BEFORE THE

PUBLIC SERVICE COMMISSION OF THE STATE OF NORTH DAKOTA

Otter Tail Power Company Environmental Cost Recovery Rider Tariff	)))	Case No. PU-13-79
Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc. Environmental Cost Recovery Rider Rates	))))	Case No. PU-13-83
Otter Tail Power Company Environmental Cost Recovery Rider Rates	)))	Case No. PU-13-84
Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc. Environmental Cost Recovery Rider Tariff	))))	Case No. PU-13-85

OAH File No. 20130326

DIRECT TESTIMONY

OF

MARK THOMA

ON BEHALF OF

OTTER TAIL POWER COMPANY

and MONTANA-DAKOTA UTILITIES COMPANY

August 26, 2013

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Mark Thoma. My business address is 215 South Cascade Street, Fergus Falls, Minnesota 56537.

Q. BY WHOM ARE YOU EMPLOYED AND WHAT IS YOUR POSITION?

A. I am the Manager, Environmental Services for Otter Tail Power Company ("Otter Tail" or the "Company").

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS AND EXPERIENCE.

A. I am a native of Fergus Falls, Minnesota, and graduated in 2001 from the University of North Dakota with a Bachelor of Science Degree in Chemical Engineering. Shortly thereafter I began my employment with Otter Tail, providing environmental compliance support in Otter Tail's Environmental Services Department. My primary responsibilities were in the area of air quality, including review and implementation of environmental regulations, development of compliance strategies, data collection, and development of permit applications. I was given additional responsibilities within the Department in 2006 as a Senior Compliance Specialist, and in 2011 as Principal, Environmental Services. In 2012, I was named Manager of the Environmental Services Department, which is my current role. Prior to being named Manager, I worked closely with Terry Graumann, the former Manager of the Environmental Services Department, who had been employed with Otter Tail for over 38 years.

Q. FOR WHOM ARE YOU PROVIDING TESTIMONY?

A. I am providing testimony on behalf of Otter Tail and Montana-Dakota Utilities Co. ("Montana-Dakota").

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. My testimony is offered to describe the regulations that require the implementation of the Air Quality Control System ("AQCS") at Big Stone Plant.

Q. PLEASE DESCRIBE THE REGIONAL HAZE RULE AND THE BIG STONE PLANT OWNERS' OBLIGATIONS CREATED BY THE RULE.

A. The underlying need to install the AQCS dates back to the 1977 amendments to the federal Clean Air Act (42 U.S.C. §7479). At that time Congress added Section 169A to set forth a national goal of preventing and remedying impairment of visibility from man-made air pollution in Class I areas of the United States. These Class I areas include the Theodore Roosevelt National Park and Lostwood National Wildlife Refuge in North Dakota. In 1990, Congress amended the Clean Air Act to strengthen and reaffirm the national goal. In response to these Clean Air Act mandates, the Environmental Protection Agency ("EPA") promulgated the Regional Haze Rule in 1999 (40 CFR Part 51 Subpart P). The Regional Haze Rule requires state environmental agencies to submit State Implementation Plans ("SIP") that reduce emissions contributing to regional haze and establish benchmarks toward meeting the goal of no man-made visibility impairment in Class I areas by 2064. The Clean Air Act and the Regional Haze Rule require electric

generating units placed into operation between 1962 and 1977, like the Big Stone Plant which began commercial operation on May 1, 1975, to install and operate Best Available Retrofit Technology ("BART") if a unit is reasonably anticipated to cause or contribute to visibility impairment in a Class I area.

Q. IS THE AQCS PROJECT AT THE BIG STONE PLANT BEING INSTALLED TO MEET THE REGIONAL HAZE RULE BART REQUIREMENTS?

A. Yes. The requirement to install the AQCS equipment was discussed at length in Otter Tail's and Montana-Dakota's Applications for Advance Determination of Prudence ("ADP") that were granted with certain conditions by the North Dakota Public Service Commission on May 9, 2012 (Case Nos. PU-11-163 and PU-11-165). As described in those proceedings, the AQCS equipment is required by the final South Dakota Regional Haze SIP that was approved by the EPA and required under the Administrative Rules of South Dakota (ARSD) chapter 74:36:21:07. EPA's final approval of the South Dakota Regional Haze SIP was published in the Federal Register on April 26, 2012.

Q. BY WHAT DATE WILL THE AQCS NEED TO BE INSTALLED AT THE BIG STONE PLANT?

A. The Big Stone Plant owners are required to install the AQCS as expeditiously as practicable, but no later than five years from EPA's approval of the South Dakota Regional Haze SIP, or April 26, 2017.

Q. WHAT WOULD THE CONSEQUENCE BE IF THE BIG STONE PLANT OWNERS DID NOT INSTALL THE BART-REQUIRED AQCS EQUIPMENT?

A. The owners would have to discontinue operation of the plant on or before April 26, 2017.

Q. HOW WAS IT DETERMINED THAT THE BIG STONE PLANT CAUSES OR CONTRIBUTES TO VISIBILITY IMPAIRMENT IN A CLASS I AREA?

A. This was a considerable effort. The Western Regional Air Partnership ("WRAP") first performed modeling on behalf of the South Dakota Department of Environment and Natural Resources ("DENR") in 2007. WRAP is a collaborative effort of state governments (including the South Dakota DENR and North Dakota Department of Health), tribal governments, and various federal agencies that was established to coordinate activities associated with the management of regional haze, visibility, and other air quality issues in the western United States. The WRAP modeling determined that Big Stone Plant would be reasonably anticipated to contribute to visibility impairment in several Class I areas. After Otter Tail was notified of the results, Otter Tail retained the Burns & McDonnell engineering firm and outside counsel from the Hunton & Williams law firm to acquire and review the WRAP modeling files. Otter Tail identified several errors in the modeling that caused Otter Tail to question the accuracy of the WRAP determination. After sharing Otter Tail's concerns with the DENR, the DENR agreed that Otter Tail should be allowed to re-run the models using the correct modeling inputs.

The initial modeling on behalf of Otter Tail was conducted by Burns & McDonnell, but it soon became apparent that the modeling complexities and the extended model run turn-around time required a cutting-edge approach and increased computer capability. Consequently, Joseph Scire of TRC Environmental Corporation ("TRC") was selected for the modeling effort in late November 2007. Joseph Scire is a respected air dispersion modeler who developed CALPUFF, which is the long-range transport air quality dispersion modeling system adopted by EPA for BART assessments. After nearly a two-year period in which Otter Tail retained TRC and Hunton & Williams to perform modeling iterations and negotiate with the DENR, EPA, and Federal Land Managers, on September 18, 2009, the DENR approved a modeling protocol that was agreeable to all parties. TRC subsequently conducted the modeling on behalf of Otter Tail, and Otter Tail submitted a final modeling report to the DENR on October 12, 2009. The modeling results indicated that Big Stone Plant contributed to visibility impairment at the Badlands National Park in South Dakota, Theodore Roosevelt National Park in North Dakota, Isle Royale National Park in Michigan, and Voyagers National Park and the Boundary Waters Canoe Area in Minnesota. Whether there was a contribution to visibility impairment was determined by visibility impacts greater than 0.5 deciviews based on the 98th percentile of the data values. Consequently, Big Stone Plant was required to install and operate BART.

Q. WHO DETERMINES WHAT IS BART?

A. As specified by Section 169A of the Clean Air Act, states are responsible for determining BART. If a state fails to make a required submission or EPA determines that a state plan is deficient, EPA will promulgate a Federal Implementation Plan ("FIP"). The South Dakota DENR has general legal authority under South Dakota Codified Laws Title 34A-1 (Air Pollution Control) to adopt and enforce rules for visibility protection, including regional haze visibility impairment.

Q. WHAT WAS THE SOUTH DAKOTA DENR'S PROCESS FOR DETERMINING BART?

A. The DENR's BART determination process is described in detail in Section 6.3 of their Regional Haze SIP that was included within Attachment 1 to Otter Tail's Application for an Advance Determination of Prudence in NDPSC Case No. PU-11-165 and Montana-Dakota's Advance Determination of Prudence in NDPSC Case No. PU-11-163. To summarize, the DENR generally followed the five basic steps of EPA's BART guidelines given in Appendix Y in 40 CFR Part 51 that were promulgated on July 6, 2005. These steps are: (1) Identify all available retrofit technologies; (2) Eliminate technically infeasible options; (3) Evaluate control effectiveness of remaining control technologies; (4) Evaluate impacts and document the results; and (5) Evaluate Visibility Impacts. Within Step 4, the costs of compliance, energy and non-air quality environmental impacts, and remaining useful life of the source are considered.

Q. HOW IS COST EFFECTIVENESS DEFINED?

A. Under the BART guidelines, cost effectiveness is determined by dividing the estimated annualized cost of the technology by the identified emissions reductions that will be achieved. Therefore, cost effectiveness is a dollar-per-ton metric.

Q. WHAT WAS DETERMINED TO BE BART FOR THE BIG STONE PLANT?

A. The South Dakota DENR determined the following control technology constitutes BART for the Big Stone Plant: a Selective Catalytic Reduction ("SCR") in conjunction with separated over-fire air ("SOFA") for control of nitrogen oxides ("NOx"), a scrubber for reducing sulfur dioxide ("SO2"), and a baghouse to control particulate matter. The AQCS project, as described in Mr. Rolfes' Direct Testimony, consists of the control technology identified as BART by the South Dakota DENR.

Q. IN GENERAL, ARE THERE CHARACTERISTICS OF BIG STONE PLANT FACTORED INTO THE BART DETERMINATION?

A. Yes. Because the BART determination is specific to the Big Stone Plant, its particular design and operational characteristics are important to the BART determination. For example, the Big Stone Plant burns subbituminous coal and it is a cyclone boiler. These were especially important characteristics for the NOx determination because, in contrast to lignite coal, SCR is a feasible technology for subbituminous coal. Being a cyclone boiler is also important because the inherent design of these boilers typically results in higher baseline levels of NOx as compared to pulverized coal ("PC") boilers.

Q. WHY IS SCR NOT FEASIBLE FOR LIGNITE BUT IT IS FOR SUBBITUMINOUS?

A. Key differences include much higher sodium and ash levels in North Dakota lignite compared to most subbituminous coals. These characteristics of lignite make the catalyst susceptible to blinding and plugging, thereby preventing the catalyst's ability to reduce NOx emissions. One can review the development of North Dakota's Regional Haze SIP for an expert discussion on this phenomenon. Dr. Michael Jones, Vice President of Research and Development at the Lignite Energy Council, also described this phenomenon at a May 15, 2013 public hearing in which EPA was taking comments on portions of the North Dakota SIP that are being reconsidered (see docket ID EPA-R08-OAR-2010-0406-0382 transcript of public hearing at www.regulations.gov).

Q. WERE OTHER NOx CONTROL TECHNOLOGIES EVALUATED FOR BIG STONE PLANT?

A. Yes. Including SCR, the DENR determined that six technologies were feasible. Of those six, the DENR determined that only three technologies – SCR, Rich Reagent Injection ("RRI"), and Selective Non-Catalytic Reduction ("SNCR") – could reduce NOx emissions sufficiently for Big Stone Plant to not reasonably contribute to visibility impairment at Class I areas.

Q. COULD YOU BRIEFLY EXPLAIN THE DIFFERENCES BETWEEN SCR, SNCR, AND RRI?

A. The principle of SNCR and RRI is similar to SCR, which is described in Mr. Rolfes' Direct Testimony, in that ammonia is injected to reduce nitrogen oxides to molecular nitrogen and water. However, as the name implies, a catalyst is not used in SNCR. The ammonia is instead injected into a specific high temperature region of the boiler. Without the catalyst, SNCR is not able to achieve the same level of NOx reductions as SCR. RRI is similar to SNCR in that it injects ammonia into specific locations in the boiler without a catalyst, but RRI adds additional injection points. RRI is normally installed in conjunction with SNCR and combustion modifications and can achieve lower NOx emissions than just installing SNCR, but RRI uses a large amount of ammonia in comparison to either SCR or just SNCR.

Q. PLEASE GIVE SOME DETAIL ON HOW THE DENR SELECTED SCR AS BART OVER SNCR AND RRI.

A. As the DENR was comparing all of the BART factors, there were no significant differences among the alternatives in regard to energy and non-air quality environmental impacts, and in remaining useful life of the source. However, there were differences in the cost effectiveness and the degree of visibility improvement expected between the technologies. Due to the fact that the cost effectiveness of all of the control options was less than $900 per ton, the DENR determined all the identified control options were cost effective on a dollars-per-ton basis. (South Dakota SIP at page 102). Finally, based on

the visibility modeling, SCR reduces Big Stone Plant's visibility impact more than the other control options, including "an additional 34 percent over the second ranked control option." (Ibid.) Therefore, the DENR considered BART to be SCR.

Q. IS THERE ANY OTHER WAY TO EVALUATE THE REASONABLENESS OF THE DENR'S DETERMINATION THAT SCR WAS COST EFFECTIVE?

A. Yes. While many states did not set a specific threshold as to what they determined to be cost effective, for comparison, the North Dakota Department of Health did establish a ceiling of $3650 per ton (in 2006 dollars). North Dakota's cost threshold was included in a Commission Staff memo from Mr. Mark Grumann, attached as Exhibit _____ (MT-1). That memo contained copy of an email that Terry Graumann received from Mr. Tom Bachman, who is a senior engineer with the North Dakota Department of Health. Mr. Bachman indicates that based on the cost effectiveness that was presented for the Big Stone Plant SCR, it would be the North Dakota Department of Health's view that the SCR would have been economically feasible based on the cost effectiveness threshold used for North Dakota's BART assessments.

Additionally, Exhibit ____ (MT-2) is a table I compiled comparing the various BART determinations and associated BART cost effectiveness for South Dakota, North Dakota, Montana, Minnesota, and Wyoming.

Q. COULD YOU PLEASE STEP THROUGH EXHIBIT ____ (MT-2)?

A. The top row of the Exhibit ____ (MT-2) table is lettered A through F and the far left row is numbered 1 through 22. These letters and numbers are simply for reference as we walk through the table. For example, Cell A1 refers to Big Stone Unit 1. Also, I should point out that any instances in which EPA disagreed with a state's SIP determination are noted in Columns A, D, E, and F. This is evident for one unit in North Dakota and several units in Wyoming.

I will first walk through the row for Big Stone to summarize the information contained in this Exhibit ____ (MT-2). Beginning with Column A, this contains the name of the Facility and Unit that is subject to BART. Column B is the Boiler Firing Method, which for Big Stone is a cyclone boiler. Column C is the Year 2012 NOx emission rate that the unit emitted, which for Big Stone was 0.70 pounds per million BTU. Column D is the BART determination that was made by either the state or EPA in terms of a NOx pounds per million BTU emission rate, which for Big Stone was 0.10 pounds per million BTU. Column E is the specific NOx control technology that was determined to be BART, which was SCR plus SOFA for Big Stone Plant. Finally, Column F is the estimated cost effectiveness from installing the NOx controls, which for Big Stone Plant was $825 per ton.

I will now move through a second example in row 4, for Milton R. Young Unit 1. Similar to Big Stone, this unit is also a cyclone boiler. The unit's 2012 emission rate was

0.34 pounds per million BTU. BART for this unit was determined to be SNCR plus advanced SOFA to achieve 0.36 pounds per million BTU, and the cost effectiveness was calculated to be $1659 per ton. Note that footnote three clarifies that this unit has actually already installed the BART technology, which explains why their 2012 emission rate already meets the BART limits.

Finally, I will move to an example in row 8 at the top of page 2 for Colstrip Unit 1 in Montana. Montana is a unique case where the state chose not to develop a SIP and therefore EPA developed a FIP for the state. Colstrip Unit 1 is a PC boiler that had a 2012 NOx emission rate of 0.31 pounds per million BTU. EPA determined BART to be SNCR plus SOFA, the same as Milton R. Young Unit 1, but Colstrip must achieve 0.15 pounds per million BTU. The cost effectiveness for Colstrip Unit 1 to install BART was estimated to be $1564 per ton. The difference in the BART emission limits between Milton R. Young Unit 1 and Colstrip Unit 1 shows a typical difference between the level of control that can be achieved by SNCR at cyclone-fired boilers versus PC-fired boilers.

Q. WHERE DID YOU GET THE INFORMATION FOR EXHIBIT ____ (MT-2)?

A. I compiled the BART determination information from each state's most current SIP or FIP actions, and the information in Columns A and B were taken from on-line EPA databases.

Q. WHAT ARE YOUR CONCLUSIONS FROM EXHIBIT ____ (MT-2)?

A. My general conclusion is that by scanning Column F, the cost effectiveness of installing SCR at Big Stone Plant is within the range, and in many cases less than, the cost effectiveness of other area NOx BART determinations. Another conclusion that I would draw is that this Exhibit reinforces the distinct differences in NOx emissions between the five cyclone boilers and all the other PC units. For example, PC units installing SNCR, such as Colstrip Units 1 and 2, are able to achieve much lower NOx emissions than cyclone-fired boilers installing SNCR, such as at Milton R. Young. Additionally, Colstrip's NOx emission limit with SNCR of 0.15 pounds per million BTU is only marginally higher than Big Stone Plant's SCR BART limit of 0.10 pounds per million BTU or the Allen S. King Plant's 2012 NOx emission rate with SCR of 0.09 pounds per million BTU. Finally, since I just mentioned the Allen S. King Plant, I should point out that this is the only other facility in this Exhibit that is substantially similar to Big Stone Plant, because it is also a cyclone boiler that burns PRB coal.

Q. STILL REGARDING EXHIBIT ____ (MT-2), ARE YOU AWARE OF THE WYOMING BART DETERMINATIONS?

A. I am generally familiar with the determinations.

Q. IT HAS RECENTLY BEEN IN THE NEWS THAT SEVERAL AREA PLANTS IN WYOMING ARE CHALLENGING THEIR BART DETERMINATIONS. IN YOUR OPINION, WHY IS THIS?

A. Wyoming is a much different case than the South Dakota BART determination for Big Stone Plant. In Wyoming, EPA is proposing to reject several state NOx BART determinations, and instead issue a FIP that would require several units to put on SCR. Similar to Big Stone Plant, the Wyoming units burn PRB coal; however, compared to Big Stone, these Wyoming units are all PC units that can obtain much lower levels of NOx with low NOx burners or SNCR than Big Stone can achieve with SNCR. Also, I would like to note that the State of Wyoming's SIP requires five PC units to install SCR to either satisfy BART or the state's long-term strategy to reduce haze.

Q. MOVING AWAY FROM EXHIBIT ____ (MT-2) ONTO A DIFFERENT TOPIC, WHAT IS THE EXPECTED VISIBILITY IMPROVEMENT FROM INSTALLING SCR VERSUS SNCR AT BIG STONE PLANT?

A. As shown in Table 6-14 of the South Dakota Regional Haze SIP, the largest deciview difference between control option 6 for SNCR and control option 8 for SCR is approximately 0.2 deciviews. Deciviews are an atmospheric haze index that expresses changes in visibility.

Q. WILL THERE BE ANY PERCEPTIBLE VISIBILITY IMPROVEMENT BY INSTALLING SCR VERSUS SNCR AT BIG STONE PLANT?

A. According to EPA, a difference of 0.5 - 1.0 deciviews is generally considered a perceptible change. Therefore, there may not be any perceptible visibility improvement between the Big Stone Plant SNCR and SCR control options.

Q. IF THE REGIONAL HAZE RULE IS ABOUT IMPROVING VISIBILITY, WHY DOES IT MAKE SENSE TO INSTALL SCR OVER SNCR WHEN THERE MAY NOT BE ANY PERCEPTIBLE VISIBILITY IMPROVEMENT BETWEEN THE TWO TECHNOLOGIES?

A. In making their BART determinations, states are required to consider all of the statutory factors together. This includes the costs of compliance, energy and non-air quality environmental impacts of compliance, the remaining useful life of the source, and the degree of visibility improvement at the source which may be reasonably anticipated to result from the use of the technology. The South Dakota DENR examined all of these factors when making their BART determination for Big Stone Plant.

A similar question came up in the proposed Montana BART determination for Colstrip Units 1 and 2. In that case, the operator of the plant argued that installing SNCR would result in no reasonably anticipated visibility benefit because it would result in a maximum visibility improvement of 0.085 deciviews (see docket ID EPA-R08-OAR-2011-0851-0178 at www.regulations.gov). However, in the final September 18, 2012

rule EPA affirmed the BART determination, stating: "Visibility impacts below the thresholds of perceptibility cannot be ignored because regional haze is produced by a multitude of sources and activities which are located across a broad geographic area." 77 FR 57867.

EPA also responded similarly to a comment they received on the proposed North Dakota Regional Haze SIP. The commenter argued that the visibility benefits which EPA claims can be achieved with NOx control technologies are not perceptible. EPA responded in the preamble to their final April 6, 2012 action on the North Dakota SIP by stating "...the BART Guidelines establish that predicted visibility improvement below perceptibility thresholds does not provide a basis to automatically eliminate a control option: 'Even though the visibility improvement from an individual source may not be perceptible, it should still be considered in setting BART because the contribution to haze may be significant relative to other source contributions in the Class I area. Failing to consider less than perceptible contributions to visibility impairment would ignore the CAA's intent to have BART requirements apply to sources that contribute to, as well as cause, such impairment.' " 77 FR 20908 (and citing 70 FR 39129).

Q. DO YOU HAVE ANY OTHER OBSERVATIONS ON THE SOUTH DAKOTA DENR'S BART DETERMINATION FOR SCR TECHNOLOGY OF THE BIG STONE PLANT?

A. Yes. I recently conducted a query of generating units similar to Big Stone Plant, i.e. large cyclone-fired boilers burning PRB, and found that there will not be any units similar to Big Stone that just have an SNCR installed and that are scheduled to remain operating after 2016.

For example, the Allen S. King Plant in Minnesota, which is the closest cyclone-fired PRB boiler in proximity to Big Stone, voluntarily installed an SCR in 2007 as part of Xcel Energy's Metro Emissions Reduction Project (MERP). A table summarizing my query is included as Exhibit ____ (MT-3).

Q. COULD YOU PLEASE STEP THROUGH EXHIBIT ____ (MT-3)?

A. The top row of the Exhibit ____ (MT-3) table is lettered A through H for reference as we walk through the table. Thus, Column A contains the names of various states that have cyclone-fired electric generating units that primarily fire PRB coal. The table lists the states in alphabetical order. Column B lists the name of the plant with a cyclone boiler, Column C gives the specific boiler ID of the cyclone unit, Column D gives the year the boiler first produced electricity, and Column E is the megawatt-capacity that EPA has on file for the unit. Column F is labeled "BART Eligible" with a question mark. This column will either have a Yes or No in it for each particular unit. As I mentioned earlier,

a unit is BART eligible if it was placed into operation between 1962 and 1977. Column G is labeled "Existing NOx Controls" with a designation whether or not the cyclone boiler currently has an SCR, SNCR, or RRI installed. Finally, Column H is titled "OTP Comments" which simply has my brief remarks about a few units, mainly to note if a unit is planning to, or has recently, shut down.

I will go ahead and walk through two examples in this table. First, looking at the first unit listed, the George Neal North unit in Iowa, this boiler came on line in 1964, according to EPA's database has a capacity of 135 MW, and is BART eligible. The boiler does not currently have an SCR, SNCR, or RRI installed, however it is under a consent decree to stop burning coal by April of 2016.

Perhaps for ease of reference I can also walk through the last row in the table on page 2. That row is for the one cyclone-fired boiler in Wisconsin, Edgewater Unit 4. That unit came on line in 1969, has a capacity of 321 MW, and is BART eligible. The unit currently has RRI installed, and I have noted that it is under a consent decree to retire or repower by the end of 2018.

Q. HAVE ANY OF THE GENERATING FACILITIES' EMISSIONS REDUCTIONS EQUIPMENT INSTALLATIONS IDENTIFIED IN EXHIBIT ____ (MT-3) BEEN REVIEWED BY THE COMMISSION?

A. Yes. I am generally aware that in Xcel's 2008 rate case the Commission approved Xcel's recovery of costs incurred to add an air quality control system to its Allen S. King Plant. Similar to the Big Stone Plant AQCS, the air quality control system additions included flue gas scrubbers for control of sulfur dioxide emissions, fabric filters for control of particulate matter, and selective catalytic reduction and an over-fire air system for NOx reduction.

Q. WHAT IS YOUR MAIN CONCLUSION FROM EXHIBIT ____ (MT-3)?

A. My main conclusion is that by approximately the time the Big Stone Plant SCR is operational, there will not be any units similar to Big Stone that just have an SNCR installed. I arrive at this conclusion by looking at the 29 boilers other than Big Stone in Exhibit ____ (MT-3). Nineteen of those boilers already have SCR installed. Of the ten that do not have SCR, three have recently shut down, two plan to shut down around the time the Big Stone Plant SCR will be operational, and the remaining five have installed RRI, which as I briefly discussed before is a technology that was evaluated for Big Stone to have nearly the same cost effectiveness as SCR but achieve far fewer NOx reductions. Thus, there are no units similar to Big Stone Plant that are scheduled to be operating past 2016 with just an SNCR installed.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

TO: COMMISSIONERS, ILLONA JEFFCOAT-SACCO AND PAT FAHN

FROM: MARK GRUMAN, RATEPAYER ADVOCACY STAFF MG

SUBJECT: BIG STONE AQCS, CASE NOS. PU-11-163 AND PU-11-165

DATE: APRIL 11, 2012

CC: MARK BRING AND DAN KUNTZ

After listening to the commission's work session held on March 23, 2012, staff is concerned with the possible outcome of not granting a full ADP decision in the above referenced cases. As you know, the ratepayer advocacy staff supported the Big Stone AQCS proposal submitted by MDU and Otter Tail. While we understand the commission's principled objections, we believe the ramifications of maintaining that course will be harmful to the ratepayers in the long-run.

Under North Dakota's Administrative Agencies Practice Act Section 28-32-25, an administrative agency may avail itself of information or evidence not presented at a hearing as long as all parties are in agreement as to its inclusion into the record. A ten days' notice is required for further testimony; however, the required ten days' notice can also be shortened by agreement of the parties to the case if an immediate hearing is desired by the commission.

We request that the commission avail itself of competent and relevant information not presented at the formal hearing. Specifically, we request that the commission consider the following information not discussed at the hearing:

1. Absent a full ADP decision, the project will be delayed and possibly abandoned as it is too large of an investment to secure financing by the largest owner. According to Otter Tail's 2010 annual report to the commission, its total company rate base is $446 million. Otter Tail's ownership share of the AQCS project is 53.9% of $489 million or $263 million.

2. Since the hearing, the U S Senate failed to pass an extension of the Production Tax Credit last month. As you recall, staff's analysis determined that a Wind/Gas/Market approach to securing electricity was slightly cheaper than the proposed AQCS project but that the volatility of natural gas prices and market prices would be a concern for this alternative approach. Without the extension of the PTC, AQCS is now estimated to be nearly 1.5 cents/kWh cheaper than the next least cost resource scenario of Wind/Gas/Market.

3. As the commission will recall from the Big Stone 2 hearing, the building of Big Stone 2 would have enabled the exportation of an additional 500 MW's of electricity from North Dakota. The commission should consider by inference the impact that closing down Big Stone would have on regional transmission facilities, including North Dakota's export capabilities. I say inference because transmission studies are expensive and time consuming to complete. While it is likely Otter Tail would sell its share of Big Stone and

the plant would continue to run, it is not assured and at a minimum would be costly to its ratepayers.

4. There is very strong language supporting the recovery of federally mandated costs in NDCC 49-05-04.2 to not only allow a return on such investments and associated operating expenses but also a current return on construction work in progress. Since the formal hearing in November, the Environmental Protection Agency has taken final action to approve South Dakota's State Implementation Plan to address regional haze. The commission should consider whether this new action constitutes a federal environmental mandate in reaching its decision in these proceedings.

5. If the commission desires to create an incentive for the companies to aggressively manage its AQCS project costs, the commission should consider capping the ADP at the estimated price without coverage for the 20% overage as requested in the application. Doing so will require the companies to request cost recovery for any costs over the estimated price and will help ensure that the project remains the least cost option for ratepayers. This is not to say that imprudently incurred costs are covered so long as the cap it met. Staff believes an ADP is a regulatory compact in principle and does not extend to imprudently incurred costs. In this regard, the responsibilities of management remains throughout the construction period and until final costs and rates are approved by the commission. This approach would provide needed assurance to financing institutions yet put some risk on management to perform.

6. Pursuant to an inquiry from Terry Graumann, Manager of Environmental Services for Otter Tail Power Company, Tom Bachman of the North Dakota Department of Health indicated support for the suite of control technologies as proposed by MDU and OTP. Although Mr. Bachman has not been recently contacted, his presence could be requested if the commission so desires. The following is a copy of the email received:

> This email is in response to inquiry about North Dakota's criteria for determining Best Available Retrofit Technology (BART) under the Regional Haze Program. The North Dakota Department of Health (NDDH) used a cost effectiveness threshold of $3,650 per ton of pollutant removed and an incremental cost threshold of $6,500 per ton of pollutant removed. Selective Catalytic Reduction (SCR) was not required for North Dakota sources because it was determined to be technically infeasible and/or exceeded our cost thresholds. The high concentration of sodium and potassium in the fly ash from North Dakota lignite can cause SCR catalyst poisoning, blinding and plugging. Since SCR technology was not demonstrated to work for North Dakota lignite, it was considered technically infeasible. However, SCR is a proven technology for units burning subbituminous coal, such as the Big Stone Generating Station (Big Stone). Our review of the BART analysis for Big Stone indicates a cost effectiveness of $825 per ton of NOx removed for SCR plus separated over fire air. The incremental cost from the next most efficient control technology was $871 per ton of NOx removed. The NDDH considers these costs to be very reasonable. Not knowing all of the data surrounding the BART determination for Big Stone, and assuming the economic assessment to be valid, it would be the NDDH's view that SCR would have been economically feasible based on the cost effectiveness thresholds used for North Dakota's BART assessments.

State and EPA NOx BART Determinations for SD, ND, MT, MN and WY[1]

	A	B	C	D	E	F
	Facility and Unit	Boiler Firing Method	Year 2012 NOx Emission Rate (lb/mmbtu)	BART Determination: NOx Rate (lb/mmbtu on a 30-day rolling average)	BART Determination: NOx Controls[2]	BART Cost Effectiveness ($/ton NOx removed)
	SOUTH DAKOTA					
1	Big Stone Unit 1 (1975, 470 MW)	Cyclone	0.70	0.10	SCR + SOFA	$825
	NORTH DAKOTA					
2	Stanton Station Unit 1 (1967, 130 MW)	Pulverized Coal (PC)	0.24	0.29 (Lignite) 0.23 (Subbituminous)	SNCR + OFA + LNB	$3052 (Lignite) $3,778 (Sub)
3	Coal Creek Units 1 and 2 (Unit 1 1979, 554 MW) (Unit 2 1981, 560 MW) ***Proposed ND State SIP***	PC	0.21 (Unit 1) 0.15 (Unit 2)	***SIP***: 0.17	***SIP***: Additional SOFA + LNB	***SIP***: $411
	Coal Creek Units 1 and 2 ***Final EPA FIP***			***FIP***: 0.13	***FIP***: SNCR + SOFA + LNB	***FIP***: $2500
4	Milton R. Young Unit 1 (1970, 250 MW)	Cyclone	0.34[3]	0.36[3]	SNCR + ASOFA[3]	$1424
5	Milton R. Young Unit 2 (1977, 455 MW)	Cyclone	0.33[3]	0.35[3]	SNCR + ASOFA[3]	$1268
6	Leland Olds Station Unit 1 (1966, 221 MW)	PC	0.24	0.19	SNCR + SOFA	$2487
7	Leland Olds Station Unit 2 (1975, 448 MW)	Cyclone	0.31	0.35	SNCR + SOFA	$1659

[1] Information compiled from: State and EPA Regional Haze SIP and FIP actions for SD, ND, MT, MN, and WY; EPA's Clean Air Market Database at http://ampd.epa.gov/ampd/; and EPA table of coal unit characteristics 2012 at http://www.epa.gov/airmarkets/images/CoalUnitCharacteristics2012.xls.

[2] LNB = Low NOx Burners
OFA, SOFA, ASOFA = Over-fire Air, Separated Over-fire Air, Advanced Separated Over-fire Air
SCR, SNCR = Selective Catalytic Reduction, Selective Non-Catalytic Reduction

[3] Milton R. Young installed this technology during 2010 and 2011, which explains why the 2012 NOx emission rate in Column C already meets the BART limits in Column D.

State and EPA NOx BART Determinations for SD, ND, MT, MN and WY

	A	B	C	D	E	F
	Facility	Boiler Firing Method	Year 2012 NOx Emission Rate (lb/mmbtu)	BART Determination: NOx Rate (lb/mmbtu on a 30-day rolling average)	BART Determination: NOx Controls	BART Cost Effectiveness ($/ton NOx removed)
	MONTANA[4,5]					
8	Colstrip Unit 1 (1975, 307 MW)	PC	0.31	0.15	SNCR + SOFA	$1564
9	Colstrip Unit 2 (1976, 307 MW)	PC	0.33	0.15	SNCR + SOFA	$1571
	MINNESOTA					
10	Sherburne County Unit 1 (1976, 762 MW)	PC	0.19	0.15	SOFA + LNB + Optimized Controls	$430
11	Sherburne County Unit 2 (1977, 752 MW)	PC	0.19	0.15	Existing LNB/SOFA + Optimized Controls	$360
12	Boswell Energy Center Unit 3 (1973, 351 MW)	PC	0.05[6]	0.07	SCR + LNB + OFA[6]	$3201
13	Allen S King[5] (1968, 610 MW)	Cyclone	0.09	Not Applicable[7]	Not Applicable[7]	Not Applicable[7]

[4] The State of Montana chose to not propose a SIP, therefore EPA developed a FIP for the state

[5] The JE Corette Plant (1968, 158 MW) was also subject to BART, however the plant is planned to be shuttered in April 2015

[6] Boswell 3 installed the SCR, LNB, and OFA equipment in 2009

[7] Allen S King Unit 1 was determined to not be subject to BART because it already had installed SCR in 2007 as part of Xcel Energy's voluntary Metro Emissions Reduction Project (MERP)

State and EPA NOx BART Determinations for SD, ND, MT, MN and WY

	A	B	C	D	E	F
	Facility	Boiler Firing Method	Year 2012 NOx Emission Rate (lb/mmbtu)	BART Determination: NOx Rate (lb/mmbtu on a 30-day rolling average)	BART Determination: NOx Controls	BART Cost Effectiveness ($/ton NOx removed)
	WYOMING *Information below based on proposed EPA action on June 10, 2013*					
14	Jim Bridger Unit 1 (1974, 530 MW)	PC	0.18	Phase 1 BART: 0.28 Phase 2 Long Term Strategy: 0.07	Phase 1: SOFA + LNB Phase 2: SCR by 12/31/2022	Phase 1: $256 Phase 2: $2393
15	Jim Bridger Unit 2 (1975, 530 MW)	PC	0.19	Phase 1 BART: 0.28 Phase 2Long Term Strategy: 0.07	Phase 1: SOFA + LNB Phase 2: SCR by 12/31/2021	Phase 1: $308 Phase 2: $3015
16	Jim Bridger Unit 3 (1976, 530 MW)	PC	0.20	0.07[8]	SCR + SOFA + LNB[8] by 12/31/2015	$2961
17	Jim Bridger Unit 4 (1979, 530 MW)	PC	0.19	0.07[8]	SCR + SOFA + LNB[8] by 12/31/2016	$2492
18	Laramie River Units 1 - 3 (Unit 1 1980, 565 MW) (Unit 2 1981, 570 MW) (Unit 3 1982, 570 MW) ***Proposed WY State SIP***	PC	0.17 (Unit 1) 0.19 (Unit 2) 0.19 (Unit 3)	***SIP***: 0.21	***SIP***: OFA + LNB	***SIP***: ≈$2000
	Laramie River Units 1 - 3 ***Proposed EPA FIP***			***FIP***: 0.07	***FIP***: SCR + OFA + LNB	***FIP***: ≈$3700
19	Dave Johnston Unit 3 (1964, 220 MW) ***Proposed WY State SIP***	PC	0.21	***SIP***: 0.28	***SIP***: OFA + LNB	***SIP***: $648
	Dave Johnston Unit 3 ***Proposed EPA FIP***			***FIP***: 0.07	***FIP***: SCR + OFA + LNB	***FIP***: $2540

[8] For Jim Bridger Units 3 and 4, the State technically determined that BART was SOFA + LNB and that SCR is being required as part of the State's long term haze strategy. However, the timeframe to install SCR is within the timeframe that BART controls would have to be installed pursuant to 51.308(e)(iv).

State and EPA NOx BART Determinations for SD, ND, MT, MN and WY

	A	B	C	E	F	G
	Facility	Boiler Firing Method	Year 2012 NOx Emission Rate (lb/mmbtu)	BART Determination: NOx Rate (lb/mmbtu on a 30-day rolling average)	BART Determination: NOx Controls	BART Cost Effectiveness ($/ton NOx removed)
	WYOMING *Continued* *Information below based on proposed EPA action on June 10, 2013*					
20	Dave Johnston Unit 4 (1972, 330 MW) ***Proposed WY State SIP***	PC	0.15	***SIP***: 0.15	***SIP***: OFA + LNB	***SIP***: $137
	Dave Johnston Unit 4 ***Proposed EPA FIP***			***FIP***: 0.12	***FIP***: SNCR + OFA + LNB	***FIP***: $740
21	Naughton Units 1 - 2 (Unit 1 1963, 160 MW) (Unit 2 1968, 210 MW) ***Proposed WY State SIP***	PC	0.34 (Unit 1) 0.22 (Unit 2)	***SIP***: 0.26	***SIP***: OFA + LNB	***SIP***: ≈$400
	Naughton Unit 1 - 2 ***Proposed EPA FIP***			***FIP***: 0.07	***FIP***: SCR + OFA + LNB	***FIP***: ≈$2300
22	Naughton Unit 3 (1971, 330 MW)	PC	0.35	0.07	SCR + OFA + LNB	$3243
23	Wyodak Unit 1 (1978, 335 MW) ***Proposed WY State SIP***	PC	0.19	***SIP***: 0.23	***SIP***: OFA + LNB	***SIP***: $881
	Wyodak Unit 1 ***Proposed EPA FIP***			***FIP***: 0.17	***FIP***: SNCR + OFA + LNB	***FIP***: $1979

EPA Database of Large Cyclone-Fired Boilers Primarily Firing PRB Coal[1]

A	B	C	D	E	F	G			H
State	Plant Name	Boiler /Generator ID	Boiler Year On Line	MW Capacity	BART Eligible?	Existing NOx Controls			OTP Comments
						SCR	SNCR	RRI	
Iowa	George Neal North	1	1964	135	Yes				Under Consent Decree to stop burning coal by April 2016
Illinois	Baldwin Energy Complex	1	1970	624	Yes	X			
	Baldwin Energy Complex	2	1973	629	Yes	X			
	Coffeen	1	1965	340	Yes	X			
	Coffeen	2	1972	560	Yes	X			
	Joliet 9	6	1959	314	No			X	
	Kincaid Generation LLC	1	1967	584	Yes	X			
	Kincaid Generation LLC	2	1968	584	Yes	X			
	Powerton	5	1973	770	Yes			X	
	Powerton	6	1976	770	Yes			X	
	Will County	1	1955	151	No				Shut down in Dec. 2010
	Will County	2	1955	148	No				Shut down in Dec. 2010
Indiana	Michigan City	12	1974	469	Yes	X			
	R M Schahfer	14	1976	431	Yes	X			
	State Line Energy	4	1962	303	Yes				Shut down in March 2012

A	B	C	D	E	F	G			H
State	Plant Name	Boiler /Generator ID	Boiler Year On Line	MW Capacity	BART Eligible?	Existing NOx Controls			OTP Comments
						SCR	SNCR	RRI	
Kansas	La Cygne	1	1973	724	Yes	X			
Minnesota	Allen S. King	1	1968	610	Yes	X			
Missouri	Asbury	1	1970	213	Yes	X			
	New Madrid	1	1972	580	Yes	X			
	New Madrid	2	1977	580	Yes	X			
	Sibley	3	1969	401	Yes	X			
	Sioux	1	1967	497	Yes			X	
	Sioux	2	1968	497	Yes			X	
	Thomas Hill	1	1966	175	Yes	X			
	Thomas Hill	2	1969	275	Yes	X			
South Dakota	Big Stone	1	1975	470	Yes				SCR required by Regional Haze SIP
Tennessee	Allen Steam Plant	1	1958	245	No	X			Per Consent Decree, must also install FGD on all units or retire by 12/31/18
	Allen Steam Plant	2	1959	245	No	X			
	Allen Steam Plant	3	1959	245	No	X			
Wisconsin	Edgewater	4	1969	321	Yes			X	Per Consent Decree, must retire or repower by 12/31/18

[1] Information compiled from: Emissions & Generation Resource Integrated Database (eGRID2012 Version 1.0) at http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html, EPA's Clean Air Markets Division Database at http://ampd.epa.gov/ampd/, and EPA table of coal unit characteristics 2012 at http://www.epa.gov/airmarkets/images/CoalUnitCharacteristics2012.xls. Comments column added from OTP research. In this Exhibit, large boilers are defined to be boilers that are greater than 125 MW.