APPLICANTS' EXHIBIT 22

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

BIG STONE II

PARTNERS IN GENERATION

TESTIMONY OF DAVID GAIGE, P.E.

TABLE OF CONTENTS

BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION

DIRECT TESTIMONY OF DAVID GAIGE, P.E.

I. INTRODUCTION

Q: Please state your name and business address.

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

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

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

Q: What is your educational background?

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

Q: What is your employment history?

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

Q: What are your responsibilities in your current position?

A: I am involved in all aspects of assisting clients obtain environmental approvals for proposed projects. This includes preparation of environmental impact statements, preparation of compliance plans to assure compliance with regulatory requirements, and preparation of permit applications in compliance with applicable regulations including prevention of significant deterioration and new source review.

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

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

Q: What professional organizations do you belong to?

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

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

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

II. PURPOSE AND SUMMARY OF TESTIMONY

Q: What is the purpose of your testimony?

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

Q: Please summarize your testimony.

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

III. APPLICABLE REGULATORY REQUIREMENTS

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

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

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

Q: How are these regulations implemented in South Dakota?

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

IV. PREVENTION OF SIGNIFICANT DETERIORATION

Q: Which regulation establishes the requirements for PSD review?

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

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

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

Q: Are SO_2 and NO_x regulated under PSD for Big Stone Unit II permitting purposes?

A: No. Due to the controls that are being installed to control SO_2 and NO_x emissions, the net increase estimated for these pollutants is below the *de minimis* threshold for PSD review.

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

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

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

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

Q: What does a PSD permit application consist of?

A: The PSD application consists of the following:

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

V. BEST AVAILABLE CONTROL TECHNOLOGY (BACT) ANALYSIS

Q: What does BACT mean?

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

Q: What are the limits for BACT?

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

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

A: It is important that the BACT level be measurable and testable to be able to demonstrate that the unit or source is able to achieve the BACT emission rate. The ability to demonstrate compliance with the permit conditions makes the permit enforceable. Wtihout the ability to demonstrate compliance neither the source nor the regulatory agency would be able to determine if BACT was being achieved. There are some cases where the imposition of an emissions standard would be infeasible (e.g., where emission cannot be measured), and BACT is described as a design or piece of equipment, work practice, operational standard, or a combination of these. In such a case, the means to determine compliance is also described.

Q: How is a BACT analysis conducted?

A: In nonbinding guidance from the EPA, EPA suggests a "top-down" BACT process as follows:

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

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

Step 1 – Identify all control technologies

Step 2 – Eliminate all technically infeasible control technologies

Step 3 – Rank control technologies by control effectiveness

Step 4 – Evaluate most effective controls and document results

Step 5 – Select BACT

The EPA has consistently interpreted the statutory and regulatory BACT definitions as containing two core requirements that EPA believes must be met by any BACT determination. First, the BACT analysis must include consideration of the most stringent available technologies: i.e., those that provide the "maximum degree of emissions reduction." Second, any decisions to require a lesser degree of emissions reduction must be justified by an objective analysis of "energy, environmental, and economic impacts" contained in the record or the permit decisions on a case-by-case determination. Critical to this determination is the identification of the project. For example, a unit burning a high sulfur coal will result in greater emissions of sulfuric acid mist (SAM) than a similarly equipped unit burning a low sulfur coal. Because the high sulfur coal unit has more SAM in the exhaust stream, it will generally be able to achieve a higher "removal efficiency" even though the emission rate may be the same or lower for the unit burning the low sulfur coal. In this case, less emphasis must be placed on the "removal efficiency" than on the relative energy, environmental and economic impacts.

The BACT analysis evaluates control technologies for individual pollutants, but in the final analysis the control equipment has to be evaluated as an integrated air pollution control system. Many of the control technologies are interdependent, and reducing emissions for one pollutant may result in adverse impacts and higher emissions of another pollutant. As one example, some technologies that reduce NO_x emissions will unavoidably result in higher CO and VOC emissions due to reaction kinetics. The best overall air pollution control system utilizes the mix of control technologies that yields the optimal overall performance and lowest overall emission levels for that specific case or installation. Other important concepts in a BACT analysis include those of "commercial availability" a technology has to be available for sale under commercial terms and it must be demonstrated in practice. In addition, an emission limit must be achieved not only under ideal or average conditions, but under reasonably foreseeable worst case conditions for the life of the project.

Q: Was this "top-down" process followed for this project?

A: Yes. It was used as a framework.

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

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

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

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

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

A: BACT was determined to be emission limits of

PM_{10}	0.03 lb /MMBtu
CO	0.16 lb /MMBtu
VOC	0.0036 lb /MMBtu
SAM	0.005 lb /MMBtu
Fl	0.0006 lb /MMBtu

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

A: ASDR 74:36:11 requires that the Applicants undergo initial performance tests to demonstrate initial compliance. Initial tests on the coal-fired boiler will include PM_{10}, VOC, and CO emissions. Tests for SAM and Fl will also be done if required by the DENR. After the initial tests, continuous compliance will be demonstrated using a continuous emission monitoring system (CEMS) to monitor emissions of NO_x, SO_2, opacity, a diluent, and volumetric flow rate. The Applicants will also comply with the continuous monitor requirements of the Clean Air Mercury Rule.

Q: How will emissions limits be established for SO_2 and NO_x?

A: As part of Big Stone Unit II, the existing Big Stone Unit I flue gas will be ducted to a wet flue gas desulfurization (WFGD) system to control SO_2 emissions from Big Stone Unit I and Big Stone Unit II. Emissions of NO_x from the Big Stone Unit II boiler will be controlled by combustion controls, including low NO_x burners, and a selective catalytic reduction (SCR) system. Additionally, the emissions of NO_x resulting from Big Stone Unit I will be reduced. As a result, Big Stone Unit II will be added with no significant emissions increase in SO_2 or NO_x. The permit will impose restrictions to ensure this. The actual emissions will be significantly lower than historic emission rates.

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

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

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

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

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

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

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

A: Particulate emissions occur from the cooling tower as a result of the total solids (suspended and dissolved metals and minerals) in the water droplets entrained in the air stream leaving the cooling tower. These droplets of water (containing particulate) are known as drift. The most efficient way to minimize drift emissions from cooling towers is by installing high efficiency drift eliminators. For this project, high efficiency drift eliminators capable of controlling drift emissions to 0.0005 percent of the circulating water flow through the cooling tower have been selected for the cooling tower, and represents BACT.

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

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

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

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

VI. PROTECTION OF AIR QUALITY

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

A: As part of the PSD application, computer modeling analysis is required to predict the effect of the proposed Big Stone Unit II project on the ambient air quality. In order to determine the effect of this project, Burns & McDonnell used a computer dispersion model approved by EPA and DENR. The analysis was performed for the proposed Big Stone Unit II project and the results predict that there would be no violation of the National Ambient Air Quality Standards (NAAQS), which are specifically established to protect public health and welfare. Moreover, the models predict there will be no violation of the "PSD increment"- a small margin of increase above existing baseline air quality intended to "prevent significant deterioration."

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

A: EPA established a limit on how much the air quality in an area can deteriorate referred to as increments. Increments were established for SO_2, PM10, and NO_2. Since SO_2 and NOx emissions are not increasing, these increments will not be consumed. The particulate emissions were modeled, and the results showed that the increment would not be consumed and that ambient levels are highest along the facility fence line and quickly drops off as the distance from the fence increases. Thus, there is no indication that this project would preclude future development.

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

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

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

A: The National Ambient Air Quality Standards were designed specifically to protect these populations with a margin of safety. The existing air quality in South Dakota is in attainment with these standards and the proposed project will not have a significant increase for SO_2 and NO_x. As described earlier, dispersion modeling performed for the proposed project indicates that the project will not cause an exceedance of the NAAQS for PM_{10} and CO.

Q: What about additional impacts on the surrounding area?

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

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

A: Previously Big Stone Unit I changed from a lignite fuel to low sulfur Powder River Basin fuel that has reduced the historic emissions of SO_2. As part of this project, the Big Stone Unit II Applicants have voluntarily added a flue gas desulphurization system that will reduce the annual emissions of SO_2, when compared to the 2004 emissions. Also, as part of the proposed project, the emission controls for NO_x from Big Stone Unit I will be improved, resulting in a net reduction in NOx emissions as well.

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

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

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

A: The Acid Rain rules in Part IV of the Clean Air Act have been very effective at limiting, reducing, and monitoring emissions of pollutants that would have an effect on Acid Rain. Big Stone Units I and II will need to comply with the Acid Rain rules, and in fact the voluntary reductions at Unit I may result in some SO_2 allowances that can be sold or traded to offset some of the costs. Overall, because of the plan to reduce SO_2 emissions from Unit 1, this new plant will have very little effect on acid rain.

Q: How will mercury be regulated?

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

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

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

Q: Does this conclude your testimony?

A: Yes.