Direct Testimony and Schedules
Roger A. Clarke

State of Minnesota
Before the Office of Administrative Hearings
For the Minnesota Public Utilities Commission

In the Matter of a Petition by Excelsior Energy Inc. for Approval of a Power Purchase Agreement Under Minn. Stat. § 216B.1694, Determination of Least Cost Technology, and Establishment of a Clean Energy Technology Minimum Under Minn. Stat. § 216B.1693

OAH Docket No. 12-2500-17260-2
PUC Docket No. E6472/M-05-1993

Environmental Impacts

September 5, 2006

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I. INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR NAME.

A. My name is Roger A. Clarke.

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

A. I am the Manager of Waste and Remediation for Northern States Power Company doing business as Xcel Energy ("Xcel Energy" or the "Company").

Q. FOR WHOM ARE YOU TESTIFYING?

A. I am testifying on behalf of Xcel Energy.

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS AND EXPERIENCE.

A. I have 18 years of experience in environmental and regulatory activities primarily associated with supporting electrical generation. Currently, I am the Manager of Xcel Energy's Waste and Remediation team. The Waste and Remediation team is responsible for conducting Environmental Site Assessments and due diligence with respect to the acquisition and/or divestiture of real property. During my career, my responsibilities have spanned all of the primary disciplines of environmental management, air, water, and waste. While I was at NRG some of my key responsibilities were: completing multi-media environmental due diligence on a diverse array of generating technologies across a broad geographic area; implementing and managing multi-media compliance programs and strategies; and providing permitting support (including but not limited to air and water permits) and compliance support to project teams assigned to construct new generating capacity. Since rejoining Xcel Energy I have lead multimedia teams assigned

to conduct environmental due diligence on various proposals for contracted baseload capacity. My resume is provided as Exhibit___(RAC-1), Schedule 1.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I assess the MEP-I LLC's ("Mesaba 1 LLC") claims regarding emissions from Mesaba Unit 1. Integrated Gasification Combined Cycle ("IGCC") technology offers the promise of low emissions of air pollutants. The question for this analysis is whether Mesaba Unit 1 will, as required by the clean energy technology statute, significantly reduce certain specified emissions (sulfur dioxide, nitrogen oxide, particulate and mercury) as compared to those of traditional technologies.

To complete my assessment, I reviewed Mesaba 1 LLC's Petition, including the Final Report prepared by ICF Consulting ("ICF") entitled "*Air Quality and Health Benefits Modeling: Relative Benefits Derived from the Operation of the MEP-I/II IGCC Power Station*" (the "ICF Report"), and the testimony of several witnesses, including Baxter Jones, Robert S. Evans II, Thomas L. Osteraas and Daniel Schrag. Based on this review, I conclude that:

- *ICF's modeling assumptions are sufficiently problematic as to raise questions about the validity of its results.* For example, there is incomplete information and modeling to accurately and thoroughly compare the emissions profile of Mesaba Unit 1 with that of other traditional technologies. Such a comparison is further complicated because both IGCC and Super Critical Pulverized Coal ("SCPC") technology are continually improving.
- *While IGCC technology's ability to support carbon sequestration is clear, a number of infrastructure, regulatory, and liability issues must first be*

addressed These issues must be overcome before geologic sequestration of carbon dioxide ("CO_2") will be a viable disposal option for large-scale energy projects.

Thus, I believe there is insufficient information to determine that Mesaba Unit 1 will significantly reduce emissions over traditional technologies for the designated emissions.

Further, the modeling assumptions utilized by ICF to support the demonstration that the proposed project is, or is likely to be, a least-cost source of baseload capacity have some problems, thus making it unclear whether the results claimed by Mesaba 1 LLC are valid.

II. ASSESSMENT OF ICF REPORT

Q. PLEASE DISCUSS YOUR CONCERN WITH THE ICF REPORT'S COMPARISON OF IGCC TO TRADITIONAL TECHNOLOGIES.

A. Some of the assumptions made in the ICF Report do not facilitate a direct comparison of the benefits of the IGCC technology over other solid fuel baseload technologies. I have identified the following flaws:

1) The externality cost calculations include costs that are in part attributable to differences in the demographics of the selected plant sites. Consequently, the environmental and health benefits described in the ICF Report will not be attributable strictly to the differences in technology, but will at least in part relate to the assumed locations of the plants.

2) The total annual emissions data used in ICF's modeling are noticeably lower than those reported in Mesaba 1 LLC's Application to the Minnesota Pollution Control Agency for a New Source Review Construction Authorization Permit dated June 16, 2006 ("Permit Application"). It is not clear what ICF's modeling would show had it used the emissions reported in Mesaba 1 LLC's Permit Application.

3) The ICF Report compares emissions from Mesaba Unit 1 to only one technology (SCPC) and does not consider other solid fuel technologies, such as a circulating fluidized bed ("CFB") technology. CFB technology has the potential for lower emissions of sulfur dioxide, particulate matter, and volatile organics than the modeled SCPC plant. Further, no comparison has been performed on other traditional technologies such as hydro power, nuclear, or combined cycle gas plants. Although these are not solid fuel baseload technologies, they are traditional generation technologies.

Because of these limitations in the ICF Report, I do not believe there is sufficient information to conclude that Mesaba Unit 1 would significantly reduce emissions compared to traditional technologies, and I cannot determine whether sufficient differences exist in the air quality and health benefits modeling between the Mesaba Unit 1 and other solid fuel technologies to support the conclusion drawn by Mesaba 1 LLC.

A. Emissions Analysis

Q. PLEASE DESCRIBE IN GREATER DETAIL WHY THE REPORT'S DIRECT COMPARISON OF AIR EMISSIONS AND HEALTH BENEFITS IS INCONCLUSIVE.

A. ICF uses a tool called Regional Modeling System for Aerosols and Deposition ("REMSAD") to compare the relative air quality and health benefits of IGCC and SCPC. As confirmed by Mesaba 1 LLC's response to Xcel Energy's Information Request No. 88, the model assumed that the IGCC facility was located in northern Minnesota, while the hypothetical SCPC plant was located in central Minnesota near Becker, Minnesota. Because the two technologies were not modeled at the same location, there is a potential that the reported differences in relative air quality and health benefits reflect variables other than the different technologies. Specifically, as acknowledged in the ICF Report, the difference in the proposed facility locations and the difference in emissions combine to give considerably lower estimated mortality risks for Mesaba Unit 1 (ICF Report page 3-9).

Q. WHY DOES THIS MATTER?

A. The differences in demographic composition of the two locations have the potential to affect the assessment of health benefits and the associated externality calculation. Consequently, it is reasonable to conclude that the relative health impacts are at least in part higher for the hypothetical SCPC plant due to the differences in demographics between the two locations.

Q. ISN'T THE ICF REPORT SIMPLY TRYING TO COMPARE TWO KNOWN AND LIKELY POTENTIAL SITES?

A. That may be, but this approach does not allow for an effective and accurate comparison of the emissions characteristics and health benefits of IGCC and other solid fuel technologies. To get a more precise result, the modeling should have been conducted such that the only variables not controlled were those associated with the performance differences between the two

technologies (i.e., both technologies would be modeled at the same location). Not doing so is a concerning flaw in ICF's comparison.

Q. LET'S TURN TO YOUR SECOND CONCERN REGARDING THE ASSUMED EMISSIONS FROM MESABA UNIT 1. CAN YOU ELABORATE?

A Yes. A second major concern with the ICF Report is that the total annual emissions currently predicted from Mesaba Unit 1 are significantly higher than those modeled to support the Petition. ICF calculated the modeled daily emissions by dividing the annual total emissions by 344, the number of days the facility is planned to operate. However, the total annual emissions data used to support the REMSAD modeling are noticeably lower than those identified as the annual expected emissions identified on Table 6 in Section IV of the Petition and on Table 7.2-1 of Mesaba 1 LLC's Permit Application.

Q. DOES MESABA 1 LLC EXPLAIN THIS DIFFERENCE?

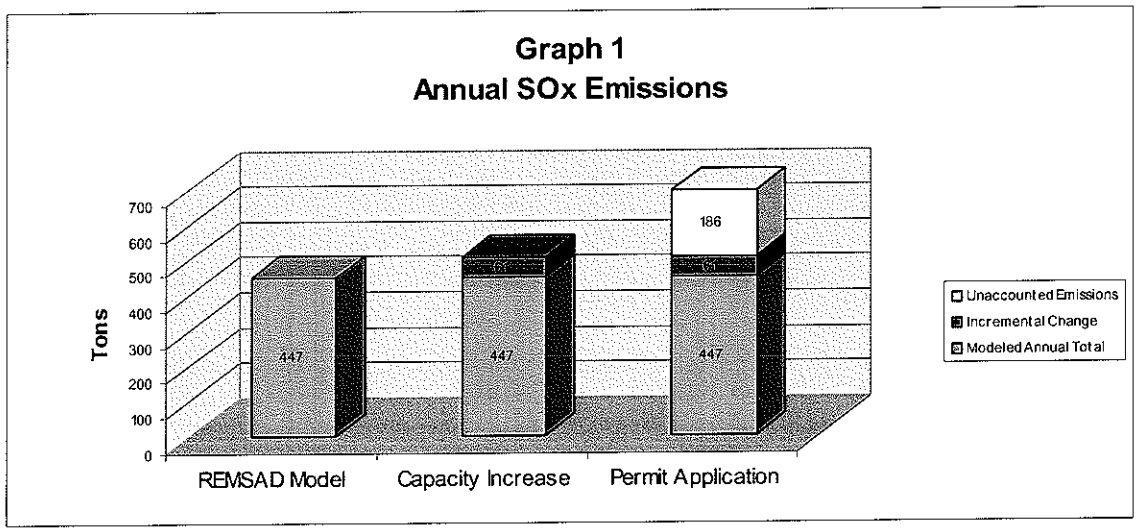
A. The ICF Report indicates that when it conducted the modeling, the capacity of the proposed Mesaba Unit 1 project was projected to be 531 MW. The capacity for the project is now 603 MW, representing an approximate 14 percent increase in the unit capacity. Mr. Baxter Jones' testimony suggests that air quality and health impacts are linear with power production and that "the relative small adjustment in size assumption would not be expected to materially affect the conclusions of our overall, comparative health risk analysis."

Q. IS THIS EXPLANATION SATISFACTORY?

A. No. To demonstrate, I compared the annual total emissions under the Petition with those in the Permit Application for three cases:

- Annual total emissions modeled,
- Projected total annual emissions associated with the incremental change in unit capacity, and
- Total annual emissions identified on page 132 of the new source review construction authorization Permit Application.

This analysis shows that, with respect to sulfur dioxide for example, the total annual emissions cited in the Permit Application are 55 percent higher than what ICF modeled. Graph 1 below illustrates this result.



Exhibit___(RAC-1), Schedule 2, attached to my testimony, contains Graphs 2 through 5, which show the results for the other modeled emissions. These graphs illustrate that the annual total emissions as identified in the Permit Application are higher than those assumed by the ICF Report by the following margins:

Emission	Percent Increase
Nitrous Oxide (NO)	16%
Carbon Monoxide	27%
Particulates	28%
Volatile Organic Compounds	55%

Part of this increase in the annual emission totals can be attributed to the 14-percent increase in capacity for Mesaba Unit 1. However, this information is inconsistent with the suggestion of Mr. Jones that emissions are essentially linear with power production, as there are emission increases that have not been accounted for by his statement. Thus, Mr. Jones' explanation is not satisfactory. This issue clouds the results of the ICF Report.

Q. WHAT DOES THIS MEAN FOR THE MESABA UNIT 1'S EMISSIONS CLAIMS?

A. Mr. Jones' testimony assumes that Mesaba Unit 1's actual annual total emissions are lower than those presented in Mesaba 1 LLC's Permit Application. To support the Petition's emissions claims, the information from the Mesaba Unit 1's Permit Application should have been used.

Q. PLEASE TURN TO YOUR THIRD CONCERN WITH THE ICF REPORT, THE SELECTION OF TECHNOLOGIES. PLEASE EXPLAIN.

A. The ICF Report limited its assessment to emissions data for Mesaba Unit 1 and a hypothetical SCPC plant. There are other existing "traditional" solid fuel baseload technologies prevalent in the energy industry that should also have been compared to Mesaba Unit 1. For example, Montana Dakota Utilities' Gascoyne project (which the Petition acknowledges, but ICF did not model) proposed for North Dakota will employ CFB technology with an emission limit of 0.038 lbs/MMBtu (U.S. EPA's RACT/BACT/LAER clearinghouse Record ND-0021). ICF's modeling should have considered other recognized and prevalent solid fuel baseload technologies equipped with emissions controls that are being permitted in the same timeframe as Mesaba Unit 1.

Q. WHAT WOULD A COMPARISON TO CFB DEMONSTRATE?

A. The comparison would demonstrate that some CFB plant projects currently being permitted have significantly lower emission rates for some criteria pollutants than those used in ICF's modeling of the hypothetical SCPC plant. For instance, Table 1 below shows the emissions rates for the proposed South Heart CFB project located in South Heart, North Dakota, (http://www.epa.gov/ttn/catc/rblc/htm/onlinelibrary.html) and the emission rates of those facilities modeled by ICF.

Table 1 – Comparative Emission Rates

	Mesaba Unit 1 lbs/MMBtu	Hypothetical SCPC lbs/MMBtu	South Heart CFB lbs/MMBtu
Sulfur Dioxide	0.021	0.08	0.039
Nitrogen Oxides	0.059	0.07	0.09
Carbon Monoxide	0.038	0.15	0.15
Particulate Matter	0.009	0.02	0.013
Volatile Organics	0.003	0.004	0.0025

As you can see from the table, the South Heart project emission rate for sulfur dioxide is 51 percent lower than the emission rate modeled for the Hypothetical Super Critical Pulverized Coal unit. The data also shows that the project's particulate matter emission rates are 35 percent lower and its volatile organic emission rate is 37 percent lower than the emission rates of the hypothetical SCPC unit modeled by ICF.

B. Mercury Analysis

Q. PLEASE DISCUSS YOUR CONCERNS REGARDING THE MERCURY ANALYSIS.

A. I offer the following observations regarding the ICF Report's mercury analysis:

- Mercury speciation data was available from only two IGCC facilities, neither of which uses the fuel proposed by Mesaba Unit 1.
- The analysis is subject to some of the same flaws of using different plant locations, making the direct comparison of the qualitative air emissions and health benefits questionable and the extent to which the benefits result from the technologies unclear.

Q. PLEASE ELABORATE ON YOUR FIRST POINT REGARDING MERCURY DATA.

A. Page 2.9 of the ICF Report indicates that mercury speciation data was available from only two IGCC facilities: the Wabash River Plant, with 100 percent of its mercury emissions classified as elemental, and the Polk Power Station with 90 percent of it mercury emissions classified as elemental. The ICF Report modeling assumes that 100 percent of Mesaba Unit 1's mercury emissions will be elemental. I understand that the basis for this assumption was the similarities between the processes proposed for use in Mesaba Unit 1 and those of the Wabash River Plant.

Q. DID ICF PERFORM SIMILAR ANALYSIS OF MERCURY EMISSIONS FOR BOTH IGCC AND SCPC?

A. No. Page 2.10 of the report states that, given the data gaps in its Alternative SCPC case, ICF concluded that a sensitivity case using a lower percentage of emissions of elemental mercury was necessary. Considering the limited mercury speciation data associated with IGCC plants, the mercury modeling should have taken a more conservative approach by modeling a sensitivity case for IGCC with a lower percentage of elemental mercury. This approach would have been consistent with the modeling approach for the alternative SCPC case. This modification is particularly important in light of the fact that

Mesaba Unit 1 will burn a different fuel (sub-bituminous vs. bituminous coal) than the fuel consumed by the two plants that were the source of the IGCC data.

Q. WHY IS THIS CONSISTENCY IMPORTANT?

A. This is significant because the speciation of mercury emissions has significant impacts on the deposition of mercury, thus affecting the modeling of the mercury deposition and consequently the relative health benefits. The modeling of sensitivity cases for both the IGCC and SCPC technologies would have been prudent.

Q. PLEASE ELABORATE ON YOUR SECOND CONCERN REGARDING THE MERCURY ANALYSIS REGARDING COMPARABILITY.

A. Similar to the issues identified regarding the emissions report, the mercury analysis does not allow for a direct comparison of mercury emissions from Mesaba Unit 1 and the hypothetical SCPC plant, due to assumed plant location differences, and did not consider alternate solid fuel baseload technologies. First, the ICF Report acknowledges that substantially more people (including women of child-bearing age) reside within the areas impacted by the hypothetical SCPC unit than the IGCC plant, such that at least a portion of the corresponding impacts were due to location differences rather than technology difference. The qualitative impacts from the mercury emissions would had been more directly comparable had the two types of plants been modeled at the same geographical location.

Second, the analysis only compared the emissions from the proposed Mesaba IGCC project and a hypothetical SCPC plant. As discussed earlier, there are

other existing solid fuel baseload technologies that are prevalent in the energy industry that were not considered in this evaluation.

Q. WHAT DO YOU BELIEVE THE RESULTS MIGHT BE IF THESE ISSUES WERE CORRECTED?

A. If the technologies were modeled from the same location and the annual emissions included in Mesaba Unit 1's Permit Application were used, the relative health impacts would be closer. To make this determination, however, one would need to rerun the REMSAD modeling using corrected assumptions that addressed the issues I have identified and recalculate the benefit to air quality and human health.

Q. DID THE ANALYSIS COMPARE ANY OTHER TECHNOLOGIES SUCH AS HYDRO, NUCLEAR, OR COMBINED CYCLE GAS PLANTS.

A. No, the analysis was limited to the Mesaba IGCC plant and the hypothetical Super Critical Pulverized Coal plant.

C. Externality Analysis

Q. DO YOU HAVE ANY CONCERNS WITH RESPECT TO THE EXTERNALITY VALUES USED IN THE ICF REPORT?

A. Yes. The Petition assumes environmental costs related to PM_{25} to demonstrate the environmental benefits of Mesaba Unit 1, but the Minnesota Public Utilities Commission ("Commission") has not established an externality value for this emission. The Commission's Order establishing externality values (Docket No. E999/CI-93-583) provides for a qualitative discussion of PM_{25} (as it does for mercury), but does not establish a value or allow the unilateral development of a new externality value. Instead, Mesaba 1 LLC

should have discussed $PM_{2.5}$ and mercury qualitatively and has not done so for $PM_{2.5}$. The environmental analysis of the project should reflect the requirements of the Commission's orders rather than attempting to establish an externality value for $PM_{2.5}$ in this proceeding.

D. Technology Advancements

Q. DO YOU HAVE ANY OBSERVATIONS REGARDING THE TECHNOLOGY COMPARISONS PRESENTED BY MESABA 1 LLC IN THIS PROCEEDING?

A. Yes. First, the Petition asserts that the Mesaba Unit 1 could achieve better across-the-board emission results than the other coal-fired facilities selected for comparison. However, with the possible exception of nitrous oxide and carbon monoxide emissions, the implementation of controls for one pollutant does not preclude the use of those controls for another. In other words, the comparison provided is not complete. It should not be assumed that just because SCPC or CFB facilities have not yet been permitted with the full compliment of the most effective emission control devices that it cannot be done. The comparison should include the emissions reductions the traditional technologies can achieve.

Second, the same drivers that prompted the development and enhancement of IGCC technologies are also driving vendors to continue to reduce the emissions profiles of other coal-fired technologies, such as SCPC and CFB.

Q. ARE IMPROVEMENTS STILL BEING MADE TO THE APPLICATION OF THE IGCC TECHNOLOGY TO LARGE SCALE ENERGY PROJECTS?

A. According to the literature I have reviewed, yes.

The EPA released a final report discussing IGCC and pulverized coal technologies in July of 2006 (Environmental Footprints and Costs of Coal-based Integrated Gasification Combined Cycle and Pulverized Coal Technologies). The EPA characterized IGCC technology as a promising, dynamic and rapidly evolving technology.

While several projects are being planned, and numerous similar air emissions control systems are being utilized within the petroleum and chemical industries, the EPA indicated in this report that with the exception of controls for CO_2, the control systems utilized to reduce emissions from IGCC plants had only been demonstrated at two existing coal and petroleum coke-based facilities in the US. In the executive summary of this report, the EPA indicated that the remaining uncertainty with IGCC technology is associated with demonstrating that the emission control systems can be successfully utilized continuously and for an extended time period as would be required in the electrical generation industry.

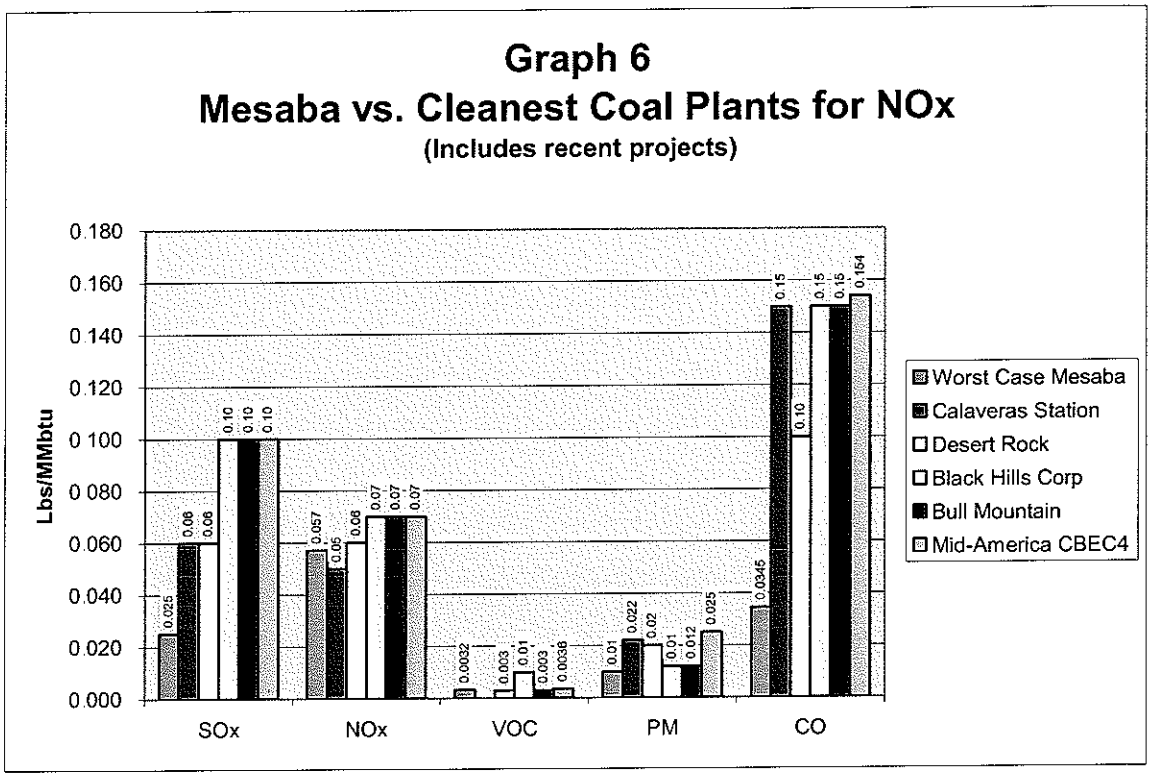
Q. WHAT OTHER FACTORS NEED TO BE CONSIDERED IN COMPARING EMISSIONS REDUCTION OF VARIOUS SOLID FUEL TECHNOLOGIES?

A. Recently announced SCPC projects that have a lower combination of criteria pollutant emissions than those identified in the Petition should be considered. For example, the Environmental Protection Agency ("EPA") issued a draft air permit for Sithe Global's Desert Rock 1500-MW supercritical pulverized coal plant. This plant has a lower combination of emission limits for both NOx and SOx (0.06 lbs/MMBtu) than any of the cleanest coal plants identified by Mesaba 1 LLC in the Petition. In addition, the City Public Service of San Antonio has permitted a new coal fired plant at its Calaveras Station. This

plant is anticipated to be operational in 2010 and has a lower combination of emission limits for NOx and SOx (0.05 and 0.06 lbs/MMBtu) than those identified in the Petition.

Q. WHAT WOULD A COMPARISON OF THESE PLANTS TO MESABA UNIT 1 LOOK LIKE?

A. Graph 6 below compares the relative emission rates for these two recent projects to the coal plants previously identified in the Petition. Graph 6 is comprised of the same emissions data as shown in Figure 15 of Section I (page 32) of the Petition. It also contains the emission data from the Calaveras Station and Sithe's Global Desert Rock Facility. You can see from this graph that the NOx emissions from these two facilities are nearly identical to those of the Mesaba Unit 1. In contrast to the other low emitting plants previously identified by Mesaba 1 LLC, you can also see that while the sulfur dioxide emissions are higher than those of Mesaba Unit 1, they are significantly lower than those coal fired plants identified by Mesaba 1 LLC.



Q. HOW DO THESE NEW PLANTS COMPARE WITH THE HYPOTHETICAL SCPC ICF MODELED?

A. The data shown on Table 2 below compares the emissions rates for the hypothetical SCPC unit modeled by ICF to these new SCPC projects.

Table 2 – Proposed Coal-Fired Pulverized Coal Boilers

	SOx # s/MMBtu	NOx # s/MMBtu	PM10 # s/MMBtu	CO # s/MMBtu	VOC # s/MMBtu	Average Time
Hypothetical SCPC	0.08	0.07	0.02	0.15	0.004	Unknown
Desert Rock	0.06	0.06	0.02	0.10	0.003	24 hour
Calaveras Lake	0.06	0.05	0.022	0.15		Annual

Q. WHAT DOES THIS COMPARISON DEMONSTRATE?

A. The data shows that the recently announced projects are expected to achieve even lower emission rates for some criteria pollutants – specifically SOx and NOx – than those modeled by ICF.

III. CARBON SEQUESTRATION ISSUES

Q. IS THE MESABA UNIT 1 PROJECT GOING TO PROVIDE CARBON SEQUESTRATION WHEN IT BECOMES OPERATIONAL IN 2011?

A. No.

Q. HAS MESABA 1 LLC PROVIDED A CO_2 SEQUESTRATION DEMONSTRATION OR PLAN?

A. Not specifically. The project will leave space for the possible future addition of CO_2 sequestration at Mesaba Unit 1.

Q. WHAT IS YOUR ASSESSMENT OF THE POSSIBILITY OF CARBON SEQUESTRATION?

A. The opportunity and subsequent benefits of CO_2 sequestration from an IGCC plant is certainly appealing. However, there are significant challenges that must be overcome before sequestration is achievable for a large-scale energy project located in Minnesota.

Q. PLEASE EXPLAIN.

A. A recent document published by the Global Energy Technology Strategy Program (GTSP) on CO_2 capture and geologic storage suggests that there are not any viable CO_2 sequestration opportunities available in northern Minnesota (p. 26 of Carbon Dioxide Capture and Geologic Storage, published April 2006). The Big Sky Carbon Sequestration Partnership has recently asserted the potential of CO_2 geologic sequestration within Minnesota basalt bedrock. While I understand that basalt is prevalent in the northern Minnesota, previous discussions with the MPCA have suggested that this is

not a likely option as the basalt is likely to be fractured and therefore unsuitable.

Q. HOW WOULD MESABA UNIT 1 SEQUESTER CO_2?

A. CO_2 that is captured by the Mesaba Unit 1 would presumably need to be transported outside of Minnesota for sequestration. According to the response to Xcel Energy Information Request No. 99, Mesaba 1 LLC indicated that the most likely sequestration option would be to transport the CO_2 via pipeline to the oil fields in the Williston Basin. Assuming connection into the existing CO_2 pipeline in Beulah North Dakota, the new connecting pipeline would need to be over 400 miles long.

Q. DOES THE LITERATURE SUGGEST THIS APPROACH COULD WORK?

A. According to the GTSP's publication "Carbon Dioxide Capture and Geologic Storage," pipeline transportation of CO_2 is an established practice. Page 15 of this document reports that more than 3,000 miles of dedicated CO_2 pipeline exists in the United States. This document also concludes the practice of injecting CO_2 into oil fields for enhanced oil recovery is well established and appears to be a viable option for the sequestration of CO_2.

Q. ARE THERE CHALLENGES TO IMPLEMENTING THIS APPROACH?

A. Assembling the capture, transportation, and storage pieces together for a large-scale project such as the 603-MW Mesaba Unit 1 plant has not been commercially demonstrated. The GTSP report suggests that potential large-scale carbon capture storage systems are probably still decades away (Section 1 page 21).

There are also two relatively new issues identified regarding the long-term CO_2 sequestration. The first relates to the allocation of liability risks associated with the geologic sequestration of CO_2. While the practice of injecting CO_2 to enhance oil recovery is not new, significant questions remain with respect to the ownership and liability for the sequestered CO_2. The Department of Energy's ("DOE") site selection process for the *FutureGen* project considered as key criteria the ownership and liability for the CO_2. In section 7 of the July 21, 2006 submittal of the document from the *FutureGen* Alliance to the Department of Energy entitled "*Results of Site Offeror Proposal Evaluation,*" the Alliance indicates that, in part, its rationale for the selection of the two sites in Texas was attributed to the State of Texas' agreement to assume title to and liability for the CO_2 produced from the project.

The second issue relates to the need to establish a permitting mechanism for geologic CO_2 sequestration. In a July 18, 2006 presentation, Dina Kruger, Director of the Climate Change Division, Office of Atmospheric Programs, EPA indicates that the geologic sequestration of CO_2 through well injection meets the definition of underground injection in section 1421(d)(1) of the Safe Drinking Water Act. The presentation therefore suggested that the Safe Drinking Water Act provided the regulatory framework for the permitting of the storage of CO_2.

The significance of this information is that while the technical pieces required for the capture, transportation and geologic storage of CO_2 appear to be available, there are ongoing technical, financial, legal, and regulatory challenges that must be overcome before geologic sequestration of CO_2 becomes a viable disposal option for large scale energy projects.

IV. CONCLUSION

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.

A. Based on my review of the information provided by Mesaba 1 LLC, I conclude that the modeling of environmental impacts includes assumptions that are problematic enough to raise questions about its results. These flaws lead me to conclude that there is insufficient information to determine that Mesaba Unit 1 would significantly reduce emissions over traditional technologies for the designated emissions. Given the data presented, I am uncertain as to how the results from the ICF Report would change if the issues I have identified were incorporated in the comparison between the proposed Mesaba Unit 1 and other solid fuel baseload capacity technologies. In addition, while IGCC technology's ability to support carbon sequestration is clear, there are a number of infrastructure, regulatory, financial, and liability issues that must be addressed before this approach is viable in Minnesota.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

Roger A. Clarke
Manager of Waste and Remediation
Xcel Energy
250 Marquette Plaza
Minneapolis, Minnesota 55401

May 2006 – Present

Manager, Waste and Remediation, Xcel Energy

Responsible for the managing compliance staff supporting Northern State Power Company's (NSP) Department of Transportation hazardous materials, regulated wastes, and PCB compliance programs, staff managing NSP's ash compliance program, compliance staff managing remediation projects and conducting environmental site assessments, and staff responsible for the management and operation of Xcel Energy's Hazardous Waste Storage Facility. I have also been responsible for managing multimedia project teams assigned to assess various proposals for base load capacity.

Dec 2002 – May 2006

Lead Environmental Analyst, Xcel Energy

Responsible for the development and implementation of compliance programs and strategies associated with the management of hazardous, specially regulated, universal and TSCA wastes. I was also responsible for the development and implementation of Northern State Power's (NSP) PCB compliance program.

January 2001 – December 2002

Director, Environmental Services, NRG Energy.

Responsible for environmental support of NRG's divestiture and acquisition activities. Managed environmental issues associated with the assimilation of newly acquired facilities into NRG's environmental management system. I was also responsible for providing environmental permitting and compliance support for the construction of new combined cycle plants.

July 1995 – January 2001

Manager, Environmental Services, NRG Energy, Inc.

Responsible for managing regional compliance staff for NRG's generating plants located in NRG's northeastern territory and for the development and implementation of compliance strategies primarily associated with air quality and water quality issues. I was also responsible for completing environmental due diligence on domestic and international power plants.

February 1989 – July 1995

Environmental Analyst, Northern States Power Company

Responsible for providing permitting and compliance support for NSP coal ash and refuse derived fuel ash disposal facilities. I was also responsible for working with stakeholder group to negotiate regulations for the management of Waste Combustor Ash.

October 1986 – February 1989

Plant Chemical Specialist, Sherburne County Generating Plant (NSP)

Responsible for the chemical analysis of steam cycle water, associated cooling water, lubricating systems, air pollution control systems, NPDES outfalls and ground water monitoring wells.

September 1985 – October 1986

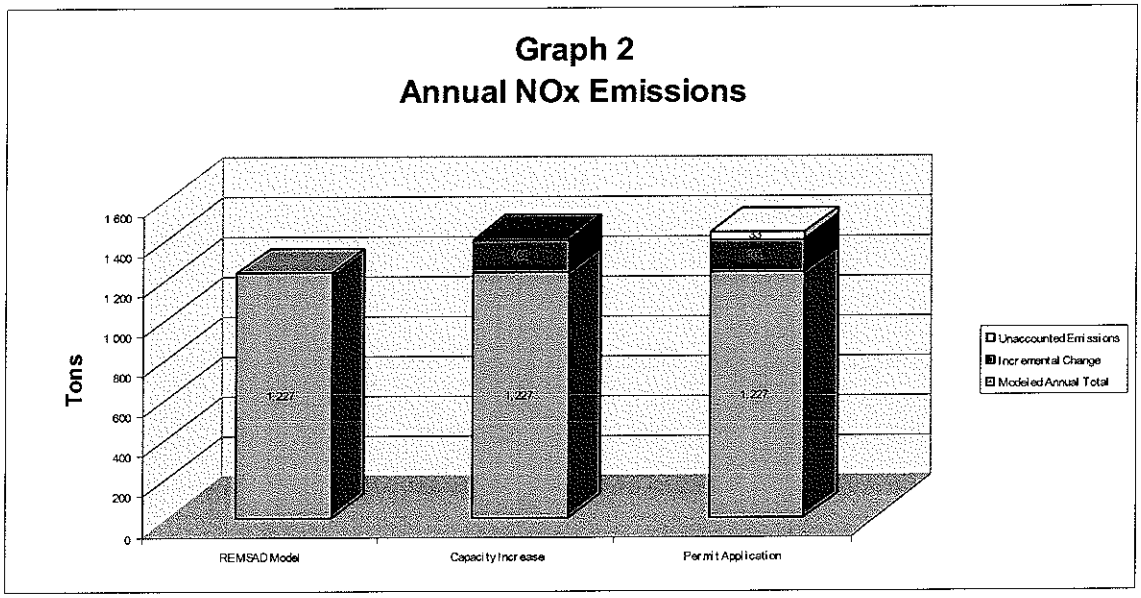
Research Assistant, Northern States Power Company

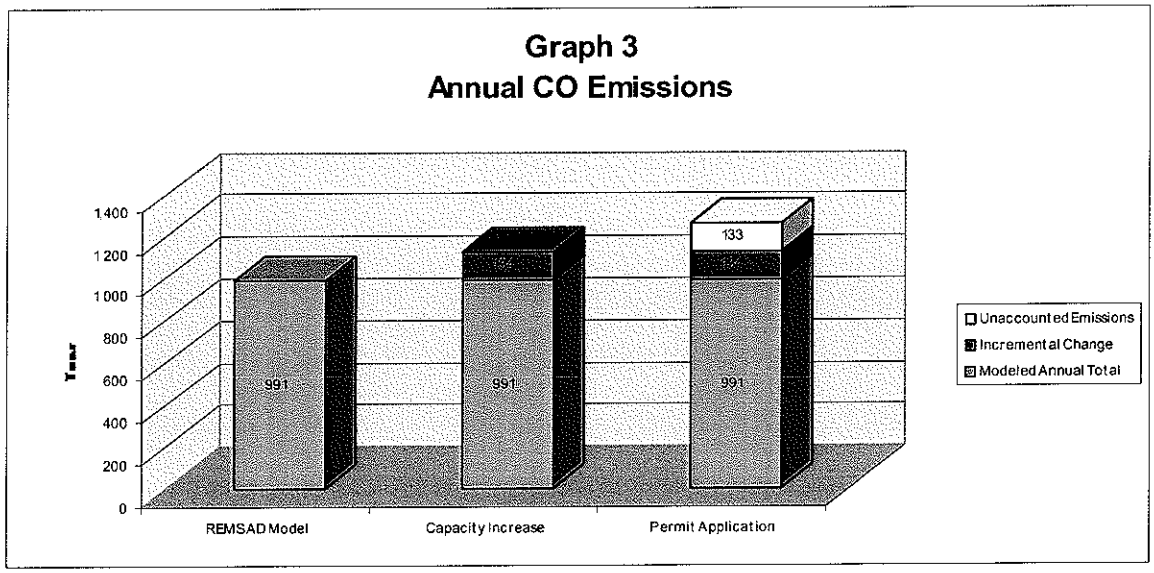
Responsible for routine maintenance of ambient air quality monitoring stations associated with the Sherburne County Generating Station and assisting with environmental monitoring of Mississippi River. Also responsible for the statistical analysis of air quality deposition data, and creation of exhibits to support NSP's testimony in response to the Minnesota's Acid Rain Initiative.

Education:

St. Cloud State University-Masters of Science:	Aquatic Biology
St. Cloud State University-Bachelors of Science:	Biology (Zoology Emphasis) Minor: Applied Statistics

Annual Emissions Comparisons





Annual Emissions Comparisons