

**SOUTH DAKOTA PUBLIC UTILITIES COMMISSION**

**CASE NO. EL05-022**

**IN THE MATTER OF THE APPLICATION BY OTTER TAIL POWER COMPANY**

**ON BEHALF OF THE BIG STONE II CO-OWNERS**

**FOR AN ENERGY CONVERSION FACILITY SITING PERMIT FOR THE**

**CONSTRUCTION OF THE BIG STONE II PROJECT**

**DIRECT TESTIMONY**

**OF**

**DAVID GAIGE, P.E.**

**SENIOR PROJECT MANAGER, ENVIRONMENTAL STUDIES AND PERMITTING**

**BURNS & McDONNELL ENGINEERING COMPANY**

**MARCH 15, 2006**



**TESTIMONY OF DAVID GAIGE, P.E.**

**TABLE OF CONTENTS**

1

2

3 I. INTRODUCTION..... 1

4 II. PURPOSE AND SUMMARY OF TESTIMONY ..... 2

5 III. APPLICABLE REGULATORY REQUIREMENTS..... 3

6 IV. PREVENTION OF SIGNIFICANT DETERIORATION ..... 4

7 V. BEST AVAILABLE CONTROL TECHNOLOGY (BACT) ANALYSIS ..... 5

8 VI. PROTECTION OF AIR QUALITY ..... 11

1           **BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION**

2                           **DIRECT TESTIMONY OF DAVID GAIGE, P.E.**

3   **I.     INTRODUCTION**

4   **Q:     Please state your name and business address.**

5   A:     David Gaige, P.E., Burns & McDonnell Engineering Co., 9785 S. Maroon Circle,  
6   Centennial, Colorado 80112.

7   **Q:     By whom are you employed, and in what capacity?**

8   A:     Burns & McDonnell Engineering Co., as a Senior Project Manager in the Environmental  
9   Studies and Permitting Division.

10 **Q:     What is your educational background?**

11 A:     I received a Bachelor of Science Degree from Texas Tech University in 1970 and a  
12 Master of Science Degree from Colorado State University in 1974. I have been a registered  
13 Professional Engineer in the State of Colorado since 1977.

14 **Q:     What is your employment history?**

15 A:     I began my career working for a state regulatory agency. Prior to returning to school to  
16 obtain my Master's degree, I worked as permit review engineer for the Colorado Air Pollution  
17 Control Agency.

18 **Q:     What are your responsibilities in your current position?**

19 A:     I am involved in all aspects of assisting clients obtain environmental approvals for  
20 proposed projects. This includes preparation of environmental impact statements, preparation of  
21 compliance plans to assure compliance with regulatory requirements, and preparation of permit

1 applications in compliance with applicable regulations including prevention of significant  
2 deterioration and new source review.

3 **Q: What work experience have you had relating to air quality permitting?**

4 A: I prepared one of the first Prevention of Significant Deterioration (PSD) applications for  
5 a coal-fired power plant in the country. I have also developed Best Available Control  
6 Technology (BACT) limitations for several large sources including combustion turbines, coal  
7 fired steam electric generation, mining and manufacturing.

8 **Q: What professional organizations do you belong to?**

9 A: I am an active member of the Air & Waste Management Association (AWMA) and the  
10 American Society of Mechanical Engineers (ASME).

11 **Q: What classes and other training have you taken relating to air pollution control?**

12 A: I have taken several Air Pollution Training courses offered by EPA.

13 **II. PURPOSE AND SUMMARY OF TESTIMONY**

14 **Q: What is the purpose of your testimony?**

15 A: The purpose of my testimony is to address the potential air quality impacts of the Big  
16 Stone Unit II Project and the various South Dakota regulations relating to it.

17 **Q: Please summarize your testimony.**

18 A: South Dakota is presently in compliance with all ambient air quality standards. The Big  
19 Stone Unit II Project will require a PSD Permit. The PSD program requires the installation of  
20 BACT, which I describe for Big Stone Unit II later in my testimony. The Big Stone Unit II plant  
21 will not cause a violation of the National Ambient Air Quality Standards or the PSD increments.

1 **III. APPLICABLE REGULATORY REQUIREMENTS**

2 **Q: What state regulations concerning air emissions are applicable to Big Stone Unit II?**

3 A: The following Administrative Rules of South Dakota (ARSD) are applicable:

- 4 • ARSD 74:36:05 - Operating Permits for Part 70 Sources
- 5 • ARSD 74:36:06:02 - Allowable Emissions for Fuel-Burning Units
- 6 • ARSD 74:36:07 - New Source Performance Standards
- 7 • ARSD 74:36:08 - National Emission Standards for Hazardous Air Pollutants
- 8 • ARSD 74:36:09 - State Origin PSD Review
- 9 • ARSD 74:36:10 - New Source Review
- 10 • ARSD 74:36:11 - Performance Testing
- 11 • ARSD 74:36:12 - Control of Visible Emissions
- 12 • ARSD 74:36:13 - Continuous Emission Monitoring Systems
- 13 • ARSD 74:36:16 - Acid Rain Program

14 **Q: How are these regulations implemented in South Dakota?**

15 A: EPA delegated the authority to implement the federal PSD regulations in South Dakota to  
 16 the South Dakota Department of Environment and Natural Resources (DENR). Other state  
 17 regulations that apply to the Big Stone facility implement other federal programs, including the  
 18 operating permit program under Title V of the Clean Air Act; the National Emissions Standards  
 19 for Hazardous Air Pollutants (NESHAP); New Source Performance Standards (NSPS); and Title  
 20 IV of the Clean Air Act, which regulates acid rain. All applicable regulations are detailed in the  
 21 air permit application that the Applicants filed on July 20, 2005 with the DENR.

1 **IV. PREVENTION OF SIGNIFICANT DETERIORATION**

2 **Q: Which regulation establishes the requirements for PSD review?**

3 A: The PSD review is found in ARSD 74:36:09, which includes a requirement to analyze  
4 BACT.

5 **Q: Please discuss how the PSD regulation applies to the Big Stone Unit II Project.**

6 A: In accordance with New Source Review requirements, the existing Big Stone Unit I is a  
7 major stationary source. The addition of the second unit, Big Stone Unit II, is a major  
8 modification subject to the provisions of PSD because the annual emissions of certain pollutants  
9 from Big Stone Unit II exceed the amount set in the regulations identifying a major modification.

10 **Q: Are SO<sub>2</sub> and NO<sub>x</sub> regulated under PSD for Big Stone Unit II permitting purposes?**

11 A: No. Due to the controls that are being installed to control SO<sub>2</sub> and NO<sub>x</sub> emissions, the  
12 net increase estimated for these pollutants is below the *de minimis* threshold for PSD review.

13 **Q: Is lead regulated under PSD for Big Stone Unit II permitting purposes?**

14 A: No. The potential emissions of lead are below the PSD threshold of 0.6 tons per year.

15 **Q: Why is mercury not regulated under PSD for Big Stone Unit II permitting  
16 purposes?**

17 A: Mercury compounds are excluded from PSD review by the 1990 Clean Air Act  
18 Amendments because they are listed as a hazardous air pollutant (HAP), and HAPs are exempt  
19 from BACT. On March 15<sup>th</sup> of 2005, mercury emissions limits were proposed under the Clean  
20 Air Mercury Rule (CAMR). In accordance with CAMR requirements, an emission limit will be  
21 established for this pollutant, but it is not as a result of the PSD BACT determination.

22 **Q: What does a PSD permit application consist of?**

1 A: The PSD application consists of the following:

- 2 • A description of the project and a case-by-case BACT determination;
- 3 • An air quality analysis to determine if the project will cause or significantly
- 4 contribute to a violation of the National Ambient Air Quality Standards (NAAQS)
- 5 or PSD increment; and
- 6 • An assessment of the effects on visibility, industrial growth, soil, and vegetation.

7 **V. BEST AVAILABLE CONTROL TECHNOLOGY (BACT) ANALYSIS**

8 **Q: What does BACT mean?**

9 A: The acronym stands for Best Available Control Technology, but it actually means an  
 10 emission rate (rather than a technology) that is determined to be “best” for the specific  
 11 application. The South Dakota state regulations defer to the federal definition of BACT.

12 **Q: What are the limits for BACT?**

13 A: No emissions, including the emission limit proposed as BACT, can exceed the applicable  
 14 limits established in the federal regulations for new source performance standards (40 CFR 60),  
 15 or the national emission standards for hazardous air pollutants established in the federal  
 16 regulations (40 CFR 61). The equipment that will be affected by the proposed modification will  
 17 be subject to 40 CFR Part 60, Subpart Da for the Big Stone Unit II boiler, 40 CFR Part 60,  
 18 Subpart Y for the coal storage, transfer, and loading systems; and 40 CFR Part 60, Subpart IIII  
 19 for the diesel generator. Additionally, the diesel generator and fire pump is subject to the  
 20 National Emission Standard for Hazardous Air Pollutants (NESHAP) 40 CFR Part 61, Subpart  
 21 ZZZZ.

22 **Q: Does it matter whether the chosen BACT level is measurable and testable?**

1 A: It is important that the BACT level be measurable and testable to be able to demonstrate  
 2 that the unit or source is able to achieve the BACT emission rate. The ability to demonstrate  
 3 compliance with the permit conditions makes the permit enforceable. Without the ability to  
 4 demonstrate compliance neither the source nor the regulatory agency would be able to determine  
 5 if BACT was being achieved. There are some cases where the imposition of an emissions  
 6 standard would be infeasible (e.g., where emission cannot be measured), and BACT is described  
 7 as a design or piece of equipment, work practice, operational standard, or a combination of these.  
 8 In such a case, the means to determine compliance is also described.

9 **Q: How is a BACT analysis conducted?**

10 A: In nonbinding guidance from the EPA, EPA suggests a “top-down” BACT process as  
 11 follows:

12 “In brief, the top-down process provides that all available control technologies be ranked  
 13 in descending order of control effectiveness. The PSD applicant first examines the most  
 14 stringent--or “top”--alternative. That alternative is established as BACT unless the  
 15 applicant demonstrates...that technical considerations, or energy, [secondary]  
 16 environmental, or economic impacts justify a conclusion that the most stringent  
 17 technology is not “achievable” in that case. If the most stringent technology is eliminated  
 18 in this fashion, then the next most stringent alternative is considered, and so on.”

19 The 1990 Workshop Manual identifies the basic steps of a top-down BACT analysis as follows:

- 20 Step 1 – Identify all control technologies
- 21 Step 2 – Eliminate all technically infeasible control technologies
- 22 Step 3 – Rank control technologies by control effectiveness



1 Step 4 – Evaluate most effective controls and document results

2 Step 5 – Select BACT

3 The EPA has consistently interpreted the statutory and regulatory BACT definitions as  
4 containing two core requirements that EPA believes must be met by any BACT determination.

5 First, the BACT analysis must include consideration of the most stringent available technologies:

6 i.e., those that provide the “maximum degree of emissions reduction.” Second, any decisions to

7 require a lesser degree of emissions reduction must be justified by an objective analysis of

8 “energy, environmental, and economic impacts” contained in the record or the permit decisions

9 on a case-by-case determination. Critical to this determination is the identification of the project.

10 For example, a unit burning a high sulfur coal will result in greater emissions of sulfuric acid

11 mist (SAM) than a similarly equipped unit burning a low sulfur coal. Because the high sulfur

12 coal unit has more SAM in the exhaust stream, it will generally be able to achieve a higher

13 “removal efficiency” even though the emission rate may be the same or lower for the unit

14 burning the low sulfur coal. In this case, less emphasis must be placed on the “removal

15 efficiency” than on the relative energy, environmental and economic impacts.

16 The BACT analysis evaluates control technologies for individual pollutants, but in the

17 final analysis the control equipment has to be evaluated as an integrated air pollution control

18 system. Many of the control technologies are interdependent, and reducing emissions for one

19 pollutant may result in adverse impacts and higher emissions of another pollutant. As one

20 example, some technologies that reduce NO<sub>x</sub> emissions will unavoidably result in higher CO and

21 VOC emissions due to reaction kinetics. The best overall air pollution control system utilizes the

22 mix of control technologies that yields the optimal overall performance and lowest overall

1 emission levels for that specific case or installation. Other important concepts in a BACT  
 2 analysis include those of “commercial availability” a technology has to be available for sale  
 3 under commercial terms and it must be demonstrated in practice. In addition, an emission limit  
 4 must be achieved not only under ideal or average conditions, but under reasonably foreseeable  
 5 worst case conditions for the life of the project.

6 **Q: Was this “top-down” process followed for this project?**

7 A: Yes. It was used as a framework.

8 **Q: How were control options identified for Step 1 of the BACT determination?**

9 A: Each source that would be modified or added to the facility that would emit an applicable  
 10 pollutant (PM<sub>10</sub>, CO, VOC, and fluoride) were analyzed for control technologies and emission  
 11 limits that were consistent with BACT. One of the best ways to identify available control  
 12 technologies is to review previous BACT determinations for similar sources.

13 **Q: What was the general conclusion from the review of these sources?**

14 A: EPA maintains a database of previous decisions referred to at the RACT-BACT-LAER  
 15 Clearinghouse (RBLC). The review of the RBLC and other data sources confirmed that control  
 16 equipment on pulverized coal units has been limited to few types. Baghouses and electrostatic  
 17 precipitators both have been used to control emissions of particulate matter, and generally have a  
 18 99% removal efficiency. Wet FGD or dry FGD have been used to control acid gases. No  
 19 technology other than “combustion control” has been identified as BACT for CO or VOC  
 20 emissions.

21 **Q: What were the results of the BACT determination for the new coal-fired boiler?**

22 A: BACT was determined to be emission limits of

1 PM<sub>10</sub> 0.03 lb /MMBtu  
 2 CO 0.16 lb /MMBtu  
 3 VOC 0.0036 lb /MMBtu  
 4 SAM 0.005 lb /MMBtu  
 5 F1 0.0006 lb /MMBtu

6 **Q: How will compliance with the BACT limits be determined?**

7 A: ASDR 74:36:11 requires that the Applicants undergo initial performance tests to  
 8 demonstrate initial compliance. Initial tests on the coal-fired boiler will include PM<sub>10</sub>, VOC, and  
 9 CO emissions. Tests for SAM and F1 will also be done if required by the DENR. After the  
 10 initial tests, continuous compliance will be demonstrated using a continuous emission monitoring  
 11 system (CEMS) to monitor emissions of NO<sub>x</sub>, SO<sub>2</sub>, opacity, a diluent, and volumetric flow rate.  
 12 The Applicants will also comply with the continuous monitor requirements of the Clean Air  
 13 Mercury Rule.

14 **Q: How will emissions limits be established for SO<sub>2</sub> and NO<sub>x</sub>?**

15 A: As part of Big Stone Unit II, the existing Big Stone Unit I flue gas will be ducted to a wet  
 16 flue gas desulfurization (WFGD) system to control SO<sub>2</sub> emissions from Big Stone Unit I and Big  
 17 Stone Unit II. Emissions of NO<sub>x</sub> from the Big Stone Unit II boiler will be controlled by  
 18 combustion controls, including low NO<sub>x</sub> burners, and a selective catalytic reduction (SCR)  
 19 system. Additionally, the emissions of NO<sub>x</sub> resulting from Big Stone Unit I will be reduced. As  
 20 a result, Big Stone Unit II will be added with no significant emissions increase in SO<sub>2</sub> or NO<sub>x</sub>.  
 21 The permit will impose restrictions to ensure this. The actual emissions will be significantly  
 22 lower than historic emission rates.

1 **Q: Was a BACT analysis performed for any other equipment?**

2 A: Yes, particulate emissions result from the cooling tower, the diesel generator, the diesel  
3 fire pump, and the material handling system. Some CO and VOC emissions also result from the  
4 diesel engines.

5 **Q: What was the result of the BACT analysis for material handling?**

6 A: The coal, limestone, and fly ash handling equipment will all generate some particulate  
7 emissions. For many of the transfer points, the emissions can be enclosed. This allows for  
8 mechanical collection of the material and subsequent removal from the exhaust gas stream.  
9 Baghouses have the highest control efficiencies of any particulate matter control option and,  
10 according to the "top-down" approach, must be considered first. The industry "standard" for  
11 baghouse outlet emission rates is 0.01 grains per dry standard cubic foot (gr/dscf). Where  
12 collection and control with a baghouse is not feasible, for example unpaved roads and outdoor  
13 storage piles, wet suppression was selected as the best technology.

14 **Q: How will compliance with these BACT limits be determined?**

15 A: Compliance Assurance Monitoring (CAM) was proposed for the applicable emission  
16 points for particulate emissions. CAM is applicable to controlled sources that are not suited to  
17 continuous emissions monitoring (CEMS). An example of CAM is monitoring pressure drop  
18 across a baghouse. The CAM compliance plan for this facility will be developed as part of the  
19 Title V operating permit application in accordance with ARSD 74:36:05.

20 **Q: What was the result of the BACT analysis for the cooling towers?**

21 A: Particulate emissions occur from the cooling tower as a result of the total solids  
22 (suspended and dissolved metals and minerals) in the water droplets entrained in the air stream

1 leaving the cooling tower. These droplets of water (containing particulate) are known as drift.  
 2 The most efficient way to minimize drift emissions from cooling towers is by installing high  
 3 efficiency drift eliminators. For this project, high efficiency drift eliminators capable of  
 4 controlling drift emissions to 0.0005 percent of the circulating water flow through the cooling  
 5 tower have been selected for the cooling tower, and represents BACT.

6 **Q: What was the result of the BACT analysis for diesel equipment?**

7 A: The emergency diesel fire pump and diesel generator will be limited to ultra low sulfur  
 8 diesel fuel (15 ppm). This value is actually lower than originally proposed in the PSD  
 9 application. This limit matches the requirements of the NSPS proposed after the PSD  
 10 application was submitted. In addition, good combustion practices and proper maintenance  
 11 procedures will be used to limit VOC and PM<sub>10</sub> emissions from these engines. The fire pump  
 12 will be limited in normal operation to 500 hours per year. This will allow time to test the unit  
 13 each month in accordance with fire protection insurance requirements.

14 **Q: How will compliance with this BACT determination be monitored?**

15 A: It is anticipated that the manufacturers' certifications, annual hours of operation, and  
 16 annual fuel use will be monitored and reported to the agency periodically. Specific monitoring  
 17 requirements will be established in the Title V operating permit or as special conditions to the  
 18 construction permit.

19 **VI. PROTECTION OF AIR QUALITY**

20 **Q: What assurances are there that air quality is protected?**

21 A: As part of the PSD application, computer modeling analysis is required to predict the  
 22 effect of the proposed Big Stone Unit II project on the ambient air quality. In order to determine

1 the effect of this project, Burns & McDonnell used a computer dispersion model approved by  
 2 EPA and DENR. The analysis was performed for the proposed Big Stone Unit II project and the  
 3 results predict that there would be no violation of the National Ambient Air Quality Standards  
 4 (NAAQS), which are specifically established to protect public health and welfare. Moreover, the  
 5 models predict there will be no violation of the "PSD increment"- a small margin of increase  
 6 above existing baseline air quality intended to "prevent significant deterioration."

7 **Q: Will other industries be able to build in the area?**

8 A: EPA established a limit on how much the air quality in an area can deteriorate referred to  
 9 as increments. Increments were established for SO<sub>2</sub>, PM<sub>10</sub>, and NO<sub>2</sub>. Since SO<sub>2</sub> and NO<sub>x</sub>  
 10 emissions are not increasing, these increments will not be consumed. The particulate emissions  
 11 were modeled, and the results showed that the increment would not be consumed and that  
 12 ambient levels are highest along the facility fence line and quickly drops off as the distance from  
 13 the fence increases. Thus, there is no indication that this project would preclude future  
 14 development.

15 **Q: Will Big Stone Unit II affect any Class I areas?**

16 A: Class I areas are places in the country that Congress considered to be relatively pristine,  
 17 such as National Parks. The rest of the country was designated Class II. There are no Class I  
 18 areas within 186 miles of the Big Stone Power Plant. The impact on visibility in the nearest  
 19 sensitive area, Pipestone National Monument which is 90 miles from the Big Stone Power Plant,  
 20 was examined. A visibility screening model (VISCREEN) was used to predict the effect the  
 21 project would have. Results of the modeling showed no significant visibility impairment.

1 **Q: Will Big Stone Unit II have any adverse effects on sensitive populations, such as**  
 2 **children, the elderly, and asthmatics?**

3 A: The National Ambient Air Quality Standards were designed specifically to protect these  
 4 populations with a margin of safety. The existing air quality in South Dakota is in attainment  
 5 with these standards and the proposed project will not have a significant increase for SO<sub>2</sub> and  
 6 NO<sub>x</sub>. As described earlier, dispersion modeling performed for the proposed project indicates that  
 7 the project will not cause an exceedance of the NAAQS for PM<sub>10</sub> and CO.

8 **Q: What about additional impacts on the surrounding area?**

9 A: The impact of Big Stone Unit II on soils, vegetation and threatened and endangered  
 10 species was considered as part of the PSD process. The construction and operation of Big Stone  
 11 Unit II is not expected to have a detrimental effect on plants, soils or wildlife. A full analysis of  
 12 these impacts can be found in the PSD application.

13 **Q: What have the Applicants done beyond the regulatory requirements to protect the**  
 14 **air quality?**

15 A: Previously Big Stone Unit I changed from a lignite fuel to low sulfur Powder River Basin  
 16 fuel that has reduced the historic emissions of SO<sub>2</sub>. As part of this project, the Big Stone Unit II  
 17 Applicants have voluntarily added a flue gas desulphurization system that will reduce the annual  
 18 emissions of SO<sub>2</sub>, when compared to the 2004 emissions. Also, as part of the proposed project,  
 19 the emission controls for NO<sub>x</sub> from Big Stone Unit I will be improved, resulting in a net  
 20 reduction in NO<sub>x</sub> emissions as well.

21 **Q: Once the PSD construction permit is issued, are there other permits required?**

1 A: An operating permit, referred to as a Title V permit, will be developed for the facility to  
 2 regulate operation of the facility. After the unit begins operation and the initial compliance tests  
 3 are complete, the DENR will spell out the emission limits for each piece of equipment at the  
 4 facility (both new and existing) as well as the compliance demonstration methods. Record  
 5 keeping is required and semi-annual and annual reports on the compliance status are also  
 6 required and will be provided to DENR.

7 **Q: Will this project have an effect on Acid Rain?**

8 A: The Acid Rain rules in Part IV of the Clean Air Act have been very effective at limiting,  
 9 reducing, and monitoring emissions of pollutants that would have an effect on Acid Rain. Big  
 10 Stone Units I and II will need to comply with the Acid Rain rules, and in fact the voluntary  
 11 reductions at Unit I may result in some SO<sub>2</sub> allowances that can be sold or traded to offset some  
 12 of the costs. Overall, because of the plan to reduce SO<sub>2</sub> emissions from Unit 1, this new plant  
 13 will have very little effect on acid rain.

14 **Q: How will mercury be regulated?**

15 A: The NSPS for the coal-fired boiler requires that subbituminous coal-fired units, such as  
 16 the Big Stone Unit II project that use a wet FGD system, must achieve a mercury emission rate  
 17 of  $42 \times 10^{-6}$  lb per megawatt hour or less, based on a 12-month rolling average. The Big Stone  
 18 Unit II boiler will be in compliance with this mercury standard. Additionally, the Big Stone Unit  
 19 II boiler will also comply with the continuous monitor requirements of the Clean Air Mercury  
 20 Rule (CAMR). The CAMR (adopted March 15, 2005) has been challenged by a number of  
 21 entities and its outcome is uncertain at this time. However, the plant will be required to conform  
 22 to the final rule once the regulatory requirements have been defined.



1 **Q: Will this unit be affected by the Clean Air Interstate Rule (CAIR) rule?**

2 A: No. The final Clean Air Interstate Rule covers 28 eastern states and the District of  
3 Columbia. Air emissions in these states were determined by EPA to contribute to unhealthy  
4 levels of ground-level ozone, fine particles or both in downwind states. Minnesota is included  
5 for particulate only but South Dakota and 23 other states are not included in the CAIR region  
6 because they do not contribute to down wind nonattainment.

7 **Q: Does this conclude your testimony?**

8 A: Yes.

9