Responses to Questions Regarding Kirtland Products Air Emissions
April 30, 2012

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Background Summary

On August 29, 2011, MDEQ-AQD approved Permit to Install No. 47-11A for Kirtland Products located at 1 Altair Drive, Boyne City, MI. Kirtland Products is a new wood pelletizing facility located in an industrial park. The facility began operating in November of 2011, and completed their startup/shakedown process in December. In January 2012, MDEQ-AQD began receiving citizen complaints and concerns from residents primarily living approximately ¼ mile south and ½ mile north of the facility. Their complaints and concerns included odors, noise, fallout, irritancy, and concerns for other unseen potential health effects, which they associated with the air emissions from Kirtland Products. Staff inspections of the facility have not resulted in any violation notices. Opacity readings have been within permitted limits. Stack testing is required within 180 days of the startup/shakedown period, but has not yet been conducted. A committee was formed consisting of Boyne City residents, company representatives and Boyne City officials to pursue resolution of various concerns regarding Kirtland Products' operation. The committee submitted a list of nine questions to MDEQ-AQD on April 13, 2012. The committee's questions requested information on the exposure and potential toxicity of the air emissions from this facility. The following are the questions submitted and the staff responses.

Questions and Responses

1. What are the dangers to human health for the chemicals currently called for being monitored under the Permit to Install?

AQD Response:

The permit requires stack testing for opacity, particulate matter (PM), particulate matter that has an aerodynamic diameter less than or equal to a nominal 10 microns (PM10), particulate matter that has an aerodynamic diameter less than or equal to a nominal 2.5 microns (PM2.5), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC), formaldehyde, and speciated hazardous air pollutants (e.g., acetaldehyde, acrolein, benzene, hydrochloric acid, methanol, phenol, propionaldehyde, toluene, and xylenes). Many of these specific substances can cause irritation of the eyes, nose and throat at sufficiently high concentrations. Much of the facility emissions come from the wood-fired pellet drying system. The wood drying system's emissions are a complex mixture of woodsmoke and gases emitted from the processed wood chips as they are dried. Woodsmoke is a mixture of thousands of chemicals in the form of gases and small particles, and it is known to be irritating at sufficiently high concentrations. Irritancy of the eyes, nose and throat is one of the most important

potential health hazards of this facility's emissions.

Particulate matter emissions can pose a hazard of respiratory and cardiovascular effects, at sufficiently high concentrations and durations of exposure. The aggravation of asthma symptoms is possible with exposure to elevated PM and other substances in woodsmoke. The EPA's National Ambient Air Quality Standards (NAAQS) for particulate matter are specifically designed to protect from these effects.

Some of the substances to be tested are carcinogenic, including benzene, acetaldehyde, and formaldehyde. Again, the danger to human health is dependent on the concentration and the duration of exposure. This is discussed further below.

2. At what concentrations do these chemicals become a concern for both short and long term exposure? What are the threshold levels?

AQD Response:
Some of the substances to be tested do not have a known "threshold", that is, a level below which no adverse effects would occur. This includes fine particulate matter (PM2.5) and the carcinogens. To evaluate the acceptability and safety of facility emissions, AQD utilizes the NAAQS and the Michigan air toxics screening levels. Facility impacts below these levels do not pose a significant concern for public health, and are considered acceptable by AQD. Exposures above those levels may not necessarily result in harm, but the level of concern increases as exposures exceed the acceptable levels. Some of the acceptable limits are protective of short-term exposures and health effects, while some are based on long-term exposures while providing protection from both short-and long-term health effects. This table summarizes the health protective levels:

Substance	Type of protective level	Health Protective level	Time period
Particulate matter less than 10 microns (PM_{10})	NAAQS	150 (ug/m^3)	24 hours
Particulate matter less than 2.5 microns ($PM_{2.5}$)	NAAQS	15 ug/m^3	annual
		35 ug/m^3	24 hours
Nitrogen oxides (NOx)	NAAQS	0.053 parts per million (ppm)	annual
		0.100 ppm	1 hour
Carbon monoxide	NAAQS	9 ppm	8 hours
		35 ppm	1 hour
acetaldehyde	MI cancer risk of 1 in 1 million[1]	0.5 ug/m^3	annual
acrolein	MI non-cancer protective levels	0.02 ug/m^3	annual
		5 ug/m^3	1 hour
benzene	MI cancer risk of 1 in 1 million[1]	0.1 ug/m^3	annual
formaldehyde	MI cancer risk of 1 in 100,000[1]	0.8 ug/m^3	annual
hydrochloric acid	MI non-cancer protective levels	20 ug/m^3	annual
		2100 ug/m^3	1 hour
methanol	MI non-cancer protective level	3250 ug/m^3	1 hour
phenol	MI non-cancer protective level	600 ug/m^3	1 hour
propionaldehyde	MI non-cancer protective level	8 ug/m^3	24 hours
toluene	MI non-cancer protective level	5000 ug/m^3	24 hours
xylenes	MI non-cancer protective level	100 ug/m^3	24 hours

[1] Under the Michigan air toxics rules, these cancer risk protective levels are associated with a lifetime (70 year) exposure-related increase in cancer risk of no more than 1 in one million or one in 100,000, as noted.

3. How do these levels compare to the expected emissions from the plant?

AQD Response:
In order to compare facility emissions with health protective levels, we first had to estimate the emissions, based on the best available information. Next, we used a model to account for the emission rates, facility operations, facility smokestacks, and the meteorology, to estimate the highest impacts that could occur at any location

outside of the facility where people could be exposed (the "ambient air"). For the pollutants with a NAAQS, we accounted for the facility impacts in addition to the pollutant levels that may already be present due to "background" levels and the emissions of other facilities. All of the modeled ambient air impacts of the Kirtland Products permitted emissions were acceptably low; they were below the health protective levels.

4. What are the effects on human health when stack emissions come into direct contact with people on the ground due to temperature inversions and wind conditions?

AQD Response:
As indicated above, our assessment of the proposed permit used assumptions about the levels of anticipated emissions from this type of facility. Based on those assumptions, the levels that people may be exposed to are safe. Our assessment accounted for the meteorology, including temperature inversions, wind variation, etc. We will ensure that the facility operates within the permitted conditions, and respond to citizen complaints when they arise. We will ensure that the required stack testing is done appropriately, and evaluate the results to ensure that the actual facility emissions are safe.

5. How much are stack emissions diluted when they come into contact with people due to the conditions noted in number 4 above?

AQD Response:
There are several factors that go into how much pollutant concentrations are diluted before reaching ground level. These factors include the amount of pollutant coming out of a stack, how tall the stack is, the speed in which the pollutant is leaving the stack, and the temperatures and wind conditions at the time the pollutant is exiting the stack. Also, terrain in the surrounding area is taken into consideration. What is most important is the maximum ground level impact of a pollutant when the plume reaches the ground level. The modeling demonstration is done to calculate this maximum concentration, to ensure that anticipated and permitted emissions will not result in exposures above safe limits.

6. How does the modeling of emissions dispersion address exposure levels to people nearby at the schools, places of employment and residences? How safe is it and how does this compare to known risks?

AQD Response:
As indicated above, the ambient air location with the highest level of impact must meet the health protective levels. The highest point of impact is typically quite close to the source, and dispersion over greater distances ensures that the concentrations in the air decrease. For the Kirtland Products emissions, the modeled maximum point of impact was about 37 feet east of the smokestacks. Since the focus of our assessment was on the point of highest impact, we have not estimated the lower levels of impact at other

specific locations such as schools or neighborhoods. But, we could discuss that with you further to see if we can provide you with further characterization of impacts at a particular location(s) for particular substances of interest.

The question of, "how does this compare to known risks", is difficult to completely address without more detail in the question. With regard to cancer risk, the background rate of cancer in our society is that one in every two (males) or one in every three (females) people will have some form of cancer in their lifetime – that is a known level of risk. In comparison, the modeled maximum ambient air impacts of the facility emissions are below the acceptable risk levels, which are an extra risk over a lifetime of exposure of one in one hundred thousand (formaldehyde) or one in one million (benzene and acetaldehyde). With regard to respiratory and cardiovascular diseases, which are known common diseases in our society, the facility impacts do not exceed the air quality standards and health protective levels that are designed to protect everyone, including sensitive subpopulations. Therefore, the emissions from Kirtland Products are not anticipated to add to the known incidence rates of these diseases.

7. How do these levels compare to the threshold levels discussed in number 2 above?

AQD Response:
As indicated above, we are confident that modeled ambient air levels at schools, residences, and places of employment would be below levels of concern, because the levels in those locations would be lower than the maximum impacted location that we focused on in our assessment. The stack test data will be used to verify that the anticipated and permitted emission rates are not being exceeded.

8. What chemicals could potentially be emitted from the plant that aren't being monitored under the permit to install that would be of concern to public health?

AQD Response:
As stated previously, woodsmoke is a very complex mixture and can consist of thousands of substances. Gases emitted from the wood pellets during drying can also consist of many volatile substances. AQD relies upon the best available information when evaluating proposed air emission projects. In the case of Kirkland Products, the best available information was EPA emission factors. Those factors identified emission rates for 72 substances (particulate matter, nitrogen oxides, carbon monoxide, sulfur dioxide, plus 68 "air toxics") for these types of sources. The modeled ambient air impacts were all below the health protective levels, so none posed a significant concern to public health. The substances to be included in the stack testing were selected because their modeled impacts were relatively higher fractions of the health protective levels.

9. Are all chemicals listed as carcinogens by the DEQ/EPA being monitored/tested for by the stack testing?

AQD Response:
No. AQD regulates many substances as potential human carcinogens. When the best available information indicates that they can be emitted by a source under review, we model the impacts and ensure that a lifetime of exposure at the highest impact point is not associated with an extra cancer risk of one in one hundred thousand or one in one million. The emission factors for the Kirtland Products emissions included 21 carcinogens. Most of the 21 had modeled impacts far below 1% of the health protective level. The three carcinogens that will be stack tested had 3.6% of the one in one million lifetime extra risk level (acetaldehyde), 10% of the one in one hundred thousand lifetime extra risk level (formaldehyde), and 1.4% of the one in one million lifetime extra risk level (benzene). The total lifetime extra risk of these three carcinogens at the point of maximum impact is approximately one in one million. Accounting for all 21 carcinogens would still result in a maximum lifetime extra risk of approximately one in one million.

Detailed Air Pollutant Impact Analysis
for Locations Near Kirtland Products, Boyne City, Michigan

June 11, 2012

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Results

We performed dispersion modeling to determine the predicted ambient air impacts for all of the air toxics substances that had emission rate estimates for Kirtland Products, and fine particulate matter ($PM_{2.5}$), at each of the nine specific addresses.

Figure 1 shows the locations of the nine requested addresses and the locations of the maximum modeled impacts for the air toxics and for $PM_{2.5}$ (annual averaging time). The maximum impact locations vary depending on the averaging time (1-hour, 8-hours, 24-hours, or annual). Also, there are differences in the maximum impact locations between

the air toxics and $PM_{2.5}$ because the air toxics analysis utilized only one year of meteorological data while the $PM_{2.5}$ analysis utilized five years of meteorological data.

Figures 2-6 show contour plots for three selected pollutants that may be of relatively high interest: $PM_{2.5}$ (24-hour and annual average), acrolein (1-hour average), and formaldehyde (annual average). These show the maximum impact location and level, and the diminishing concentrations at locations more distant from the point of modeled maximum impact. Although dispersion generally results in diminishing levels at greater distances from the source, the meteorology and terrain can result in some localized "hotspots," as shown in the contour plots.

Another way of viewing the air toxics information in the attached spreadsheets is shown in **Tables 1 and 2** below, which show the modeled impacts at each location for acrolein (1-hour average) and formaldehyde (annual average), respectively.

Tables 3 and 4 provide the modeled impacts at each requested address for $PM_{2.5}$ with 24-hour and annual averaging times, respectively.

The detailed results for the air toxics are contained in the attached **spreadsheets**, with one spreadsheet for each address. The fourth-to-last column of each spreadsheet provides the predicted ambient impact (PAI) in micrograms per cubic meter for the facility air toxics emissions ("Burner/dryer PAI [ug/m^3]").

As indicated in these tables, figures, and spreadsheets, the anticipated and permitted facility emissions are not estimated to have ambient air impacts above levels of acceptability for public health protection.

Table 1. Modeled ambient air impacts of acrolein (1-hour averaging time).

Location	Concentration (micrograms per cubic meter; ug/m^3)
[health protective level]	5 (non-cancer protective level)
[maximum modeled impact]	0.722
450 Cozy Nook	0.0385
1038 Roosevelt St.	0.0774
930 Brockway St.	0.0933
611 Beardsley St.	0.0885
206 Air Industrial Park	0.114
1315 Boyne Ave.	0.0799
1323 Boyne Ave.	0.113
1116 Nordic Dr.	0.0797
00080 Addis Rd. N	0.0298

Table 2. Modeled ambient air impacts of formaldehyde (annual averaging time).

Location	Concentration (micrograms per cubic meter; ug/m^3)
[health protective level]	0.8 (increased lifetime cancer risk of 1 in 100,000)
[maximum modeled impact]	0.084
450 Cozy Nook	0.00893
1038 Roosevelt St.	0.017
930 Brockway St.	0.0427
611 Beardsley St.	0.0179
206 Air Industrial Park	0.0837
1315 Boyne Ave.	0.0245
1323 Boyne Ave.	0.0531
1116 Nordic Dr.	0.0425
00080 Addis Rd. N	0.0146

Table 3. Modeled ambient air impacts of fine particulate matter ($PM_{2.5}$; 24-hour averaging time) for Kirtland emissions plus other local sources.

Location	Concentration (micrograms per cubic meter; ug/m^3)
[health protective level]	35 (national standard)
[maximum modeled impact]	12.57 (for Kirtland emissions plus other local sources. Note that Kirtland plus other sources plus background = 34.57 ug/m^3)
450 Cozy Nook	2.24
1038 Roosevelt St.	3.3
930 Brockway St.	6.72
611 Beardsley St.	4.58
206 Air Industrial Park	8.55
1315 Boyne Ave.	5.79
1323 Boyne Ave.	7.75
1116 Nordic Dr.	5.38
00080 Addis Rd. N	1.99

Table 4. Modeled ambient air impacts of fine particulate matter ($PM_{2.5}$; annual averaging time) for Kirtland emissions plus other local sources.

Location	Concentration (micrograms per cubic meter; ug/m^3)
[health protective level]	15 (national standard)
[maximum modeled impact]	2.42 (for Kirtland emissions plus other local sources. Note that Kirtland plus other sources plus background = 10.3 ug/m^3)
450 Cozy Nook	0.39
1038 Roosevelt St.	0.62
930 Brockway St.	0.89
611 Beardsley St.	0.9
206 Air Industrial Park	1.65
1315 Boyne Ave.	1.13
1323 Boyne Ave.	1.51
1116 Nordic Dr.	0.98
00080 Addis Rd. N	0.38

Figure 1. Maximum Modeled Impact Locations for $PM_{2.5}$ (annual) and All Air Toxics

KEY:

1. Max annual $PM_{2.5}$ Impact

2. Max Annual Air Toxics Impact

3. Max 24-hr Air Toxics Impact

4. Max 8-hr Air Toxics Impact

5. Max 1-hr Air Toxics Impact

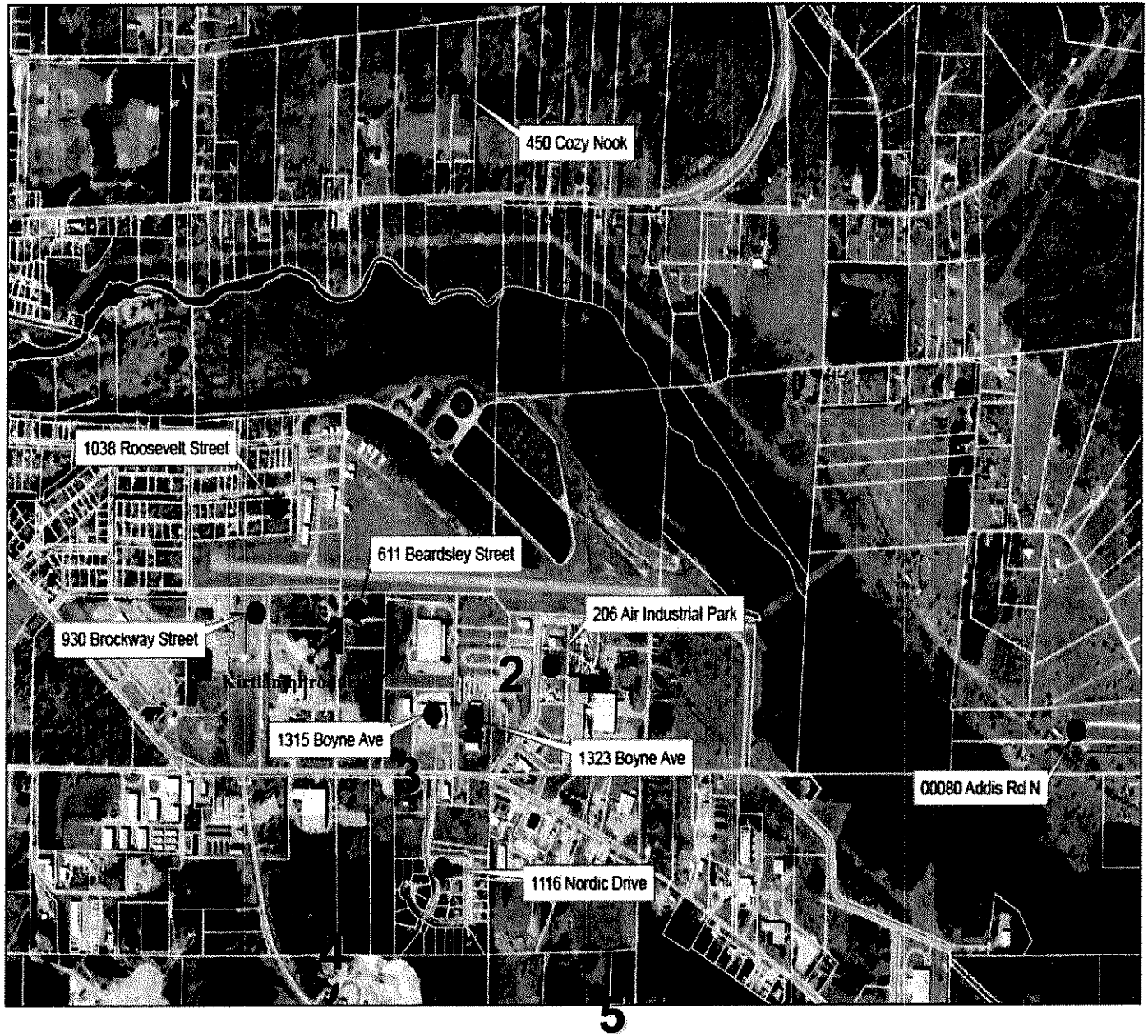


Figure 2. $PM_{2.5}$ 24-hr Modeled Impacts and Location of Maximum, in ug/m^3

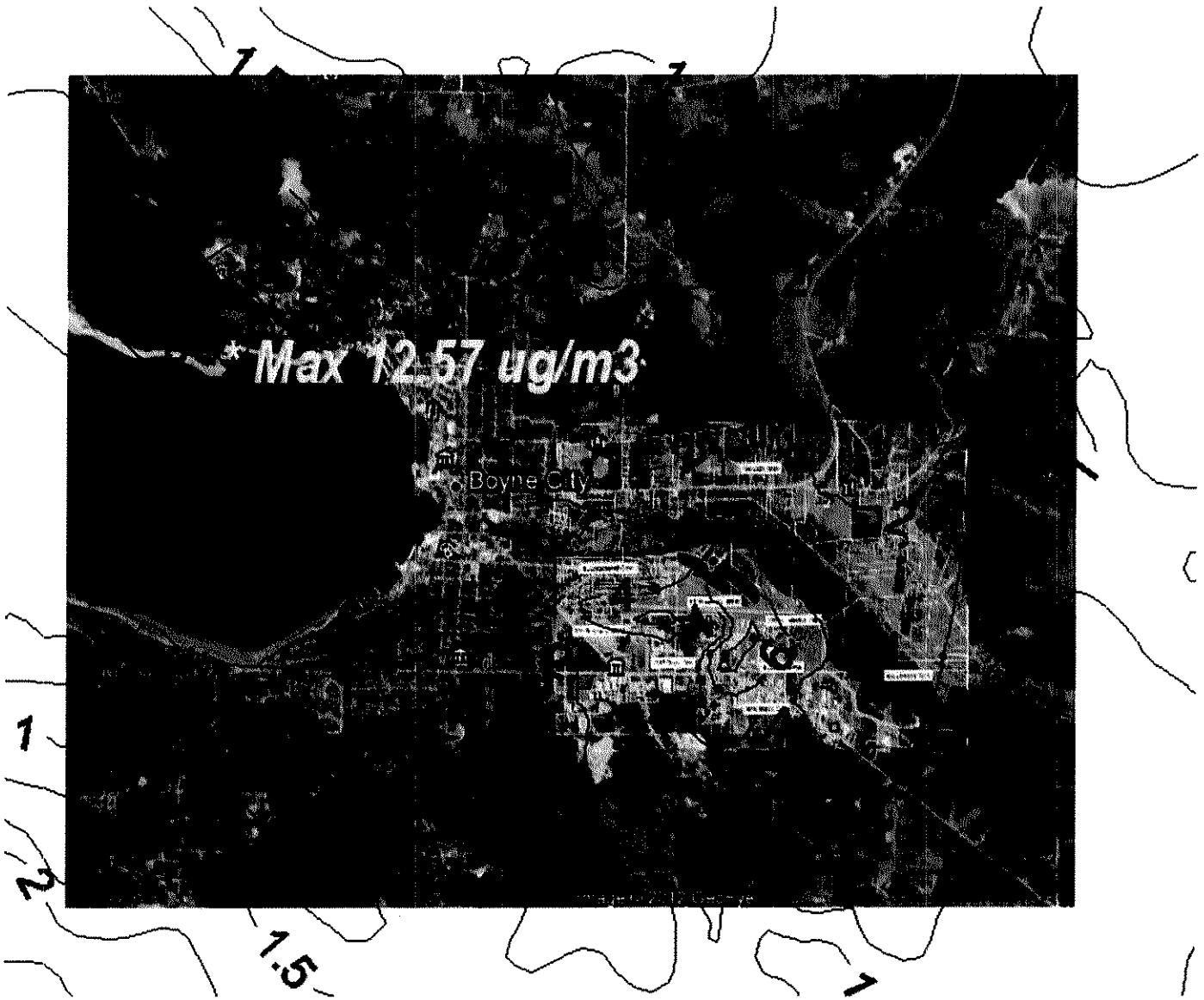
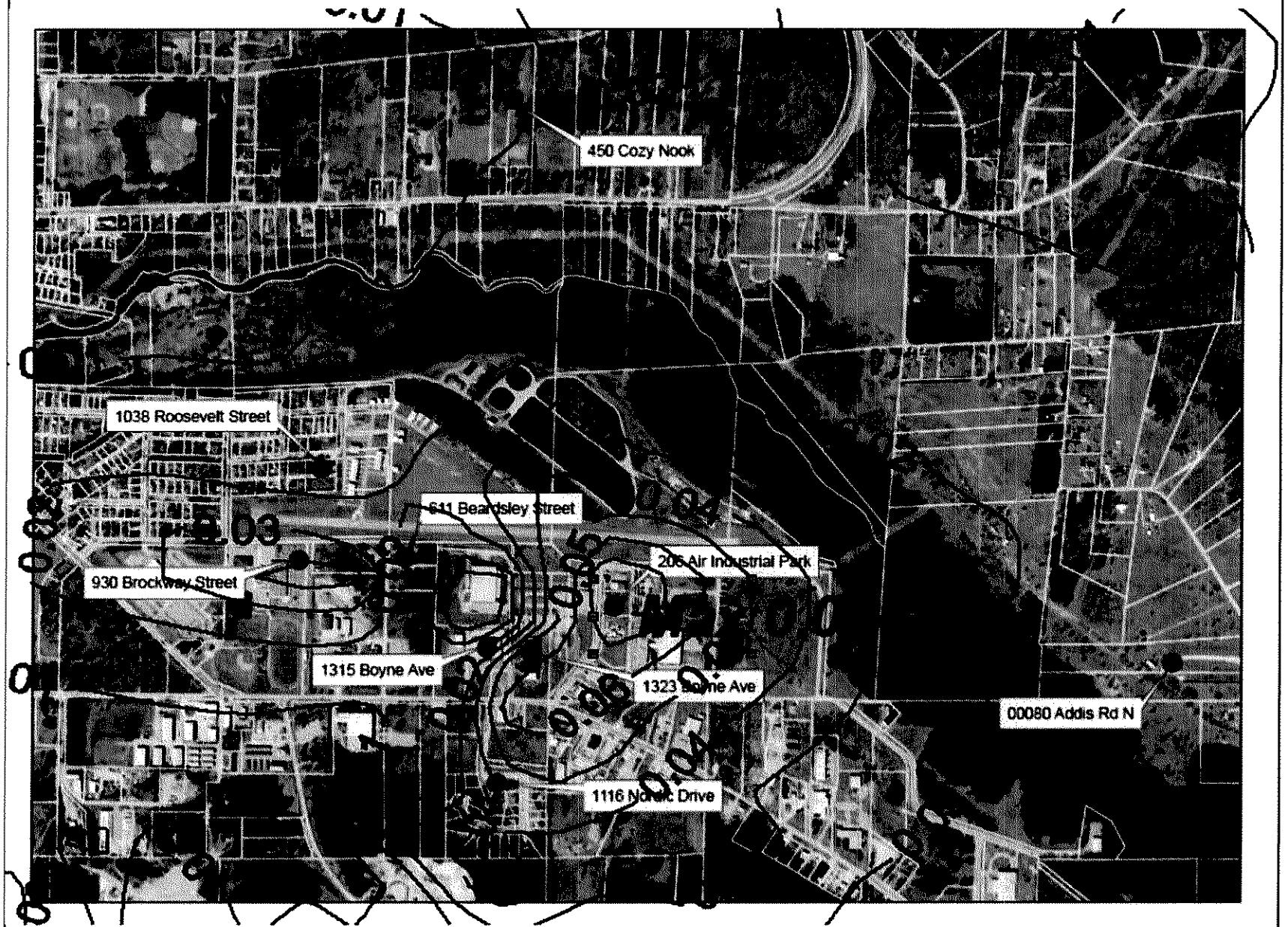


Figure 3. $PM_{2.5}$ 24-hr Modeled Impacts Near Facility, in ug/m^3

Figure 4. $PM_{2.5}$ Annual Modeled Impacts, in ug/m^3

Figure 5. Acrolein 1-hr Modeled Impacts in ug/m^3

Figure 6. Formaldehyde Annual Modeled Impacts, in ug/m^3



Chemical	CAS	Natural Gas EF* (lb/mmbtu)	Wood dryer EF** (lb/ODT)	ITSL (µg/m³)	Avg Time	IRSL / SRSL (µg/m³)	Avg Time	NG burner emissions (lb/hr) - MMBtu/hr	Wood-dryer Emissions (lb/hr) - ODT/hr	SUM of burner/ dryer emissions (lb/hr)	SUM of burner/ dryer emissions (g/s)	AERMOD Impacts (µg/m3 / g/s)	Burner/ dryer PAI (µg/m3)	PASS/FAIL	% of screening	Comments
								1	6.49							
Indeno(1,2,3,c,d)pyrene[5]	193-39-5	1.76E-09				0.0005	annual	1.76E-09		1.76E-09	2.22E-10	0.06	1.33E-11	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
Benzo(b)fluoranthene[5]	205-99-2	1.76E-09				0.0005	annual	1.76E-09		1.76E-09	2.22E-10	0.06	1.33E-11	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
Benzo(a)pyrene[5]	50-32-8	1.18E-09				0.0005	annual	1.18E-09		1.18E-09	1.48E-10	0.06	8.89E-12	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
Benzo(a)anthracene[5]	56-55-3	1.76E-09				0.0005	annual	1.76E-09		1.76E-09	2.22E-10	0.06	1.33E-11	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
Dibenzo(a,h)anthracene[5]	53-70-3	1.18E-09				0.0005	annual	1.18E-09		1.18E-09	1.48E-10	0.06	8.89E-12	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
Dibenzo(a,h)anthracene[5]	53-70-3	1.18E-09				0.0005	annual	1.18E-09		1.18E-09	1.48E-10	0.06	8.89E-12	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
7,12-dimethylbenz(a)anthracene[5]	57-97-6	1.57E-08				0.0005	annual	1.57E-08		1.57E-08	1.98E-09	0.06	1.19E-10	PASS	0.00002%	Carcinogenic PAHs (as benzo(a)pyrene)
Chrysene[5]	218-01-9	1.76E-09				0.0005	annual	1.76E-09		1.76E-09	2.22E-10	0.06	1.33E-11	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
3-Methylchloranthrene[5]	56-49-5	1.76E-09				0.0005	annual	1.76E-09		1.76E-09	2.22E-10	0.06	1.33E-11	PASS	0.00000%	Carcinogenic PAHs (as benzo(a)pyrene)
POH Combined Impact						0.0005	annual						2.12E-10	PASS	0.00004%	Carcinogenic PAHs (as benzo(a)pyrene)
Benzaldehyde	100-52-7		5.40E-03			0.4	annual		3.50E-02	3.50E-02	4.42E-03	0.06	2.65E-04	PASS	0.066%	
Benzo(g,h)perylene	191-24-2	1.18E-09		12	24 h			1.18E-09		1.18E-09	1.48E-10	1.06	1.57E-10	PASS	0.000000001%	
3-Carene[18]	13466-78-9		2.64E-02	1120	8 hr				1.71E-01	1.71E-01	2.16E-02	2.14	4.62E-02	PASS	0.004%	
p-Cymene	99-87-6		1.10E-03	10	annual				7.14E-03	7.14E-03	9.00E-04	0.06	5.40E-05	PASS	0.001%	
2,5-Dimethyl benzaldehyde	5779-94-2		9.90E-04	0.1	annual				6.43E-03	6.43E-03	8.10E-04	0.06	4.86E-05	PASS	0.049%	
Toluene(H)	108-88-3	3.33E-06	3.90E-03	5000	24 hr			3.33E-06	2.53E-02	2.53E-02	3.19E-03	1.06	3.38E-03	PASS	0.0001%	
Acetaldehyde(H)	75-07-0	4.00E-05	3.90E-02	9	24 hr			4.00E-05	2.53E-01	2.53E-01	3.19E-02	1.06	3.38E-02	PASS	0.376%	
Acetaldehyde(H)	75-07-0	4.00E-05	3.90E-02			0.5	annual	4.00E-05	2.53E-01	2.53E-01	3.19E-02	0.06	1.91E-03	PASS	0.383%	
Acetone	67-64-1		3.10E-02	5900	8 hr				2.01E-01	2.01E-01	2.53E-02	2.14	5.42E-02	PASS	0.001%	
Acrolein(H)	107-02-8	6.40E-06	9.90E-03	0.02	annual			6.40E-06	6.43E-02	6.43E-02	8.10E-03	0.06	4.86E-04	PASS	2.429%	
Acrolein(H)	107-02-8	6.40E-06	9.90E-03	5	1 hr			6.40E-06	6.43E-02	6.43E-02	8.10E-03	4.76	3.85E-02	PASS	0.771%	
Anthracene	120-12-7	2.35E-09		1000	24 hr			2.35E-09		2.35E-09	2.96E-10	1.06	3.14E-10	PASS	0.00000000003%	
Pyrene	129-00-0	4.90E-09		100	24 hr			4.90E-09		4.90E-09	6.18E-10	1.06	6.55E-10	PASS	0.00000000065%	
Fluoranthene	206-44-0	2.94E-09		140	24 hr			2.94E-09		2.94E-09	3.71E-10	1.06	3.93E-10	PASS	0.00000000028%	
Acenaphthylene	208-96-8	1.76E-09		35	24 hr			1.76E-09		1.76E-09	2.22E-10	1.06	2.36E-10	PASS	0.00000000067%	
Butylaldehyde	123-72-8		1.30E-03	7	24 hr				8.44E-03	8.44E-03	1.06E-03	1.06	1.13E-03	PASS	0.016%	
Crotonaldehyde	4170-30-3		5.40E-04	9	1 hr				3.50E-03	3.50E-03	4.42E-04	4.76	2.10E-03	PASS	0.023%	
Formaldehyde(H)	50-00-0	7.35E-05	1.82E-01			0.8	annual	7.35E-05	1.18E+00	1.18E+00	1.49E-01	0.06	8.93E-03	PASS	1.116%	
Hexaldehyde	66-25-1		4.10E-03	2	annual				2.66E-02	2.66E-02	3.35E-03	0.06	2.01E-04	PASS	0.010%	
Isovaleraldehyde	590-86-3		7.30E-04	800	annual				4.74E-03	4.74E-03	5.97E-04	0.06	3.58E-05	PASS	0.00000%	
Propionaldehyde	123-38-6		2.80E-03	8	24 hr				1.82E-02	1.82E-02	2.29E-03	1.06	2.43E-03	PASS	0.030%	
o-Tolualdehyde[20]	529-20-4		4.40E-04	440	24 hr				2.86E-03	2.86E-03	3.60E-04	1.06	3.81E-04	PASS	0.0001%	
p-Tolualdehyde[20]	104-87-0		3.00E-03	440	24 hr				1.95E-02	1.95E-02	2.45E-03	1.06	2.60E-03	PASS	0.001%	
Valeraldehyde	110-62-3		2.60E-03	1760	8 hr				1.69E-02	1.69E-02	2.13E-03	2.14	4.55E-03	PASS	0.0003%	
Benzene(H)	71-43-2	2.25E-06	3.10E-03	30	24 hr			2.25E-06	2.01E-02	2.01E-02	2.54E-03	1.06	2.69E-03	PASS	0.009%	
Benzene(H)	71-43-2	2.25E-06	3.10E-03			0.1	annual	2.25E-06	2.01E-02	2.01E-02	2.54E-03	0.06	1.52E-04	PASS	0.152%	
Arsenic(H)	7440-38-2	1.96E-07				0.0002	annual	1.96E-07		1.96E-07	2.47E-08	0.06	1.48E-09	PASS	0.001%	
Barium	7440-39-3	4.31E-06		5	8 hr			4.31E-06		4.31E-06	5.44E-07	2.14	1.16E-06	PASS	0.00002%	
Beryllium(H)	7440-41-7	1.18E-08		0.02	24 hr			1.18E-08		1.18E-08	1.48E-09	0.06	8.89E-11	PASS	0.000000%	
Beryllium(H)	7440-41-7	1.18E-08				0.0004	annual	1.18E-08		1.18E-08	1.48E-09	0.06	8.89E-11	PASS	0.0000%	
Cadmium(H)	7440-43-9	1.08E-06				0.0006	annual	1.08E-06		1.08E-06	1.36E-07	0.06	8.15E-09	PASS	0.001%	
Chromium, total(H)	7440-47-3	1.37E-06		5	8 hr			1.37E-06		1.37E-06	1.73E-07	2.14	3.70E-07	PASS	0.00001%	
Chromium IV	7440-47-3	1.37E-06		0.008	24 hr			1.25E-07		1.25E-07	1.57E-08	1.06	1.67E-08	PASS	0.00021%	
Chromium IV	7440-47-3	1.37E-06				0.000083	annual	1.25E-07		1.25E-07	1.57E-08	0.06	9.43E-10	PASS	0.001%	
Cobalt(H)	7440-48-4	8.24E-08		0.2	8 hr			8.24E-08		8.24E-08	1.04E-08	2.14	2.22E-08	PASS	0.00001%	
Copper	7440-50-8	8.33E-07		2	8 hr			8.33E-07		8.33E-07	1.05E-07	2.14	2.25E-07	PASS	0.00001%	
Lead(H)	7439-92-1	4.90E-07		0.15	3 mo			4.90E-07		4.90E-07	6.18E-08	1.06	6.55E-08	PASS	0.00004%	
Manganese(H)	7439-96-5	3.73E-07		0.05	annual			3.73E-07		3.73E-07	4.69E-08	0.06	2.82E-09	PASS	0.00001%	
Mercury(H)	7439-97-6	2.55E-07		0.3	24 hr			2.55E-07		2.55E-07	3.21E-08	1.06	3.40E-08	PASS	0.00001%	
Molybdenum	7439-98-7	1.08E-06		30	8 hr			1.08E-06		1.08E-06	1.36E-07	2.14	2.91E-07	PASS	0.000001%	
Nickel(H)	7440-02-0	2.06E-06				0.0042	annual	2.06E-06		2.06E-06	2.59E-07	0.06	1.56E-08	PASS	0.000%	
Selenium(H)	7782-49-2	2.35E-08		2	8 hr			2.35E-08		2.35E-08	2.96E-09	2.14	6.34E-09	PASS	0.0000003%	
Vanadium	7440-62-2	2.25E-06		0.5	1 hr			2.25E-06		2.25E-06	2.84E-07	4.76	1.35E-06	PASS	0.0003%	

Chemical	CAS	Natural Gas EF* (lb/mmbtu)	Wood dryer EF** (lb/ODT)	ITSL (µg/m³)	Avg Time	IRSL / SRSL (µg/m³)	Avg Time	NG burner emissions (lb/hr) - MMBtu/hr	Wood-dryer Emissions (lb/hr) - ODT/hr	SUM of burner/ dryer emissions (lb/hr)	SUM of burner/ dryer emissions (g/s)	AERMOD Impacts (µg/m3 / g/s)	Burner/ dryer PAI (µg/m3)	PASS/FAIL	% of screening	Comments
Zinc (as zinc oxide)	7440-66-6	2.84E-05		50	8 hr			2.84E-05		2.84E-05	3.58E-06	2.14	7.67E-06	PASS	0.0000153%	Used screening level for zinc oxide.
Acenaphthene(H)	83-32-9	1.76E-09		210	24 hr			1.76E-09		1.76E-09	2.22E-10	1.06	2.36E-10	PASS	0.00000000001%	
Phenanthrene	85-01-8	1.67E-08		0.1	annual			1.67E-08		1.67E-08	2.10E-09	0.06	1.26E-10	PASS	0.0000001%	
Fluorene	86-73-7	2.75E-09		140	24 hr			2.75E-09		2.75E-09	3.46E-10	1.06	3.67E-10	PASS	0.0000000003%	
Naphthalene	91-20-3	1.30E-06		3	24 hr			1.30E-06		1.30E-06	1.64E-07	1.06	1.74E-07	PASS	0.0000058%	
Naphthalene	91-20-3	1.30E-06				0.08	annual	1.30E-06		1.30E-06	1.64E-07	0.06	9.83E-09	PASS	0.0000%	
Butane	106-97-8	2.06E-03		23800	8 hr			2.06E-03		2.06E-03	2.59E-04	2.14	5.55E-04	PASS	0.0000023%	
Cis 1,2-dichloroethylene	156-59-2		7.90E-04	7	24 hr				5.13E-03	5.13E-03	6.46E-04	1.06	6.85E-04	PASS	0.010%	
Methanol(H)	67-56-1		5.90E-02	3250	1 hr				3.83E-01	3.83E-01	4.82E-02	4.76	2.30E-01	PASS	0.007%	
2-Methylnaphthalene(H)	91-57-6	2.40E-08		10	annual			2.40E-08		2.40E-08	3.02E-09	0.06	1.81E-10	PASS	0.00000000%	
Methy ethyl ketone	78-93-3		2.20E-03	5000	24 hr				1.43E-02	1.43E-02	1.80E-03	1.06	1.91E-03	PASS	0.00004%	
Methylene Chloride(H)	75-09-2		9.20E-03			2	annual		5.97E-02	5.97E-02	7.52E-03	0.06	4.51E-04	PASS	0.023%	
Phenol (H)	108-95-2		5.20E-03	600	1 hr				3.37E-02	3.37E-02	4.25E-03	4.76	2.02E-02	PASS	0.003%	
a-pinene[18]	80-56-8		3.37E-01	1120	8 hr				2.19E+00	2.19E+00	2.76E-01	2.14	5.90E-01	PASS	0.053%	
b-pinene[18]	127-91-3		7.30E-02	1120	8 hr				4.74E-01	4.74E-01	5.97E-02	2.14	1.28E-01	PASS	0.011%	
Styrene(H)	100-42-5		3.80E-04	1000	24 hr				2.47E-03	2.47E-03	3.11E-04	1.06	3.29E-04	PASS	0.00003%	
Styrene(H)	100-42-5		3.80E-04			1.7	annual		2.47E-03	2.47E-03	3.11E-04	0.06	1.86E-05	PASS	0.001%	
a-terpene[18]	8006-64-2		3.50E-02	1120	8 hr				2.27E-01	2.27E-01	2.86E-02	2.14	6.12E-02	PASS	0.005%	
Hexane	110-54-3	1.76E-03		700	24 hr			1.76E-03		1.76E-03	2.22E-04	1.06	2.36E-04	PASS	0.00003%	
Pentane	109-66-0	2.55E-03		17700	8 hr			2.55E-03		2.55E-03	3.21E-04	2.14	6.87E-04	PASS	0.000004%	
(m,p)-xylenes(H)[2]	1330-20-7	6.40E-05	3.80E-03	100	24 hr			6.40E-05	2.47E-02	2.47E-02	3.12E-03	1.06	3.30E-03	PASS	0.003%	
(o)-xylenes(H)[2]	95-47-6		3.80E-04	100	24 hr				2.47E-03	2.47E-03	3.11E-04	1.06	3.29E-04	PASS	0.0003%	
a-pinene, b-pinene, and d-carene[18]				1120	8 hr					2.89E+00	3.64E-01	2.14	7.79E-01	PASS	0.070%	

(H) - hazardous air pollutants.
* Based on AP-42 Emission Factors from Sections 1.4.
** Based on AP-42 Emission Factors from Section 10.6.2 (Table 10.6.2-6). Annual emission impacts adjusted for 5930 hr/yr operation for formaldehyde.
[2] The ***combined*** ambient impact of all forms of xylene with Note #2 cannot exceed the initial threshold screening level (ITSL) of 100 ug/m3 (24-hour average).
[5] The seven carcinogenic polycyclic aromatic hydrocarbons (PAHs) should be evaluated additively utilizing the comparative potency estimates approved by the AQD Scientific Advisory Panel (July 20, 1995), compared to the screening level for benzo(a)pyrene (CAS # 50-32-8).
[18] The ***combined*** ambient impact of turpentine and monoterpenes (a-pinene, b-pinene, and d-carene) listed with Note #18 cannot exceed the ITSL of 1120 mg/m3 (8 hr. averaging time).
[20] The ***combined*** ambient impact of meta- and para-tolualdehyde cannot exceed the ITSL of 440 ug/m3 (24-hour average).

Generic Impacts modeled at 1 g/sec

Avg. Time	Maximum Impact	450 Cozy Nook	1038 Roosevelt Street	930 Brockway Street	611 Beardsley Street	206 Air Industrial Park	1315 Boyne Avenue	1323 Boyne Avenue	1116 Nordic Drive	00080 Addis Road N
	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
annual	0.56	0.06	0.114	0.287	0.12	0.563	0.165	0.357	0.286	0.098
1-hr	89.2	4.76	9.56	11.52	10.93	14.12	9.87	13.92	9.85	3.68
8-hr	16.78	2.14	5.48	7.4	4.24	9.65	4.55	10.3	5.47	1.79
24-hr	7.94	1.06	2.61	5.96	1.83	5.01	1.86	4.9	3.23	1.04