	0.00	0.03	3.21	0.83	0.02	0.19	0.41	0.00	0.00	0.03	0.07	0.00	0.56	0.48	0.57	0.00
St. Michael	1999-2000	9099	0.05	0.00	0.04	0.00	0.00	0.04	3.60	1.00	0.02	0.18	0.47	0.00	0.00	0.03	0.07	0.00	0.72	0.62	0.72	0.00
Virginia	1999-2000	9157	0.05	0.00	0.05	0.00	0.00	0.05	4.00	1.11	0.03	0.17	0.54	0.00	0.00	0.03	0.18	0.00	0.73	0.63	0.74	0.00
West Lakeland	1999-2000	3547	0.06	0.00	0.06	0.00	0.00	0.06	3.53	0.94	0.02	0.20	0.46	0.00	0.00	0.03	0.06	0.00	0.66	0.56	0.67	0.00
Apple Valley	2000-2001	45527	0.04	0.00	0.04	0.00	0.00	0.04	3.45	0.82	0.03	0.15	0.43	0.00	0.00	0.03	0.06	0.00	0.58	0.48	0.58	0.00
Brandon Township	2000-2001	450	0.04	0.00	0.04	0.00	0.00	0.04	3.07	0.79	0.02	0.17	0.41	0.00	0.00	0.03	0.06	0.00	0.53	0.44	0.54	0.00
Duluth 7551	2000-2001	86918	0.05	0.00	0.05	0.00	0.00	0.05	4.45	1.12	0.04	0.12	0.65	0.00	0.00	0.03	0.06	0.00	0.91	0.77	0.91	0.00
Fort Ripley	2000-2001	74	0.05	0.00	0.04	0.00	0.00	0.05	3.45	1.02	0.02	0.18	0.48	0.00	0.00	0.03	0.07	0.00	0.75	0.66	0.75	0.00
Grand Rapids	2000-2001	7764	0.08	0.00	0.07	0.00	0.00	0.07	5.07	1.22	0.04	0.20	0.75	0.00	0.00	0.03	0.07	0.00	0.92	0.78	0.92	0.00
North Mankato	2000-2001	11798	0.04	0.00	0.04	0.00	0.00	0.04	3.90	0.96	0.02	0.16	0.56	0.00	0.00	0.03	0.09	0.00	0.70	0.59	0.70	0.00
Willmar	2000-2001	18351	0.04	0.00	0.04	0.00	0.00	0.04	4.19	1.06	0.03	0.22	0.60	0.00	0.00	0.03	0.06	0.00	0.75	0.62	0.75	0.00

The statewide data was analyzed to see if there were differences by region, monitoring year or population of the city or township. Overall, regional differences were minimal. The Twin Cities area tended to be higher in concentration for many pollutants since that region is much more populated and contains many more emission sources than the other regions of Minnesota. There were no statistical differences between the other regions. Urban areas generally have higher concentrations of air toxics that are associated with motor vehicles. These compounds include acetaldehyde, benzene, ethyl benzene, formaldehyde, toluene and xylenes and are most likely associated with mobile sources (MPCA 2005c).

Given the relatively low inhalation risks from the proposed project, it is unlikely the project would add significantly to the existing background risk.

5.6 State/Federal Control Requirements

GRE is proposing to modify its existing Title V permit that will include the proposed peaking plant. The permit application will propose emission limitations based on operating hours and applicable Best Available Control Technology (BACT).

Prevention of Significant Deterioration

The proposed project is a major modification at an existing major source under PSD, therefore the project is subject to PSD review.

New Source Performance Standards (NSPS).

As part of the air permitting process, the applicability of NSPS will be evaluated. The applicability of NSPS was considered in the BACT determination (i.e. BACT must be at least as stringent as any applicable NSPS). The air permit application will provide additional details on the applicability of NSPS to the project.

Part 61 NESHAPS

The applicability of Part 61 NESHAPS has been evaluated for this project and applicable standards are reflected in the air pollution control technology for the specific emission units and accounted for in the emission calculations. The air permit application provides additional details on any Part 61 NESHAPS that are applicable to the project.

Part 63 NESHAPS

As part of preparing the air permit application, existing and proposed MACT standards have been evaluated for applicability to this project and the applicable standards are reflected in the air pollution control technology for the specific emission units and accounted for in the emission calculations. The air permit application will provide additional details on the Part 63 NESHAPS that are applicable to the project .

Minnesota Standards of Performance (SOPs) for Stationary Sources

The potential applicability of Minnesota SOPs to this project will be evaluated as part of the air permit application preparation process. The air permit application will provide additional details on the SOPs that are applicable to the project.

5.7 Emergency Generators

The MPCA requests that a project proposer inventory and characterize emergency generators and fire pumps at the facility separately from the inventory of emission sources included in the risk estimate.

The corporate offices have an emergency generator. The Elk River Station also has a small propane fired generating set for charging the back-up batteries. These sources were not modeled for the AERA.

There are no diesel fire pumps at the Elk River Station.

5.8 Accidental Releases

Minnesota's Notification of Deviations, Shutdowns and Breakdowns rule (Minn. R. 7019.1000) requires the owner or operator of an emission facility to notify the MPCA of shutdowns or breakdowns that cause any increase in emissions. The MPCA maintains a log of these notifications. In addition, the permit to be issued for the project may require the facility to maintain records of start-up, shutdown, breakdown or malfunctions of operating units and/or control equipment. The MPCA will generate a report from the Incident Management System that logs shutdown and breakdown reports for the previous five years.

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