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BEFORE THE
MINNESOTA OFFICE OF ADMINISTRATIVE HEARINGS
100 Washington Square, Suite 1700
Minneapolis, Minnesota 55401-2138
FOR THE
MINNESOTA PUBLIC UTILITIES COMMISSION
127 7th Place East, Suite 350
St. Paul, Minnesota 55101-2147

In the Matter of the Petition of Excelsior Energy Inc. and Its Wholly Owned Subsidiary MEP-I, LLC, for Approval of Terms and Conditions for the sale of Power from Its Innovative Energy Project Using Clean Energy Technology under Minn. Stat. § 216B.1694 and a Determination that the Clean Energy Technology Is or Is Likely to Be a Least-Cost Alternative under Minn. Stat. § 216B.1693

PREPARED REBUTTAL TESTIMONY AND EXHIBITS OF

EXCELSIOR ENERGY INC. AND MEP-I LLC

EDWARD N. STEADMAN

OCTOBER 10, 2006
CORRECTED OCTOBER 31, 2006

EXCELSIOR ENERGY INC.

BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

PREPARED REBUTTAL TESTIMONY AND EXHIBITS OF

EDWARD N. STEADMAN

I.
INTRODUCTION AND QUALIFICATIONS

Q Please state your name.

A My name is Edward N. Steadman.

Q By whom are you employed and what is your position?

A I am a Senior Research Advisor at the Energy & Environmental Research Center (EERC) at the University of North Dakota (UND). I am one of the founders of, and currently direct, the Plains CO_2 Reduction (PCOR) Partnership. The EERC has ten Centers of Excellence that were initiated to provide solutions to strategic energy and environmental issues, one of those centers being the Center for Climate Change and CO_2 Sequestration.

Q What is the mission of EERC?

A The EERC is recognized as one of the world's leading developers of cleaner, more efficient energy and environmental technologies to protect and clean our air, water, and soil.

The EERC is a high-tech, nonprofit branch of UND. The EERC operates like a business; conducts research, development, demonstration, and commercialization activities; and is dedicated to moving promising technologies out of the laboratory and into the commercial marketplace.

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Table 1. PCOR Phase II Partners as of 10/9/06
University of North Dakota Energy & Environmental Research Center (EERC)
Advanced Geotechnology Inc.
Air Products and Chemicals
Alberta Department of Energy
Alberta Energy and Utilities Board
Alberta Geological Survey
Amerada Hess Corporation
Apache Canada Ltd.
Basin Electric Power Cooperative
British Columbia Ministry of Energy, Mines and Petroleum Resources
Carbozyme, Inc.
Center for Energy and Economic Development (CEED)
Dakota Gasification Company
Ducks Unlimited Canada
Ducks Unlimited, Inc.
Eagle Operating, Inc.
Eastern Iowa Community College District
Encore Acquisition Company
Environment Canada
Excelsior Energy Inc.
Fischer Oil and Gas, Inc.
Great Northern Power Development, LP
Great River Energy
Interstate Oil and Gas Compact Commission
Iowa Department of Natural Resources – Geological Survey
Lignite Energy Council
MEG Energy Corporation
Minnesota Power
Minnkota Power Cooperative, Inc.
Missouri Department of Natural Resources
Montana–Dakota Utilities Co.
Montana Department of Environmental Quality
National Commission on Energy Policy
Natural Resources Canada
Nexant, Inc.
North Dakota Department of Commerce Division of Community Services
North Dakota Department of Health
North Dakota Geological Survey
North Dakota Industrial Commission Department of Mineral Resources, Oil and Gas Division
North Dakota Industrial Commission Lignite Research, Development and Marketing Program
North Dakota Industrial Commission Oil and Gas Research Council
North Dakota Natural Resources Trust
North Dakota Petroleum Council
Continued. . .

Table 1. PCOR Phase II Partners as of 10/9/06 (continued)
North Dakota State University
Otter Tail Power Company
Petroleum Technology Transfer Council
Prairie Public Television
Ramgen Power Systems, Inc.
Saskatchewan Industry and Resources
SaskPower
Suncor Energy Inc.
University of Alberta
U.S. Department of Energy
U.S. Geological Survey Northern Prairie Wildlife Research Center
Western Governors' Association
Wisconsin Department of Agriculture, Trade and Consumer Protection
Xcel Energy

Q For whom are you testifying?

A I am testifying on behalf of MEP-I LLC and Excelsior Energy Incl. (collectively "Excelsior"), the developers of the Mesaba Energy Project (the "Project").

Q Please summarize your qualifications and experience.

A I began working at the EERC (when it was known as the Energy and Mineral Research Center) in 1986 as a Research Associate, conducting research into the chemical and physical mechanisms of coal combustion and the characterization of coal and coal ash.

In 1988, I was named Research Manager of the Fuels and Materials Science area, where I was responsible for inorganic analytical methods. In 1994, I was appointed Associate Director for Research, a position in which I developed and administered environmental programs involving water management and contamination cleanup and built industry–government–academic teams to carry out research, development, demonstration, and commercialization of environmental products and technologies.

In 2003, I became a Senior Research Advisor, a position in which I direct a multidisciplinary team of researchers for the PCOR Partnership, a carbon sequestration

Investments in CO_2 sequestration infrastructure will likely become more prevalent as carbon markets mature and prices for carbon offsets stabilize. Markets will ultimately dictate the types of projects that are economical, but geologic sequestration projects and the offsets they produce will likely become a significant part of those markets. IGCC is an option that should be explored in the transition to a carbon-managed economy because of its CO_2 stream concentration.

As a matter of policy the EERC does not endorse one technology over another. That said, it is clear to the EERC that the IGCC technology has advantages which can positively impact the cost of carbon capture and sequestration not enjoyed by conventional coal-fired base load power generation technologies. Thus the EERC's vision is that IGCC may well be a feasible method of getting started with carbon capture and sequestration from base load power plants.

Q Does EERC have a vision for the region regarding the linking of power plant CO_2 sources and geological sinks?

A It is possible to draw a reasonable pipeline route through the PCOR Partnership region that links many of the major stationary sources with the region's best geologic sinks. This is shown in Figure 12.

This approach is not unreasonable. It has been done previously in the Permian Basin, as shown in Figure 13.

Q How long will it take and what must happen for carbon markets to develop and drive sources of CO_2 to build pipeline to capture the long-term value of carbon sequestration units?

A Although existing carbon markets in Europe have seen significant trading volumes for less than a year, they do provide some insight into the likely structure and behavior of

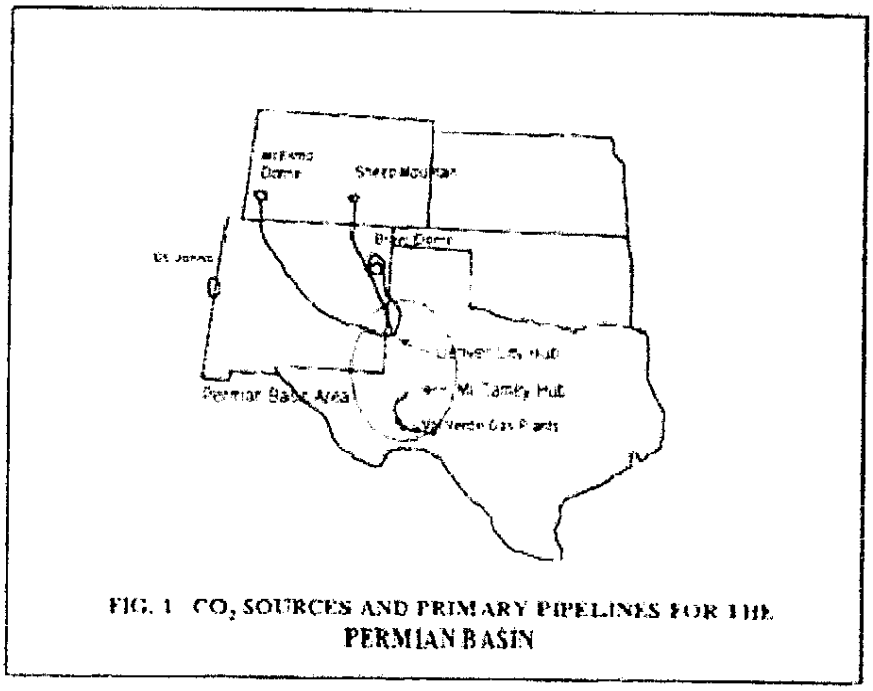

FIG. 1 CO_2 SOURCES AND PRIMARY PIPELINES FOR THE PERMIAN BASIN

Figure 13. CO_2 sources and primary pipelines for the Permian Basin.

carbon markets in the United States as carbon management becomes more important. Prices on the European market reached very high levels earlier this year as the Kyoto Protocol went into force. Prices spiked at over €30 per ton of carbon and then dropped precipitously as it became apparent that companies were better able to reduce overall CO_2 emissions through the adoption of increased energy efficiency strategies. The prices have stabilized and started to climb of late.

The Chicago Climate Exchange is a voluntary trading platform that has established some precedents for trading carbon credits in the United States Prices have been climbing in anticipation of increased focus on the potential to regulate carbon emissions and environmental stewardship concerns.

The most relevant example of a commercial-scale project that uses anthropogenic CO_2 for EOR and sequestration is the Weyburn project. EnCana's CO_2 EOR project has

been under way since 2000 at its Weyburn unit. Located in the southeast corner of the province of Saskatchewan in western Canada, the Weyburn unit is a 70-square-mile oil field discovered in 1954. The Weyburn Field is part of the large Williston sedimentary basin, which straddles Canada and the United States (Figure 14).

In September 2000, EnCana initiated the first phase of a CO_2 EOR scheme in 18 inverted 9-spot patterns. The flood is to be expanded in phases to a total of 75 patterns over the next 15 years. The CO_2 is approximately 95% pure, and the initial injection rate is 5500 tons/day (equivalent to 95 mmscfd). A total of approximately 22 million tons of CO_2 is expected to be injected into the reservoir over the project life. The CO_2 is a purchased by-product from the DGC's synthetic fuel plant in Beulah, North Dakota, and is transported through a 204-mi pipeline to Weyburn, Saskatchewan, Canada. The pipeline, compressors, and other infrastructure were all made a reality based on the economics of the EOR aspect of the project. There are many other potential EOR projects.

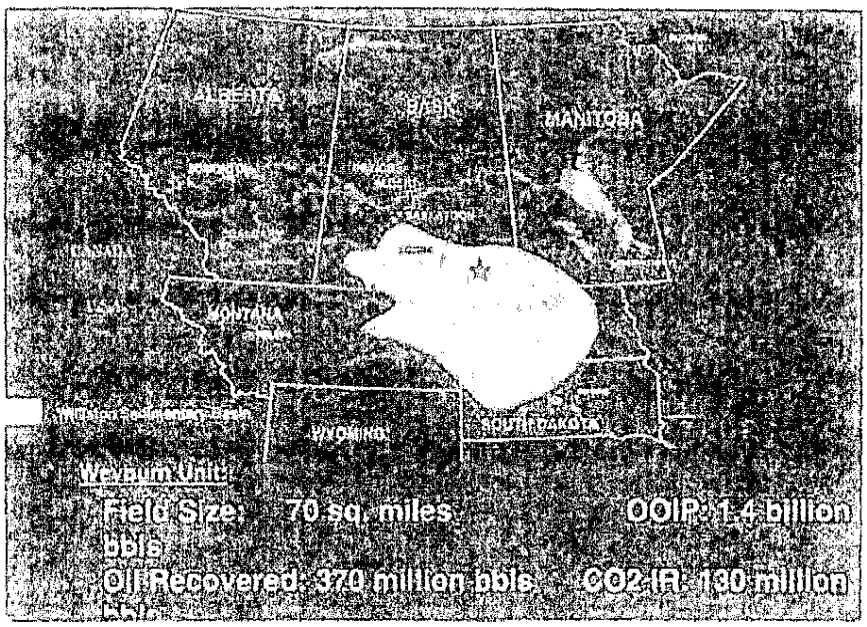

Figure 14. Location of the Weyburn Unit.

Q What are PCOR and EERC doing to further this vision of a future carbon constrained economy?

A ***Working to match sources and sinks.***

The CO_2 emissions from the various regional stationary sources are periodically reviewed to ascertain that they are up to date. Any major new sources that come online will be added to the database. Matches made with geologic sinks are reviewed when new information is found. If necessary, better sinks are matched to sources for which the data have been updated.

EERC has worked with North Dakota governmental decision-makers to provide for expedited pipeline-siting processes.

The PCOR Partnership has worked with partners to facilitate the development of draft legislation that would expedite the siting of pipelines to transport energy-related commodities including CO_2.

Creating CO_2 management plan options for Excelsior Energy Inc.

A carbon management plan is being developed for Excelsior Energy Inc.'s Mesaba IGCC plant. This will include recommendations for CO_2 geologic sequestration and waste management options that minimize or eliminate the release of greenhouse gases into the atmosphere. Also included in the plan will be local opportunities for terrestrial carbon sequestration. This plan is significant in that it is being performed prior to plant construction.

Other things EERC has done.

The PCOR Partnership is committed to developing environmentally sound and practical approaches to carbon management for our partners. We are continuing to characterize the region with respect to sequestration opportunities and are keeping our membership informed with respect to the regulatory and political backdrop for carbon

management activities. Our outreach activities seek to better inform our partners and the general public with respect to carbon management. The PCOR Partnership has assessed and prioritized the opportunities for sequestration in the region and helped to resolve the technical, regulatory, and environmental barriers to the most promising sequestration opportunities. At the same time, it has informed policy makers and the public regarding CO_2 sources, sequestration strategies, and sequestration opportunities. The following products have been completed:

- A comprehensive regional assessment of CO_2 sources and sinks.
- The development of the PCOR Partnership DSS, a GIS-based database providing our sponsors with a tool to evaluate CO_2 sequestration opportunities in the PCOR Partnership region.
- Identification, ranking, and action plans for promising sequestration demonstration projects.
- Key GIS products for CO_2 sources and sinks, infrastructure, and regulatory issues.
- Recommendations for monitoring and verification systems.

Further, the PCOR Partnership has worked with partners to facilitate the development of draft legislation that would expedite the siting of pipelines to transport energy-related commodities including CO_2.

The EERC has an extensive outreach program to provide the general public, regional decision makers, and industry executives with the information needed to understand the issues surrounding CO_2 sequestration. Materials include a regional atlas that has also been distributed to teachers for use in their classrooms, a video called "Nature in the Balance – CO_2 Sequestration" that has been aired on Prairie Public Television that is a primer for CO_2 sequestration, various fact sheets about different sequestration topics, articles in regional newspapers, and a public Web site including links to the more than 20 topical reports that were produced by the PCOR Partnership during the Phase I effort.

Public focus groups have provided feedback on the effectiveness of various aspects of the outreach materials.

During Phase II, the PCOR Partnership team is facilitating the field validation of CO_2 sequestration at four sites:

- Sequestration of a mixture of approximately 30% H_2S and 70% CO_2 in Zama, Alberta, for EOR.
- Deep sequestration of CO_2 in the Beaver Lodge oil field in western North Dakota for EOR.
- Sequestration in an unminable North Dakota lignite seam for ECBM recovery.
- Quantification of the amount of carbon that can be sequestered terrestrially in the wetlands.

D. EXCELSIOR ENERGY'S CO_2 MANAGEMENT PLAN

Q What will be addressed in the CO_2 management plan for Excelsior Energy?

A The EERC is conducting the following activities for Excelsior Energy Inc.:

- Development of a CO_2 Management Plan.
- Assessment of CO_2 sequestration opportunities.
  - Indirect sequestration of CO_2 into terrestrial sinks – The EERC will conduct reconnaissance-level evaluation of the carbon sequestration potential of regional terrestrial features, including forests, wetlands, and peat bogs in northern Minnesota.
  - Direct sequestration of CO_2 into geological sinks – The EERC will evaluate geologic formations and features that may be suitable for the storage of CO_2 generated by the Excelsior plant. These include, but are not necessarily limited to, oil and gas fields in the eastern margin of the Williston Basin, sedimentary rocks of the Mid-Continent Rift, mafic rocks of the Duluth Complex, and abandoned underground iron mines.
- Screening and matching of sink–source pairs specific to Excelsior operations. Sequestration opportunities identified during the assessment will be ranked according to engineering, economic, and public acceptance considerations.

The options that will most likely be available to Excelsior Energy Inc. for different time frames will be described and action plans developed to the extent possible when the management plan is prepared.

The action plans will likely include estimates of the CO_2 generated by the Mesaba plant as well as nearby sources, matching of these source(s) to the most proximal sinks with appropriate capacity, and an estimate of the likelihood that value-added products could be produced from the sequestration of Excelsior's CO_2. If the CO_2 from other sources can be combined with the Mesaba CO_2, estimates will be made as to pipeline route and possible division of costs between the sources and potential users of the CO_2.

Ultimate goal is to provide Excelsior EOR and saline formation sequestration options.

The Carbon Management Plan will include the results of a detailed examination of oil fields in the PCOR Partnership region that may be suitable candidates for CO_2 flood EOR activities. Because of their relatively close proximity compared to other basins, oil fields of the Williston Basin will be the primary focus of these efforts. A list of specific oil fields that may be suitable will be compiled and key characteristics of each field, including CO_2 storage capacity, potential incremental oil recovery, and major operating companies, will be provided. Any unique engineering, infrastructure, or regulatory requirements that may be associated with the fields will be described and evaluated with respect to potential impact to an EOR project.

The Carbon Management Plan will also include the results of evaluations of several saline formations in the region. At a minimum, the CO_2 storage capacity and other key characteristics of three saline aquifer formations in the Williston Basin will be evaluated in the context of Excelsior's planned IGCC facilities. Any unique engineering, infrastructure, or regulatory requirements that may be associated with the saline aquifer

systems will be described and evaluated with respect to potential impact to Excelsior carbon management operations.

Q **What deliverables are planned regarding Excelsior's CO_2 management options and costs for its Minnesota power plants?**

A ***Best practices manual for IGCC units laying out steps required to prepare for carbon-constrained future.***

We will prepare a Best Practices Manual for carbon management at IGCC facilities.

White paper discussing the conceptual elements identified in the preceding question.

We will prepare a white paper discussing the conceptual elements identified in the Carbon Management Plan.

Specific match of Excelsior sources to carbon sinks under each of the regulatory solution sets (i.e., expedient, moderate, and deliberate timetables).

The technical and economic information compiled on sources, infrastructure, and sinks will be used to develop recommendations regarding matches of Excelsior sources with types of carbon sinks under various regulatory conditions within the region.

Base maps showing potential pipeline routes and infrastructure requirements (i.e., pumping stations, distribution laterals, etc.) that would serve to deliver CO_2 produced by the Mesaba Energy Project to EOR/saline formation sequestration sites; and graphical displays of potential options for linking other facilities to the distribution laterals.

Please refer to Figure 14.

Cost analysis attending each regulatory solution set and the appropriate regulatory mechanism that would support the timetable established.

We will be providing cost analyses, as appropriate, for the various options that are identified.

Phase III proposal to DOE for deploying carbon capture technology via IGCC Mesaba Energy Project.

It is possible that we would team with Excelsior Energy Inc. to develop a Phase III proposal.

Q What is the timetable for delivering Excelsior's management plan?

A The white paper will be completed in December 2006. The Best Practices Manual for IGCC units will be completed in November 2007. All other analyses will be completed by the end of December 2007.

Q Can this timetable be expedited?

A Proper planning is required to design the demonstration of a carbon sequestration system and to qualify for demonstration project funds from DOE. The funding required will be awarded on DOE's time line. Excelsior is doing everything it can to obtain an expedited demonstration action plan and to obtain funding. We will help them reach the demonstration stage as soon as possible, because Excelsior's project, and what will be learned from it, is an important step in fulfilling the vision of the PCOR Partnership and the EERC for the future carbon-constrained economy in the region.

III.
COMMENTS ON CARBON MANAGEMENT TESTIMONY FILED SEPTEMBER 5, 2006

Q Have you also reviewed the testimony of Xcel witness Roger A. Clarke regarding carbon management issues?

A Yes.

Q Do you have a comment on Mr. Clarke's conclusion: "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." (Clarke Direct Testimony at 20)?

A Yes. While the issues identified by Mr. Clarke do exist, there are a number of ongoing EOR projects which have overcome many of the issues and provide a road map for the development of systems in the future. The PCOR Partnership, and others within RCSP, have made much progress in developing strategies and solutions for the implementation of carbon sequestration in the region. In my opinion, carbon sequestration from base load power plants in Minnesota is feasible and will be implemented in the future.

Q **Further, have you reviewed the direct testimony of the Environmental Intervenors witness, J. Drake Hamilton?**

A Yes.

Q **Do you have a comment on his testimony?**

A Yes, and in particular to that portion of his testimony at p. 8, ll, 17–20 which states:

"To my knowledge no one has assessed whether carbon capture and sequestration is feasible from this particular site. However, based on statements from those studying carbon sequestration it appears unlikely that carbon sequestration would ever be a viable option for the Mesaba Project."

Q **What is that comment?**

A First, with regard to the first sentence quoted above, the PCOR Partnership is currently assessing the feasibility of specific carbon sequestration options for the Mesaba project and plans to assist Excelsior in applying for demonstration grant funds from DOE for the Mesaba Project. Second, I find the second sentence quoted above presumptive. Based on my work within the PCOR Partnership, the fact that there are existing EOR

carbon sequestration systems that have been successfully operating for many years delivering CO_2 hundreds of miles from source to sink, the fact that there are a number of sinks suitable to receive and sequester CO_2 from the Mesaba Project which are within technically distances feasible for pipeline transport of CO_2, and the fact that IGCC technology may offer relatively efficient carbon capture retrofitting, it is my opinion that carbon sequestration may be a viable and feasible option for the Mesaba Project. Rendering a valid technical opinion on the feasibility of employing carbon sequestration for the Mesaba Project is not possible prior to the completion of our assessment.

Q. Have you reviewed the direct testimony of Minnesota Power witness Michael G. Cashin regarding carbon capture and sequestration?

A. Yes.

Q. Do you have a comment on his testimony?

A. Yes. On page 5, lines 16–18, Mr. Cashin testifies: "But an IGCC plant in northeastern Minnesota has no realistic opportunity for carbon capture and storage." On page 9, lines 9–11, Mr. Cashin testifies: "The focus on environmental benefits in this proceeding must be on the Mesaba Project's inability to provide carbon capture and sequestration in Minnesota."

My comment is that carbon capture and sequestration from an IGCC plant in Northeastern Minnesota may be feasible and realistic even though the geology of Minnesota does not offer optional carbon sinks. CO_2 pipelines to carry CO_2 from Minnesota sources, such as IGCC power plants, to carbon sinks in North Dakota or Canada are technically feasible using technology currently in use.

Q Have you reviewed the direct testimony of mncoalgasplant.com witness Ronald R. Rich regarding carbon management issues?

A Yes and I have these comments regarding Mr. Rich's comments on whether carbon capture and sequestration from large power plants is feasible and his comments on the plan for carbon sequestration the PCOR Partnership is developing for Excelsior at p. 5–6 of his testimony.

First, I disagree that there is no prior experience to draw upon for carbon sequestration from a power plant "of this configuration." It is unclear what Mr. Rich meant by "of this configuration." If he was referring to IGCC technology in a power plant, he is technically correct. However, his statement fails to take into consideration that the carbon sequestration system which has been utilized at the DGC synthetic fuel plant facility in Beulah, North Dakota, since 1999 is a system employed on a large coal gasification technology somewhat similar to the IGCC technology to be utilized by Mesaba. The CO_2 will be removed from Mesaba's syngas production prior to combustion of the gas for energy just as the CO_2 is removed from the Beulah plant before the syngas is converted to other fuels.

Second, with regard to the plan the PCOR Partnership is developing, it is incorrect to state that it has a wetlands or terrestrial sequestration focus. Terrestrial sequestration is one of two types of CO_2 that the PCOR Partnership is demonstrating. Second, Mr. Rich's statement that "Higher capacity, more viable sequestration locations with sufficient potential capacity exceed 1000 miles from the West Range plant site" is incorrect. There is more than enough geologic capacity for the CO_2 produced by the Mesaba plants in North Dakota alone.

IV. CONCLUSION

Q Please summarize your testimony.

A
- At this time, it appears that it may be feasible for Excelsior Energy Inc.'s Mesaba Energy Project to capture CO_2 and transport it via pipeline to geologic sinks with the capacity to store all of the CO_2 emissions during the plant's lifetime.
- The lack of CO_2 source streams in the region may make EOR an attractive option for the Mesaba CO_2 in the near term.
- The transition to a carbon-managed world may provide Excelsior Energy Inc. with other opportunities in the form of carbon credits that it can sell.
- In a carbon-managed situation, pipeline distance may become less important since CO_2 sequestration will likely be required. This is likely to result in the construction of a pipeline network in which the CO_2 produced by many sources is transported to an area containing many sinks. The pipeline cost to each user could, therefore, be minimized.
- Because Excelsior Energy Inc. is preparing a carbon management plan prior to plant construction, it may be possible for them to take advantage of the near-term opportunities presented by EOR that might not be possible otherwise.

Base load power plants supplying fungible carbon sequestration units to a future carbon marketplace are essential to a future carbon-constrained economy. IGCC technology is compatible with a carbon-constrained economy and offers technological advantages for the capture of carbon over other coal-fired technologies for base load plants. Delay in constructing Excelsior's IGCC plant may delay progress toward carbon sequestration in the region because of the important contribution to implementation of the system Excelsior is making. The locations of the Mesaba Project IGCC power plants in northern Minnesota do not necessarily disqualify the sites from becoming sources in an effective and efficient carbon sequestration system for the region using EOR and geological sinks located hundreds of miles from the sites. Excelsior's plants may be well positioned as early participants in the new carbon-constrained economy and, as early

market entrants, may be able to find carbon sequestration options that will provide some level of economic return.

Q Does this conclude your testimony?

A Yes, it does.