Statement of Basis

Air Quality Construction Permit

Otter Tail Power Company
Big Stone Power Plant

Big Stone City, South Dakota

South Dakota Department of Environment and Natural Resources

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1.0 BACKGROUND

Otter Tail Power Company operates the Big Stone power plant near Big Stone City, South Dakota. The Big Stone power plant is co-owned by NorthWestern Corporation d/b/a NorthWestern Energy, Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc., and Otter Tail Power Company. The Big Stone power plant is a steam to electric energy conversion facility which uses subbituminous coal as the primary fossil fuel. The power plant also supplies steam to the adjacent POET Biorefining facility. The primary Standard Industrial Classification (SIC) code is 4911 – Electric Services. Big Stone's operating permit was set to expire on June 9, 2014. However a renewal application was submitted to the Department of Environment and Natural Resources (DENR) on December 2, 2013. This was considered timely and in accordance with ARSD 74:36:05:08 Big Stone may continue to operate under the current permit until a renewal is issued.

On January 6, 2012, Big Stone was issued a construction permit for the installation of pollution controls and associated equipment at the Big Stone facility. The Air Quality Control System (AQCS) project is the outcome of a Best Available Retrofit Technology (BART) determination under the State of South Dakota's Regional Haze Program (ARSD 74:36:21) and the State Implementation Plan (SIP). This permit was revised on September 30, 2013 to account for changes in the design of AQCS.

On June 2, 2014, Big Stone submitted an application for a new construction permit to DENR. This application proposes the removal of the five baghouses associated with Units 6 and 7a-d. The proposal calls for the addition of a single large baghouse in order to control the emissions from all 5 units. The new baghouse would increase the possible air flow rate from 132,000 actual cubic feet per minute (ACFM) (4 baghouses at 30,500 (ACFM) and one at 12,000 ACFM) to a maximum of 200,000 ACFM. It should be noted that this proposal does not request any changes to the coal receiving operations; it simply seeks to change the control system.

1.1 Existing Permitted Equipment

Table 1-1 provides a list of units covered under the existing Title V air quality operating permit for the Big Stone power plant that are affected by the proposed construction.

Table 1-1 – List of permitted processes and equipment

Unit	Description	Operating Rate	Control Device
#6	Rotary car dumper conveyor.	3,000 tons per hour	Baghouse
#7a	Rotary car dumper building.	3,000 tons per hour. The maximum capacity may increase to 3,600 tons per hour during the term of this permit.	Baghouse
#7b			Baghouse
#7c			Baghouse
#7d			Baghouse

1.2 Proposed Equipment Changes

Table 1-2 provides the details of the proposed changes to the existing equipment listed above. It should be noted that DENR is removing the stipulation that Big Stone may increase the maximum capacity of Unit #7 during the duration of this permit. This stipulation was incorporated when DENR allowed for potential changes be written into permit renewals. However, these types of changes are now handled through DENR's air quality construction permit program and the ambiguity will be removed the next time the permit is opened.

Table 1-2 – List of permitted processes and equipment

Unit	Description	Operating Rate	Control Device
#6	Rotary car dumper conveyor.	3,000 tons per hour	200,000 actual cubic feet per minute baghouse
	Rotary car dumper building.		

2.0 New Source Performance Standards

DENR reviewed the new source performance standards under 40 CFR Part 60 and determined there are no New Source Performance Standards applicable to the proposed revisions.

3.0 New Source Review

ARSD 74:36:10:01 states that New Source Review (NSR) regulations apply to areas of the state which are designated as nonattainment pursuant to the Clean Air Act for any pollutant regulated under the Clean Air Act. Big Stone power plant is located near Big Stone City, South Dakota, which is in attainment or unclassifiable for all the pollutants regulated under the Clean Air Act. Therefore, the Big Stone power plant is not subject to NSR review.

4.0 Prevention of Significant Deterioration

The original Prevention of Significant Deterioration (PSD) rules in effect prior to March 1, 1978, were published in the Federal Register on December 5, 1974. These rules applied to the following 17 specific source categories and which were constructed after June 1, 1975:

1. Fossil-Fuel Steam Electric Plants of more than 1,000 million Btus;
2. Kraft Pulp Mills;
3. Portland Cement Plants;
4. Primary Zinc Smelters;
5. Iron and Steel Mills;
6. Primary Aluminum Ore Reduction Plants;
7. Primary Copper Smelters;

8. Municipal Incinerators capable of charging more than 250 tons of refuse per 24 hour day;
9. Sulfuric Acid Plants;
10. Petroleum Refineries;
11. Lime Plants;
12. Phosphate Rock Processing Plants;
13. By-Products Coke Oven Batteries;
14. Sulfur Recovery Plants;
15. Carbon Black Plants;
16. Primary Lead Smelters; and
17. Fuel Conversion Plants.

Big Stone power plant is considered a fossil-fuel steam electric plant of more than 1,000 million Btus, which is one of the 17 named PSD source categories. However, Big Stone commenced construction prior to June 1, 1975, and was not required to obtain a PSD permit under the original PSD rules.

Under the current PSD rules, a PSD review applies to new major stationary sources and major modifications to existing major stationary sources in areas designated as attainment under Section 107 of the Clean Air Act for any regulated pollutant. The following is a list of regulated pollutants under the PSD program:

1. Total suspended particulate matter (TSP);
2. Particulate matter 10 microns in diameter or less (PM10);
3. Particulate matter 2.5 microns in diameter or less (PM2.5);
4. Sulfur dioxide (SO_2);
5. Nitrogen oxides (NOx);
6. Carbon monoxide (CO);
7. Ozone – measured as volatile organic compounds (VOCs);
8. Lead;
9. Greenhouse gases (carbon dioxide, nitrous oxide, methane, etc.)
10. Fluorides;
11. Sulfuric acid mist;
12. Hydrogen sulfide;
13. Reduced sulfur compounds; and
14. Total reduced sulfur.

If the source is considered one of the 28 named PSD source categories listed in Section 169 of the federal Clean Air Act, the major source threshold is 100 tons per year of any regulated pollutant, except for greenhouse gases. The major source threshold for all other sources is 250 tons per year of any regulated pollutant, except for greenhouse gases.

The major source threshold for greenhouse gases is given below:

1. New PSD source because of a criteria air pollutant, the major source threshold for greenhouse gases is 75,000 tons per year of carbon dioxide equivalent or more;

2. New PSD source if greenhouse gas emissions are 100,000 tons per year of carbon dioxide equivalent or more;
3. For an existing PSD source because of a criteria air pollutant, a major modification for greenhouse gases is an increase of 75,000 tons per year of carbon dioxide equivalent or more;
4. For an existing non-PSD source that has the potential to emit 100,000 tons per year of carbon dioxide equivalent emissions or more, a major modification for greenhouse gases is an increase of 75,000 tons per year of carbon dioxide equivalent or more; and
5. In addition to subsection (2) and (4), a specific greenhouse gas, without calculating the carbon dioxide equivalent, also needs to emit greater than 100 or 250 tons per year, whichever is applicable, to be regulated.

The Big Stone power plant is considered a major source; therefore, any changes to the existing facility require evaluation to determine whether the proposed change is considered a major modification under the PSD program. A major modification under PSD is defined as any physical change or change in the method of operation of a major source resulting in a significant emissions increase of a regulated pollutant and a significant net emissions increase of that pollutant. A significant emissions increase under PSD is defined as a net emissions increase or the potential emissions increase that equals or exceeds the pollutant specific thresholds in Table 4-1 and/or, major modifications constructed within 10 kilometers of a Class I area, that impact a Class I area equal to or greater than 1 microgram per cubic meter ($\mu g/m^3$) (24-hour average). The Big Stone power plant is not located within 10 kilometers of a Class I area.

Table 4-1 PSD major modification thresholds

Pollutant	**Threshold [1]**
TSP	25 tons per year
PM10	15 tons per year
PM2.5	10 tons per year
SO_2	40 tons per year
NO_x	40 tons per year
CO	100 tons per year
Ozone[2]	40 tons per year
Lead	0.6 tons per year
Fluorides	3 tons per year
Sulfuric Acid Mist	7 tons per year
Hydrogen Sulfide	10 tons per year
Total Reduced Sulfur[3]	10 tons per year
Reduced Sulfur Compounds [3]	10 tons per year
Municipal waste combustor organics[4]	0.0000035 tons per year
Municipal waste combustor metals[5]	15 tons per year
Municipal waste combustor acid gases[6]	40 tons per year
Municipal waste combustor landfills emissions[7]	50 tons per year

1-Taken from 40 CFR § 52.21(b)(23)(i)
2- Measured as VOC of NO_x emissions
3- Including Hydrogen Sulfide emissions

4- Measured as total tetra-through octa-chlorinated dibenzo-p-dioxins and dibenzofurans
5- Measured as particulate matter
6- Measured as sulfur dioxide and hydrogen chloride
7- Measured as nonmethane organic compounds

The PSD regulations establish the following procedure for determining if a proposed project is subject to a PSD review:

1. Determine the potential increase in emissions from the proposed project and compare it to the significant emission rates in 40 CFR §52.21(b)(23). If the potential increase (does not include or consider any proposed decreases resulting from the proposed project) is greater than the significant emission rate, proceed; if not, the source is not subject to a PSD review.
2. Determine the beginning and ending dates of the contemporaneous period as it relates to the proposed modification.
3. Determine which emissions units at the source experienced (or will experience, including any proposed decreases resulting from the proposed project) a creditable increase or decrease in emissions during the contemporaneous period.
4. Determine which emissions changes are creditable.
5. Determine, on a pollutant-by-pollutant basis, the amount of each contemporaneous and creditable emissions increase and decrease.
6. Sum all contemporaneous and creditable increases and decreases with the increase from the proposed modification to determine if a significant net emissions increase will occur.

Since the proposed construction at Big Stone is a control device, and does not involve the addition of any new emission units, DENR can determine the potential increase in emissions for the proposed construction by subtracting the baseline actual emissions from the projected actual emissions. This is in accordance with 40 CFR § 52.21 (a)(2)(iv)(*c*). The results can then be compared to major modification thresholds listed above to determine applicability to PSD evaluation.

4.1 Projected Actual Emissions and Baseline Actual Emissions Calculations

The proposed construction at Big Stone will limit particulate emissions from the rotary car dumber building. The only potential regulated pollutant emitted from the proposed baghouse is particulate matter. Therefore only particulate emissions will be evaluated.

Projected actual emissions are defined as the maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a regulated pollutant in any one of the 5 years following the date the unit resumes regular operation. The definition also allows for a 10 year window if the emission units design capacity increases, or the potential to emit regulated pollutant increases and a full utilization of the unit would result in a significant emission increase or a significant net emission increase at the major stationary source. Baseline actual emissions are defined as the average tons per year emitted during any consecutive 24-month period within the 5 years immediately preceding when the owner or operator begins the proposed construction.

Projected actual emissions could possibly be based on the traditional definition of potential emissions. However it is unrealistic that Big Stone would operate the conveyors every hour of every day, as their operation is dependent on having train cars to unload. Therefore a more realistic limiting factor will be found. It is reasonable to assume Big Stone would not receive more coal than it could physically burn in a given year, as the coal reserves are continually kept full. Given this information, DENR will use the maximum heat input to calculate projected actual emissions for Big Stone's proposed construction. The values calculated from this should be considered conservative as it is based on Big Stone operating at full capacity at all times.

Big Stone's main boiler has a maximum permitted heat input of 5,609 million British Thermal Units (MMBtus) per hour. If the unit is operated at full power for the whole year it would have heat input of 49,134,840 MMBtus per year. Big Stone submitted documents claiming an average heating value of 8,292 Btus per pound of coal. By dividing the heat input by the heating value of the coal, DENR determined a projected actual coal usage to be 2,962,786 tons per year. Finally dividing by the Big Stone provided average process rate of 2,582.5 tons per hour it can be calculated that the system would need to operate 1,147.3 hours. These operational hours will be used to calculate the projected actual emissions for the proposed unit.

As stated above the Baseline actual emissions have a very specific definition and require an average of the emissions from 2 consecutive years. Big Stone provided information from the 2012 and 2013. This information will be used as the baseline actual emissions for the facility.

Additionally the emission calculations are partially based on air flow through the baghouse. For example, Big Stone provided DENR with two numbers for the proposed baghouse; the 200,000 acfm air flow rate and 0.01 grains per dry standard cubic feet (gr./dscf). Before potential emissions can be calculated the air flow needs to be converted to dry standard cubic feet per minute (dscfm). This is done using standard conditions of 20 degrees Celsius (~68 degrees Fahrenheit or 528 Rankine) and 1 atmosphere (~14.7 pounds per square inch), worst case local conditions of -40 degrees Celsius (-40 degrees Fahrenheit or 420 Rankine) and 0.96 atmosphere (14.11 pounds per square inch, and Equation 4-1. Due to the low evaluation temperature DENR is considering moisture content to be negligible. Finally Equation 4-2 is used to calculate the potential emissions. The results are summarized in Table 4-2.

Equation 4-1 acfm to dscfm Conversion

$$dscfm = (acfm)\frac{(528\ Rankine)x(Local\ \mathrm{Pr}essure\ pounds\ per\ square\ inch)}{(Local\ Temperature\ Rankine)x(14.7\ pounds\ per\ square\ inch)}$$

Equation 4-2 Potential Emissions

$$Ton/Year = \frac{\frac{EmissionRate(\frac{gr.}{dscf})}{7{,}000(\frac{gr.}{pound})} \times FlowRate(dscfm) \times 60\frac{\min utes}{Hour} \times Operational\frac{hours}{year}}{2000\frac{pounds}{tons}}$$

Table 4-2 – Projected and Baseline Actual Particulate Emissions

Unit	Flow Rate (acfm)	Flow Rate (dscfm)	Baseline Actual Coal Usage (tons/year)	Hours per year	Emission Rate (gr/dscf)	Baseline Actual Emissions $PM_{10}/PM_{2.5}$ (ton/year)
Baseline Actual Emissions						
#6	12,000	14,484	1,991,550	742.4	0.02[1]	0.9
#7a-d	122,000	147,254	1,991,550	742.4	0.02[1]	9.4
					Total	**10.3**
Unit	**Flow Rate (acfm)**	**Flow Rate (dscfm)**	**Projected Actual Coal Usage (tons/year)**	**Hours per year**	**Emission Rate (gr/dscf)**	**Projected Actual Emissions $PM_{10}/PM_{2.5}$ (ton/year)**
Projected Actual Emissions						
new	200,000	241,400	2,962,786	1,147.3	0.01	11.9
					Total	**11.9**

1- Listed in Big Stones application

Based on the provided information, the projected actual emissions at the facility are 11.9 tons per year and the baseline actual emissions are 10.3. That amounts to a 1.6 ton per year difference. This is less than the 10 ton major modification threshold for PM2.5. Therefore based on the information provided to DENR the proposed construction will not be considered a major modification and no further PSD evaluation is necessary.

4.2 Stack Testing and Limit

In accordance with ARSD 74:36:09:02 and 40 CFR 52.21(b) (4), the PSD program defines potential to emit as the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Since DENR used an operational limit to establish the projected actual emission calculations, the calculations are tantamount to the potential to emit under the PSD program. The definition states that air pollution control equipment can only be considered part of the design if the effects on emissions are federally enforceable. Therefore, DENR will require a federally enforceable PM10 limit of 0.01 gr/dscf be placed in the permit.

In order to ensure compliance with this limit, DENR will require a performance test. Although

the limit is a PM10 limit DENR will accept any particulate test approved by the EPA (i.e. Method 5, 5I, or 201 and 202) as long as it demonstrates compliance with the 0.01 gr./dscf PM10 limit. This is because all emissions coming from the baghouse should be less than 2.5 microns and therefore the same in any of the tests regardless if it is designed for totals suspended particulate, PM10, or PM2.5.

It should be noted that the PSD program requires the actual projected emissions to be monitored for 10 years after to ensure the validity of the calculations. DENR already requires that all emissions be submitted to the department for the annual operational report under the operational permit. This reporting should be sufficient to demonstrate compliance. Since Big Stone only has 1 year after startup of the proposed construction to add the proposed unit to the operational permit DENR will not include specific reporting requirements in this permit. However, DENR will require annual records to be kept for the unit permitted under this permit.

5.0 National Emission Standards for Hazardous Air Pollutants

DENR reviewed the National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR Part 61 and determined that there are no NESHAP standards applicable to Otter Tail Power Company's proposed revisions.

6.0 Maximum Achievable Control Technology Standards

DENR reviewed the Maximum Achievable Control Technology (MACT) standards and determined that there are no promulgated maximum achievable control technology standards applicable to the proposed construction.

7.0 State Emission Limits

The State of South Dakota has established total suspended particulate matter and sulfur dioxide emission limits in ARSD 74:36:06 and a standard for opacity in ARSD 74:36:12. In accordance with ARSD 74:36:12:01, each unit is subject to a visible emission limit of less than 20 percent opacity.

In accordance with 74:36:06:01 and 74:36:06:05 the state particulate limit does not apply, as Big Stone is taking a limit on emissions, and the 0.01 gr/dscf at 200,000 acfm (21.2 pounds per hour) is more stringent than the state limit for a 3,000 ton per hour unit (266.2 pounds per hour).

8.0 Air Quality Construction Permit

In accordance with ARSD 74:36:20:04, Big Stone is required to obtain a construction permit for the proposed Dust Collection System because it is required to take a limit to avoid PSD permitting. Big Stone will be required to submit an application for a modification to the Title V air quality operating permit within 12 months of startup of the Dust Collection System.

9.0 Recommendation

Otter Tail Power Company will be required to comply with the requirements stipulated in the following regulations:

1. ARSD 74:36:05 – Operating Permits for Part 70 Sources;
2. ARSD 74:36:11 – Performance Testing;
3. ARSD 74:36:12 – Control of Visible Emissions; and
4. ARSD 74:36:20 – Construction Permits for New Sources or Modifications;

Based on the information submitted in the air quality permit application, DENR recommends conditional approval of an air quality construction permit revision for Otter Tail Power Company for the Big Stone Power Plant near Big Stone City, South Dakota. Questions regarding this permit review should be directed to John Conklin, Engineer I.