of Wisconsin, Final Decision on Application for Elm Road Generating Station, page 26). More recently, the State of Wisconsin Division of Hearings and Appeals rendered an opinion in the permitting of the Elm Road Generating Station that the Wisconsin Department of Natural Resources did not err in excluding IGCC from its BACT/LAER analysis of the proposed PC-fired units based on the substantial differences in the process technology (Wisconsin Division of Hearings and Appeals, Findings of Fact, Conclusions of Law and Order dated February 3, 2005). Therefore, as an alternative technology consideration for the project, it was concluded that IGCC is currently a developmental technology that does not meet the following project-specific selection criteria:

1) IGCC is not commercially proven;
2) IGCC does not have proven availability experience consistent with the performance achieved by conventional coal fired power plant technologies, such as CFB or pulverized coal (PC). The best known IGCC operating availability is in the range of 70 percent versus an expectation of 90+ percent for NMU's needs;
3) Commercial risk of IGCC technology is currently considered higher than that of CFB or PC technology;
4) Current capital, operating and maintenance costs of IGCC technology are higher than for CFB technologies;
5) There are no known vendors or suppliers of IGCC technology that can offer the type of commercial package necessary to satisfy the requirements of NMU and its costs of power needs; and
6) The required footprint far exceeds the available site limitations.

2.5.2 Pulverized Coal (PC)

Pulverized coal fired boiler technology has been used by the utility industry and major industrial steam users as an efficient means of generating steam for direct thermal uses and/or electrical power generation over a long period of time. A further development of the technology in the later 20th century up to present day is the use of super-critical pulverized coal combustion, which further enhances the combustion efficiency of the process. Sub-critical pulverized coal boilers commonly operate in pressure ranges of 1,800 to 2,400 psia and steam temperatures of 950 F to

1,050 F. The more recent super-critical PC boiler technology pushes pressures in the range of 3,700 psia to over 4,000 psia and steam temperatures to 1,100 F and above.

PC technology has a long track record and is well proven over a wide range of unit capacities. The current trend toward super-critical cycles has been driven by the need to maximize cycle efficiencies, thus driving operating costs down and lowering emissions on a per MW basis. The development of super-critical technology has primarily focused on unit sizes in the 500 MW+ size ranges, which is well beyond the unit capacity needed by NMU. Although efficient, a super-critical cycle applied to a 10 MW power plant would be significantly higher in capital and operating costs than the CFB technology chosen.

Sub-critical PC technology has been used over a long period of time for steam and power generation greater than the size range needed for NMU's project. For years, it was the default technology of choice for coal-fired generation. The successful development of CFB combustion technology coupled with increasingly stringent environmental standards has led over the past 20 years to a situation where CFB, although marginally less efficient, has become the standard approach for unit capacities in the 250 MW and lower size range.

Another factor that separates CFB from sub-critical PC is fuel flexibility. PC units are designed to burn purely coal. A CFB unit can accommodate coal plus a range of opportunity fuels such as wood.

The selective use of opportunity fuels such as wood was a consideration in the selection of CFB combustion technology. The use of PC technology would not allow for this degree of fuel flexibility.

Therefore, as an alternative technology consideration for the project, it was concluded that neither sub-critical nor super-critical PC technology is appropriate to meet this Projects' selection criteria because:

1) Super-critical PC cycles are a good choice for major generating units at the 500-MW unit size and larger, but are not appropriate due to high capital and operating costs for a unit size of 10 MW.
2) For the 10 MW unit size planned, CFB has largely replaced sub-critical PC design as the technology of choice.
3) PC based combustion technology does not offer the fuel flexibility desired by NMU for this project.

3.0 SUMMARY OF APPLICABLE REQUIREMENTS

A new "major" stationary source of air pollution or a major modification at an existing major source is required to obtain an air permit through the new source review (NSR) process. Prevention of Significant Deterioration (PSD) new source review is required for sources located in attainment and unclassified areas. Non-attainment new source review (NANSR) is required in areas where monitoring data show that certain pollutant(s) are not meeting the applicable ambient air quality standard. These areas are referred to as non-attainment areas. A new source, or modification at an existing source, can be subject to both PSD and NANSR if the area in which the source is located is attainment for one or more pollutants and non-attainment for other pollutants, and the source is considered "major" for both the attainment and non-attainment pollutants.

3.1 FEDERAL REQUIREMENTS

Northern Michigan University is currently not a major stationary source as defined in the PSD regulations at 40 CFR 52.21, because the NMU facility's potential to emit of any regulated pollutant is limited to less than the major source threshold of 100 tons per year (tpy) by federally enforceable conditions of Permit No. 126-05. This permit was approved on July 21, 2005, and includes three (3) 70,000 lbs steam/hour; natural gas/No. 2 oil fired boilers and miscellaneous exempt equipment. Neither is the existing NMU facility a major source of hazardous air pollutants as defined in 40 CFR 63.2.

The existing facility is located approximately 60 miles from the nearest Class I area (Seney National Wildlife Refuge), which is located in Schoolcraft County. NMU's campus is located on the north side of the City of Marquette, Michigan, and is designated as an attainment/unclassified area for all pollutants subject to a National Ambient Air Quality Standard (NAAQS) under the Clean Air Act (CAA).

3.1.1 Prevention of Significant Deterioration (PSD)

The federal PSD regulations are codified in 40 CFR §52.21 and require that all major new or modified stationary sources located within an attainment area and emitting any pollutant regulated under the Clean Air Act (CAA) in excess of the applicable significance level be reviewed by the U.S. EPA, or the state agency, provided the state has an approved program. Michigan is a delegated state under PSD NSR and NANSR and issues permits on behalf of the U.S. EPA. A ***major stationary source*** is defined as any one of 28 listed source categories that have the potential to emit 100 tpy or more, or any other stationary source that has the potential to emit 250 tpy or more, of any criteria pollutant regulated under the Clean Air Act.

PSD review is used to determine whether significant air quality deterioration will result from the new or modified source. As part of the PSD review process, major sources are required to address the following items prior to issuance of a permit:

- Control technology review (BACT)
- Air quality analysis (monitoring)
- Ambient impact analysis
- Source information
- Additional impact analysis

The control technology review includes a determination of Best Available Control Technology (BACT) for the proposed project and equipment subject to PSD. The air quality analysis (pre-construction monitoring) requires that the source collect ambient air monitoring data in the impact area for at least one year prior to the start of construction. MDEQ has historically waived this requirement since air monitoring stations are currently being operated by the State and sufficient data exists. The ambient impact analysis requires a demonstration of compliance with federal and state air quality standards and allowable PSD Increments using computational models. Impacts on non-attainment areas may also be required if the source is expected to contribute to violations of any applicable air quality standard. Source information, including process design parameters and control equipment information, must be submitted with the permit application to the reviewing agency. Finally, an additional impact analysis of the proposed source on soils, vegetation, wildlife and visibility, especially on Class I PSD areas, may be required if requested by the state agency or any Federal Land Manager (FLM), as well as analysis of impacts due to increases in emissions and industrial growth in the community associated with the proposed source.

over 250 tons/yr

For 250 [illegible]

The CFB boiler is subject to a BACT review for $PM/PM_{10}/PM_{2.5}$, SO_2, NO_x, and CO under the PSD rules at 40 CFR 52.21(j), as the potential emission rates of SO_2 and CO will be greater than the major threshold of 100 tpy and $PM/PM_{10}/PM_{2.5}$ and NO_x are greater than their corresponding significant emission rate thresholds. The BACT analysis is provided in Section 5.0.

PSD review also requires a source impact analysis [40 CFR 52.21(k)] and additional impact analyses [40 CFR 52.21(o)]. The source impact analysis is presented in Section 6.0. This analysis demonstrates that the proposed facility will not cause or contribute to any violation of the applicable federal ambient air quality standards. Additional impact analyses are presented in Section 7.0, demonstrating that the proposed boiler will not adversely impact the Class I areas and will not impose any additional impacts.

3.1.2 New Source Performance Standards (NSPS)

U.S. EPA has promulgated a new source performance standard for industrial, commercial, institutional boilers at 40 CFR Part 60 Subpart Db. The General Provisions contained in Subpart A apply to all sources specified in the rest of the NSPS. These general requirements include, but are not limited to:

- Monitoring and reporting to assure that the particular source is in compliance with the applicable NSPS rules;
- Initial compliance testing to verify that the source meets the applicable limits specified in the applicable NSPS Subpart;
- Notification and recordkeeping.

Subpart Db – Industrial-Commercial-Institutional Steam Generating Units

Subpart Db applies to each steam generating unit ("boiler") that commences construction, modification or reconstruction after June 19, 1984, and that has a heat input capacity from fuels combusted in the boiler of greater than 100 MMBtu/hr. This subpart has been revised and the final rule amendments became effective on February 27, 2006.

Subpart Db contains emissions limits, compliance determination methods and procedures, and recordkeeping and reporting requirements. Specifically, it contains emissions standards for sulfur dioxide, particulate matter, and nitrogen oxides. These standards are as follows:

- 60.42b – Standard for Sulfur Dioxide: 0.20 lb/MMBtu or 90% Reduction
- 60.43b – Standard for Particulate Matter: 0.10 lb/MMBtu
- 60.44b – Standard for Nitrogen Oxides: 0.60 lb/MMBtu

3.1.3 National Emission Standards for Hazardous Air Pollutants (NESHAP)

Modified facilities, such as NMU, may be subject to the federal requirements for Hazardous Air Pollutants (HAPs) by either of two ways. The first step in determining applicability is to review the pollutant- and source-specific regulations promulgated in 40 C.F.R. §§61 and 63. These regulations are collectively known as the National Emission Standards for Hazardous Air Pollutants (NESHAPs). The second step for determining applicability is to evaluate whether the modification will be a major source of HAPs and, therefore, subject to the case-by-case Maximum Achievable Control Technology (MACT) requirements pursuant to Section 112(g) of the federal Clean Air Act should a federal NESHAP not exist.

Prior to the Clean Air Act Amendments of 1990, the U.S. EPA regulated a relatively small number of chemicals known as Hazardous Air Pollutants (HAPs). The initial list of HAPs included asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides and vinyl chloride. The regulations promulgated to control emissions of these chemicals are found at 40 C.F.R. §61. With the passage of the 1990 Clean Air Act Amendments, a list of 189 HAPs was adopted into law. A ***major source*** of Hazardous Air Pollutants is defined in Section 112 of the Clean Air Act, in part, as a stationary source that has the potential to emit 10 tons per year or more of any listed hazardous air pollutant or 25 tons per year of any combination of listed hazardous air pollutants subject to regulation under the Clean Air Act. The U.S. EPA was required to develop a listing of major source categories and area sources of HAPs and to promulgate regulations to control the emissions of HAPs from those sources. These regulations are found at 40 C.F.R. §63. U.S. EPA has not promulgated a NESHAP for utility boilers.

Case-By-Case MACT

Effective June 1998, a requirement for a case-by-case determination of the MACT applies to all new and reconstructed major sources of HAPs pursuant to Section 112(g) of the federal Clean Air Act and 40 C.F.R. §§63.40 to 63.44. The NESHAP for Industrial, Commercial, and Institutional Boilers and Process Heaters, 40 CFR Part 63, Subpart DDDDD became effective on September 13, 2004. This subpart applies to an industrial, commercial, and institutional boiler or process heater as defined in 63.7575, that is located at, or is part of a major source of HAP as defined in 63.2.

NMU is currently not a major source of HAP, and will remain an area (minor) source of HAPs after issuance of the air use permit. The maximum single HAP is estimated at 5.3 tons per year (HCl), and the maximum potential combined HAP emissions for NMU (new boiler plus existing boilers) will be 23.4 tons per year. These emission rates are based on full-year operation at 8760 hours per year. Therefore, the NESHAP requirements under 40 CFR Part 63, Subparts A and DDDDD will not apply to the proposed boiler, or the natural gas/No. 2 fuel oil boilers.

3.1.4 Prevention of Accidental Release

Section 112(r) of the Clean Air Act Amendments of 1990 directed the EPA to establish requirements in order to prevent the accidental release of a hazardous air pollutant. Due to the storage of bulk chemicals (e.g., anhydrous ammonia) for use in varied industries, EPA promulgated regulations that require facilities that store certain chemicals in amounts greater than the respective threshold quantity to prepare a Risk Management Plan (RMP) in order address how the chemicals will be stored and measures used to prevent their accidental release to the surrounding environment. The requirements governing accidental releases can be found in 40 C.F.R. Part 68 – Chemical Accident Prevention Provisions. These regulations are found in 40 CFR Part 68.

At this time, NMU is not proposing any storage tanks or vessels that would be subject to these regulations.

3.1.5 Compliance Assurance Monitoring

The Compliance Assurance Monitoring (CAM) rule (40 CFR Part 64) establishes criteria for monitoring certain air pollution control devices to provide reasonable assurance of compliance with emission limits and standards. As specified in 40 CFR 64.2(a), the CAM rule applies, on a pollutant specific basis, to each emission unit at a source that is a major source and is required to obtain a Michigan Renewable Operating Permit (Title V of the 1990 federal Clean Air Act) that meets all of the following:

- The unit is subject to an emission limitation or standard for the pollutant;
- The unit uses a control device to achieve compliance with the limit or standard; and
- Potential uncontrolled emissions of the pollutant are equal to, or greater than, part 70 major source thresholds for that pollutant (100 tpy of a criteria pollutant, 10 tpy of a single HAP, or 25 tpy of all HAPs combined).

Additionally, 40 CFR 64.2(b)(1)(i) specifies an exemption from the CAM rule that is applicable to this analysis. This section exempts emission units (on a pollutant specific basis) subject to the emission limitations or standards proposed by the EPA after November 15, 1990 pursuant to section 111 or 112 of the Act.

Since the proposed boiler is subject to the amended NSPS, 40 CFR 60, Subpart Db (effective date, February 27, 2006), it is exempt from the CAM rule for particulate matter and sulfur dioxide, pursuant to 64.2(b)(1)(i). No add-on control is being proposed for CO.

3.1.6 Federal Acid Rain Program

The proposed boiler is not a "utility boiler", as defined in section 402 of the Clean Air Act. Therefore, the boiler will not be subject to the Acid Rain Program Regulations under 40 CFR Parts 72 to 78.

3.2 MICHIGAN-SPECIFIC REQUIREMENTS

Michigan has developed regulations in order to both implement and supplement the federal requirements. Specifically, MDEQ has promulgated rules and regulations under the Natural Resources and Environmental Protection Act (Act 451 of 1994, As Amended) and Section 336 of the Michigan Compiled Law (MCL) for the control of air pollution.

Air Use Permit (Permit-to-Install) Overview

The State of Michigan requires that all sources of air pollution must obtain a Permit-to-Install prior to construction. Federal rules for Prevention of Significant Deterioration (PSD), 40 C.F.R. 52.21, also require a major modification of a major stationary source to obtain approval prior to beginning on-site construction of the major modification(s). Issuance of a State of Michigan Permit-to-Install will satisfy the federal requirement to obtain approval prior to constructing the modification. The State of Michigan is a federally delegated state for issuing PSD permits.

Prior to obtaining approval of a Permit-to-Install in Michigan, the source must demonstrate compliance with all applicable federal and state rules and regulations. This includes a public participation process, with an option for a public hearing, to allow all interested people the opportunity to make comments on the proposed modification.

The Permit-to-Install will include conditions covering the installation and operation of the equipment until a Renewable Operating Permit (ROP) is issued or modified to allow long-term operation of the modified source, assuming that the applicant has submitted an administratively complete application for a ROP within the time frame for obtaining a permit shield.

The Permit-to-Install conditions include some or all of the following: emission limits; equipment restrictions; design parameters; operating requirements; testing and sampling requirements; monitoring, recordkeeping and reporting. These are required to ensure that the source will continuously comply with the state and federal requirements applicable to the project.

Toxic Air Contaminants (TACs) Discussion

MDEQ Rules 224 to 232 (R 336.1224 to R 336.1232) regulate the emission of Toxic Air Contaminants (TACs) from new and modified emission units. The substantive requirements are contained in Rules 224 and 225, T-BACT Requirements for New and Modified Sources and Health-Based Screening Level Requirement for New and Modified Sources, respectively. The proposed project will be subject to Michigan Air Toxics requirements pursuant to Rules 224 and 225.

3.2.1 Best Available Control Technology for Toxics (T-BACT)

Michigan Rule 224 (R 336.1224) specifies that new or modified emission units cannot emit toxic air contaminants in excess of the maximum allowable emission rate based upon the application of best available control technology for toxics (T-BACT). However, Rule 224(2)(a)(iii) states that the requirement for T-BACT does not apply to "other toxic air contaminants that are particulate matter, if the standard promulgated under section 112(d) of the clean air act or the determination made under section 112(g) or 112(j) of the clean air act controls similar compounds that are also particulate matter." In this instance, EPA has promulgated a mercury emission limit under NESHAP for Industrial, Commercial, Institutional boilers equal to 3.0 E-06 lb/MMBtu heat input. Consequently, NMU is required to ensure that the emissions of Hg meet a limit representative of T-BACT. NMU is proposing to meet the NESHAP limit, which is considered the "MACT Floor" and equivalent to T-BACT for this project.

3.2.2 Health Based Screening Levels for Air Toxics

Michigan Rule 225 (R 336.1225) requires that the ambient concentrations ($\mu g/m^3$) produced by the emissions of toxic air contaminants (TACs) from the new or modified source be less than or equal to the screening levels that are established by the MDEQ – Air Quality Division (AQD). Screening levels for non-carcinogenic compounds are referred to as Initial Threshold Screening Levels (ITSLs), while screening levels for carcinogenic compounds are referred to as Initial Risk Screening Levels (IRSLs). Rule 226 (R 336.1226) contains exemptions from the requirements contained in Rule 225 and Rule 227 (R336.1227) and specifies methods for demonstrating compliance with the state air toxics rules, including methodologies for establishing screening levels.

The TAC emissions from the installation of the new CFB will consist of some trace metal compounds and HAPs. The potential TAC emission rates are presented in Appendix B and the ambient impacts of these TAC emissions have been shown to be in compliance with all of the applicable screening levels using the air quality modeling procedures contained in R 336.1240 and R 336.1241.

3.2.3 Requirement for Lower Emission Rate than Required by T-BACT

Rule 228 allows the department to determine, on a case-by-case basis, that the maximum allowable emission rate determined in Rules 224 or 225 may not provide adequate protection of human health or the environment. During a pre-application meeting with MDEQ on June 29, 2006, staff from MDEQ – Toxics Unit indicated that the emissions from the proposed facility are not at a level of concern to warrant any additional analysis to determine an emission rate lower than T-BACT.

3.2.4 Standards for Density of Emissions

Under Michigan Rule 301 (R 336.1301), visible emissions from processes and process equipment are limited to 20 percent opacity on a 6-minute average, with an allowance that one 6-minute average per hour may exceed 20 percent opacity provided it does not exceed 27 percent opacity. However, certain operations at the facility are subject to specific requirements contained in Michigan's Part 3 rules.

The level of particulate emissions proposed by NMU in this application are at or lower than the applicable PM and/or opacity standards for fuel burning equipment contained in Part 3 of the Michigan Air Pollution Control Rules. No other source specific criteria pollutant standards apply.

3.2.5 Emission Limitations and Prohibitions – Sulfur-Bearing Compounds

Michigan has adopted specific rules to limit the emissions of SO_2 from power plants. Specifically, Rule 401 limits the sulfur content in fuel for power plants to 1.0% for units capable of producing greater than 500,000 lbs of steam per hour. However, Rule 401 allows for an exemption from the sulfur in-fuel requirement if the facility is subject to a federal emission standard and requires only that the unit meet an emission rate based on the sulfur content in the fuel. Since the unit will be subject to a federal emission standard for SO_2 contained in 40 C.F.R. Part 60 (NSPS) and this emission limit is lower than that contained in Table 42 of Rule 401, the unit will be compliance with the Michigan Part 4 rules.

3.2.6 Emission Limitations and Prohibitions – New Sources of VOC Emissions

Michigan's Part 7 Rules require new sources of VOC not allow emissions in excess of the lowest maximum allowable emission rate, otherwise known as VOC BACT. The total net emissions of VOC will be less than significant emission threshold of 40 tpy. In addition, the CFB boiler will employ good combustion techniques in order to reduce the emission of volatile compounds from the unit and is considered BACT for VOC.

3.2.7 Emission Limitations and Prohibitions – Oxides of Nitrogen

Michigan's Part 8 Rules govern the level of emissions allowed by both SIP call and non-SIP call stationary sources and requires that units larger than 250 MMBtu/hr meet certain limits based on the season. Additionally, MDEQ is drafting new rules in order to implement the provisions of the Clean Air Interstate Rule (CAIR), which will augment the existing Part 8 rules.

NMU is proposing to meet an emission limit lower than the NSPS limit of 0.6 lb/MMBtu for emissions of NO_x from the new CFB.

4.0 SUMMARY OF EMISSION ESTIMATES

This section presents the emission estimates for the CFB unit and coal handling equipment as a result of installing the new boiler.

4.1 CIRCULATING FLUIDIZED BED BOILER EMISSION CALCULATIONS

The proposed CFB boiler is nominally rated at 185 MMBtu/hr heat input for coal firing and 205 MMBtu/hr heat input for 100% wood firing. The boiler will combust coal, wood, or a mixture of coal and wood and utilize limestone to control sulfur dioxide (SO_2), hydrogen chloride (HCl) and other acid gas (inorganic HAP) emissions (e.g. H_2SO_4 acid mist, HF, chlorine, etc.). In addition, a fabric filter (baghouse) will be installed to control particulate matter ($PM/PM_{10}/PM_{2.5}$), lead (Pb), and non-volatile metallic HAPs; a selective non-catalytic reduction (SNCR) system will be installed to control nitrogen oxides (NO_x) emissions; and good combustion controls and operating practices will be used to control emissions of carbon monoxide (CO), volatile organic compounds (VOC), and volatile organic HAPs (VOHAP).

The CFB boiler will use a mixture of fuels to produce a maximum gross heat input of approximately 185 MMBtu/hr. The primary pollutants that will be emitted from the CFB boiler will consist of particulate matter ($PM_{10}/PM_{2.5}$), SO_2, NO_x, and CO.

The emissions have been calculated on both a short-term (lb/hr) and long-term (tpy) basis. All annual calculations are based on continuous operation at 8,760 hours per year. The potential emissions of regulated pollutants and toxic air contaminants (TAC), including hazardous air pollutants (HAP) from the CFB boiler are summarized below and detailed in the attached Appendix B.

The potential emission rates of regulated pollutants from the proposed CFB boiler are listed in Table 4-1.

Table 4-1 Potential PSD-Regulated Pollutant Emission Rates from the CFB Boiler

Pollutant	Emission Rates			Basis
	lb/MM Btu	lb/hr	tpy	
PM/PM_{10} (filterable)	0.025	5.1	22.4	PSD-BACT
PM_{10} (filterable & condensable	0.03	6.2	26.9	PSD-BACT
SO_2 (1)	0.48	88.8	388.9	PSD-BACT
NO_x	0.10	20.5	89.8	PSD-BACT
CO	0.17	34.9	152.6	PSD-BACT
VOC (as Propane)	0.02	4.0	18.0	R702-BACT
Lead	1.34E-05	0.0025	0.011	(2)
H_2SO_4 Mist	6.1E-03	1.1	4.9	(3)
Fluorides (as HF)	0.01	0.2	0.7	T-BACT
Total Reduced Sulfur (including H_2S)(4)	NA	NA	NA	NA

Notes:

(1) SO_2 emission rates are based on 3.5 percent (average max.) sulfur coal and 92 percent reduction requirement per NSPS. The limits are also based on a 30-day rolling average.

(2) The lead estimated emission rates represents the maximum of PRB, bituminous, & wood fuels, and are based on a statistical analysis of respective typical coals, with a 99% control efficiency of the baghouse collector, with wood emissions being based on the AP-42 emission factor.

(3) Based on a BACT determination regarding the Plum Point Energy permit for an 800-MW pulverized coal fired utility boiler, located in Arkansas. The limit should be based on a 24-hour average.

(4) Due to the oxidation of fuels in the boiler, sulfur-bearing compounds will be oxidized to SO_2. Therefore, total reduced sulfur and reduced sulfur compounds, including H_2S are not likely to be formed and thus, will not be emitted.

4.1.1 Particulate Matter ($PM/PM_{10}/PM_{2.5}$)

PM = 10 PM = 2.5

The "significant net increase" threshold for $PM_{10}/PM_{2.5}$ emissions is 15 tpy. Recent EPA guidance for $PM_{2.5}$ requires that in the interim period between the dates of the $PM_{2.5}$ NAAQS designations and when EPA promulgates regulations to implement NANSR 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 flyash. A CFB boiler is specifically designed to reduce the amount of particulate emissions by utilizing a high temperature cyclone to capture the unburned portion of the ash and return it to the primary combustion chamber.

The boiler will be equipped with a cyclone and baghouse to control particulate matter (PM) emissions, including PM_{10} and $PM_{2.5}$. The baghouse will be designed to meet a PM/PM_{10} emission rate of 0.030 lb/MMBtu heat input (filterable and condensable) when firing coal, wood, or a mixture of coal and wood and is more stringent than the NSPS (Subpart Db) limit of 0.10 lb/MMBtu heat input (for coal and mixtures of coal with other fuels provided the annual capacity factor greater for other fuels is 10% or greater, by heat input), and the State Implementation Plan (SIP) – R 336.1331 PM limit of 0.30 lb/1,000 lbs exhaust gas, corrected to 50% excess air. The boiler will comply with the opacity limit established pursuant to R 336.1301(Rule 301(1)).

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

$$\boldsymbol{PM_{10}\ Emissions} = \frac{0.03\ lb}{MMBtu} \times \frac{205\ MMBtu}{hr} \times = \frac{6.15\ lb}{hr}$$

$$\boldsymbol{PM_{10}\ Emissions} = \frac{6.15\ lb}{hr} \times \frac{8760\ hr}{yr} \times \frac{1\ ton}{2000\ lb} = \frac{26.94\ ton}{yr}$$

Compliance with the PM/PM_{10} emission limits will be determined by conducting the performance tests required under the NSPS, Subparts A and Db. The facility will install, operate, certify and maintain a continuous opacity monitoring system (COMS) to demonstrate continuous compliance with the PM/PM_{10} and opacity limits.

4.1.2 Sulfur Dioxide (SO_2)

Sulfur dioxide emissions are proportional to the sulfur content of the coal. In order to minimize the SO_2 emissions, the boiler will be fired with bituminous coal with maximum sulfur content not to exceed 3.5 percent by weight and co-fired with limestone and wood, as available. The potential sulfur dioxide (SO_2) emissions will be reduced by the use of limestone, which will be mixed with the coal. Wood, as defined in 40 CFR 60.41b, will also be used as fuel and will be fired alone or co-fired with coal. The firing of wood alone or in combination with coal will reduce the potential SO_2 emissions from the boiler because wood contains very little sulfur. The boiler will be designed to meet the NSPS SO_2 emission limit of 0.20 lb/MM Btu heat input, or 8 percent (0.08)

NO. 1.5% at Marquette BPL

of the potential SO_2 emission rate (92 percent reduction) and 1.2 lb/MMBtu heat input, based on a 30-day rolling average. Based on the maximum 3.5 weight percent coal and 92 percent reduction requirement, the allowable SO_2 emission rate will be 0.48 lb/MMBtu.

$$\boldsymbol{SO_2\ Emissions} = \frac{0.48\ lb}{MMBtu} \times \frac{185\ MMBtu}{hr} \times = \frac{88.80\ lb}{hr}$$

$$\boldsymbol{SO_2\ Emissions} = \frac{88.80\ lb}{hr} \times \frac{8760\ hr}{yr} \times \frac{1\ ton}{2000\ lb} = \frac{388.94\ ton}{yr}$$

The facility will install, calibrate, maintain, and operate a continuous emission monitoring system (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 as required in 60.47b(a). Initial and continuous compliance with the SO_2 emission limits and percent reduction requirements will be determined using the CEMS. The initial performance test will be conducted over 30 consecutive operating days of the boiler. The first operating day included in the initial performance test will be scheduled within 60 days after achieving the maximum production rate at which the boiler will be operated, but not later than 180 days after initial startup of the boiler. Compliance with the SO_2 emission limit and percent reduction requirements will be determined using a 30-day rolling average at the end of each steam generating unit operating day.

4.1.3 Nitrogen Oxides (NO_x)

Nitrogen oxides (NO_x) 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 NO). Fuel NO_x is formed when the nitrogen in the fuel (fuel-bound nitrogen) is combined with oxygen in the combustion air form nitrogen oxides. When firing natural gas, or other gaseous fuels, thermal NO_x is the primary mechanism through which NO_x is formed since the concentration of nitrogen in natural gas is negligible. However, when firing solid fuel (i.e., coal) or liquid (i.e., distillate or waste oils) fuels in the boiler, a greater percentage of the total NO_x formed is due to the release of fuel-bound nitrogen in the fuel. Through proper design and good combustion practices the formation of NO_x can be limited by controlling the peak combustion temperature, gas residence time at peak temperature, and the air-to-fuel ratio. CFB's have been specifically designed to burn at temperatures that are lower than the prime temperatures in which NO_x is formed.

The boiler will be equipped with SNCR to reduce the nitrogen oxides emissions. The CFB boiler and SNCR system will be designed to achieve a NO_x emission rate of 0.10 lb/MMBtu heat input when firing coal, wood, or a mixture of coal and wood. This limit is based on BACT determinations pursuant to 40 CFR 52.21(j). The limit is based on a 30-day rolling average and is more stringent than the applicable NSPS limit of 0.60 lb/MMBtu heat input.

$$\boldsymbol{NO_x\ Emissions} = \frac{0.10\ lb}{MMBtu} \times \frac{205\ MMBtu}{hr} \times = \frac{20.50\ lb}{hr}$$

$$\boldsymbol{SO_2\ Emissions} = \frac{20.50\ lb}{hr} \times \frac{8760\ hr}{yr} \times \frac{1\ ton}{2000\ lb} = \frac{89.79\ ton}{yr}$$

The facility will install, calibrate, maintain, and operate continuous emission monitoring systems (CEMS) for measuring NO_2 concentrations, with either O_2 or carbon dioxide CO_2 concentrations, and will record the output of the systems. Initial and continuous compliance with the NO_x emission limit will be determined using the CEMS.

4.1.4 Carbon Monoxide (CO)

CO 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 not sufficient turbulence (or mixing) of the combustion gases or if there will be a combination of these conditions in the combustion chamber.

Based on the experience of Cummins & Barnard, Inc. (C&B) and review of the RACT/BACT/LAER Clearinghouse (RBLC), an emission factor of 0.17 lb/MMBtu heat input was used to evaluate the emissions from the CFB boiler. It was determined that the CO emissions