3.0 SUMMARY OF EMISSION CALCULATIONS

This section presents the emission estimates for the proposed ASCPC boiler, material handling, and other ancillary equipment to be installed at the facility as part of this project. Section 3.1 presents the emission rates for the ASCPC boiler. The auxiliary boiler emission rates are presented in Section 3.2 while the remaining ancillary equipment emission rates are presented in Section 3.3. Material handling emissions for the ASCPC project are found in Section 3.4 while the particulate emission rates from the existing facility (required for demonstrating compliance with NAAQS) are presented in Appendix E. Emission rates for the cooling tower are found in Section 3.5 and finally a summary of the emissions for the ASCPC project are presented in Section 3.6

3.1 ADVANCED SUPER CRITICAL, PULVERIZED COAL FIRED BOILER

The proposed ASCPC boiler will be nominally rated at 8,190 MMBtu/hr heat input with a gross output of approximately 930 MW/hr. The emission rates are reflective of maximum operation with coal as the fuel source and consistent with the maximum pollutant emissions across a range of coal fuels proposed for this project. (The fuel specifications have been presented in section 2.2). The emission calculations also reflect the selection of BACT as discussed in Section 5.0.

The primary regulated pollutants that will be emitted from the boiler will consist of particulate matter ($PM/PM_{10}/PM_{2.5}$), SO_2, NO_x, and CO with lesser amounts of volatile organic compounds (VOCs), acid gases, and hazardous air pollutants (HAPs).

A combination of combustion control technologies (LNBs, with OFA) and an SCR system will be used for NO_x control. Combustion controls and operating practices will be used to minimize emissions of CO, VOC, and volatile organic HAPs.

A fabric filter (baghouse) will be utilized to control particulate matter and metals emissions. Injection of hydrated lime into the flue gas stream, upstream of the fabric filter, will be used to control SO_3/H_2SO_4 formation, while injected activated sorbent will be used for mercury control. A wet limestone forced oxidation FGD will be utilized to control emissions of SO_2 and acid gases (hydrogen fluoride (HF) and hydrogen chloride (HCl)). The emissions have been calculated on both a short-term (lb/hr) and long-term (tpy) basis. Annual calculations are based on continuous operation (i.e. 8,760 hours per year) at baseload (100% load) conditions. The potential emissions of regulated pollutants and TACs, including HAPs from the new equipment are summarized below and detailed in the attached Appendix B.

The potential mass emission rates and the proposed limits of regulated pollutants from the ASCPC boiler are presented in Table 3-1.

Table 3-1 Pollutant Emission Rates and Proposed Limits from the ASCPC Boiler

Pollutant	Mass Emission Rates		Proposed Limits		
	lb/hr [1]	tpy	Rates	Units	Averaging Times
PM_{10} (filterable)	98.3	430.5	0.012	lb/MMBtu	2-hour
PM_{10} Total [2]	204.8	896.8	0.025	lb/MMBtu	2-hour
SO_2	491.4	2,152.3	0.06	lb/MMBtu	30-day
NO_x	409.5	1,793.6	0.05	lb/MMBtu	30-day
CO	1,023.8	4,484.0	0.125	lb/MMBtu	30-day
VOC	29.6	129.7	0.0036	lb/MMBtu	2-hour
Lead	Note [3]	0.29	573	lb/yr	Annual
H_2SO_4 Mist	32.8	143.5	0.004	lb/MMBtu	2-hour
Fluorides (as HF)	2.5	8.76	0.0003	lb/MMBtu	2-hour
Mercury	Note [3]	0.03	64.4	lb/yr	Annual
Aggregate HAPs	25.7	112.4	None	None	None

[1] The lb/hr emission rates for the boiler reflect the maximum short-term emission rates during normal operation
[2] The total particulate emissions are represented as the sum of the filterable and condensable particulate emissions.
[3] The emission limits for mercury and lead are based on an annual basis, therefore, short-term emission rates are not applicable.

3.1.1 Particulate Matter

Particulate matter may be emitted as a solid, or it can be emitted as a condensable material. The filterable particulate, "front half", emissions are easily captured in the particulate control device and consist of carbonaceous materials, silica, and various trace quantities of metals found in the coal feedstock and ash. Condensable particulate matter consists primarily of inorganic compounds, typically nitrogen compounds and sulfur compounds, existing in vapor form at the high temperatures of a utility boiler flue gas stream that condense, or nucleate, into particles when cooled below 20°C.

The PSD major source/modification "significant net increase" threshold for $PM_{10}/PM_{2.5}$ emissions is 15 tpy, as total PM_{10} emissions (the sum of the filterable and condensable portions). Recent USEPA guidance for $PM_{2.5}$ requires that in the interim period between the dates of the $PM_{2.5}$ NAAQS designations and when USEPA promulgates regulations to implement NSR for the $PM_{2.5}$ NAAQS, states should use PM_{10} as the surrogate for determining whether a facility or modification is considered major for $PM_{2.5}$ under PSD. Therefore states and facilities should use projected PM_{10} emissions and net emissions increases (and decreases) as a surrogate for $PM_{2.5}$.

The particulate emissions will primarily consist of ash; the inorganic matter that does not participate in combustion. The particulate matter emissions have been conservatively estimated as $PM_{10}/PM_{2.5}$ for permitting and modeling.

3.1.1.1 Emission Calculation

The short-term and long-term maximum potential emission rates for PM_{10} have been calculated using the following equations:

$$\textbf{Filterable } PM_{10} \textbf{ Emissions} = \frac{0.012\ lb}{MMBtu} \times \frac{8{,}190\ MMBtu}{hr} = \frac{98.28\ lb}{hr}$$

$$\textbf{Filterable } PM_{10} \textbf{ Emissions} = \frac{98.28\ lb}{hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{430.5\ ton}{yr}$$

$$\textbf{Total } PM_{10} \textbf{ Emissions} = \frac{0.025\ lb}{MMBtu} \times \frac{8{,}190\ MMBtu}{hr} = \frac{204.75\ lb}{hr}$$

$$\textbf{Total } PM_{10} \textbf{ Emissions} = \frac{204.75\ lb}{hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{896.8\ ton}{yr}$$

3.1.1.2 Proposed Limit

The fabric filter will be designed to meet a filterable particulate emission rate of 0.012 lb/MMBtu heat input and a total (filterable + condensable) particulate emission rate of 0.025 lb/MMBtu heat input, based on a two-hour average.

3.1.1.3 Compliance Method

Compliance with the particulate emission limits will be determined by conducting the initial performance tests required under the Standards of Performance for New Stationary Sources (NSPS), Subparts A and Da. In addition, total particulate will be measured using Method 5B with a Method 202 train (or equivalent) to collect both filterable and condensable particulate. The facility will install, operate, certify and maintain a continuous opacity monitoring system (COMS), a bag leak detector system or a continuous emission monitoring system (CEMS), to demonstrate continuous compliance with the particulate limits.

3.1.2 Sulfur Dioxide

Sulfur dioxide emissions are generated during the combustion process as a result of thermal oxidation of the sulfur found in coal. Thus, the potential SO_2 emissions are proportional to the sulfur content of the coal. Both Eastern bituminous and PRB sub-bituminous have a range of heating values, sulfur contents, and trace metals. The blends that will be selected will not exceed a 1.4 lb/MMBtu SO_2 inlet concentration. When using 100% PRB coal this FGD system inlet concentration will always be met. When coals are blended with the potential to exceed this design value, Consumers will record fuel analysis and blended fuel amounts, or operate a CEMS for measuring the inlet SO_2 concentrations. A CEMS for measuring the SO_2 inlet concentration would only be installed to meet operational and process requirements, if a wide range of sulfur content fuels were being used and it would reduce the recordkeeping requirements. The wet FGD system will be designed to meet an SO_2 outlet emission rate of 0.06 lb/MMBtu, even during the maximum design loading of SO_2 (i.e., an inlet concentration of 1.4 lb/MMBtu SO_2).

3.1.2.1 Emission Calculation

The SO_2 emission rate of 0.06 lb/MMBtu is equivalent to 491.4 lb/hr and 2,152 tpy as shown below:

$$\textit{\textbf{SO}}_{\textbf{2}}\ \textit{\textbf{Emissions}} = \frac{\textit{0.06 lb}}{\textit{MMBtu}} \times \frac{\textit{8,190 MMBtu}}{\textit{hr}} = \frac{\textit{491.4 lb}}{\textit{hr}}$$

$$\textit{\textbf{SO}}_{\textbf{2}}\ \textbf{Emissions} = \frac{\textit{491.4 lb}}{\textit{hr}} \times \frac{\textit{8,760 hr}}{\textit{yr}} \times \frac{\textit{1 ton}}{\textit{2,000 lb}} = \frac{\textit{2152.3 ton}}{\textit{yr}}$$

This limit is equivalent to 0.53 pound per megawatt hour (lb/MWh) gross, and therefore will be compliant with the NSPS Subpart Da emission limit of 1.4 lb/MWh on a 30 day rolling average.

$$\textit{\textbf{SO}}_{\textbf{2}}\ \textit{\textbf{Emissions}} = \frac{\textit{0.06 lb}}{\textit{MMBtu}} \times \frac{\textit{8,190 MMBtu}}{\textit{hr}} \times \frac{\textit{hr}}{\textit{930 MWh gross}} = \frac{\textit{0.53 lb}}{\textit{MWh gross}}$$

3.1.2.2 Proposed Limit

The proposed SO_2 emission limit is 0.06 lb/MMBtu heat input based on a 30-day rolling average.

3.1.2.3 Compliance Method

The facility will install, calibrate, maintain, and operate a CEMS for measuring SO_2 concentrations, with either oxygen (O_2) or carbon dioxide (CO_2) concentrations, and will record the output of the system. The facility will also monitor the hourly flow rate and the average hourly gross electrical output as required in the Code of Federal Regulations Title 40, Part 60 (40 CFR 60), Subpart Da (specifically 60.48a(m)). Continuous compliance with the SO_2 emission limit will be determined using the CEMS.

3.1.3 Nitrogen Oxides

Nitrogen oxides are present in the flue gas in two forms: thermal NO_x and fuel NO_x. Thermal NO_x forms when nitrogen and oxygen molecules in the combustion air are disassociated at peak flame temperatures and recombined into oxides of nitrogen (primarily nitrous oxide). Fuel NO_x is formed when the nitrogen in the fuel (fuel-bound nitrogen) is combined with oxygen in the combustion air.

Because NO_x emissions are a function of combustion operating conditions; maximizing combustion efficiency, which would reduce CO emissions, must be balanced with the potential increase of NO_x emissions that could occur. Through proper design and combustion controls, including LNBs and OFA, the formation of NO_x can be limited by controlling the peak flame temperature, gas residence time at peak flame temperature, and the air-to-fuel ratio, while minimizing CO emissions.

Consumers will also utilize a SCR system as a post-combustion control device. Through the use of a reagent, ammonia, and a catalyst, the SCR process selectively reduces the NO_x into molecular nitrogen and water vapor.

3.1.3.1 Emission Calculation

Emissions of NO_x have been determined based on continuous operation at baseload conditions. The short-term and long-term maximum potential emission rates for NO_x have been calculated based on the 30 day rolling average BACT limit of 0.05 lb/MMBtu using the following equations:

$$\mathbf{NO_x\ Emissions} = \frac{0.05\ lb}{MMBtu} \times \frac{8{,}190\ MMBtu}{hr} = \frac{409.5\ lb}{hr}$$

$$\mathbf{NO_x\ Emissions} = \frac{409.5\ lb}{hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{1793.6\ ton}{yr}$$

This limit is equivalent to 0.44 lb/MWh gross, and therefore will be compliant with the NSPS Subpart Da emission limit of 1.0 lb/MWh on a 30 day rolling average.

$$\mathbf{NO_x\ Emissions} = \frac{0.05\ lb}{MMBtu} \times \frac{8{,}190\ MMBtu}{hr} \times \frac{hr}{930\ MWh\ gross} = \frac{0.44\ lb}{MWh\ gross}$$

3.1.3.2 Proposed Limit

The proposed emission limit is 0.05 lb/MMBtu heat input, based on a 30-day rolling average. This limit is consistent with recent BACT determinations pursuant to 40 CFR 52.21(j) and is more stringent than the applicable NSPS limit of 1.0 lb/MWh.

3.1.3.3 Compliance Method

The facility will install, calibrate, maintain, and operate a CEMS for measuring NO_x concentrations, with either O_2 or CO_2 concentrations, and will record the output of the systems.

The facility will also monitor the hourly flow rate and the average hourly gross electrical output as required in 40 CFR 60.48a(i). Continuous compliance with the NO_x emission limit will be determined using the CEMS.

3.1.4 Carbon Monoxide

Carbon monoxide is an intermediate combustion product that is formed when the reaction of CO to CO_2 cannot proceed to completion. These emissions typically occur when there is a lack of available oxygen, if the combustion gas temperature is too low, if the residence time is too short, if there is insufficient turbulence (or mixing) of the combustion gases or if a combination of these conditions exists in the combustion chamber.

Because CO emissions are a function of combustion operating conditions, the most direct approach for reducing these emissions is to maximize combustion efficiency. However, maximizing combustion efficiency must be balanced with the potential increase of NO_x emissions that could occur when combustion efficiency is associated with high combustion chamber temperatures. An ASCPC boiler is designed to optimize the combustion process, thereby reducing the formation of CO. The ASCPC boiler will be designed to include continuous mixing of air and fuel in proper proportions, extended residence times, and consistent high temperatures in the combustion chamber. The excess air and high combustion temperatures will be properly balanced to provide as much reduction of CO as possible without significantly increasing the formation of NO_x. Finally, proper operation and maintenance will insure that the boiler will continue to operate as designed.

3.1.4.1 Emission Calculation

The short-term and long-term maximum potential emission rates for CO have been calculated based on the BACT limit of 0.125 lb/MMBtu using the following equations:

$$\textbf{CO Emissions} = \frac{0.125\ lb}{MMBtu} \times \frac{8{,}190\ MMBtu}{hr} = \frac{1023.8\ lb}{hr}$$

$$\textbf{CO Emissions} = \frac{1023.8\ lb}{hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{4484\ ton}{yr}$$

3.1.4.2 Proposed Limit

The proposed limit is 0.125 lb/MMBtu, on a 30 day rolling average.

3.1.4.3 Compliance Method

The facility will install, calibrate, maintain, and operate a CEMS for measuring CO concentrations, with either O_2 or CO_2 concentrations, and will record the output of the systems. Continuous compliance with the CO emission limit will be determined using the CEMS.

3.1.5 Volatile Organic Compounds

Hydrocarbons, or VOCs, are emitted due to incomplete combustion of volatile matter occurring in the boiler. The inherent design and operation of the ASCPC boiler provides the factors facilitating complete volatile combustion including extended residence time, consistent high temperatures in the combustion chamber, and continuous mixture of fuel and air. Therefore, through proper design and good combustion practices, the formation of VOCs can be minimized.

3.1.5.1 Emission Calculation

The short-term and long-term maximum potential emission rates for VOC have been estimated using the AP-42 emission factor of 0.06 pound of VOC per ton of coal (lb/ton). Due to the difference in heating values, the emissions were conservatively estimated assuming the boiler operates at maximum capacity while firing 100% Western sub-bituminous coal (i.e., the heating value of Western sub-bituminous coal is lower than Eastern bituminous coal, thus a greater mass (tons) of Western sub-bituminous coal is needed to provide the same heat input) using the following equations:

$$\begin{array}{c}\textbf{Western sub-bituminous}\\ \textbf{Coal Usage}\end{array} = \frac{8{,}190\ MMBtu}{hr} \times \frac{lb}{8{,}300\ Btu} \times \frac{1{,}000{,}000\ Btu}{MMBtu} = \frac{986{,}747\ lb}{hr}$$

$$\begin{array}{c}\textbf{Western sub-bituminous}\\ \textbf{Coal Usage}\end{array} = \frac{986{,}747\ lb}{hr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{493.4\ ton}{hr}$$

$$\textbf{VOC Emissions} = \frac{0.06\ lb}{ton} \times \frac{493.4\ ton}{hr} = \frac{29.6\ lb}{hr}$$

$$\textbf{VOC Emissions} = \frac{29.6\ lb}{hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{129.7\ ton}{yr}$$

The equivalent lb/MMBtu emission factor can be found using the following equation:

$$\textbf{VOC Emissions} = \frac{0.06\ lb}{ton} \times \frac{1\ ton}{2{,}000\ lb} \times \frac{lb}{8{,}300\ Btu} \times \frac{1{,}000{,}000\ Btu}{MMBtu} = \frac{0.0036\ lb}{MMBtu}$$

3.1.5.2 Proposed Limit

The proposed limit is 0.0036 lb/MMBtu, as propane, based on a 2-hr average.

3.1.5.3 Compliance Method

An initial Method 25A performance test will be used to demonstrate compliance. Since the emissions of VOCs are due to incomplete combustion, the CEMS for measuring CO concentrations will be used to determine that combustion is proper, and therefore VOCs are being minimized.

3.1.6 Lead

The emissions of lead are dependent upon the lead content of the fuel and the removal efficiency of the particulate collection device. Information and data obtained from industry and USEPA, as well as sampling data from other NTH Consultants, Ltd. projects, indicates that over 99% of the Pb is emitted in particulate form (particle-phase). Consequently, a well-performing particulate control device, such as a fabric filter, can be expected to capture nearly all of the potential Pb emissions.

USEPA’s ProUCL software was employed to perform a statistical analysis on the analytical data from the years 2001-2005 with the 95% UCL values from the worst-case year chosen for calculating the annual emissions (tpy). The results of the statistical analysis are presented in Tables 3-2 and 3-3. Note, the 2001 data set for Eastern bituminous coal consisted of 16 shipments of coal, however, the lead content was known for only 7 of those coals. Therefore, these results were not used for emissions estimates. The bold values and highlighted values represent the emission factors considered representative for each coal type.

Table 3-2. ProUCL Results for Lead Content of Western Sub-bituminous coal

Year	Coal Heating Value (Btu/lb)	Lead 95% UCL (ppm)	Lead 95% UCL (lb/MMBtu)
2005	8851	3.48	3.93E-04
2004	8892	2.84	3.20E-04
2003	8904	3.43	3.86E-04
2002	8805	3.76	**4.27E-04**
2001	8816	3.11	3.53E-04

Table 3-3. ProUCL Results for Lead Content of Eastern Bituminous coal

Year	Coal Heating Value (Btu/lb)	Lead 95% UCL (ppm)	Lead 95% UCL (lb/MMBtu)
2005	12538	8.99	7.17E-04
2004	12350	14.4	**1.17E-03**
2003	12290	14.1	1.14E-03
2002	12279	13.6	1.11E-03
2001[1]	12290	15.5	1.26E-03

[1] The 2001 data set for Eastern bituminous coal consisted of 16 shipments of coal, however, the lead content was known for only 7 of those coals. Therefore, these results were not used for emissions estimates.

3.1.6.1 Emission Calculations

The lead data consisted of mass based concentrations only (i.e., part per million, wet basis (ppm_{wet}). Therefore, the equivalent lb/MMBtu values were found using these ppm_{wet} values along with the 95% UCL for coal heating values from the same year. The following example is based on the 95% UCL value for Western sub-bituminous coal data from 2002:

$$\begin{array}{c}\textbf{\textit{Pb}}\\ \textbf{\textit{Emission Factor}}\end{array} = \frac{3.76\ \text{part}}{1{,}000{,}000\ \text{parts}} \times \frac{\text{lb}}{8{,}805\ \text{Btu}} \times \frac{1{,}000{,}000\ \text{Btu}}{\text{MMBtu}} = \frac{4.27\ \text{E-04 lb}}{\text{MMBtu}}$$

This same methodology was utilized for each coal type and each year. The emission factors found to be the most representative of the future coal usage have been summarized in Table 3-4.

Table 3-4. Lead Annual Emission Factors

Coal Type	Lead (lb/MMBtu) Annual Emission Rate (95% UCL)
Western sub-bituminous coal	4.27E-04
Eastern bituminous coal	1.17E-03

These emission factors, along with a control efficiency of 99% for the fabric filter, were then used to calculate the potential emission rate.

The potential emission rate was conservatively estimated assuming the facility operated the boiler at maximum rated capacity and at a 50/50 Western sub-bituminous /Eastern bituminous coal blend (based on heat input) on a continuous basis (i.e., 8,760 hr/yr).

$$\textbf{Pb Emissions} = \frac{4.27\text{ E-04 lb}}{\text{MMBtu}} \times 50\% + \frac{1.17\text{ E-03lb}}{\text{MMBtu}} \times 50\% = \frac{7.985\text{E-04 lb}}{\text{MMBtu}}$$

$$\textbf{Pb Emissions} = \frac{7.985\text{ E-04 lb}}{\text{MMBtu}} \times \frac{8{,}190\text{ MMBtu}}{\text{hr}} \times \frac{8{,}760\text{ hr}}{\text{yr}} \times (1-0.99) = \frac{572.9\text{ lb}}{\text{yr}}$$

$$\textbf{Pb Emissions} = \frac{572.9\text{ lb}}{\text{yr}} \times \frac{1\text{ ton}}{2{,}000\text{ lb}} = 0.29\text{ tpy}$$

3.1.6.2 Proposed Limits

Using the results of the statistical analysis, as described in the preceding section, and applying a control efficiency of 99% for the fabric filter, the emission limit is 573 lb/year (0.29 tpy). This is significantly below the Pb significant emission rate threshold of 0.6 tpy.

3.1.6.3 Compliance Method

Fuel analysis for lead content and fuel use will be used to demonstrate compliance.

3.1.7 Sulfuric Acid Mist

The amount of sulfuric acid (H_2SO_4) mist formed is dependent upon the formation of a precursor, SO_3. SO_3 is formed as a result of the oxidation of SO_2 in the high temperature environment of the furnace and in the SCR process. While the SCR is used to reduce the formation of NO_x, the production rate of SO_3 is proportional to the SCR catalyst volume. Therefore, the greater the volume of the catalyst used to reduce NO_x, the greater the conversion of SO_2 to SO_3 and thus H_2SO_4.

The formation of H_2SO_4 mist will be limited through proper design and good combustion practices. Furthermore, the boiler will primarily fire low sulfur Western sub-bituminous coal, with up to 50% blends with Eastern bituminous coal. Therefore, the sulfur loading of this facility is significantly less than plants firing 100% high sulfur Eastern bituminous coals.

3.1.7.1 Emission Calculation

The AQCS has been designed to meet an H_2SO_4 emission rate of 0.004 lb/MMBtu. The short-term and long-term maximum potential emission rates for H_2SO_4 have been calculated using the following equations:

$$\boldsymbol{H_2SO_4\ Emissions} = \frac{0.004\ lb}{MMBtu} \times \frac{8{,}190\ MMBtu}{hr} = \frac{32.76\ lb}{hr}$$

$$\boldsymbol{H_2SO_4\ Emissions} = \frac{32.76\ lb}{hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{143.5\ ton}{yr}$$

3.1.7.2 Proposed Limit

The proposed limit is 0.004 lb/MMBtu, based on a 2-hr average.

3.1.7.3 Compliance Method

An initial Method 8 performance test will be used to demonstrate compliance.

3.1.8 Fluorides (as HF)

Hydrogen fluoride (HF) is generated in ASCPC boilers from the oxidation of fluorine present in the coal. While the hydrated lime injected upstream of the fabric filter will remove some HF (when using sulfur fuels approaching 1.4 lb SO_2/MMBtu at the wet FGD inlet), the wet FGD will be the primary control for HF emissions.

Again, USEPA's ProUCL software was employed to perform a statistical analysis on the coal analytical data from the years 2001-2005. The 99th percentile values from the worst-case year were chosen for the maximum short-term emissions (lb/hr) and the 95% UCL values were chosen for calculating the annual emissions (tpy). The results of the statistical analysis are presented in Tables 3-5 and 3-6, with the bolded values representing the maximum.

Table 3-5. ProUCL Results for Fluorine Content of Western Sub-bituminous Coal

Year	**Coal**	**Fluorine**	**Fluorine**	**Fluorine**	**Fluorine**
	Heating Value (Btu/lb)	**95% UCL (ppm)**	**95% UCL (lb/MMBtu)**	**99th Percentile (ppm)**	**99th Percentile (lb/MMBtu)**
2005	8851	60.4	6.82E-03	68.0	7.68E-03
2004	8892	63.2	7.11E-03	83.7	9.41E-03
2003	8904	68.4	7.68E-03	83.7	9.40E-03
2002	8805	68.1	**7.73E-03**	75.0	8.52E-03
2001	8816	61.5	6.98E-03	83.7	**9.49E-03**

Table 3-6. ProUCL Results for Fluorine Content of Eastern Bituminous Coal

Year	**Coal**	**Fluorine**	**Fluorine**	**Fluorine**	**Fluorine**
	Heating Value (Btu/lb)	**95% UCL (ppm)**	**95% UCL (lb/MMBtu)**	**99th Percentile (ppm)**	**99th Percentile (lb/MMBtu)**
2005	12538	72.5	**5.78E-03**	93.0	**7.42E-03**
2004	12350	69.7	5.64E-03	86.0	6.96E-03
2003	12290	70.5	5.74E-03	86.0	7.00E-03
2002	12279	69.4	5.66E-03	73.6	5.99E-03
2001	12290	68.1	5.54E-03	69.4	5.65E-03

5.1.1.1 Emission Calculation

The fluorine data consisted of mass based concentrations only (i.e., part per million, wet basis). Therefore, the equivalent lb/MMBtu values were found using these ppm_{wet} values along with the 95% UCL for coal heating values from the same year. The following example is based on the Western sub-bituminous coal data from 2002:

$$\textbf{\textit{Fluorine Emission Factor}} = \frac{68.1\ \text{part}}{1{,}000{,}000\ \text{parts}} \times \frac{\text{lb}}{8{,}805\ \text{Btu}} \times \frac{1{,}000{,}000\ \text{Btu}}{\text{MMBtu}} = \frac{7.73\ \text{E-03 lb}}{\text{MMBtu}}$$

This same methodology was utilized for each coal type and each year. The fluorine emission factors found to be the most representative of the future coal usage have been summarized in Table 3-7.

Table 3-7. Summary of Short- and Long-term Emission Factors as Fluorine

Coal Type	Fluorine (lb/MMBtu)	
	Hourly Emission Rate (99th Percentile)	Annual Emission Rate (95% UCL)
Western sub-bituminous Coal	9.49E-03	7.73E-03
Eastern bituminous Coal	7.42E-03	5.78E-03

Since fluorine is emitted in the form of hydrogen fluoride, the emission factors presented in Table 3-7 were converted using their molar equivalents, as follows:

$$\begin{array}{c}\textit{HF}\\ \textit{Emission Factor}\end{array} = \frac{\textit{7.73 E-03 lb of F}}{\textit{MMBtu}} \times \frac{\textit{lb-mole}}{\textit{18.9984 lb of F}} \times \frac{\textit{20.0063 lb of HF}}{\textit{lb-mole}} = \frac{\textit{8.14E-03 lb of HF}}{\textit{MMBtu}}$$

A summary of these conversions has been presented in Table 3-8.

Table 3-8. Summary of Short- and Long-term emission factors as Hydrogen Fluoride

Coal Type	Hydrogen Fluoride (lb/MMBtu)	
	Hourly Emission Rate (99th Percentile)	Annual Emission Rate (95% UCL)
Western sub-bituminous coal	9.99E-03	8.14E-03
Eastern bituminous coal	7.81E-03	6.09E-03

These emission factors, along with a control efficiency of 97% from the wet FGD, were then used to calculate the short-term and long-term maximum potential emission rates. Because the fluorine content is higher in Western sub-bituminous coal, the short-term maximum potential emission rate was calculated based on the boiler operating at maximum rated capacity while firing 100% Western sub-bituminous coal. Therefore, the short-term emission rate was calculated as follows:

$$\textbf{HF Emissions} = \frac{9.99\text{ E-03 lb}}{\text{MMBtu}} \times (1-0.97) = \frac{0.0003\text{ lb}}{\text{MMBtu}}$$

$$\textbf{HF Emissions} = \frac{0.0003\text{ lb}}{\text{MMBtu}} \times \frac{8{,}190\text{ MMBtu}}{\text{hr}} = \frac{2.5\text{ lb}}{\text{hr}}$$

The long-term maximum potential emission rate was conservatively estimated assuming the facility operated the boiler at maximum rated capacity and at a 100% Western sub-bituminous coal on a continuous basis (i.e., 8,760 hr/yr).

$$\textbf{HF Emissions} = \frac{8.14\text{ E-03 lb}}{\text{MMBtu}} \times \frac{8{,}190\text{ MMBtu}}{\text{hr}} \times \frac{8{,}760\text{ hr}}{\text{yr}} \times \frac{1\text{ ton}}{2{,}000\text{ lb}} \times (1-0.97) = 8.8\text{ tpy}$$

3.1.8.2 Proposed Limit

Using the results of the statistical analysis, as described in the preceding section, and applying a control efficiency of 97% for the wet FGD, the proposed short-term emission limit is 0.0003 lb/MMBtu, based on a 2-hour averaging time. Note, the test sample times may need to be even longer due to low HF concentration.

3.1.8.3 Compliance Method

An initial Method 26A performance test will be used to demonstrate compliance.

3.1.9 Total Reduced Sulfur, including Hydrogen Sulfide

Due to the oxidation of fuels in the boiler and the use of good combustion controls, the sulfur-bearing compounds will be oxidized to SO_2 rather than reduced to form total reduced sulfur (TRS) and reduced sulfur compounds (RSC), including hydrogen sulfide (H_2S). Therefore, the formation of TRS compounds, including H_2S, is expected to be minimal.

3.1.9.1 Compliance Method

Since the emissions of this pollutant are expected to be minimal, PSD is not applicable and compliance will be determined through proper operation of the boiler.

3.1.10 Mercury

Mercury is a naturally occurring constituent of coal. Thus, emissions of mercury are dependent upon the mercury content of the fuel. Other factors that effect the potential emissions of mercury include the chlorine content of the coal, unburned carbon or loss on ignition within the boiler, type of burner design and the removal efficiency of the add-on control technology.

Many existing technologies and systems used for control of particulate matter, sulfur dioxide, and oxides of nitrogen have been demonstrated to have significant co-benefits for control of mercury emissions. Specifically, use of FGD, fabric filters, and SCR can all result in mercury reduction co-benefits. Information and data obtained from industry and USEPA suggest that removal efficiencies of up to 80% are readily obtained in ASCPC boilers firing blends of bituminous and sub-bituminous coals and utilizing a fabric filter and/or other technology for the control of SO_2 and NO_x.

The NSPS for electric utilities at 40 CFR 60.45Da include mercury emission limits for various fuel types. The limit for bituminous coal is 0.02 lb per gigawatt-hour (lb/GWh) on an output or gross basis. The limit for sub-bituminous coal is 0.066 lb/GWh on an output or gross basis. The emission limit for a blend of these two fuel types would be proportional to their respective heat input rates. The lowest rate that would apply to this proposed source would occur when a 50/50 blend was being used. That limit would be $0.5 \times (0.020 + 0.066) = 0.043$ lb mercury per GWh, equivalent to 4.88 E-06 lb/MMBtu.

Consumers is also prepared to meet the State of Michigan’s regulatory goal of 90% reduction from input mercury levels or 0.008 lb/GWh, both on a calendar year basis. To achieve a 90% reduction (or 0.008 lb/GWh), Consumers will also utilize an emerging technology called activated sorbent injection that has the potential to achieve higher levels of mercury control. Likely, the sorbent utilized will be activated carbon or halogenated activated carbon.

Again, USEPA's ProUCL software was employed to perform a statistical analysis on the analytical data from the years 2001-2005 with the 95% UCL values from the worst-case year chosen for calculating the annual emissions (tpy). Mercury data were available on a part per million by weight basis along with the Btu value of each shipment of coal. Therefore, the mercury concentrations were converted to a lb/MMBtu value for each shipment of coal before performing the statistical analysis. The results of the statistical analysis are presented in Table 3-9 with the bolded values representing the maximum values for each coal type.

Table 3-9. ProUCL Results for Mercury

Year	Western sub-bituminous (lb/MMBtu)	Eastern bituminous (lb/MMBtu)
	95% UCL	95% UCL
2005	**6.96E-06**	4.93E-06
2004	5.32E-06	8.73E-06
2003	5.36E-06	**1.10E-05**
2002	5.52E-06	1.02E-05
2001	5.86E-06	8.75E-06

3.1.10.1 Emission Calculation

The bolded emission factors in Table 3-9 were then used to calculate the maximum potential emission rate.

While mercury is not a PSD regulated pollutant, the emissions of mercury were analyzed to satisfy a request from the MDEQ. In this particular instance, the MDEQ has requested that Consumers perform a HHRA for both mercury and lead. The results of the HHRA can be found in Section 8.0 and Appendix H.

The HHRA requires the determination of long term deposition of mercury and lead, which depends on the annual average emission rate. The annual emission rate was conservatively estimated assuming the facility operated the boiler at maximum rated capacity and at a 50/50

Western sub-bituminous /Eastern bituminous coal blend (based on heat input) on a continuous basis (i.e., 8,760 hr/yr) with 90% control.

$$\textbf{Hg Emissions} = \frac{6.96E\text{-}06\ lb}{MMBtu} \times 50\% + \frac{1.10E\text{-}05\ lb}{MMBtu} \times 50\% = \frac{8.98\ E\text{-}06\ lb}{MMBtu}$$

$$\textbf{Hg Emissions} = \frac{8.98\ E\text{-}06\ lb}{MMBtu} \times \frac{8{,}190\ MMBtu}{hr} \times \frac{8{,}760\ hr}{yr} \times (1\text{-}0.9) = \frac{64.4\ lb}{yr}$$

$$\textbf{Hg Emissions} = \frac{64.4\ lb}{yr} \times \frac{1\ ton}{2{,}000\ lb} = 0.03\ tpy$$

This mass limit, based on 90% control, is equivalent to 0.008 pound per megawatt hour (lb/GWh) gross, and therefore will be compliant with the proposed State of Michigan limit of 0.008 lb/GWh, based on a calendar year average.

$$\textbf{Hg Emissions} = \frac{64.4\ lb}{yr} \times \frac{hr}{930\ MWh\ gross} \times \frac{yr}{8{,}760\ hr} \times \frac{1{,}000\ MWh}{GWh} = \frac{0.008\ lb}{GWh\ gross}$$

3.1.10.2 Proposed Limit

Using the results of the statistical analysis, as described in the preceding section, the proposed emission limit is 64.4 lb/year based on a combination of control technologies being employed.

3.1.10.3 Compliance Method

A mercury CEMS will be used to demonstrate compliance using the procedures in 40 CFR 60.50Da(h).

3.1.11 Hazardous Air Pollutants and Toxic Air Contaminants

The proposed ASCPC boiler will emit TACs, including some of the HAPs listed in Section 112(b)(1) of the Clean Air Act (CAA). All HAPs are considered as TACs under the State of Michigan Air Toxics rules. The potential HAP/TAC emission factors for coal (Western sub-bituminous and Eastern bituminous coals) have been reviewed and the maximum emission factor for each HAP/TAC was used to calculate the maximum hourly and annual emission rates from the ASCPC boiler. The maximum emission factors and mass emission rates are listed in

Appendix B. The HAP emission factors obtained from the AP-42 document were available as lb/ton factors and the calculations follow the same methodology as presented for VOC.

The HAP/TAC emissions can be divided into the following four common categories: mercury, metallic HAP/TAC, inorganic HAP/TAC, and organic HAP/TAC. Mercury, lead, H_2SO_4, and HF were discussed previously. The compounds in each pollutant category and emission control techniques used for each category are discussed below.

3.1.11.1 Metallic HAPs/TACs

The groups of compounds included under this pollutant category are: antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, nickel, phosphorus, selenium, vanadium, and zinc. Most of these non-mercury metallic HAP/TAC compounds appear in the flue gas fly ash, which is emitted as particulate matter. Therefore, the same control techniques that would be used to control the flyash PM will control non-mercury metallic HAP/TAC emissions.

The proposed ASCPC boiler is subject to BACT for PM emissions, and a fabric filter will be utilized to control PM emissions from the boiler. Since the non-mercury metallic HAP/TAC will be emitted as part of PM emissions, the fabric filter will also control the non-mercury metallic HAP/TAC emissions. Therefore, the proposed fabric filter is considered to represent the Best Available Control Technology for TACs (T-BACT) for these compounds. The maximum controlled HAP/TAC emission rates are used in the dispersion modeling analysis to demonstrate compliance with the Michigan air toxics requirements under Rules 225-232. The modeling analysis is presented in Section 6.0.

3.1.11.2 Inorganic HAPs/TACs

The primary inorganic HAP/TAC emitted from boilers are acid gases, such as HF, H_2SO_4, and HCl. Therefore, the control technologies that were previously discussed for HF and H_2SO_4 removal will also reduce HCl emissions and other inorganic compounds that are acidic gases.

The proposed ASCPC boiler will use a wet FGD system to SO_2 control acid gases. The wet FGD represents T-BACT for these compounds (the full list of inorganic HAP/TAC is presented in Appendix B). The maximum controlled inorganic HAP/TAC emission rates were used in the dispersion modeling analysis (presented in Section 6.0) to demonstrate compliance with the Michigan air toxics requirements under Rules 225-232.

3.1.11.3 Organic HAPs/TACs

Organic HAP/TAC emissions are emitted due to incomplete combustion of organic matter found in the coal. These emissions include alkanes, alkenes, aldehydes, alcohols, and polycyclic organic matter (POMs). The inherent design and operation of the boiler provides the factors facilitating complete organic combustion including extended residence time, consistent high temperatures in the combustion chamber, and continuous mixture of fuel and air. Therefore, proper design and good combustion practices minimize the formation of organic HAP/TAC emissions and represents T-BACT for these compounds.

The maximum organic HAP/TAC emission rates are used in the dispersion modeling analysis (presented in Section 6.0) to demonstrate compliance with the Michigan air toxics requirements under Rules 225-232.

3.2 AUXILIARY BOILER

Consumers is proposing to install an auxiliary boiler to assist in start up of the ASCPC boiler and to provide auxiliary steam loads such as building heating when the ASCPC unit is down. The proposed auxiliary boiler will be a natural gas fired boiler with a design heat input rating of 220 MMBtu/hr. The auxiliary boiler will utilize pipeline quality natural gas fuel, with an approximate heating value of 1,020 Btu per standard cubic foot (Btu/scf). The primary pollutants that will be emitted from the auxiliary boiler will consist of NO_x and CO with lesser amounts of VOCs, SO_2 and particulate matter. The boiler will have LNBs, flue gas recirculation and combustion control optimization to minimize emissions.

The emissions have been calculated on both a short-term (lb/hr) and long-term (tpy) basis. The ASCPC boiler is designed for baseload operations and is expected to operate on a nearly continuous basis, with a minimum number of starts each year; therefore, operation of the auxiliary boiler should be infrequent. As a conservative approach, the long-term emissions have been estimated assuming the auxiliary boiler operates continuously (i.e., 8,760 hr/yr). The potential emissions of regulated pollutants and TACs, including HAPs from the new equipment are summarized below and detailed in the attached Appendix B.

The potential mass emission rates and the proposed limits of regulated pollutants from the auxiliary boiler are presented in Table 3-10.

Table 3-10. Pollutant Emission Rates and Proposed Limits for the Auxiliary Boiler

Pollutant	Mass Emission Rates		Proposed Limits		
	lb/hr	tpy	Rates	Units	Averaging Times
PM_{10} - Filterable [1]	0.41	1.8	None	None	None
PM_{10} - Total (Filt + Cond) [1]	1.64	7.2	None	None	None
SO_2	0.13	0.57	None	None	None
NO_x	4.0	17.3	0.018	lb/MMBtu	30-day rolling
CO	7.7	33.7	0.035	lb/MMBtu	2-hour
VOC	1.19	5.2	None	None	None
Lead	1.08E-04	4.72E-04	None	None	None
Mercury	5.61E-05	2.46E-04	None	None	None
Aggregate HAPs	0.41	1.8	None	None	None

[1] According to Table 1.4-2 of the AP-42, all particulate is assumed to be less than 1.0 micrometer in diameter. Therefore, these emissions represent PM, PM_{10}, and $PM_{2.5}$.

3.2.1 Emissions Calculations

The auxiliary boiler is being designed to meet a NO_x emission rate of 0.018 lb/MMBtu and a CO emission rate of 0.035 lb/MMBtu. The short-term and long-term maximum potential emission rates have been calculated using the following equations:

$$\textbf{\textit{NO}}_x\ \textbf{\textit{Emissions}} = \frac{0.018\ lb}{MMBtu} \times \frac{220\ MMBtu}{hr} = \frac{3.96\ lb}{hr}$$

$$\textbf{\textit{NO}}_x\ \textbf{\textit{Emissions}} = \frac{3.96\ lb}{hr} \times \frac{8{,}760\ \ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{17.3\ ton}{yr}$$

$$\textbf{\textit{CO Emissions}} = \frac{0.035\ lb}{MMBtu} \times \frac{220\ MMBtu}{hr} = \frac{7.7\ lb}{hr}$$

$$\textbf{\textit{CO Emissions}} = \frac{7.7\ lb}{hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{33.7\ ton}{yr}$$

All other short-term and long-term potential emission rates have been estimated using the emission factors for natural gas combustion found in Chapter 1.4 of the AP-42. An example calculation for VOC emissions is presented below, while a summary of the regulated pollutants and their proposed limits are presented in Table 3-10:

$$\textbf{\textit{VOC Emissions}} = \frac{5.5\ lb}{MMscf} \times \frac{MMscf}{1{,}020\ MMBtu} = \frac{5.39\ E\text{-}03lb}{MMBtu}$$

$$\textbf{\textit{VOC Emissions}} = \frac{5.39\ E\text{-}03lb}{MMBtu} \times \frac{220\ MMBtu}{hr} = \frac{1.19\ lb}{hr}$$

$$\textbf{\textit{VOC Emissions}} = \frac{1.19\ lb}{Hr} \times \frac{8{,}760\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{5.2\ ton}{yr}$$

3.2.2 Proposed Limit

The proposed NO_x limit for the auxiliary boiler is 0.018 lb/MMBtu based on a 30-day average. The proposed CO limit is 0.035 lb/MMBtu, based on a 2-hour averaging time.

3.2.3 Compliance Method

Initial compliance will be determined using Method 10 for CO with ongoing compliance determined through recordkeeping.

Initial compliance will be determined through an initial 30-day performance test for NO_x using a CEMS. Ongoing compliance will be performed using a CEMS or an approved parametric monitoring system (PEMS) as specified in Subpart Db of the NSPS.

3.3 EMERGENCY GENERATOR (AND OTHER DIESEL-FIRED EQUIPMENT)

The diesel-fired equipment will include an emergency generator, a diesel driven fire pump, a diesel driven fire booster pump, and a diesel driven wet FGD quench pump. The generator will be designed for an electrical output of 2,000 kW (approximately 2,980 HP) and will be used to provide safe plant shutdown and critical load operation in the event of a power grid failure. A summary of the equipment ratings has been provided in Table 3-11.

Table 3-11. Diesel-Fired Equipment Ratings

Engine	Size (Mechanical Output)	
	hp	kW
Emergency Generator	2980	2,222
Fire Pump	525	391
Fire Booster Pump	60	45
wet FGD Quench Pump	455	339

The emergency generator, as well as the pumps, will be driven by diesel-fired engines, using low sulfur (0.05 percent) diesel fuel to minimize emissions of SO_2. The primary pollutant that will be emitted from the diesel-fired equipment will consist of NO_x, with lesser amounts of SO_2, CO, VOCs, and particulate matter.

The emissions have been calculated on both a short-term (lb/hr) and long-term (tpy) basis. The diesel-fired equipment is expected to operate on as needed basis (i.e., emergency situation and maintenance activities) and therefore, the emissions have been estimated assuming a maximum operating schedule of 500 hours per year, per engine. The potential emissions of regulated pollutants and TACs, including HAPs from the new equipment are summarized in Table 3-14 and detailed in the attached Appendix B.

3.3.1 Emissions Calculations

Emission factors for the diesel-fired engines were obtained from Chapter 3.3 of the AP-42 for engines less than 600 HP and from Chapter 3.4 for engines greater than 600 HP (i.e., the emergency generator rated at 2,980 HP) and from the NSPS Subpart IIII. The NSPS has several different applicable emission limitations, dependent upon the following criteria: engine model year, maximum engine power, displacement per engine cylinder, and whether the engine meets the definition of a fire pump. Table 3-12 summarizes the most stringent emission limitations (i.e. those established for the latter model years) from the NSPS that apply to the engines.

Table 3-12. NSPS, Subpart IIII Emissions Limits

Engine Size kW (hp)	Emission Limits (g/kWh)			Notes
	$NMHC+NO_x$	CO	PM	
$37 \leq kW < 75$ ($50 \leq hp < 100$)	4.7	5.0	0.40	Tier 3 standards from 40 CFR 89.112 for 2008 and later model year engines. [1]
$225 \leq kW < 450$ ($300 \leq hp < 600$)	4.0	3.5	0.20	Tier 3 standards from 40 CFR 89.112 for 2006 and later model year engines. [1]
$kW > 560$ ($hp > 750$)	6.4	3.5	0.20	Tier 2 standards from 40 CFR 89.112 for 2006 and later model year engines. [1]

[1] Starting in 2007 for emergency engines with a maximum engine power greater than 50 hp, the manufacturer must certify, pursuant to 40 CFR 60.4202(a)(2), that the engine meets the standards for new nonroad compression ignition engines for the same model year and maximum power as listed in 40 CFR 89.112 and 89.113.

The applicable emission factors from Table 3-12 have been converted to units of lb/MMBtu and, along with the appropriate AP-42 emission factors, are shown for each engine in Table 3-13. An example calculation of the conversion between units of g/kWh and lb/MMBtu is shown below.

$$\textit{CO Emission Factor} = \frac{3.5\ g}{kWh} \times \frac{0.7457\ kW}{hp} \times \frac{hp\text{-}hr}{7{,}000\ Btu} \times \frac{1{,}000{,}000\ Btu}{MMBtu} \times \frac{lb}{453.59\ g} = \frac{0.82\ lb}{MMBtu}$$

Table 3-13. Applicable Emission Factor for Diesel-fired Engines

Pollutant	Emission Factor Source	Emergency Generator (lb/MMBtu)	Fire Pump (lb/MMBtu)	Fire Booster Pump (lb/MMBtu)	Wet FGD Quench Pump (lb/MMBtu)
PM_{10} – Filterable	NSPS	0.05	0.05	0.09	0.05
PM_{10} - Total [1]	AP-42	0.0573	0.31	0.31	0.31
SO_2 [2]	AP-42	0.0505	0.0505	0.0505	0.0505
NO_x	NSPS [3]	1.50	0.94	1.10	0.94
CO	NSPS	0.82	0.82	1.17	0.82
VOC	NSPS [3]	1.50	0.94	1.10	0.94

[1] The total particulate emissions are represented as the sum of the filterable and condensable particulate emissions.

[2] Chapter 3.4 AP-42 lists the sulfur content as (1.01 × Sulfur Content) in units of lb/MMBtu. As the sulfur content of the diesel fuel will be limited to a maximum of 0.05%, the SO_2 emission factor is found as $SO_2 = 1.01 \times 0.05 = 0.0505$. While, Chapter 3.3 lists a separate emission factor of 0.29 lb/MMBtu, 0.0505 is more representative based on the maximum sulfur content of the fuel.

[3] The NSPS, Subpart IIII does not have individual limits for NO_x or VOC. Instead the limit is applicable to the sum of the two pollutants. Therefore, each pollutant has been estimated at their worst-case, while the limit is applicable to their sum.

The following example calculation of SO_2 short-term and long-term maximum (at 500 hr/yr) potential emission rates from the emergency generator is representative of the methodology utilized for all diesel-fired equipment.

$$\boldsymbol{SO_2\ Emissions} = \frac{0.0505\ lb}{MMBtu} \times \frac{MMBtu}{1{,}000{,}000\ Btu} \times \frac{7{,}000\ Btu}{hp\text{-}hr} \times 2980\ hp\text{-}hr = \frac{1.05\ lb}{hr}$$

$$\boldsymbol{SO_2\ Emissions} = \frac{1.05\ lb}{hr} \times \frac{500\ hr}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{0.26\ ton}{yr}$$

The potential emissions of regulated pollutants from the diesel-fired equipment are summarized below and presented in detail in the attached Appendix B.

Table 3-14. Potential PSD-Regulated Pollutant Emission Rates from the Diesel-Fired Equipment

Pollutant	**Emergency Generator**		**Fire Pump**		**Fire Booster Pump**		**Wet FGD Quench Pump**		**Summary of Diesel-fired Equipment**	
	lb/hr	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**
PM_{10} – Filterable	0.98	0.24	0.17	0.04	0.04	0.01	0.15	0.04	**1.34**	**0.34**
PM_{10} - Total [2]	1.20	0.30	1.14	0.28	0.13	0.03	0.99	0.25	**3.5**	**0.86**
SO_2 [3]	1.05	0.26	1.07	0.27	0.12	0.03	0.92	0.23	**3.2**	**0.79**
NO_x	31.35	7.8	3.45	0.86	0.46	0.12	2.99	0.75	**38.3**	**9.57**
CO	17.15	4.29	3.02	0.76	0.49	0.12	2.62	0.65	**23.3**	**5.82**
VOC	31.35	7.8	3.45	0.86	0.46	0.12	2.99	0.75	**38.26**	**9.57**
Aggregate HAPs	0.034	0.01	0.014	0.004	0.002	4.07E-04	0.012	0.001	**0.06**	**0.02**

[1] The total particulate emissions are represented as the sum of the filterable and condensable particulate emissions.

[2] Emission factors for SO_2 were derived from the AP-42 Table 3.4-1 as 1.01 × Sulfur Content at 0.05% sulfur, regardless of the size of the engine.

3.3.2 Proposed Limit

Limiting the hours of operation is the most effective way to ensure compliance with the emission limits; therefore, each diesel-fired engine will be limited to an annual operation of less than 500 hours per year. Furthermore, the sulfur content of the diesel fuel will be limited to 0.05 percent.

3.3.3 Compliance Method

Consumers will record the number of hours of operation for each of the diesel-fired engines, as well as the sulfur content of the fuel.

3.4 MATERIAL HANDLING

Particulate emissions from material handling operations will occur as a result of several activities, including material transfer, bulldozing, wind erosion, etc. In addition to particulate emissions from coal handling, other particulate sources have been investigated. These include the transfer and storage of limestone and fly ash, and truck hauling emissions of raw materials and waste products. These emissions are discussed in the following sections.

3.4.1 Coal Handling Emissions

Fabric filters will be located in the plant to capture fugitive dust from the transfer of coal. All of the new fabric filter dust collection systems are being designed to meet a limit of 0.004 grains per dry standard cubic foot (gr/dscf). In addition, all conveyors will have 360° enclosures to prevent fugitive emissions during coal conveyance.

The annual emission rates for material handling operations have been estimated using equation (1) from section 13.2.4.3 of the AP-42 with a control efficiency of 99 percent for fabric filter control. The material handling equipment will not operate 24 hours per day, 7 days per week (i.e., most of the transfer points will only be operated one or two shifts per day). However, short-term emission rates are required for air quality modeling purposes. In such cases, the emissions from fabric filters have been conservatively estimated assuming the design outlet grain loading (gr/dscf) coupled with the exhaust flow rates. Furthermore, the fabric filters will be operating at approximately ambient conditions; therefore, no corrections were necessary for converting between “dry standard” and “actual” cubic feet.

The new ASCPC unit will receive bulk deliveries of coal by rail and by ship, depending upon factors such as weather and market fluctuation. Coal received by rail will be brought into the Dumper House where rubber curtains will be utilized to enclose each rail car. The Dumper House will be ventilated through a fabric filter dust collection system at a rate of 150,000 actual cubic foot per minute (acfm), with an outlet dust loading of 0.004 gr/dscf to minimize the fugitive emissions. The coal will be dumped into a hopper at the bottom of the Dumper House and then be transferred by conveyor to the Coal Barn, Coal Dome, Crusher House or the Reserve Storage. While Consumers fully expects to also receive coal by ship (as weather and coal markets allow), the Dumper House is being designed to handle the full plant capacity (new ASCPC plus existing units) of 8,000,000 tons per year. Therefore, the annual emissions from the Dumper House were conservatively estimated assuming an 8,000,000 ton per year throughput.

The short-term potential emission rates have been calculated using the following equation:

$$\textbf{\textit{Short-term PM}}_{10}\textbf{\textit{ Emissions for the Dumper House}} = \frac{0.004\ gr}{dscf} \times \frac{150{,}000\ ft^3}{min} \times \frac{60\ min}{hr} \times \frac{lb}{7{,}000\ gr} = \frac{5.14\ lb}{hr}$$

The long-term emissions (drop activities from the rail car into the hopper and from the hopper onto the conveyor) are represented by the following equation from AP-42, Section 13.2.4:

$$E_{PM10}\ \textbf{(lb /ton /drop)} = k \times (0.0032) \times (U/5)^{1.3} \div (M/2)^{1.4}\text{, where}$$

E = Emission factor (lb PM_{10} /ton of coal /drop)
k = particle size multiplier (k_{PM10} = 0.35)
U = mean wind speed, mph (@ MBS=9.3 mph, 5-year average for Y2002-Y2006)
M = material moisture content (%) (6.1% from Consumers coal data)

$$E_{PM10} = 0.35 \times (0.0032) \times (9.3/5)^{1.3} \div (6.1/2)^{1.4} = 5.27\text{ E-04 lb } PM_{10}\text{ /ton of coal /drop}$$

$$\begin{array}{c}\textbf{Annual } PM_{10}\textbf{ Emissions}\\ \textbf{for the Dumper House}\end{array} = \frac{5.27\text{ E-04 lb}}{\text{ton of coal}} \times \frac{8{,}000{,}000\text{ ton of coal}}{\text{yr}} \times \frac{1\text{ ton}}{2{,}000\text{ lb}} \times (1-0.99) = \frac{0.02\text{ tpy}}{\text{drop}}$$

$$\begin{array}{c}\textbf{Annual } PM_{10}\textbf{ Emissions}\\ \textbf{for the Dumper House}\end{array} = \frac{0.02\text{ tpy}}{\text{drop}} \times 2\text{ drops} = 0.04\text{ tpy}$$

Note, this same methodology is utilized for all of the material handling calculations. Therefore, only summary tables are presented for the remaining emission rates. For detailed specifications regarding each material handling transfer point and the associated calculations, please refer to Appendix B.

From the Dumper House, coal will be conveyed to transfer tower #1 (TT K5-1), a fully enclosed structure with a 10,000 acfm fabric filter dust collection system. From TT K5-1, the coal will either enter the Coal Barn or be conveyed to TT K5-2. The Coal Barn is an enclosed structure for the 60,000-ton active storage pile with fugitive emissions further controlled by a 70,000 acfm fabric filter dust collection system. Inside the Coal Barn, the coal will either be placed into the active pile (inside the Coal Barn) by the traveling stacker or sent to TT K5-3. From the active pile, dual-chain, traveling reclaimers will load the coal onto a conveyor to be sent to TT K5-2.

Coal sent to TT K5-3, controlled by a 5,000 acfm fabric filter dust collection system, will be used to create the 18,000 ton Reserve Stockout (East of the Reserve Storage pile) conical pile. A second 18,000 ton conical pile, Reserve Stockout (West of the Reserve Storage pile), can also be formed from coal returning from TT K5-2. Fugitive emissions from the transfer of coal to the conical piles will be minimized through the use of telescopic chutes.

The Reserve Storage pile will be built-up during the summer months such that size of the pile will vary depending on the time of year, reaching a peak storage size around November. The pile will be sprayed with a chemical surfactant or covered with a crusting agent to further reduce fugitive emissions.

Emissions may also be generated from wind erosion directly from the piles during high wind speed conditions. The wind speed must be great enough to lift and carry the fine material, i.e., the wind speed must exceed the threshold friction velocity.

The Reserve Storage pile will be designed to have a maximum capacity of 1,000,000 tons of coal, roughly a 45-day supply for the plant. The emissions from the Reserve Storage and the two Reserve Stockout piles have been estimated using Section 13.2.5, Industrial Wind Erosion, from the AP-42. As described in the AP-42, these equations only apply to dry, exposed materials. Therefore, these equations are expected to over predict the emissions as Michigan can expect to receive precipitation on average 120 days per year (from Figure 13.2.2-1, AP-42). Furthermore, the calculations do not take into account that the pile will only be at its maximum size at the beginning of the winter months. For the purposes of applying a control efficiency, the Reserve Storage pile has been divided into two (2) areas: A compacted portion accounting for 85% of the area with the remaining 15% representing the portion which is active on a daily basis. Per the existing Fugitive Dust Control Plan for the facility, issued 03/18/2005, if the wind speeds are greater than 30 mph, there will be no bulldozer activity during those hour(s). Furthermore, the compacted area will be controlled with a chemical surfactant capable of achieving 80% control.

A detailed description of this methodology is presented in Appendix B, while Table 3-15 presents a summary of the mass emission rates associated with the wind erosion calculations.

Table 3-15. A Summary of the Wind Erosion from the Coal Piles

Wind Erosion Activities	PM (lb/hr) [1]	PM (tpy)	PM_{10} (lb/hr) [1]	PM_{10} (tpy)
Active Portion of the Reserve Pile	1.07	0.23	0.53	0.12
Compacted Portion of the Reserve Pile	1.21	0.26	0.60	0.13
Reserve Stockout Piles (combined)	0.17	0.03	0.09	0.02
Total Emissions	**2.4**	**0.53**	**1.2**	**0.26**

[1] The hourly emission rates are based upon the 24-hour average of the maximum daily emission rates found using the AP-42, Chapter 13.2.5 equations.

From the Reserve Stockout piles, the coal will either be bulldozed and compacted into the Reserve Storage pile, or bulldozed into one of the underground feed hoppers. The emissions from the bulldozing activities have been conservatively estimated assuming there are two (2) bulldozers operating continuously for 16 hours per day, 365 days per year. This is a very conservative estimate as most of the coal handling activity is expected to occur inside the fully enclosed Coal Barn. The conical piles will only be formed when the Coal Barn is at its maximum storage capacity, while building up the Reserve Storage, or during emergency situations.

Emissions from the bulldozer activity have been estimated by using Equations (1a, for short-term and 2, for annual) from AP-42 13.2.2. During high wind events, wet supression will be utilized as required to reduce the potential for wind erosion, with an estimated control efficiency of 85 percent.

Therefore, the short-term emissions have been estimated using Equation 1a:

$$\mathbf{E_{PM10}\ (lb/VMT)} = k \times (s/12)^a \times (W/3)^b \quad \text{where}$$

E = size specific emission factor
s = surface material silt content (%) (2.2% based on Table 13.2.4-1)
VMT = vehicle miles traveled
W = mean vehicle weight, (tons) (Bulldozer = 77 tons)
k, a, and b are empirical constants ($k_{PM10} = 1.5$, $a_{PM10} = 0.9$, $b_{PM10} = 0.45$ from Table 13.2.2-2)

For the annual emissions, the AP-42 accounts for natural mitigation due to Michigan's precipitation through the use of equation 2, from Section 13.2.1:

$$E_{PM10}\ \mathbf{(lb/VMT)} = k \times (s/12)^{a} \times (W/3)^{b} \times ((365-P)/365),\ where$$

P = Annual number of days (120) with at least 0.01" of precipitation, from AP-42 Figure 13.2.2-1

As the bulldozers are traveling over the surface of the coal pile and not a "typical" unpaved road, the silt content of the road was selected from Table 13.2.4-1 represented the mean value for "as received coal" from coal-fired power plants. The distance (VMT) the bulldozers travel has been estimated assuming an average daily speed of 0.5 miles per hour. Therefore, the emission factors have been estimated using the following equations:

Short-term Emissions

$$E_{PM10} = 1.5 \times (2.2/12)^{0.9} \times (77/3)^{0.45}$$

$$E_{PM10} = 1.4\ lb/VMT$$

$$\mathbf{PM_{10}\ Emissions} = 2\ bulldozers \times \frac{1.4\ lb}{VMT} \times \frac{0.5\ miles}{hr} \times (1-0.85) = \frac{0.21\ lb}{hr}$$

Annual Emissions

$$E_{PM10} = 1.5 \times (2.2/12)^{0.9} \times (77/3)^{0.45} \times ((365-120)/365)$$

$$E_{PM10} = 0.94\ lb/VMT$$

$$\mathbf{PM_{10}\ Emissions} = 2\ bulldozers \times \frac{0.94\ lb}{VMT} \times \frac{0.5\ miles}{hr} \times \frac{16\ hr}{day} \times (1-0.85) = \frac{2.26\ lb}{day}$$

$$\mathbf{PM_{10}\ Emissions} = \frac{2.26\ lb}{day} \times \frac{365\ day}{yr} \times \frac{1\ ton}{2{,}000\ lb} = \frac{0.41\ ton}{yr}$$

From the piles, coal will be bulldozed into either the East or West Feed Hoppers. As coal drops from the hoppers to the conveyors, 5,000 acfm fabric filter dust collection systems (one at each hopper) will be utilized to capture and control fugitive emissions from each drop point. From the

East Feed Hopper, coal will be sent to TT K5-4, equipped with a 5,000 acfm fabric filter dust collection system, before joining the Coal Barn conveyor that transfers coal to TT K5-2. Coal reclaimed through the West Feed Hopper will be sent directly to TT K5-2.

The transfer tower, TT K5-2, will be controlled by a 20,000 acfm fabric filter dust collection system as it is a central location for coal handling operations. TT K5-2 can receive coal from a multiple of sources: TT K5-1, the Coal Barn, and the West Feed Hopper. TT K5-2 has a 300 ton surge bin directing coal to the next transfer tower (TT K5-5) or sending excess coal to the Reserve Stockout (West). TT K5-5 is equipped with a 10,000 acfm fabric filter dust collection system for minimizing fugitive emissions.

From TT K5-5, coal is sent to the Crusher House K5, equipped with a 15,000 acfm fabric filter dust collection system. The Crusher House will contain crushing equipment used to reduce the coal particle size before being sent to the ASCPC Tripper Rooms in the boiler house. The facility will also have the ability to bypass the Crusher House and send the coal to the Coal Dome for storage or to feed their existing boilers from their existing conveyance system. The Tripper Rooms in the ASCPC boiler house feed coal to the day silos, which in turn feed the pulverizing equipment located in the boiler house. Two fabric filter dust collection systems will be used for the day silos: one sized at 15,000 acfm for the North Silo Row and transfer operations, and one sized at 6,000 acfm for the South Silo Row.

Table 3-16 provides a summary of the particulate emissions from the rail unloading activities and subsequent coal handling and storage operations.

Table 3-16. A Summary of the Coal Handling Operations for Coal Delivered by Rail

Emission Source	**PM (lb/hr)**	**PM (tpy)**	**PM_{10} (lb/hr)**	**PM_{10} (tpy)**
Dumper House, Rail Unloading	5.14	0.09	5.14	0.04
Transfer Tower, TT K5-1	0.34	0.04	0.34	0.02
Coal Barn	2.40	0.18	2.40	0.08
Transfer Tower, TT K5-3	0.17	0.02	0.17	0.01
Reserve Stockout, East of Reserve Storage (Drop onto pile)	1.11	0.28	0.53	0.13
Reserve Stockout, West of Reserve Storage (Drop onto pile)	1.11	0.28	0.53	0.13
Fugitives from Bulldozer Activity on the Coal Pile	0.97	1.89	0.21	0.41
Hopper for Reserve Stockout, East of Reserve Storage (Loading)	0.11	0.22	0.05	0.11
Hopper for Reserve Stockout, West of Reserve Storage (Loading)	0.11	0.22	0.05	0.11
Hopper for Reserve Stockout, East of Reserve Storage (Transfer to Conveyor)	0.17	0.01	0.17	0.01
Hopper for Reserve Stockout, West of Reserve Storage (Transfer to Conveyor)	0.17	0.01	0.17	0.01
Transfer Tower, TT K5-4	0.17	0.01	0.17	0.01
Transfer Tower, TT K5-2	0.69	0.09	0.69	0.04
Transfer Tower, TT K5-5	0.34	0.04	0.34	0.02
Crusher House, K5	0.51	0.09	0.51	0.04
Tripper Room, North Silo Row	0.51	0.07	0.51	0.03
Tripper Room, South Silo Row	0.21	0.04	0.21	0.02
Total Emissions	**14.25**	**3.60**	**12.20**	**1.22**

In addition to rail delivery, the new ASCPC unit will have the option of receiving coal through ship delivery. Coal received by ship will be unloaded, utilizing a self-unloading conveyor equipped with a movable boom to minimize fugitive emissions, at a maximum rate of 7,000 tons per day, up to 10 hours per day. The coal will be conveyed to a dockside hopper, where it will be dropped through a wet-suppression ring to further minimize the fugitive emissions. As the coal is transferred from the hopper onto a conveyor, the emissions will be controlled by a 12,000 acfm fabric filter dust collection system.

From the hopper, the coal will be conveyed into the 90,000 ton Coal Dome. The Coal Dome is a completely enclosed structure, equipped with two fabric filter dust collection systems, each rated at 30,000 acfm to minimize fugitive emissions. The coal received by ship for the new ASCPC unit will be stored in the Coal Dome, greatly reducing fugitive emissions. Furthermore, the dome has been sized to accommodate all of the existing facility's Western sub-bituminous coal, thereby eliminating the historic dockside of Western coal pile (Eastern bituminous coal for the existing units will continue to be stored in its current dockside location). Dual-chain, radial reclaimers will load the coal from the Coal Dome into an underground hopper, controlled by a 5,000 acfm fabric filter dust collection system. When coal leaves the dome, it will be sent to TT K5-6, controlled by a 12,000 acfm fabric filter dust collection system.

Coal from TT K5-6 will be sent to TT K5-7, controlled by a 20,000 acfm fabric filter dust collection system. Through another set of conveyors, coal can be returned to the Coal Dome, either from the existing Rail Dumper House (via TT K5-10) or from the Crusher House K5. TT K5-7 serves as the central transfer tower for the ship unloading activities. From this transfer tower, coal will either be sent to the Crusher House K5, via TT K5-8, controlled by a 20,000 acfm fabric filter dust collection system or enter the existing conveyance system through TT K5-9 (via TT K5-8) or TT K5-10. TT K5-9 is controlled by a 4,000 acfm fabric filter dust collection system, while TT K5-10 is controlled by a 10,000 acfm fabric filter dust collection system.

Table 3-17 provides a summary of the particulate emissions from the coal handling operations from ship delivery.

Table 3-17. A Summary of the Coal Handling Operations from Coal Delivered by Ship

Emission Source	PM (lb/hr)	PM (tpy)	PM_{10} (lb/hr)	PM_{10} (tpy)
Ship Unloading (Coal)	0.65	0.13	0.52	0.06
Coal Dome	2.06	0.13	2.06	0.06
Dome Hopper	0.17	0.09	0.17	0.04
Transfer Tower, TT K5-6	0.41	0.09	0.41	0.04
Transfer Tower, TT K5-7	0.69	0.09	0.69	0.04
Transfer Tower, TT K5-8	0.69	0.09	0.69	0.04
Transfer Tower, TT K5-9	0.14	0.01	0.14	0.00
Transfer Tower, TT K5-10	0.34	0.09	0.34	0.04
Total Emissions	**5.14**	**0.72**	**5.01**	**0.34**

3.4.2 Limestone Handling Emission Sources

Particulate emissions from limestone handling have been investigated using the same methodology as described for coal, including the use of the AP-42 for annual emissions (for drop activities) and assuming the design outlet grain loading (gr/dscf) for short-term emissions.

The short-term potential emission rates have been calculated using the following equation:

$$\textbf{\textit{Short-term PM}}_{\mathbf{10}}\textbf{\textit{ Emissions for the Limestone Dome}} = \frac{0.004\ gr}{dscf} \times \frac{60{,}000\ ft^3}{min} \times \frac{60\ min}{hr} \times \frac{lb}{7{,}000\ gr} = \frac{2.06\ lb}{hr}$$

The long-term emissions (drop activities) are represented by the following equation from AP-42, Section 13.2.4:

$$E_{PM10}\ \textbf{(lb /ton /drop)} = k \times (0.0032) \times (U/5)^{1.3} \div (M/2)^{1.4}, \text{ where}$$

E = Emission factor (lb PM_{10} /ton of coal /drop)
k = particle size multiplier (k_{PM10} = 0.35)
U = mean wind speed, mph (@ MBS = 9.3 mph, 5-year average for Y2002-Y2006)
M = material moisture content (%) (2.6% representing Michigan limestone, stored in outdoor piles)

$$E_{PM10} = 0.35 \times (0.0032) \times (9.3/5)^{1.3} \div (2.3/2)^{1.4} = 2.1\text{ E-03 lb } \mathrm{PM}_{10}\text{ /ton of coal /drop}$$

$$\textbf{Annual PM}_{10}\textbf{ Emissions for the Limestone Dome} = \frac{2.1\text{ E-03 lb}}{\text{ton of coal}} \times \frac{86{,}925\text{ ton of limestone}}{\text{yr}} \times \frac{1\text{ ton}}{2{,}000\text{ lb}} \times (1-0.99) = \frac{9.1\text{ E-04 tpy}}{\text{drop}}$$

$$\textbf{Annual PM}_{10}\textbf{ Emissions for the Limestone Dome} = \frac{9.1\text{ E-04 tpy}}{\text{drop}} \times 2\text{ drops} = 1.8\text{ E-03 tpy}$$

Limestone will be unloaded, utilizing a self-unloading conveyor equipped with a movable boom to minimize fugitive emissions, at a maximum rate of 7,000 tons per day, up to 10 hours per day. The limestone will be conveyed to a dockside hopper, where it will be dropped through a wet-suppression ring to further minimize the fugitive emissions. As the limestone is transferred from the hopper onto a conveyor, the emissions will be controlled by a 12,000 acfm fabric filter dust collection system.

From the hopper, the limestone will be conveyed to the 90,000 ton Limestone Dome. The Limestone Dome is a completely enclosed structure, equipped with two fabric filter dust collection systems, each rated at 30,000 acfm to minimize fugitive emissions. Inside the dome, a front-end loader will load the limestone into one of the two underground hoppers, controlled by a 5,000 acfm fabric filter dust collection system.

When limestone leaves the dome it will be conveyed through a series of three (3) transfer towers, each controlled by a 5,000 acfm fabric filter dust collection system, before being conveyed to a silo in the Limestone Reagent Preparation Building. The silo will be equipped with a 1,500 acfm blower-assisted bin vent filter controlled to a rate of 0.004 gr/dscf.

A 3,000 acfm fabric filter dust collection system will also be used to collect particulate emissions from the activities within the Limestone Reagent Preparation Building.

Table 3-18 provides a summary of the particulate emissions from the limestone handling operations from ship delivery.

Table 3-18. A Summary of the Limestone Handling Operations

Emission Source	PM (lb/hr)	PM (tpy)	PM_{10} (lb/hr)	PM_{10} (tpy)
Ship Unloading (Limestone)	1.33	0.009	0.85	0.004
Limestone Dome	2.06	0.006	2.06	0.003
Limestone Dome Hopper	0.17	0.004	0.17	0.002
Transfer Tower, TT LS5-1	0.17	0.002	0.17	0.001
Transfer Tower, TT LS5-2	0.17	0.002	0.17	0.001
Transfer Tower, TT LS5-3	0.17	0.002	0.17	0.001
Limestone Day Silo	0.05	0.001	0.05	0.001
Limestone Reagent Preparation Building	0.10	0.004	0.10	0.002
Total Emissions	**4.23**	**0.03**	**3.74**	**0.01**

3.4.3 Ash Storage Emissions

Ash generated by the new ASCPC unit will be collected in two forms, bottom ash and fly ash. The fly ash will be collected from the economizer, air heater hoppers, and the fabric filter hopper and stored in a silo utilizing a 10,000 acfm blower-assisted bin vent filter for controlling emissions to 0.004 gr/dscf. This produces estimated emission rates of 0.34 lb/hr and 1.5 tpy assuming continuous operation at the design outlet grain loading and air flow rate. Emissions from transferring the fly ash to the haul trucks and subsequently unloading the haul trucks are expected to be minimal due to the high moisture content and minimized drop heights, therefore, these emissions have not been quantified. Emissions from hauling the ash have been quantified and are discussed below in Section 3.4.4.

The bottom ash is removed from the bottom ash hopper and is conveyed at an incline which partially dewaters the ash, directing water ultimately back to the water seal at the bottom of the boiler. The bottom ash is conveyed to an open concrete bunker where it is temporarily stored until it can be loaded into a truck and removed to on-site storage. The ash collected in the concrete bunker will contain 15 to 25 percent moisture, eliminating any fugitive dust emissions as the ash is unloaded into the bunker, loaded into trucks, and placed into on-site storage.

3.4.4 Truck Hauling Emissions

Particulate emissions are generated from roadways due to the force of the wheels pulverizing loose surface material. The rolling wheels also lift and drop the pulverized particles, which are then exposed to the turbulent wake of the vehicle, as well as wind.

Emissions from vehicle activity have been estimated using USEPA's AP-42 document. The AP-42 presents equations for estimating emissions from both paved and unpaved roads.

3.4.4.1 Unpaved Road Emissions

For vehicles traveling on unpaved roads at industrial sites, the short-term emissions have been estimated using equation 1a from Section 13.2.2 of the AP-42:

$$\mathbf{E\ (lb/VMT)} = k \times (s/12)^{a} \times (W/3)^{b} \quad \text{where}$$

k = empirical constant (k_{PM10} = 1.5)
a = empirical constant (a_{PM10} = 0.9)
b = empirical constant (b_{PM10} = 0.45)
s = surface material silt content (%) (6.4% from AP-42 Table 13.2.2-1for a disposal route at a municipal solid waste landfill)
W = mean vehicle weight, tons (weighted average calculated for each road segment)

The annual emissions are calculated in the same manner, but equation 2 from the AP-42 accounts for natural mitigation due to Michigan's precipitation.

$$\mathbf{E\ (lb/VMT)} = k \times (s/12)^{a} \times (W/3)^{b} \times ((365-P)/365) \quad \text{where}$$

P = number of days in a year with at least 0.01" of precipitation (120 from AP-42, Figure 13.2.2-1)

As explained in the AP-42, these equations are intended to represent one emission factor for a specific section of road (i.e., these equations are not intended to calculate an emission factor for each vehicle weight class traveling on the road; instead it represents one emission factor for a mean weight class, for each segment of road). Therefore, the first step towards calculating the unpaved roadway emissions is to determine the mean vehicle weight on each road segment.

Specifically, the AP-42 equation requires a weighted-mean and not a standard arithmetic mean. The following table represents the expected vehicle traffic on the unpaved portion of the ash haul road.

Table 3-19. Vehicle Traffic on the Unpaved Portion of the Ash Haul Road

Vehicle Type	Vehicle weight (tons)	VMT per trip	Vehicles (trips) per day	Percentage of Total trips	VMT per day
Bottom Ash Trucks (Full)	54.4	0.19	6.5	9.8%	1.2
Bottom Ash Trucks (Empty)	33.9	0.19	6.5	9.8%	1.2
Fly Ash Trucks (Full)	54.4	0.19	26.8	40.2%	5.1
Fly Ash Trucks (Empty)	33.9	0.19	26.8	40.2%	5.1

Therefore, the weighted-mean vehicle weight (W) can be found as follows:

$$\mathbf{W} = (9.8\% \times 54.4 \text{ tons}) + (9.8\% \times 33.9 \text{ tons}) + (40.2\% \times 54.4 \text{ tons}) + (40.2\% \times 33.9 \text{ tons})$$

$$\mathbf{W} = 44.1 \text{ tons}$$

Using the weighted-mean vehicle weight and a control efficiency of 98% for speed restrictions and chemical dust suppressants, the emission factors for the unpaved portion of the Ash Haul Road can be found using the AP-42 equations.

Short-term Emissions

$$\mathbf{E} = 1.5 \times (6.4 \div 12)^{0.9} \times (44.1 \div 3)^{0.45} \times (1-0.98)$$

$$\mathbf{E} = 0.057 \text{ lb/VMT}$$

$$\textbf{Short-term PM}_{10}\textbf{ Emissions} = \frac{0.057 \text{ lb}}{\text{VMT}} \times \frac{12.7 \text{ VMT}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hours}} = \frac{0.03 \text{ lb}}{\text{hr}}$$

Annual Emissions

$$\mathbf{E} = 1.5 \times (1.6 \div 12)^{0.9} \times (44.1 \div 3)^{0.45} \times (365\text{-}120)/365 \times (1\text{-}0.98)$$

$$\mathbf{E} = 0.038 \text{ lb/VMT}$$

$$\textbf{Annual PM}_{10}\textbf{ Emissions} = \frac{0.038 \text{ lb}}{\text{VMT}} \times \frac{12.7 \text{ VMT}}{\text{day}} \times \frac{365 \text{ day}}{\text{yr}} \times \frac{\text{ton}}{2{,}000 \text{ lb}} = 0.09 \text{ tpy}$$

The gypsum sludge from the wet FGD being hauled to the disposal area will, in part, utilize an unpaved road. The emissions calculations for the unpaved portion follow the same methodology as presented for the unpaved Ash Haul Road and therefore are not repeated in this section. The detailed emission calculations are presented in Appendix B, while Table 3-20 presents a summary of the fugitive emissions from unpaved roads.

Table 3-20. Summary of Fugitive Emissions from Unpaved Roads

Emission Source	PM (lb/hr)	PM (tpy)	PM_{10} (lb/hr)	PM_{10} (tpy)
Ash Haul Road	0.11	0.33	0.03	0.09
Gypsum Haul Road	0.16	0.70	0.04	0.19
Total Unpaved Roads	**0.27**	**1.02**	**0.07**	**0.28**

3.4.4.2 Paved Road Emissions

For vehicles traveling on paved roads at industrial sites, the short-term emissions have been estimated using equation 1 from Section 13.2.1 of the AP-42:

$$\mathbf{E\ (lb/VMT)} = (k \times (sL/2)^{0.65} \times (W/3)^{1.5} - C) \text{ where}$$

k = empirical constant (k_{PM10} = 0.016)
sL = road surface silt loading, g/m^2 (7.4, from Table 13.2.1-4, AP –42 for municipal solid waste landfills)
W = weighted-mean vehicle weight, tons (calculated for each road segment)
C = emission factor for 1980’s vehicle fleet exhaust, brake wear, and tire wear, lb/VMT (C_{PM10}=0.00047, from Table 13.2.1-2)

For the annual emissions, the AP-42 accounts for natural mitigation due to Michigan's precipitation through the use of equation 2, from Section 13.2.1:

$$E\ (lb/VMT) = (k \times (sL/2)^{0.65} \times (W/3)^{1.5} - C) \times (1-P/(4N)) \text{ where}$$

P = number of days in a year with at least 0.01 inches of precipitation (P=120, from Figure 13.2.1-2)
N = number of days in the averaging period (N=365)

The following table represents the expected vehicle traffic on the paved Main Access Road.

Table 3-21. Vehicle Traffic on the Paved Main Access Road

Vehicle Type	Vehicle weight (tons)	VMT per trip	Vehicles (trips) per day	Percentage of Total trips	VMT per day
Hydrated Lime Trucks (Full)	34	0.75	0.4	0.2%	0.28
Hydrated Lime Trucks (Empty)	12	0.75	0.4	0.2%	0.28
Powered Activated Carbon (PAC) Trucks (Full)	34	0.75	0.4	0.2%	0.30
Powered Activated Carbon (PAC) Trucks (Empty)	12	0.75	0.4	0.2%	0.30
Dry Urea Trucks Karn 5 (Full)	34	0.75	0.8	0.3%	0.59
Dry Urea Trucks Karn 5 (Empty)	12	0.75	0.8	0.3%	0.59
Employee/Visitor Vehicles	2	0.75	200	85.8%	149.17
Maintenance Vehicles	3	0.75	20	8.6%	14.92
Delivery Vehicles	5	0.75	10	4.3%	7.46

With a distance weighted-mean vehicle weight of 2.5 tons and a control efficiency of 95% for speed restrictions, street sweeping and watering, the emission factors for the paved Main Access Road can be found using the AP-42 equations.

Short-term Emissions

$$\mathbf{E} = (0.016 \times (7.4/2)^{0.65} \times (2.5/3)^{1.5} - 0.00047) \times (1\text{-}0.95)$$

$$E = 0.0014 \text{ lb/VMT}$$

$$\textbf{Short-term PM}_{10}\textbf{ Emissions} = \frac{0.0014 \text{ lb}}{\text{VMT}} \times \frac{173.9 \text{ VMT}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hours}} = \frac{0.01 \text{ lb}}{\text{hr}}$$

Annual Emissions

$$\mathbf{E} = (0.016 \times (7.4/2)^{0.65} \times (2.5.3/3)^{1.5} - 0.00047) \times (1\text{-}(120/(4 \times 365))) \times (1\text{-}0.95)$$

$$E = 0.0013 \text{ lb/VMT}$$

$$\textbf{Annual PM}_{10}\textbf{ Emissions} = \frac{0.0013 \text{ lb}}{\text{VMT}} \times \frac{173.9 \text{ VMT}}{\text{day}} \times \frac{365 \text{ day}}{\text{yr}} \times \frac{\text{ton}}{2{,}000 \text{ lb}} = 0.04 \text{ tpy}$$

A portion of the Ash Haul road will also be paved with the detailed emission calculations presented in Appendix B. A summary of the emissions from paved roads is presented in Table 3-22.

Table 3-22. Summary of Fugitive Emissions from Paved Roads

Emission Source	PM (lb/hr)	PM (tpy)	PM_{10} (lb/hr)	PM_{10} (tpy)
Main Access Road	0.05	0.23	0.01	0.04
Paved Ash Haul	1.39	6.07	0.27	1.18
Total Paved Roads	**1.44**	**6.30**	**0.28**	**1.23**

3.4.5 Additional Storage Silos

Consumers will have one (1) powdered activated carbon silo and one (1) sorbent (hydrated lime) silo. There will be two (2) dry urea silos. All four (4) silos will be equipped with 900 acfm fans with an outlet dust loading of 0.004 gr/dscf. For these sources, the short-term and annual emissions from fabric filters have been conservatively estimated assuming the design outlet grain loading (gr/dscf) and exhaust flow rates coupled with maximum operation.

Table 3-23. Summary of Emissions from the Additional Storage Silos

Operation	PM (lb/hr)	PM (tpy)	PM_{10} (lb/hr)	PM_{10} (tpy)
Flyash Storage Silo	0.34	1.79E-04	0.34	8.48E-05
Hydrated Lime Storage Silo	0.03	0.14	0.03	0.14
Powdered Activated Carbon Storage Silo	0.03	0.14	0.03	0.14
Dry Urea Storage Silo "A"	0.03	0.14	0.03	0.14
Dry Urea Storage Silo "B"	0.03	0.14	0.03	0.14
Total Emissions	**0.47**	**0.54**	**0.47**	**0.54**

3.4.6 Diesel Storage Tank

Consumers will have one (1) 10,000 gallon above ground, horizontal tank for storing diesel fuel. The emissions for the tank have been calculated utilizing USEPA's TANKS program, version 4.09d. Default values were used for all settings with a conservative turnover rate of once per week (52 turnovers/year). The TANKS program predicts the VOC emissions to be 7.2 lb/year for an annual average hourly emission rate of 8.2 E-04 lb/hr. Detailed results of the TANKS program are presented in Appendix B.

3.5 COOLING TOWER

As noted in Section 2.5 the cooling tower emissions consist of mineral compounds (particulate) when the mist from the cooling towers evaporate. The estimate of these particulate emissions is made according to AP-42 Section 13.4. According to this document "a *conservatively high* PM_{10} emission factor can be obtained by (a) multiplying the total liquid drift factor by the total dissolved solids (TDS) fraction in the circulating water and (b) assuming that, once the water evaporates, all remaining solid particles are within the PM_{10} size range." The two ASCPC cooling towers with 10 cells each will be equipped with drift eliminators designed to limit drift to 0.0005% of the circulating water flow. The emission rate calculation is shown in Table 3-24.

Table 3-24. Cooling Tower Particulate Emissions

Parameter	Value
Pumping rate of recirculation pumps (gal/min)	164,500
Flow of cooling water (lbs/hr)	82,217,100
TDS of blowdown (mg/l or ppmw)	4,000
Flow of dissolved solids (lbs/hr)	328,868
Fraction of flow producing drift [1]	0.31
Control efficiency of drift eliminators (gal drift/gal flow)	0.000005
Particulate emissions per tower (lbs/hr)	0.51
Particulate emissions per tower (tpy)	2.23
Particulate emissions per tower (g/sec)	0.064
Particulate emissions from each of 10 tower cells (g/sec)	0.0064
Air flow per cell (ACFM)	1,327,000
Temperature (°F)	98

[1] Technical Report USEPA-600-7-79-251a, p63

3.6 SUMMARY OF EMISSIONS

A summary of the emissions associated with the proposed ASCPC boiler, related ancillary equipment and material handling and storage operations is presented in Table 3-25.

Table 3-25. Summary of Emissions from the ASCPC Boiler and Related Operations

Pollutant	Total New Facility		ASCPC Boiler		Aux. Boiler		Diesel-fired Equip.		Material Handling		Cooling Tower		10,000 gallon Diesel Storage Tank	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
PM_{10} (filterable)	123.5	439.0	98.3	430.5	0.41	1.79	1.34	0.34	23.0	4.15	0.51	2.23	NA	NA
PM_{10} Total [1]	233.4	911.2	204.8	896.8	1.64	7.18	3.45	0.86	23.0	4.15	0.51	2.23	NA	NA
$PM_{2.5}$	230.4	908.1	204.8	896.8	1.64	7.18	3.45	0.86	20.00	1.01	0.51	2.23	NA	NA
SO_2	494.7	2,153.7	491.4	2,152.3	0.13	0.57	3.16	0.79	NA	NA	NA	NA	NA	NA
NO_x	451.7	1,820.5	409.5	1,793.6	4.0	17.3	38.3	9.6	NA	NA	NA	NA	NA	NA
CO	1,054.7	4,523.6	1,023.8	4,484.0	7.7	33.7	23.3	5.82	NA	NA	NA	NA	NA	NA
VOC	69.1	144.4	29.6	129.7	1.19	5.20	38.26	9.57	NA	NA	NA	NA	8.18E-04	3.59E-03
Lead	0.1	0.3	0.065	0.29	1.08E-04	4.72E-04	NA	NA	NA	NA	NA	NA	NA	NA
H_2SO_4 Mist	32.8	143.5	32.8	143.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorides, as HF	2.5	8.8	2.5	8.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TRS [2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7.41E-03	0.03	7.35E-03	0.03	5.61E-05	2.46E-04	NA	NA	NA	NA	NA	NA	NA	NA
Aggregate HAPs	26.1	114.2	25.7	112.4	0.41	1.78	0.06	0.02	NA	NA	NA	NA	NA	NA

Notes:

[1] The total particulate emissions are represented as the sum of the filterable and condensable particulate emissions.

[2] TRS represents the Total Reduced Sulfur, including H_2S.