MINNESOTA DEPARTMENT OF COMMERCE

Environmental Assessment

Mankato Energy Center Expansion Project

In the Matter of Mankato Energy Center II, LLC's Application for a Site Permit for the 345 MW Expansion of the Mankato Energy Center

Docket No. IP6949/GS-15-620

Minnesota Department of Commerce
Energy Environmental Review and Analysis
February 2016

Responsible Government Unit

Department of Commerce
Energy Environmental Review and Analysis
85 7th Place East, Suite 500
St. Paul, MN 55101

Department Representative
Ray Kirsch
Environmental Review Manager
(651) 539-1841
raymond.kirsch@state.mn.us

Project Owner

Mankato Energy Center II, LLC
Calpine Corporation
500 Delaware Ave.
Wilmington, DE 19801

Project Representative
Heidi Whidden
Director, Environmental Services
(320) 468-5381
hwhidden@calpine.com

Abstract

On August 5, 2015, Mankato Energy Center II, LLC (applicant) filed a site permit application with the Minnesota Public Utilities Commission (Commission) for the Mankato Energy Center expansion project. The applicant proposes to add a combustion turbine generator, a heat recovery steam generator, and associated equipment to the existing Mankato Energy Center (MEC) in Blue Earth County. This expansion of the MEC will allow for the production of an additional 345 megawatts of electrical power.

The applicant's proposed project requires a site permit from the Commission. Department of Commerce, Energy Environmental Review and Analysis (EERA) staff is responsible for conducting environmental review for site permit applications submitted to the Commission. Accordingly, EERA staff has prepared this environmental assessment (EA) for the project. This EA addresses the issues required in Minnesota Rule 7850.3700 and those identified in the Department's scoping decision of November 3, 2015.

Following release of this EA, a public hearing will be held in the project area. The hearing will be presided over by an administrative law judge from the Office of Administrative Hearings. Upon completion of the environmental review and hearing process, the record compiled on the site permit application will be presented to the Commission for a final decision. A Commission decision on the site permit application is anticipated in early 2016.

Persons interested in this project can place their names on the project mailing list by contacting Tracy Smetana, the Commission's public advisor, by email: consumer.puc@state.mn.us, or by phone: 651-296-0406 (toll free: 1-800-657-3782).

Documents of interest for this project can be found on the State of Minnesota's eDockets system: https://www.edockets.state.mn.us/EFiling/search.jsp. Enter the year "15" and the number "620." Documents of interest can also be found on the Department's website at: www.mn.gov/commerce/energyfacilities/ Docket.html?Id=34238.

List of Preparers
Ray Kirsch, Environmental Review Manager
Minnesota Department of Commerce

Acronyms, Abbreviations, and Definitions

AERA	Air Emissions Risk Analysis
ALJ	Administrative Law Judge
BACT	Best Available Control Technologies
Commission	Minnesota Public Utilities Commission
CN	Certificate of Need
CO	Carbon Monoxide
CO_2e	Carbon Dioxide Equivalent
CTG	Combustion Turbine Generator
dB	Decibels
dBA	A-weighted Sound Level Recorded in Decibels
DNR	Minnesota Department of Natural Resources
Department	Minnesota Department of Commerce
EA	Environmental Assessment
EERA	Department of Commerce Energy Environmental Review and Analysis
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
HRSG	Heat Recovery Steam Generator
kV	Kilovolt
MEC	Mankato Energy Center
MGD	Million Gallons per Day
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NAC	Noise Area Classification
NERC	North American Electric Reliability Corporation
NLEB	Northern Long-Eared Bat
NESC	National Electrical Safety Code
NO_X	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
PSD	Prevention of Significant Deterioration
SCR	Selective Catalytic Reduction
SPCC	Spill Prevention, Contingency, and Counter Measures
USFWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compounds
WWTP	City of Mankato Wastewater Treatment Plant

Table of Contents

Tables

Figures

Appendices

Summary

Mankato Energy Center II, LLC (applicant) proposes to expand the existing Mankato Energy Center (MEC) by adding a combustion turbine generator, a heat recovery steam generator, and associated equipment. This expansion of the MEC will allow for the production of an additional 345 megawatts of electrical power. The MEC was designed and constructed to accommodate this expansion.

In order to construct the proposed project, the applicant must obtain a site permit from the Minnesota Public Utilities Commission (Commission). The Commission's docket number for the site permit application is IP6949/GS-15-620. In addition to a site permit from the Commission, the project will require approvals (e.g., permits, licenses) from other state agencies, federal agencies, and local units of government.

Department of Commerce, Energy Environmental Review and Analysis (EERA) staff is responsible for conducting environmental review for site permit applications submitted to the Commission. The intent of this review is to ensure that citizens, local governments, agencies, and the Commission are aware of the potential human and environmental impacts of the project and possible mitigation measures. The Commission considers these impacts and mitigation measures when determining whether to issue a site permit for the project.

State Review Process
EERA staff has prepared this environmental assessment (EA) for the Commission and for other agencies and entities that have permitting authority related to the project. This EA is also intended to assist citizens in providing guidance to the Commission and other decision-makers regarding the project. This EA evaluates the potential human and environmental impacts of the applicant's proposed project and possible mitigation measures.

The EA does not advocate or state a preference for the proposed project. The EA analyzes potential impacts and mitigation measures so that citizens, local governments, agencies, and the Commission can work from a common set of facts.

EERA staff initiated work on this EA by soliciting comments on: (1) the issues and impacts that should be evaluated in the EA, and (2) the mitigation measures to study in the EA. This process of soliciting comments on the contents of the EA is known as "scoping." EERA solicited comments through a public meeting on October 13, 2015, and a public comment period that ended October 27, 2015.

Based on the scoping comments received, the Department issued the scoping decision for this EA on November 3, 2015. The scoping decision details the impacts and mitigation measures that are analyzed in the EA. Once completed and issued, the EA is entered into the record for the site permit proceedings, so that it can be used by the Commission in making decisions about the project.

Upon completion of the EA, a public hearing will be held in the project area. The hearing will be presided over by an administrative law judge (ALJ) from the Office of Administrative Hearings. Members of the public will have an opportunity to speak at the hearing, present evidence, ask questions, and submit comments. The ALJ will provide a report to the Commission that summarizes the hearing proceedings and comments.

Upon completion of the environmental review and hearing process, the record will be presented to the Commission for a final decision. A decision by the Commission on a site permit for the project is anticipated in summer 2016.

Potential Impacts of Proposed Project

Impacts to human settlements are anticipated to be minimal. Aesthetic impacts are unavoidable but are anticipated to be incremental and minimal. Impacts to public health and safety are anticipated to be minimal. Air emissions are anticipated to be within all state and federal guidelines. Though the project will increase greenhouse gas emissions at the MEC, it is anticipated to reduce greenhouse gas emissions in Minnesota overall.

Impacts to land-based economies are anticipated to be minimal. Impacts to archaeological and historic resources are anticipated to be minimal. Impacts to the natural environment, including air resources, water resources, flora, and fauna are anticipated to be minimal. Impacts to rare and unique natural resources are anticipated to be minimal.

Application of Siting Factors to Proposed Project

The Commission is charged with locating large electric power generating plants in a manner that is "compatible with environmental preservation and the efficient use of resources" and that minimizes "adverse human and environmental impact[s]" while ensuring electric power reliability.[1] Minnesota Rule 7850.4100 lists 14 factors for the Commission to consider in its site permitting decisions.

The potential human and environmental impacts of the project, relative to the siting factors of Minnesota Rule 7850.4100, are anticipated to be minimal and mitigated by (1) the proposed location of the project, (2) the general conditions in section 4.0 of the Commission's generic site permit template, and (3) the requirements of downstream permits.

[1] Minnesota Statute 216E.02.

1.0 Introduction

This document is an environmental assessment (EA) that has been prepared for the Mankato Energy Center expansion project proposed by Mankato Energy Center II, LLC (applicant). This EA evaluates the potential human and environmental impacts of the applicant's proposed project and possible mitigation measures.

The EA is intended to facilitate informed decision-making by state agencies, particularly with respect to the goals of the Minnesota Environmental Policy Act – "to create and maintain conditions under which human beings and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of the state's people."[2]

1.1 Proposed Project

The applicant proposes to expand the existing Mankato Energy Center (MEC) by adding a combustion turbine generator (CTG), a heat recovery steam generator (HRSG), and associated equipment. This expansion of the MEC will allow for the production of an additional 345 megawatts of electrical power. The MEC was designed and constructed to accommodate this expansion.

The project will use natural gas as a fuel source. Existing infrastructure installed for the MEC (e.g., electrical transmission, gas pipeline, water service) will be used for the project. The project is anticipated to be operational by July 1, 2018. The estimated project cost is between $220 million and $300 million dollars.

Project Location
The proposed project is located within the existing MEC, in the city of Mankato, in Blue Earth County (**Figure 1**). The MEC was designed and constructed to accommodate the project.

Project Need
The proposed project is needed to provide electrical power to meet the projected needs of Xcel Energy's electric power customers. The project was selected by the Minnesota Public Utilities Commission (Commission) to provide this power in a competitive resource acquisition process.

1.2 State of Minnesota Review Process

In order to construct the proposed project, the applicant must obtain a site permit from the Commission. The applicant submitted a site permit application to the Commission on August 5, 2015.[3] The Commission's docket number for this application is IP6949/GS-15-620. In addition to a site permit from the Commission, the project will require approvals (e.g., permits, licenses) from other state agencies, federal agencies, and local units of government (see Section 2.3).

In considering the applicant's site permit application, the Commission must determine whether a site permit can be issued, and, if so, what conditions should be included in the permit to mitigate potential

---

[2] Minnesota Statute 116D.02.

[3] Mankato Energy Center II, LLC, Application for a Site Permit for the Proposed 345 MW Expansion of the Mankato Energy Center, August 5, 2015, eDockets Numbers 20158-113056-01, 20158-113056-02, 20158-113056-03, 20158-113056-04 [hereinafter Site Permit Application].

impacts of the project. To aid the Commission in these determinations, the Commission gets assistance from several state agencies, including the Department of Commerce (Department) and the Office of Administrative Hearings (OAH).

Department Energy Environmental Review and Analysis (EERA) staff is responsible for conducting environmental review for site permit applications submitted to the Commission. The intent of this review is to ensure that citizens, local governments, agencies, and the Commission are aware of the potential human and environmental impacts of a proposed project and possible mitigation measures. The Commission considers these impacts and mitigation measures when determining whether to issue a site permit.

The OAH, at the request of the Commission, provides an administrative law judge (ALJ) to conduct a public hearing for a proposed project. The ALJ facilitates the hearing to gather input on the project and mitigation measures appropriate for the project. The ALJ submits a report to the Commission which summarizes the input received during the hearing.

Environmental Review

EERA staff has prepared this EA for the Commission, which has before it the applicant's site permit application, and for other agencies and entities that have permitting authority related to the project. Additionally, this EA has been prepared to assist citizens in providing guidance to the Commission and other decision-makers regarding the project. The EA evaluates the potential human and environmental impacts of the project and possible mitigation measures.

The EA does not advocate for a project or a specific mitigation measure. Rather, the EA analyzes potential impacts and mitigation measures such that citizens, local governments, agencies, and the Commission can work from a common set of facts.

EERA staff initiated work on this EA by soliciting comments on: (1) the issues and impacts that should be evaluated in the EA, and (2) the mitigation measures to study in the EA. This process of soliciting comments on the contents of the EA is known as "scoping." EERA solicited comments through a public meeting on October 13, 2015, and a public comment period that ended October 27, 2015.

Based on the scoping comments received, the Department issued the scoping decision for this EA on November 3, 2015 (**Appendix A**). The scoping decision details the impacts and mitigation measures that are analyzed in the EA. Once completed and issued, the EA is entered into the record for the site permit proceedings so that it can be used by the Commission in making decisions about the project.

Public Hearing

After the EA is issued, an ALJ will conduct a public hearing for the project. The hearing will be held in the project area. Interested persons will have an opportunity at the hearing to ask questions, provide comments, and advocate for the mitigation measures that they believe are most appropriate for the project.

The ALJ will submit a report to the Commission which summarizes the input received during the public hearing. The Commission will use the ALJ report, the EA, and the entire record in deciding whether to issue a site permit for the project.

1.3 Organization of the Environmental Assessment

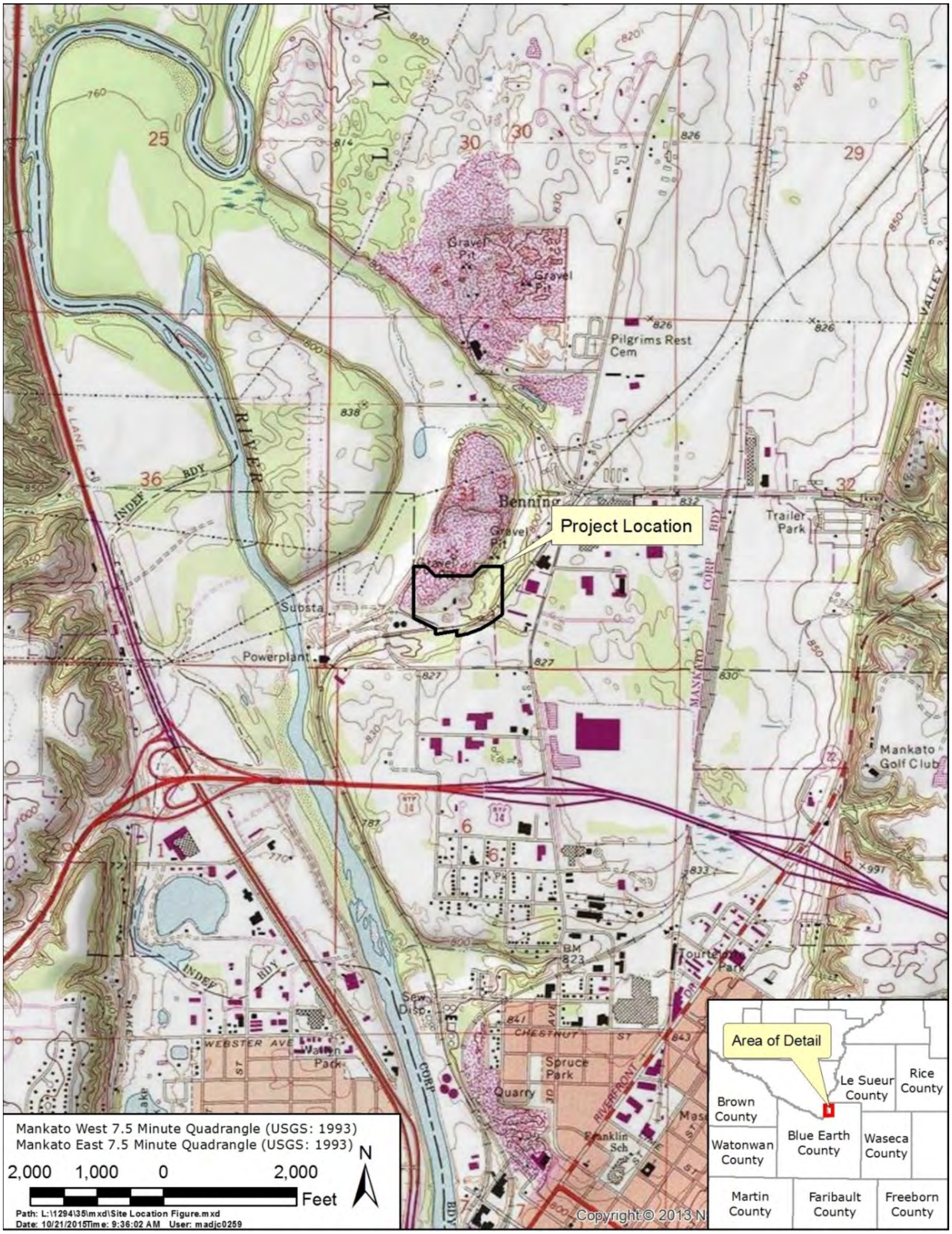
This EA addresses the issues required in Minnesota Rule 7850.3700 and those identified in the Department's scoping decision of November 3, 2015 (**Appendix A**), and is organized as follows:

Section 1.0	**Introduction**	The introduction provides an overview of the proposed project, the State of Minnesota's review process, and this EA.
Section 2.0	**Regulatory Framework**	Section 2.0 describes the regulatory framework associated with the project, including the Commission's site permitting process and other permits and approvals required for the project.
Section 3.0	**Proposed Project**	Section 3.0 describes the Mankato Energy Center expansion project as proposed by the applicant. It also describes the engineering and construction of the project
Section 4.0	**Potential Impacts of the Proposed Project**	Section 4.0 analyzes the potential impacts of the proposed project to human and natural resources and identifies measures that could be implemented to avoid, minimize, or mitigate these impacts.
Section 5.0	**Application of Siting Factors**	Section 5.0 discusses the proposed project relative to the siting factors of Minnesota Rule 7850.4100.

1.4 Sources of Information

The primary source of information for this EA is the site permit application submitted by Mankato Energy Center II, LLC. Additional sources of information are indicated in footnotes. New and additional information has been included from the applicant. Information from prior EERA environmental review documents and other state agencies is included. Information was also gathered by a site visit.

Figure 1. Project Overview Map



2.0 Regulatory Framework

The Mankato Energy Center (MEC) expansion project requires a site permit from the Minnesota Public Utilities Commission (Commission). Additionally, the project will require approvals from other state and federal agencies with permitting authority for actions related to the project.

2.1 Certificate of Need

No person may construct a large energy facility in Minnesota without a certificate of need (CN) from the Commission.[4] An electric power generating plant is a large energy facility if it has capacity to generate 50,000 kilowatts or more.[5] The proposed project will have the capacity to generate 345 MW and thus is a large energy facility. However, a CN is not required for a large energy facility if the facility is selected in a bidding process established by the Commission.[6] The proposed project was selected in such a process by the Commission.[7] As a result, the project does not require a CN.

2.2 Site Permit

In Minnesota, no person may construct a large electric power generating plant without a site permit from the Commission.[8] A large electric power generating plant is defined as electric power generating equipment and associated facilities designed for and capable of operation at a capacity of 50,000 kilowatts or more.[9] The proposed project will have the capacity to generate 345 MW and therefore requires a site permit from the Commission.

The applicant submitted a site permit application to the Commission on August 5, 2015. The application was accepted as complete by the Commission on October 14, 2015. The applicant has indicated its intention to utilize the Power Plant Siting Act's alternative review process for the project. Because the project will be fueled solely by natural gas, the project is eligible for this process.[10] The alternative review process includes environmental review and a public hearing, and typically takes six to nine months to complete.

Environmental Review

Applications to the Commission for site permits are subject to environmental review conducted by Department of Commerce, Energy Environmental Review and Analysis (EERA) staff.[11] Projects proceeding under the alternative review process require the preparation of an environmental assessment (EA).[12] An EA is a document which describes the potential human and environmental impacts of the proposed project and possible mitigation measures. The Department of Commerce determines the scope of the EA. The EA must be completed and made available prior to the public

[4] Minnesota Statute 216B.243.
[5] Minnesota Statute 216B.2421.
[6] Minnesota Statute 216B.2422, Subd. 5(b).
[7] Order Approving Power Purchase Agreement with Calpine, Approving Power Purchase Agreement with Geronimo, and Approving Price Terms with Xcel, February 5, 2015, Docket No. E-002/CN-12-1240, eDockets Number 20152-107070-01.
[8] Minnesota Statute 216E.03.
[9] Minnesota Statute 216E.01.
[10] Minnesota Statute 216E.04, Subd. 1.
[11] Minnesota Statute 216E.04, Subd. 5.
[12] Id.

hearing for the project.

On October 13, 2015, Commission staff and EERA staff held a joint public information and EA scoping meeting in the city of Mankato. The purpose of the meeting was to provide information to the public about the proposed project, to answer questions, and to allow the public an opportunity to suggest impacts and mitigation measures that should be considered in the EA for the project. Three persons attended the meeting; these persons made no comments regarding the project.[13]

A comment period followed the public meeting and was open through October 27, 2015. Comments were received from one person and two state agencies.[14] These comments did not identify specific impacts or mitigation measures to study in the EA.

The Minnesota State Historic Preservation Office noted that, based on its review of the project, there were no archaeological or historic resources in the project area that would be impacted by the project.[15]

The Minnesota Department of Transportation (MnDOT) noted that the project did not appear to impact MnDOT right-of-way.[16] MnDOT indicated that consideration should be given to the movement of oversize/overweight equipment for the project, and that the applicant should coordinate with MnDOT if such equipment is transported on local highways.[17]

After consideration of the site permit application and public comments received during the scoping process, the deputy commissioner of the Department of Commerce issued a scoping decision on November 3, 2015 (**Appendix A**). The scoping decision identifies the resources, potential impacts, and mitigation measures that are evaluated in this EA. EERA staff provided notice of the scoping decision to those persons on the project mailing list.

Public Hearing

Upon completion of the EA, a public hearing will be held in the project area.[18] The hearing will be presided over by an administrative law judge (ALJ) from the Office of Administrative Hearings. Members of the public will have an opportunity to speak at the hearing, present evidence, ask questions, and submit comments. The ALJ will provide a report to the Commission that summarizes the hearing proceedings and comments.

Comments received during the hearing on the EA become part of the record in the proceeding. EERA staff will respond to comments on the EA during the hearing comment period, but staff is not required to revise or supplement the EA document.[19] Upon completion of the environmental review and hearing process, the record will be presented to the Commission for a final decision. A decision by the Commission on a site permit for the project is anticipated in summer 2016.

[13] Comments on Scope of Environmental Assessment, eDockets Number 201510-115183-01.
[14] Id.
[15] Id.
[16] Id.
[17] Id.
[18] Minnesota Statute 216E.04, Subd. 6.
[19] Minnesota Rule 7850.3800, Subp. 5.

Permit Decision

The Commission is charged with selecting sites for electric power generating plants that minimize adverse human and environmental impacts while ensuring electric power system reliability and integrity.[20] Site permits issued by the Commission may include conditions specifying construction and operation standards. The Commission's generic site permit template for large electric power generating plants is included in **Appendix B**.[21]

Minnesota Statute Section 216E.03, subdivision 7(b) identifies 12 considerations that the Commission must take into account when evaluating sites for electric power generating plants.[22] Minnesota Rule 7850.4100 lists 14 factors for the Commission to consider when making a decision on a site permit:[23]

A. Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services;

B. Effects on public health and safety;

C. Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining;

D. Effects on archaeological and historic resources

E. Effects on the natural environment, including effects on air and water quality resources and flora and fauna;

F. Effects on rare and unique natural resources;

G. Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity;

H. Use or paralleling of existing right-of-way, survey lines, natural divisions lines, and agricultural field boundaries;

I. Use of existing large electric power generating plant sites;

J. Use of existing transportation, pipeline, and electrical transmission systems or rights-of-way;

K. Electrical systems reliability;

L. Costs of constructing, operating, and maintaining the facility which are dependent on design and route;

M. Adverse human an natural environmental effects which cannot be avoided; and

N. Irreversible and irretrievable commitments of resources.

---

[20] Minnesota Statute 216E.02.
[21] Generic Site Permit Template for a Large Electric Power Generating Plant, Minnesota Public Utilities Commission, February 8, 2016, eDockets Number 20162-118074-02.
[22] Minnesota Statute 216E.03, Subd. 7.
[23] Minnesota Rule 7850.4100.

At the time the Commission makes a final decision on a site permit, the Commission must determine whether the EA and the record created at the public hearing address the issues identified in the scoping decision.[24]

The Commission is charged with making a final decision on a site permit within 60 days after receipt of the ALJ's report.[25] A final decision must be made within six months after the Commission's determination that an application is complete. The Commission may extend this time limit for up to three months for just cause or upon agreement of the applicant.[26]

If issued a site permit by the Commission, the applicant may exercise the power of eminent domain to acquire land for the project.[27]

2.3 Other Permits and Approvals

A site permit from the Commission is the only state permit required for the siting of the project. The Commission's site permit supersedes local planning and zoning and binds state agencies.[28] Thus, state agencies are required to participate in the Commission's permitting process to aid the Commission's decision-making and to indicate sites that are not permittable.[29]

This said, various federal, state, and local permits may be required for activities related to the construction and operation of the project. All permits subsequent to the Commission's issuance of a site permit and necessary for the project (commonly referred to as "downstream permits") must be obtained by a permittee. **Table 1** includes a list of downstream permits that may be required for the project.

Federal Approvals

The U.S. Environmental Protection Agency (EPA) regulates potential impacts to human health and the environment through a variety of permit and approvals.[30] The EPA's authority extends to multiple activities including emissions to air and water and the handling of hazardous wastes.

The U.S. Federal Energy Regulatory Commission (FERC) regulates the interstate transport of electricity, natural gas, and oil.[31] FERC regulates the wholesale sale of electricity in interstate commerce.

The U.S. Fish and Wildlife Service (USFWS) requires permits for the taking of threatened or endangered species.[32] The USFWS encourages consultation with project proposers to ascertain a project's potential to impact these species and to identify mitigation measures for the project generally.

[24] Minnesota Rule 7850.3900.
[25] Id.
[26] Id.
[27] Minnesota Statute 216E.12.
[28] Minnesota Statute 216E.10.
[29] Id.
[30] U.S. Environmental Protection Agency, Our Mission and What We Do, http://www2.epa.gov/aboutepa/our-mission-and-what-we-do.
[31] U.S. Federal Energy Regulatory Commission, What FERC Does, http://www.ferc.gov/about/ferc-does.asp.
[32] U.S. Fish and Wildlife Service, Endangered Species, http://www.fws.gov/ENDANGERED/permits/index.html.

Table 1. Potential Permits and Approvals[33]

Jurisdiction	Permit
Federal Approvals	
U.S. Environmental Protection Agency	Acid Rain Permit; Risk Management Plan; Hazardous Waste Generation
Federal Energy Regulatory Commission	Exempt Wholesale Generator Self-Certification; Market-Based Rate Authorization
U.S. Fish and Wildlife Service	Threatened and Endangered Species Consultation
State of Minnesota Approvals	
Department of Natural Resources	Threatened and Endangered Species Consultation
Minnesota Pollution Control Agency	NPDES/SDS Stormwater Permit; Air Emission Facility Permit; Hazardous Waste Generator License; Storage Tank Registration and Permitting
Minnesota Department of Transportation	Special Hauling Permit
Local Approvals	
County, City	Conditional Use Permit; Building Permit; Sewer Connections

State Approvals

The Minnesota Department of Natural Resource (DNR) regulates potential impacts to Minnesota's natural resources.[34] Similar to USFWS, DNR encourages consultation with project proposers to ascertain a project's potential to impact state-listed threatened and endangered species and possible mitigation measures.

The Minnesota Pollution Control Agency (MPCA) regulates potential impacts to public health and the environment.[35] A national pollutant discharge elimination system / sanitary disposal system (NPDES/SDS) stormwater permit is required for stormwater discharges from construction sites and industrial facilities. An air permit is required for regulated facilities to ensure compliance with a variety of state and federal air quality requirements. The MPCA also regulates generation, handling, and storage of hazardous wastes.

[33] Site Permit Application, Section 11.
[34] Minnesota Department of Natural Resources, About the DNR, http://www.dnr.state.mn.us/aboutdnr/index.html.
[35] Minnesota Pollution Control Agency, About MPCA, http://www.pca.state.mn.us/index.php/about-mpca/index.html.

A permit from the Minnesota Department of Transportation (MnDOT) is required for the transport and delivery of equipment that is oversize or overweight.[36]

Local Approvals

The Commission's site permit supersedes local planning and zoning regulations and ordinances.[37] However, permittees must obtain local approvals necessary for proper local government functioning – e.g., the safe use of local roads; the inclusion of infrastructure on local government maps.

2.4 Applicable Codes

The applicant's proposed project must meet the requirements of the National Electrical Safety Code (NESC).[38] The code is designed to protect human health and the environment. It also ensures that electrical generating equipment and associated facilities are built from materials that will withstand the operational stresses placed upon them over the expected lifespan of the equipment, provided that routine maintenance is performed.

The applicant must also comply with North American Electric Reliability Corporation (NERC) standards.[39] NERC standards define the reliability requirements for planning and operating the electrical transmission grid in North America.

2.5 Issues Outside the Scope of the Environmental Assessment

In accordance with the scoping decision for this EA (**Appendix A**), the following topics are not addressed in this document:

- No-build alternative.
- Issues related to project need, size, type, or timing.
- Any site alternative not specifically identified for study in the scoping decision.

[36] Minnesota Department of Transportation, Overdimension Permits, http://www.dot.state.mn.us/cvo/oversize.
[37] Minnesota Statute 216E.10.
[38] Minnesota Statute 326B.35 (requiring utilities to comply with the most recent edition of the NESC when constructing new facilities or reinvesting capital in existing facilities); see also Appendix B, Section 4.3.1, Generic Site Permit Template.
[39] Appendix B, Section 4.3.1, Generic Site Permit Template.

3.0 Proposed Project

The applicant proposes to expand the existing Mankato Energy Center (MEC) by adding a combustion turbine generator, a heat recovery steam generator, and associated equipment. This expansion of the MEC will allow for the production of an additional 345 megawatts of electrical power. This section describes the applicant's proposed project, project construction, and project costs.

3.1 Project Description

The applicant's proposed expansion of the Mankato Energy Center (MEC) includes a new combustion turbine generator (CTG), a new heat recovery steam generator (HRSG), and associated equipment. The CTG will use natural gas as a fuel. The HSRG will supply high pressure steam to the MEC's existing steam turbine. The project will use cooling water from the city of Mankato's wastewater treatment plant (WWTP). Electrical power produced by the project will be transmitted to the existing Wilmarth substation.

Mankato Energy Center Site

The MEC is located in the city of Mankato in Blue Earth County. The plant is located on a portion of an old limestone quarry which was converted to a landfill.[40] The landfill is now closed. Construction of the plant began in 2004, and the MEC became operational in May 2006.[41] The MEC site is approximately 25 acres in size (**Figure 2**).[42]

The MEC was permitted by the Minnesota Environmental Quality Board in 2004 as a combined cycle electric generating plant with two CTGs, two HSRGs, and one steam turbine.[43] The facilities for the plant were sized to accommodate these components.[44] However, only one CTG and one HSRG were ultimately constructed.[45] Thus, the MEC, as it currently exists, is a site specifically designed for the applicant's proposed expansion. The addition of a CTG and HSRG would complete the power plant and site as it was originally planned.

---

[40] Site Permit Application, Section 2.4

[41] Additional Project Information from Applicant, January 27, 2016, eDockets Number 20161-117736-01 [hereinafter Additional Project Information from Applicant].

[42] Site Permit Application, Section 2.4.

[43] Site Permit Application, Section 2.3.

[44] Id.

[45] Id.

Figure 2. Mankato Energy Center Site

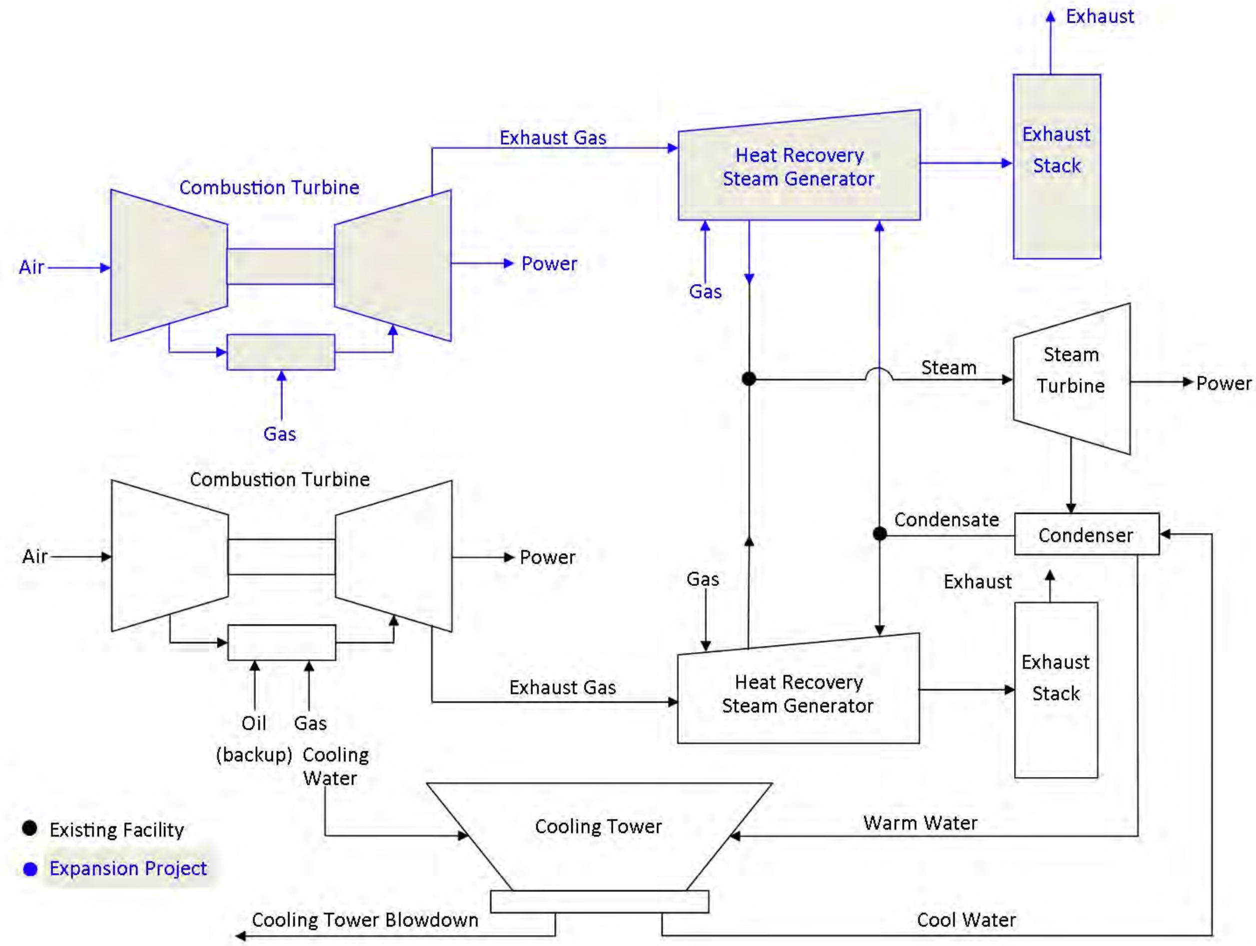
Power Generation Systems

Currently, the MEC is a combined cycle electric generating plant with one CTG, one HSRG, and a steam turbine (**Figure 3**).[46] The plant generates electrical power through the mechanical turning of the CTG and the steam turbine. This power generation configuration is known as a "1 X 1" combined cycle power plant – it has one CTG and one HSRG, with the steam from the HSRG driving one steam turbine. The applicant's proposed expansion would change the MEC into a 2 X 1 configuration.[47] The expanded plant would have two CTGs and two HSRGs, with steam from two HSRGs driving one steam turbine (**Figure 4**).

Figure 3. Mankato Energy Center[48]

[46] Site Permit Application, Section 2.7.
[47] Id.
[48] View looking south of combustion turbine generator, heat recover steam generator, and exhaust stack.

Figure 4. Power Generation Schematic for Mankato Energy Center



The applicant's proposed expansion of the MEC includes (**Figure 5, Appendix C**):[49]

- A natural-gas fired combustion turbine generator;
- A heat recover steam generator with natural gas-fired duct burners;
- Four new cooling tower cells;
- A step-up transformer and associated switchgear;
- An emergency diesel generator (if necessary); and
- Expansion of plant support systems, e.g., fire suppression, steam piping, electrical systems.

The CTG will be a natural-gas fired F-Class turbine with low nitrogen oxide (low-NO_X) combustors.[50] Electrical output of the CTG will be approximately 200 MW. Exhaust gas from the CTG will be directed

[49] Site Permit Application, Section 2.7.

to the new HSRG. The HSRG will be a triple-pressure, reheat type steam generator designed to supply high pressure stream appropriate for the existing steam turbine at the MEC.[51] The HSRG will have a selective catalytic reduction (SCR) system to reduce NO_X emissions.[52] The HSRG will also use an oxidation catalyst to reduce emissions of carbon monoxide (CO) and volatile organic compounds (VOC).[53] Exhaust gases from the CTG and HSRG will be directed to an exhaust stack, similar to the existing stack at the MEC.

Figure 5. Proposed Mankato Energy Center Expansion

The expansion project does not require a new steam turbine. The steam turbine at the MEC is sized to accommodate the additional steam from a 2 X 1 power plant configuration.[54] With steam from the new HSRG, the steam turbine will have the capacity to produce an additional 150 MW of electrical power.[55]

---

[50] Site Permit Application, Section 2.7.3.
[51] Id.
[52] Id.
[53] Id.
[54] Site Permit Application, Section 2.7.5.
[55] Id.

The MEC does not operate continuously and generates power only when needed by the electrical transmission grid.[56] As a result, the MEC generates approximately 15 percent of its maximum potential power production over the course of a year.[57] It is anticipated that the MEC will operate similarly with the expansion project.

Fuel Supply

The expansion project will be fueled solely with natural gas.[58] Natural gas is delivered to the MEC by a 20 inch pipeline, approximately four miles in length.[59] The pipeline is sized to support the natural gas requirements of the expanded MEC; thus, no new gas pipeline will be required for the expansion project.[60]

Water Supply and Use

The expansion project will use water for two primary purposes: (1) cooling water and (2) service water. Cooling water is required to dissipate the waste heat generated by the CTGs and HSRGs. This waste heat is first transferred to a condenser and then to a multi-cell evaporative cooling tower (**Figure 6**).[61] Cooling water is provided to the cooling tower through a pipeline from the Mankato wastewater treatment plant (WWTP).[62] This water is treated wastewater effluent from the WWTP. The cooling water will continue to be supplied by the Mankato WWTP for the expansion project.

There are currently eight cooling tower cells. The expansion project will require the addition of four more cells, resulting in a total of 12 cooling tower cells (**Figure 5**).[63] This addition will increase the tower's ability to dissipate heat and will increase water evaporation from the tower. The additional evaporative water loss will require approximately 74 percent more cooling water from the Mankato WWTP.[64] The applicant has indicated that they will work with the Mankato WWTP to upgrade existing pumps or install new pumps to supply additional cooling water needed for the expansion project.[65]

Service water is potable water from the Mankato municipal water system.[66] Service water is used for domestic purposes (e.g., drinking water, showers) and other plant related purposes.[67] Service water use is substantially less than cooling water use and is not anticipated to increase significantly with the expansion project.[68]

---

[56] Site Permit Application, Section 2.3.
[57] Id.
[58] Site Permit Application, Section 2.7.1.
[59] Id.
[60] Id.
[61] Site Permit Application, Section 2.7.8.
[62] Site Permit Application, Section 2.7.6.
[63] Site Permit Application, Section 2.7.8.
[64] Site Permit Application, Section 2.7.6, Table 2-1.
[65] Site Permit Application, Section 2.7.6.
[66] Site Permit Application, Section 2.7.7.
[67] Id.
[68] Id.

Figure 6. Existing Cooling Tower at Mankato Energy Center[69]

Electrical Interconnection

Electricity currently generated at the MEC by the CTG and steam turbine proceeds through step-up transformers, to a switchyard, and then to the Wilmarth substation (**Figure 7**).[70] Electricity from the CTG is stepped up to 115 kV and transmitted at this voltage to the substation. Electricity from the steam turbine is stepped up 345 kV and transmitted to the substation.

For the expansion project, a new 115 kV step-up transformer will be installed to commute the power produced by the new CTG.[71] A breaker, disconnect, and dead end structure will be added to the switchyard.[72] A new 115 kV electrical line, approximately 300 feet in length, will be added to connect the switchyard to the Wilmarth substation (**Figure 7**).

The Wilmarth substation was constructed to accommodate electrical interconnections for the MEC as originally conceived – i.e., as a 2 X 1 power plant configuration. Thus, no substation upgrades will be needed to accommodate the power generated from the expansion project.[73]

[69] View looking northeast.
[70] Site Permit Application, Sections 2.7.11, 2.7.12, and 2.7.13.
[71] Id.
[72] Id.
[73] Id.

Figure 7. Electrical Interconnection at Mankato Energy Center

3.2 Project Construction

Construction of the project would not begin until all federal, state, and local approvals have been obtained. Construction is anticipated to begin in 2016; however, the construction timeline is dependent upon a number of factors including the receipt of all approvals, weather, and the availability of labor and materials.

The applicant will employ a contractor to design and construct the expansion project to meet all of the applicant's engineering requirements and all state, local, and federal requirements.[74] Construction of the project will involve foundation work, steel erection, and the delivery and installation of heavy equipment.[75] Improvements will be made to the existing cooling tower and gas delivery systems.[76] Existing water pumps at the Mankato WWTP will be upgraded for the project.[77]

The expansion project will, at various points in the construction process, be "tied in" to existing MEC systems – including the main steam system, hot and cold reheats, the low pressure steam system, and a

[74] Additional Project Information from Applicant.
[75] Site Permit Application, Section 4.3.
[76] Additional Project Information from Applicant.
[77] Site Permit Application, Section 2.7.6.

variety of water and instrumentation systems.[78] Cold commissioning will begin as project completeness allows.[79] Hot operational testing will follow to properly clean and operate all systems.[80] The final steps will be to interconnect the steam systems of the existing MEC with the expansion project and fine tune operation of a 2 x 1 combined cycle configuration.[81]

3.3 Project Costs

The estimated total cost for project construction is between $220 and $300 million dollars.[82] The applicant indicates that this cost range may fluctuate until the project's commercial operation date has been finalized.[83] Annual operating costs for the expansion project are anticipated to be between $3.5 and $5 million dollars.[84]

[78] Additional Project Information from Applicant.
[79] Id.
[80] Id.
[81] Id.
[82] Site Permit Application, Section 2.8.
[83] Id.
[84] Id.

4.0 Potential Impacts of the Proposed Project

This section discusses the resources, potential impacts, and possible mitigation measures associated with the proposed Mankato Energy Center expansion project. Impacts can be positive or negative, short or long term. Impacts can vary in duration and intensity, by resource and across geographies. Some impacts may be avoidable; some may be unavoidable but can be mitigated; others may be unavoidable and unable to be mitigated.

Potential Impacts and Mitigation

This section analyzes potential impacts of the expansion projects on various resources. Impacts are given context through discussion of their duration, size, intensity, and location. This context is used to determine an overall resource impact level. Impact levels are described in this section using qualitative descriptors. These descriptors are not intended as value judgments, but rather as a means to both ensure a common understanding among readers and compare resource impacts between alternatives.

- **Minimal**. Minimal impacts do not considerably alter an existing resource condition or function. Minimal impacts may, for some resources and at some locations, be noticeable to an average observer. These impacts generally affect common resources over the short-term.
- **Moderate**. Moderate impacts alter an existing resource condition or function, and are generally noticeable or predictable for the average observer. Effects may be spread out over a large area making them difficult to observe, but can be estimated by modeling or other means. Moderate impacts may be long-term or permanent to common resources, but are generally short- to long-term for rare and unique resources.
- **Significant**. Significant impacts alter an existing resource condition or function to the extent that the resource is severely impaired or cannot function. Significant impacts are likely noticeable or predictable for the average observer. Effects may be spread out over a large area making them difficult to observe, but can be estimated by modeling. Significant impacts can be of any duration, and may affect common and rare and unique resources.

This section also discusses possibilities to avoid, minimize, or mitigate specific impacts. These actions are collectively referred to as mitigation.

- **Avoid**. Avoiding an impact means it is eliminated altogether by moving or not undertaking parts or all of a project.
- **Minimize**. Minimizing an impact means to limit its intensity by reducing project size or moving a portion of the project from a given location.
- **Mitigate**. Impacts that cannot be avoided or minimized could be mitigated. Impacts can be mitigated by repairing, rehabilitating, or restoring the affected environment, or compensating for it by replacing or providing a substitute resource elsewhere.

Regions of Influence

Potential impacts to human and environmental resources are analyzed in this EA within specific spatial bounds or regions of influence (ROI). The ROI for each resource is the geographic area within which the project may exert some influence; it is used in this EA as the basis for assessing the potential impacts to each resource as a result of the project. Regions of influence vary with the resource being analyzed and the potential impact. The ROI for resources analyzed in this EA are summarized in **Table 2**.

The ROI for most human and environmental resources is the site of the Mankato Energy Center (MEC). Resources at the site could be impacted by the construction and operation of the expansion project. Other resources may be impacted at a greater distance from the project. In this EA, the following ROI will be used for these resources:

- **One thousand five hundred feet.** A distance of 1,500 ft. from the project will be used as the ROI for analyzing potential aesthetic, noise, and land use impacts as well as potential impacts to public safety from water vapor plumes. These impacts may extend outside of the 1,500 ft. distance, but are anticipated to diminish relatively quickly such that potential impacts outside of this distance would be minimal.

- **One mile**. A distance of one mile from the project will be used as the ROI for analyzing potential impacts to archaeological and historic resources and to rare and unique species.

  Direct impacts to archaeological and historic resources are anticipated to occur, if at all, within the MEC site. However, indirect impacts may extend beyond the site. For example, a historic resource may be impacted by power generating equipment near, but not directly next to, the resource. Direct impacts to rare and unique species are anticipated to occur, if they occur, within the MEC site. However, indirect impacts to rare and unique species may extend beyond the site, particularly for wildlife species. Wildlife may move throughout a project area and may be impacted by limitations on their movement and their ability to access cover, food, and water.

- **Project area.** The project area, defined generally as the city of Mankato and Blue Earth County, will be used as the ROI for analyzing potential impacts to cultural values, socioeconomics, public services, air quality, and tourism and recreation. These are resources for which impacts may extend throughout the project area.

Table 2. Regions of Influence for Human and Environmental Resources

Type of Resource	Specific Resource / Potential Impact to Resource	Region of Influence (ROI)
Human Settlements	Displacement	Site
	Aesthetics, Noise, Zoning and Land Use Compatibility	1,500 Feet
	Socioeconomics, Cultural Values, Public Services	Project Area
Public Health and Safety	Fire / Electrical	Site
	Water Vapor Plumes	1,500 Feet

Type of Resource	Specific Resource / Potential Impact to Resource	Region of Influence (ROI)
	Air Quality	Project Area
Land-Based Economies	Agriculture, Forestry, Mining	Site
	Tourism and Recreation	Project Area
Archaeological and Historic Resources	---	One Mile
Natural Environment	Water Resources, Soils, Flora, Fauna	Site
Rare and Unique Species	---	One Mile

Summary of Potential Impacts of the Proposed Project

Impacts to human settlements as a result of the project are anticipated to be minimal. Aesthetic impacts are unavoidable but are anticipated to be incremental and minimal. Impacts to public health and safety are anticipated to be minimal. Air emissions are anticipated to be within all state and federal guidelines. Though the project will increase greenhouse gas emissions at the MEC, it is anticipated to reduce greenhouse gas emissions in Minnesota overall by displacing more greenhouse gas intensive fuels (e.g., coal) and facilitating wind and solar power generation.

Impacts to land-based economies are anticipated to be minimal. Impacts to archaeological and historic resources are anticipated to be minimal. Impacts to the natural environment, including air resources, water resources, flora, and fauna are anticipated to be minimal. Impacts to rare and unique natural resources are anticipated to be minimal.

The Commission, if it issues a site permit for the project, can require the permittee to use specific mitigation measures or require that certain mitigation thresholds or standards be met through permit conditions (see **Appendix B**).

4.1 Environmental Setting

The MEC expansion project is proposed to be located within the MEC, in the city of Mankato, Blue Earth County. The MEC site is approximately 25 acres in size and is zoned for commercial / industrial / public use (**Figure 2**).[85] The MEC was permitted in 2004 as a 2 X 1 combined cycle electric generating plant. The facilities for the plant were sized to accommodate a 2 X 1 combined cycle plant. However, only a 1 X 1 combined cycle plant was constructed. Consequently, the MEC has a level, graveled area within the site that is undeveloped and would be used for the expansion project (**Figure 8**).

The MEC is located in an industrial area in the northern part of the city of Mankato. Adjacent properties are industrial and manufacturing facilities including Xcel Energy's Wilmarth electric generating plant and

[85] Site Permit Application, Section 4.1.

substation, scrap metal operations, and a U.S Postal Service mail processing facility.[86] The MEC site is just south of an old limestone quarry that was converted to a landfill. The landfill is now closed. The nearest residential area is approximately one-half mile to the south of the MEC, on the south side of U.S. Highway 14.[87]

Figure 8. Area within Mankato Energy Center for Expansion Project

The MEC is located on the northern edge of a large urban/suburban area that includes the city of Mankato – a city of approximately 40,000 residents – and the city of North Mankato. The project area includes multiple roads and highways including U.S. Highway 169 and U.S. Highway 14. Areas to the north and east of the MEC consist mainly of agricultural and conservation lands.[88]

The MEC is located approximately 1,800 feet east of the Minnesota River in the Minnesota River valley (**Figure 1**). The river and river bottoms provide wildlife habitat and recreational opportunities.[89]

4.2 Socioeconomic Setting

The project area has a median household income that is generally less than the median for the State of Minnesota (**Table 3**). The percentage of the population below the poverty level is generally higher in the project area than in the state as a whole (**Table 3**).

[86] Id.
[87] Id.
[88] Id.
[89] Id.

The economy in south central Minnesota, including the project area, is relatively diverse with the four largest industries, by employment, being professional and business services, manufacturing, trade, and health services.[90] In 2012, south central Minnesota produced approximately $24.7 billion dollars in goods and services, accounting for about four percent of Minnesota's $567.8 billion dollar economy.[91] The three largest industries, by economic output, are manufacturing, professional and businesses services, and agriculture.[92]

Table 3. Socioeconomic Characteristics of Project Area[93]

Location	Population	Median Household Income (dollars)	Population Below Poverty Level (percent)
Minnesota	5,457,173	$59,836	11.5
Blue Earth County	65,385	$49,935	19.2
City of Mankato	40,411	$41,171	27.0
City of North Mankato	13,432	$61,672	6.7

4.3 Human Settlements

Large electric power generating plants have the potential to negatively impact human settlements through a variety of means. A power plant could change the aesthetics of a project area, introduce new noise sources, or displace residences or businesses.

Impacts to human settlements resulting from the MEC expansion project are anticipated to be minimal. No residences or businesses will be displaced by the project; impacts to aesthetics are anticipated to be incremental and minimal. Noise levels are anticipated to increase as a result of the project, but are projected to remain within Minnesota state noise standards. Impacts to public services are anticipated to be minimal. The project is compatible with existing and future land uses. Impacts related to construction of the project are anticipated to be minimal and temporary.

Aesthetics

Aesthetic and visual resources include the physical features of a landscape such as land, water, vegetation, animals, and manmade structures. The relative value of these visual resources in a given area depends on what individuals perceive as being beautiful or aesthetically pleasing. Viewers'

[90] Economic Composition of the South Central Region of Minnesota: Industries and Performance, http://www.extension.umn.edu/community/economic-impact-analysis/reports/docs/2014-South-Central-MN.pdf. For this report, south central Minnesota is defined as the 11 counties represented by the Region Nine Development Commission, including Blue Earth County.
[91] Id.
[92] Id.
[93] U.S. Census Bureau, State and County QuickFacts, http://quickfacts.census.gov/qfd/.

perceptions are based on their psychological connection to the viewing area and their physical relationship to the view, including distance to physical features, perspective, and duration of the view. Landscapes which are, for the average person, harmonious in form and use are generally perceived as having greater aesthetic value. Infrastructure which is not harmonious with a landscape or negatively impacts existing features of a landscape could negatively affect the aesthetics of an area.

The MEC expansion project is proposed to be built within the MEC site, which is itself within an industrial area of the city of Mankato.[94] The industrial area encompasses approximately 500 acres and includes industrial and manufacturing facilities including waste processing, scrap metal operations, a construction company, and a household hazardous waste collection site.[95] The MEC site is relatively lower than the surrounding topography with a landfill berm along the northern edge of the site.[96] U.S. Highway 14 is approximately one-half mile south of the MEC site. Immediately to the west is the Wilmarth electric generating station, an electric generating plant built in the 1940s and since converted to burn municipal solid waste.[97] Further west, approximately 1,800 feet from the MEC site, is the Minnesota River. The closest residential neighborhood is approximately two-thirds of a mile south of the MEC site, south of U.S. Highway 14.[98]

The existing MEC consists of buildings ranging in height from 30 to 120 feet.[99] The tallest existing structure at the site is the emissions stack, which is approximately 200 feet tall. The MEC expansion project will be a mirror image of the existing plant, and thus structures will be very similar in size. The tallest structure installed as a result of the expansion project will be a second emissions stack, approximately 200 feet in height.

Water vapor in emissions from the MEC stack, under certain meteorological conditions, can condense to form a plume that is visible in the project area (**Figure 9**).[100] Similarly, water vapor from the MEC cooling towers can result in a plume that is visible in the project area.[101] Plumes are most persistent and visible during cold and damp weather.[102] Generally plumes, if present, disperse and evaporate fairly quickly.[103]

Potential Impacts

Aesthetic impacts due to the MEC expansion project are anticipated to be minimal. The expansion project is harmonious with the existing landscape; it places like with like – it is the construction of an electric generating plant on the site of an existing electric generating plant. Further, any aesthetic impacts associated with the expansion will be incremental. The expansion project will introduce a new emissions stack; however the aesthetic impact of this second stack is anticipated to be incremental and minimal. Similarly, the expansion project will cause an increase in water vapor plumes, but the impact of these plumes is anticipated to be incremental and minimal. Because of the topography of the MEC site and screening by trees and other industrial facilities, the expansion project is anticipated to have limited visibility in the project area.

---

[94] Site Permit Application, Section 4.4.
[95] Id.
[96] Id.
[97] Id.
[98] Site Permit Application, Section 4.2.
[99] Site Permit Application, Section 4.4.
[100] Id.
[101] Id.
[102] Id.
[103] Id.

Figure 9. Water Vapor Plumes at Mankato Energy Center[104]

Mitigation
Aesthetic impacts as a result of the project are anticipated to be minimal; thus, no mitigation measures are proposed.

Noise

Noise can be defined as unwanted sound. Noise is measured in units of decibels (dB) on a logarithmic scale. The A weighted decibel scale (dBA) corresponds to the sensitivity range for human hearing. A noise level change of 3 dBA is barely perceptible to average human hearing while a 5 dBA change in noise level is noticeable.

All noises produced by the project must be within Minnesota noise standards (**Table 4**). These standards are promulgated by the Minnesota Pollution Control Agency (MPCA). The standards are organized by the type of environment where the noise is heard (Noise Area Classification, NAC) and the time of day. The noise standards are expressed as a range of permissible dBA within a 1-hour period; L_{50} is the dBA that may be exceeded 50 percent of the time within an hour, while L_{10} is the dBA that may be exceeded 10 percent of the time within 1 hour.

The primary noise receptors in the project area are neighboring industrial properties.[105] These industrial properties are in noise area classification three (NAC 3). The nearest residential area is approximately

[104] View looking east.

3,500 feet south of the MEC, south of U.S. Highway 14. Noise levels at the MEC site boundary are currently in the range of 63 to 67 dBA when the plant is operating.[106] These noise levels are within state noise standards for industrial properties.[107]

Table 4. Minnesota Noise Standards[108]

Noise Area Classification (NAC)	Daytime		Nighttime	
	L_{50}	L_{10}	L_{50}	L_{10}
1 – Residential	60	65	50	55
2 – Commercial	65	70	65	70
3 – Industrial	75	80	75	80

Potential Impacts

Potential noise impacts from the project fall into two categories: (1) noise impacts due to construction and (2) noise impacts due to operation of the expanded MEC. For both of these categories, noise impacts are anticipated to be minimal and within state noise standards.

Construction Noise

Construction noise sources are anticipated to include trucks, cranes, excavating equipment, pneumatic tools, and cleaning equipment.[109] Construction of the project will involve foundation work, steel erection, and the delivery and installation of heavy equipment.[110] Though construction noises are unavoidable, they are anticipated to be temporary in nature.[111] The applicant indicates that construction noise impacts will be mitigated by:[112]

- Controlling the extent and duration of significant noise generating activities during construction.
- Limiting the duration of the overall construction period by contracting for sufficient construction resources and through efficient scheduling of construction activities.

Commission site permits require that construction noise impacts be limited to daytime working hours (**Appendix B**). Based on the temporary nature of construction noises, the industrial setting of the MEC, the applicant's proposed mitigation measures, and the substantial distance to the nearest residential area, noise impacts due to construction of the project are anticipated to be minimal.

---

[105] Site Permit Application, Section 4.3.
[106] Id.
[107] Id.
[108] Minnesota Rule 7030.0040. Standards expressed in dBA. Day time is 7:00 a.m. – 10:00 p.m.; night time is 10:00 p.m. – 7:00 a.m.
[109] Site Permit Application, Section 4.3.
[110] Id.
[111] Id.
[112] Id.

Operation Noise
The MEC's power generating equipment produces noise when in operation. This equipment includes the CTG, HSRG, steam turbine, cooling tower cells, and electrical transformers.[113] Noise levels at the MEC site boundary are currently in the range of 63 to 67 dBA when the plant is operating.[114] Noise levels at the MEC site when the plant is not in operation are generally in the range of 50 to 55 dBA.[115]

The applicant modeled and estimated operational noise levels for the MEC with the expansion project (**Appendix D**). This modeling indicates that noise levels at the MEC site boundary, with the expansion project, will be approximately 73 dBA. This noise level is within state noise standards for industrial properties. It is an incremental increase of approximately 6 to 10 dBA over current operational noise levels at the plant.

Mitigation
Noise impacts from the project are anticipated to be minimal and within Minnesota noise standards. Commission permits require compliance with these standards (**Appendix B**). However, this does not mean that noise impacts would not occur. Operation of the expanded MEC will increase noise levels in the project area. Even if noise levels are within state standards, persons near the plant – e.g., persons in or near the industrial near in which the MEC is located – would likely notice an increase in noise level. Operational noise impacts are mitigated, to a great extent, by the location of the MEC (away from persons and residential receptors) and by the fact that impacts will be incremental.

Displacement
Displacement is the removal of a residence or commercial building to facilitate the construction and operation of a power plant. There are no residences or commercial buildings within the MEC site that must be removed to construct the MEC expansion project. The only buildings within the site are those required for operation of the MEC.

No displacements are anticipated as a result of the project; no mitigation measures are proposed.

Economics
The MEC expansion project will take approximately 24 to 27 months to construct.[116] The project will employ up to 250 construction workers.[117] Once in operation, the applicant anticipates adding two employees, for a total of 19 full time employees at the plant.[118]

Potential Impacts
Economic impacts resulting from the project are anticipated to be positive. The project will provide construction jobs for persons in the project area – e.g., welders, pipefitters, carpenters.[119] The wages associated with these jobs will positively impact the regional economy. The project will result in increased purchasing of local goods and services during construction and, to some extent, during

[113] Id.
[114] Id.
[115] Site Permit Application, Appendix A.
[116] Site Permit Application, Section 4.5.
[117] Id.
[118] Id.
[119] Id.

operation of the expanded plant.[120] Indirect positive impacts will accrue due to the improved load-serving capability of the electric transmission grid.

Potential negative economic impacts are anticipated to be minimal. Disruptions of local business due to construction of the project are anticipated to be minimal. Though the population below the poverty level in the project area, as a percentage of residents, is relatively greater than the state average (**Table 3**), no low-income or minority population is anticipated to be negatively and differentially impacted by the project.

Mitigation
Economic impacts resulting from the project are anticipated to be positive; thus, no mitigation measures are proposed.

<u>Cultural Values</u>
Cultural values are those community beliefs and attitudes which provide a framework for community unity and animate community actions. Cultural values are informed, in part, by history and heritage. The project area has been home to a variety of persons and cultures. In the early to mid-1800s, the area was populated primarily by Dakota Sioux. The city of Mankato was established in 1852 at the confluence of the Minnesota and Blue Earth Rivers.[121] North Mankato was established in 1898.[122] Settlers of these cities were of German, Welsh, Norwegian, Swedish, Irish, and Scottish heritage.[123]

Cultural values are also informed by the work and recreation of residents and by geographical features. The cities of Mankato and North Mankato have become a regional center for commerce, education, health care, and industry.[124] Persons in the project area have various recreational opportunities. The city of Mankato, and the project area generally, host multiple events each year, including the Deep Valley Homecoming, Mahkato Pow-Wow, and Minnesota River Ramble.[125]

Potential Impacts
No impacts to cultural values are anticipated as a result of the project. The project will not adversely impact the work or recreation of residents in the project area that underlie the area's cultural values. Nor will it adversely impact geographical features that inform these values.

Mitigation
No impacts to cultural values are anticipated as a result of the project; thus, no mitigation measures are proposed.

<u>Public Services</u>
Power plants are large infrastructure projects that have the potential to negatively impact public services, e.g., roads, utilities, emergency services. These impacts are typically temporary in nature, e.g., the inability to fully use a road or utility while construction is in process. However, impacts can be long term if they change the project area in such a way that public service options are foreclosed or limited.

[120] Id.
[121] Mankato History, http://visitgreatermankato.com/mankato/explore/history/.
[122] Id.
[123] Blue Earth County History, http://www.bechshistory.com/museum/bec-history.
[124] Site Permit Application, Section 4.6.
[125] Annual Mankato Events, http://visitgreatermankato.com/mankato/visit/events/major-events/.

Temporary impacts to public services resulting from the MEC expansion project are anticipated to be minimal. Long-term impacts to public services are not anticipated.

Roads and Highways

The primary highways in the project area are U.S. Highway 169 and U.S. Highway 14. The MEC site is located approximately one-half mile north of U.S. Highway 14, off of the Summit Avenue exit.[126] The total distance from U.S. Highway 14 to the MEC entrance is approximately 0.75 miles.[127] No road or highway improvements are required for the project.[128]

Impact to roads and highways due to the project are anticipated to be minimal and temporary. Minor, temporary impacts to road or highway usage may occur during transportation of large equipment to the MEC site, e.g., traffic delays.[129] These impacts can be minimized through coordination with roadway authorities. No impacts to roads and highways are anticipated after the project has been constructed.

Airports

The Mankato Municipal Airport is located approximately 3.7 miles northeast of the MEC site in Lime Township, Blue Earth County.[130] The airport is one of the busiest municipal airports in the state with two runways that accommodate personal, business, and commercial flights.[131]

Tall structures can impact airport operations if they are within airport safety zones. Different classes of airports have different safety zones depending on several characteristics, including runway dimensions, classes of aircraft accommodated, and navigation systems. These characteristics determine the necessary takeoff and landing glide slopes, which in turn determine the safety zones.

No impacts to the Mankato Municipal Airport are anticipated as a result of the project. The orientation of the runways at the airport is such that the MEC is not within takeoff and landing glide slopes.[132] Further, the airport is located at an elevation (1,200 feet) that is higher than the elevation of the top of the emissions stack at the MEC (995 feet).[133] Because of the distance from the airport to the MEC, the orientation of the airport's glide slopes, and the elevation of the airport relative to the MEC, no impacts to the airport are anticipated as a result of the project.

Water Utilities

Water and sewer service are provided to the MEC by the city of Mankato.[134] Cooling water for the MEC is provided from the city's municipal wastewater treatment plant (WWTP).[135] Service water is provided through the city's municipal water supply.[136] The MEC expansion project will increase the use of wastewater for cooling (see Section 4.8). The applicant has indicated that they will work with the

[126] Site Permit Application, Section 3.1.
[127] Id.
[128] Id.
[129] Site Permit Application, Section 5.3.
[130] Site Permit Application, Section 5.4.
[131] Id.
[132] Id.
[133] Id.
[134] Site Permit Application, Section 4.8.2.
[135] Site Permit Application, Section 5.2.
[136] Id.

Mankato WWTP to upgrade existing pumps or install new pumps to supply the additional cooling water needed.[137] Increases in municipal water use are not anticipated.

No adverse impacts to water utilities in the project area are anticipated as a result of the project. The expansion project will not impact water supplies in the project area.[138] Pumping capacity at the Mankato WWTP will be upgraded as a result of the project.

Electric Utilities

Electrical service in the project area is provided by Xcel Energy and regional electric cooperatives.[139] The project will provide additional electrical generation in the project area. This electrical power may be used in the project area or distributed to other areas via the electric transmission system. No adverse impacts to electrical service are anticipated as a result of the project; no mitigation measures are proposed.

Natural Gas Utilities

Natural gas service in the project area is provided by CenterPoint Energy.[140] The project will utilize an existing, dedicated natural gas pipeline (see Section 3.1). The pipeline is sized to support the natural gas requirements of the expansion project. No new gas pipeline will be required for the expansion project.[141] No adverse impacts to natural gas service are anticipated as a result of the project; no mitigation measures are proposed.

Emergency Services

Emergency services are provided to the MEC and the project area by the city of Mankato.[142] Impacts to emergency services in the project area could result from (1) an inability to communicate that there is an emergency or (2) an inability to respond to an emergency.

No impacts to communication systems are anticipated as a result of the project; therefore, no impacts to the community's ability to communicate regarding an emergency are anticipated. During construction of the project, there may be temporary impacts to roads which could impede responses to an emergency, e.g., traffic delays. However, these impacts are anticipated to be minimal. No impacts to emergency services are anticipated once the project is operational; no mitigation measures are proposed.

Zoning and Land Use Compatibility

Electric power generating plants have the potential to adversely impact existing land uses and to be incompatible with future land uses. The MEC is located in an area zoned as commercial / industrial / public utility by the city of Mankato.[143] The MEC is a site specifically designed for the proposed expansion project. Accordingly, the project is consistent with existing and future land uses and no impacts to these land uses are anticipated as a result of the project.

---

[137] Site Permit Application, Section 2.7.6.
[138] Site Permit Application, Section 5.2.
[139] Electric Utility Service Areas, http://www.mngeo.state.mn.us/eusa/index.html.
[140] CenterPoint Energy, Where We Serve, http://www.centerpointenergy.com/en-us/corporate/about-us/company-overview/where-we-serve.
[141] Site Permit Application, Section 3.2.
[142] Site Permit Application, Section 4.8.4.
[143] Site Permit Application, Section 2.4.

4.4 Public Health and Safety

Electric power generating plants have the potential to negatively impact public health and safety – during construction and operation. As with any project involving heavy equipment, power generation systems, and high voltage transmission lines, there are safety issues to consider. Potential health and safety impacts related to construction of the project include injuries due to falls, equipment use, and electrocution. Potential health impacts related to the operation of the project include health impacts from air emissions, water emissions, fire, and electrocution.

Impacts to public health and safety resulting from the MEC expansion project are anticipated to be minimal. Potential construction related impacts are anticipated to be minimal. Potential impacts related to air and water emissions are anticipated to be minimal. Though the project will increase greenhouse gas emissions at the MEC, it is anticipated to reduce greenhouse gas emissions in Minnesota overall. Potential impacts due to water vapor plumes from the plant are anticipated to be minimal. Potential impacts due to fire or electrocution at the plant are anticipated to be minimal.

<u>Air Emissions</u>

Air emissions of many types – including those from the combustion of carbon-based fuels to produce electrical power – have the potential to impact public health. Health impacts can range from relatively minor annoyances such as coughing or itching eyes, to more severe impacts that require emergency-room visits and hospital admissions.[144] To avoid and minimize these impacts, the U.S. Environmental Protection Agency (EPA) has promulgated National Ambient Air Quality Standards (NAAQS).[145] These standards are designed to protect human health and the environment.[146] The responsibility for meeting these standards in Minnesota falls to the MPCA, which, through a state implementation plan, designs and implements means to control air pollutants.[147]

In order to ensure that NAAQS are met, the EPA requires major new stationary sources of air emissions to demonstrate that they will not cause a violation of the NAAQS.[148] In Minnesota, major new stationary sources must obtain a prevention of significant deterioration (PSD) permit from the MPCA. A PSD permit may allow certain air pollutants to increase in an area (referred to as the "PSD increment"), but must prevent air quality from deteriorating below the level set by the NAAQS.[149]

In addition to meeting NAAQS and PSD requirements, certain new facilities must also demonstrate, through an air emissions risk analysis (AERA), that the potential health risks associated with their air emissions are within state guidelines.[150]

---

[144] Air Quality in Minnesota – 2015 Report to the Legislature, Minnesota Pollution Control Agency, http://www.pca.state.mn.us/index.php/about-mpca/legislative-resources/legislative-reports/air-quality-in-minnesota-reports-to-the-legislature.html.
[145] National Ambient Air Quality Standards (NAAQS), http://www3.epa.gov/ttn/naaqs/criteria.html.
[146] Id.
[147] Minnesota State Implementation Plan (SIP), http://www.pca.state.mn.us/index.php/air/air-quality-and-pollutants/general-air-quality/state-implementation-plan/minnesota-state-implementation-plan-sip.html.
[148] Prevention of Significant Deterioration Basic Information, http://www.epa.gov/nsr/prevention-significant-deterioration-basic-information.
[149] Id.
[150] Air Emissions Risk Analysis (AERA), http://www.pca.state.mn.us/index.php/air/air-monitoring-and-reporting/air-emissions-modeling-and-monitoring/air-emission-risk-analysis-aera/air-emissions-risk-analysis-aera.html.

Air emissions may include greenhouse gases – gases that, upon release to the atmosphere, warm the atmosphere and surface of the plant, leading to alterations in the earth's climate.[151] Because warming of the planet and changes in the earth's climate result in adverse human and environmental impacts, the State of Minnesota has established goals to reduce greenhouse gas emissions.[152] The state has a goal of reducing greenhouse gas emissions to 15 percent below 2005 emission levels by 2015 and to 30 percent below 2005 emission levels by 2025.[153]

Potential Impacts

The MEC, as it exists now, is fueled by natural gas with fuel oil as a backup.[154] The MEC expansion project will be fueled solely with natural gas.[155] The combustion of these fuels will result in the emission of combustion by-products that have the potential for public health impacts.[156] With appropriate mitigation measures, these emissions are anticipated to be within all state and federal standards and guidelines. Additionally, though the project will increase greenhouse gas emissions at the MEC, it is anticipated to reduce greenhouse gas emissions in Minnesota overall. As a result, public health impacts due to air emissions from the project are anticipated to be minimal.

National Ambient Air Quality Standards and Prevention of Significant Deterioration

Estimated potential annual emissions of air pollutants from the MEC expansion project are shown in **Table 5**. Because a number of air pollutants have the potential to be emitted in amounts greater than their respective PSD thresholds, the project is subject to PSD review and permitting (**Table 5**).[157] The applicant has submitted an application to the MPCA for an amendment of the MEC's current air permit (**Appendix E**).

Air dispersion modeling conducted by the applicant indicates that emissions from the project will not cause a violation of NAAQS and will not increase air pollutants in the area beyond the allowable PSD increment.[158] A PSD permit cannot be issued by the MPCA until the applicant demonstrates that the project, with appropriate mitigation measures, complies with all state and federal standards.[159] Accordingly, impacts to public health resulting from the project's impact on ambient air quality are anticipated to be minimal and within all state and federal standards.

---

[151] Greenhouse Gas Emissions Reduction, Biennial Report to the Minnesota Legislature, January 2015, https://www.pca.state.mn.us/sites/default/files/lraq-2sy15.pdf [hereinafter Greenhouse Gas Emissions Reduction Report].
[152] Id.
[153] Id.
[154] Site Permit Application, Section 5.1.
[155] Id.
[156] Id. Other emission sources at the MEC include auxiliary boilers, a diesel-fueled fire pump, a bath heater, and a proposed emergency generator.
[157] Site Permit Application, Section 5.1.2.
[158] Site Permit Application, Sections 5.1.3 and 5.1.4.
[159] Id.

Table 5. Estimated Potential Annual Air Emissions and PSD Thresholds[160]

Air Pollutant	Combined Facility Post-Project Potential Emissions (tons per year)	Expansion Project Potential Emissions (tons per year)	PSD Major Modification Threshold (tons per year)
Particulate Matter (PM)	192.91	58.71	25
PM Less Than 10 Microns (PM_{10})	175.08	52.76	15
PM Less Than 2.5 Microns ($PM_{2.5}$)	173.20	52.14	10
Sulfur Dioxide (SO_2)	98.58	30.46	40
Nitrogen Oxides (NO_x)	354.01	167.44	40
Volatile Organic Compounds (VOC)	647.02	382.58	40
Carbon Monoxide (CO)	1,266.03	768.64	100
Lead	0.52	0.01	0.6
Carbon Dioxide Equivalent (CO_2e)	3,094,401	1,576,725	75,000
Beryllium	3.91×10^{-4}	4.24×10^{-5}	0.004
Mercury	3.07×10^{-3}	9.20×10^{-4}	0.1
Sulfuric acid mist	14.88	4.58	7

Air Emissions Risk Analysis

In accordance with MPCA guidance, the applicant has conducted an air emissions risk analysis (AERA) to assess potential health impacts attributable to the project.[161] These are potential impacts to residents in the project area who could be affected directly by pollutants from the project (e.g., inhalation, deposition), as opposed to being affected by changes in ambient air quality generally. Using air dispersion modeling and several exposure scenarios, cancer and non-cancer health risks can be estimated and quantified using indices.[162] These indices are then compared to thresholds established by the MPCA and the Minnesota Department of Health.[163]

The applicant's AERA indicates that potential health risks to residents in the project area due to air emissions are within state guidelines (**Table 6).**[164] The greatest cancer risk is to a person in the project area who is outdoors continuously (modeled in the AERA as a "farmer"). The estimated risk to such persons is 0.9 additional lifetime cancers per 100,000 persons.[165] This risk is slightly less than the state

[160] Site Permit Application, Section 5.1.2, Table 5-1. Potential emissions based on continuous full power operation of the MEC (or expansion project). Actual emissions are anticipated to be substantially less; see Site Permit Application, Section 2.3 (discussing that the MEC operates only when needed by the electrical transmission grid and indicating actual power production at approximately 15 percent of potential production).
[161] Site Permit Application, Section 5.1.5.
[162] Id.
[163] Id.
[164] Id.
[165] Id.

risk guideline of one additional lifetime cancer in 100,000 persons.[166] The estimates in the AREA are conservative in that they assume maximum potential emissions from the MEC rather than estimated actual emissions.[167]

In sum, the MEC, with the expansion project, has the potential to impact the health of residents in the project area through air emissions; however, these impacts are anticipated to be within state guidelines and minimal.

Table 6. Air Emission Risk Analysis Results[168]

Screening Scenario	Risk Analysis Result	State Guideline / Threshold
Acute Hazard Index	0.8	1.0
Sub-chronic Hazard Index	0.02	1.0
Chronic Hazard Index	0.2	1.0
Cancer Risk	3×10^{-6}	1×10^{-5}
Farmer Non-cancer Hazard	0.6	1.0
Farmer Cancer Risk	9×10^{-6}	1×10^{-5}

Greenhouse Gases and Global Warming

The accumulation of greenhouse gases in the atmosphere and associated warming of the planet is leading to a variety of adverse human and environmental impacts – including more severe droughts and floods, more heat related illnesses, and a decrease in food security.[169] Though a variety of gases contribute to the greenhouse effect, the most prominent greenhouse gas is carbon dioxide.[170]

In 2012, approximately 154 million carbon dioxide equivalent (CO_2e) tons of greenhouse gases were emitted in Minnesota.[171] The electric utility sector was responsible for approximately 31 percent of this total, or about 48 million tons CO_2e.[172]

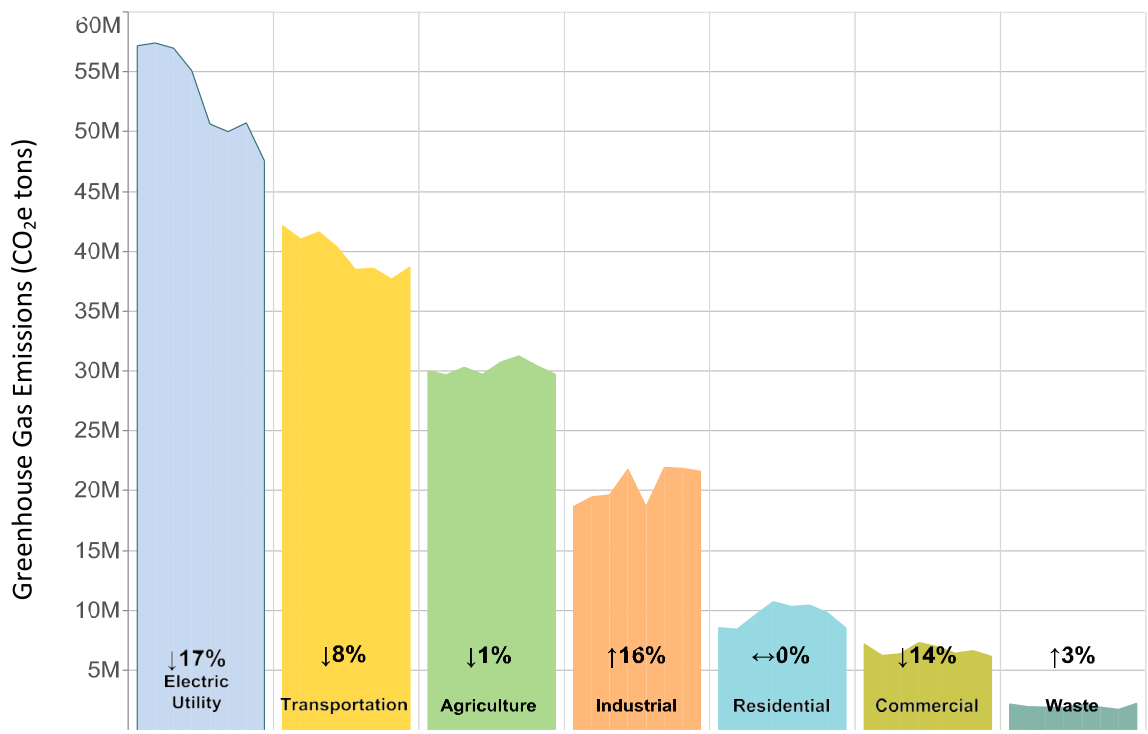
Between 2005 and 2012 Minnesota greenhouse gas emissions declined by 11 million tons CO_2e, or approximately seven percent.[173] During this period, emissions from the electric utility sector declined by approximately 17 percent (**Figure 10**). This decline was due to utilities switching to less greenhouse gas intensive fuels, such as natural gas, and the increased use of renewable energy sources (e.g., wind, solar).[174]

[166] Id.
[167] Id.
[168] Site Permit Application, Section 5.1.5, Table 5-4.
[169] Minnesota and Climate Change: Our Tomorrow Starts Today, Minnesota Environmental Quality Board, www.eqb.state.mn.us.
[170] Id.
[171] Greenhouse Gas Emissions Reduction Report.
[172] Id.
[173] Id.
[174] Id.

With the expansion project, the MEC will have the potential to emit approximately 3 million tons CO_2e per year.[175] Because the MEC operates only when needed by the electrical transmission grid, actual greenhouse gas emissions are anticipated to be approximately 15 percent of this potential, or about 450,000 tons CO_2e annually.[176]

Looking solely at the expansion project and emissions from the MEC, the project will increase greenhouse emissions at the MEC – approximately doubling current greenhouse gas emissions from the MEC.[177] Thus, the project would appear to contribute to global warming and associated human and environmental impacts. However, looking at the role of the MEC in the electric utility sector in Minnesota, the increased use of natural gas at the MEC and the displacement of more greenhouse gas intensive fuels (e.g., coal) combined with the ability of the MEC to facilitate additional wind and solar power generation is anticipated to reduce greenhouse gas emissions in Minnesota.[178] Though the displacement of more greenhouse gas intensive fuels and the addition of wind and solar power generation depend on a variety of actions by multiple actors, trends in electric utility emissions from 2005 to 2012 indicate that these activities will occur.[179] Thus, the project is anticipated to reduce greenhouse gas emissions in Minnesota overall and may reduce potential human and environmental impacts associated with global warming.

Figure 10. Minnesota Greenhouse Gas Emission Changes by Economic Sectors: 2005-2012[180]



[175] Site Permit Application, Section 5.1.2.
[176] Site Permit Application, Section 2.3 (discussing actual power production versus potential power production at the MEC).
[177] Site Permit Application, Section 5.1.2.
[178] Greenhouse Gas Emissions Reduction Report.
[179] Id. See also, Natural Gas, Renewables Projected to Provide Larger Shares of Electricity Generation, U.S. Energy Information Administration, https://www.eia.gov/todayinenergy/detail.cfm?id=21072.
[180] Greenhouse Gas Emissions Reduction Report.

Mitigation
Potential health impacts of air emissions can be mitigated by technologies and processes that minimize emissions of certain pollutants. MPCA's PSD permit will require that the MEC employ best available control technologies (BACT).[181] The applicant indicates that it will use several emission control strategies, including:[182]

- Using natural gas to fire the turbines to minimize NO_X, sulfur dioxide, and particulate emissions.
- Using dry low NO_X combustors to minimize the formation of nitrogen oxides in combustion turbines.
- Using select catalytic reduction to reduce nitrogen oxides in combustion turbine exhaust.
- Use of catalytic oxidation to reduce CO, VOC, and organic air pollutant emissions from combined cycle system exhaust gas.
- Limiting operation of the emergency generator and fire pump, as practicable, to less than 100 hours per year.
- Installing high efficiency mist eliminators to reduce cooling tower drift rates and minimize particulate matter emissions from cooling towers.
- Use of energy efficient designs, processes, and practices.

Through the PSD permitting process, the MPCA may require mitigation measures in order to ensure that the project meets all air emissions standards and guidelines.

<u>**Water Vapor Plumes**</u>
When exhaust gases are emitted from the stacks, the water vapor present in the exhaust gas can condense to form a visible plume.[183] Water vapor emitted from the cooling towers can also result in a visible plume (**Figure 9**).[184] The length and persistence of these plumes are influenced by prevailing weather conditions such as temperature, relative humidity, and wind speed.[185] The plumes are most persistent and visible during cold and damp weather.[186] The plumes, when present, disperse and evaporate fairly quickly and typically travel only short distances.[187]

Potential Impacts
Water vapor plumes from the MEC have the potential to impair visibility and/or create icy areas on nearby roadways. However, because plumes are anticipated to dissipate before reaching roadways, potential impacts to health and safety due to plumes are anticipated to be minimal.

---

181 Site Permit Application, Section 5.1.2.
182 Id.
183 Site Permit Application, Section 5.5.
184 Id.
185 Id.
186 Id.
187 Id.

Water vapor plumes from the HRSG stacks will form approximately 200 feet above ground level. When emitted at this height the plumes are anticipated to dissipate before reaching ground level.[188] The cooling towers are not as tall as the HRSG stacks; however, they utilize drift eliminators to minimize water vapor emissions that can cause fogging and icing.[189] Summit Avenue and 3rd Avenue, the nearest local roads, are approximately 800 feet from the MEC.[190] U.S. Highway 14 is approximately 0.75 miles from the MEC.[191] Based on these distances and the rate at which water vapor plumes typically evaporate and dissipate, impacts to these roadways are anticipated to be minimal. The applicants note that plumes from the MEC to date have not impacted visibility or roadway safety.[192] Water vapor plumes associated with the MEC expansion project will be incremental and impacts from the expanded MEC are anticipated to be minimal.

Mitigation

Impacts to public health and safety as a result of the MEC's water vapor plumes are anticipated to be minimal; thus, no mitigation measures are proposed.

<u>Water Emissions</u>

Water used at the MEC and rainfall at the site could become polluted with oils, chemicals, and other substances used for power production at the MEC. If polluted waters are not properly treated or handled, their discharge into the environment could result in impacts to public health. However, because waters at the MEC are treated and handled to minimize the discharge of pollutants, impacts to public health due to water emissions are anticipated to be minimal.

Potential Impacts

Process wastewater, i.e., wastewater from power systems, is collected and treated and then discharged to the Mankato WWTP.[193] The Mankato WWTP, after further treatment, discharges to the Minnesota River in accordance with its NPDES/SDS permit.[194] No changes in this process are anticipated as a result of the project. Discharges from the MEC – through the Mankato WWTP – are not anticipated to change as a result of the project and are not anticipated to adversely impact public health.

Domestic wastewater from the MEC is discharged to the city of Mankato sanitary sewer system.[195] This discharge is monitored by the city and subject to pollutant discharge limits. No changes are anticipated to this process and no impacts to the Mankato sanitary sewer system or to public health are anticipated.

Stormwater from the power production areas of the MEC is treated to separate oil and water – oil is shipped off-site for disposal; water is recycled as cooling water makeup.[196] Stormwater from non-power production areas is routed to an existing stormwater basin.[197] Stormwater flows from this basin through

[188] Id.
[189] Id.
[190] Id.
[191] Site Permit Application, Section 3.1.
[192] Site Permit Application, Section 5.5 (noting that the MEC has received no complaints to date concerning water vapor plumes).
[193] Site Permit Application, Section 2.7.9.
[194] Site Permit Application, Section 8.3.6
[195] Id.
[196] Site Permit Application, Section 8.3.5.
[197] Id.

a drainage ditch to the Minnesota River.[198] Discharges from the basin are regulated by an NPDES/SDS permit.[199] No changes in the handling of stormwater are anticipated as a result of the project. No public health impacts are anticipated as a result of stormwater from the project.

Mitigation
Impacts to public health and safety as a result of water emissions from the MEC are anticipated to be minimal; thus, no mitigation measures are proposed.

Fire and Electrocution
The power generation equipment at the MEC and the equipment proposed for the expansion project combust natural gas at high pressure and temperature and convert this heat energy to electrical power. As a result, there is a risk of fire or explosion and a risk of electrocution. However, because of systems and controls in place at the MEC, because access to the MEC is controlled, and because the MEC is relatively distant from populated areas (approximately one-half mile), the risk to public health and safety from these potential accidents is anticipated to be minimal.

Potential impacts due to safety risks at the MEC are minimized by a number of controls at the MEC including training, personal protective equipment, and signage.[200] All employees participate in on-going safety training.[201] All employees, contractors, and visitors are required to use appropriate personal protection equipment, e.g., hard hats, safety glasses, safety harnesses.[202] Employees are trained in the proper use of this equipment.[203] The MEC utilizes signage to identify hazards at the facility and the locations of safety equipment.[204]

The MEC is equipped with a security system and a fire suppression system.[205] The fire suppression system includes a diesel-fueled fire pump.[206] The city of Mankato provides any fire, police, or rescue services needed at the MEC.[207] Accordingly, public health impacts from a potential fire at the MEC are anticipated to be minimal.

The MEC utilizes step-up transformers and electrical switchgear to commute the electrical power generated at the MEC to the Wilmarth substation (see Section 3.1). The switchgear includes circuit breakers and relays that de-energize electrical equipment should a structure or conductor fall to the ground or should electrical equipment otherwise fail. Accordingly, public health impacts resulting from electrocution at the MEC are anticipated to be minimal.

Mitigation
Impacts to public health and safety as a result of fire or electrocution accidents at the MEC are anticipated to be minimal; thus, no mitigation measures are proposed.

---

[198] Id.
[199] Id.
[200] Additional Project Information from Applicant.
[201] Id.
[202] Id.
[203] Id.
[204] Id.
[205] Site Permit Application, Section 4.8.4.
[206] Site Permit Application, Section 2.7.10.
[207] Site Permit Application, Section 4.8.4.

4.5 Land-Based Economies

Electric power generating plants have the potential to impact land-based economies. Power plants require a dedicated physical area on the landscape to accommodate power generation equipment. The use of this area for power generation can prevent or otherwise limit use of the landscape for other purposes and can adversely impact land-based economies.

Impacts to land-based economies as a result of the project are anticipated to be minimal. The project will be located within the existing MEC.[208] No additional land is required for operation of the expanded MEC. The project will require the temporary use of approximately 15 acres outside of the MEC site for construction of the project.[209] The applicant anticipates securing land from a local property owner for this use.[210] Once the project is constructed, this land would be returned to its current use.

Agriculture

Impacts to agriculture as a result of the project are anticipated to be minimal. There is no agricultural land within the MEC site. The project will require the use of approximately 15 acres outside of the MEC site for construction of the project. This land will be agricultural land or vacant industrial land.[211] If agricultural land were used, it would be unavailable for cultivation for approximately two growing seasons (24-30 months).[212] After this time, the land would be returned to agricultural use. Impacts to agriculture as a result of the project are anticipated to be minimal; thus, no mitigation measures are proposed.

Forestry

No impacts to forestry are anticipated as a result of the project. There is no forested land within the MEC site. No forested land will be used for construction of the project. No mitigation measures are proposed.

Mining

No impacts to mining are anticipated as a result of the project. There are no mining operations or resources within the MEC site. There are mining operations and resources in the project area including limestone quarries and aggregate mines.[213] These operations and resources are at a distance from the MEC site and will not be impacted by the construction or operation of the project.[214] No mitigation measures are proposed.

Recreation and Tourism

No impacts to recreation and tourism are anticipated as a result of the project. The MEC is located in an industrial area away from recreational features and tourism attractions.[215] There are parks in the

[208] Site Permit Application, Section 6.0.
[209] Id.
[210] Id.
[211] Site Permit Application, Section 6.1.
[212] Id.
[213] Site Permit Application, Section 6.4.
[214] Id.
[215] Site Permit Application, Section 6.3.

project area used for recreation, but these parks are located at a distance from the MEC site and their use will not be impacted by the project.[216] No mitigation measures are proposed.

4.6 Archaeological and Historic Resources

Electric power generating plants have the potential to impact archaeological and historic resources. Archaeological resources can be impacted by the disruption or removal of such resources during the construction of a plant. Historic resources can be impacted by locating a plant in a manner that impairs or decreases the historic value of the resources.

Impacts to archaeological and historic resources resulting from the project are anticipated to be minimal. There are no archaeological or historic resources within the MEC site.[217] A review of records at the State Historic Preservation Office indicates that there are two historic farmsteads within the section where the MEC is located (Section 31, Lime Township).[218] No impacts to these farmsteads are anticipated as a result of the project. No mitigation measures are proposed.

4.7 Air Resources

Emissions from electric power generating plants can adversely impact air quality with concomitant impacts to persons, flora, and fauna. Potential impacts to air quality as a result of the project are discussed in Section 4.4. EPA air emission standards are protective of public health and public welfare, including the welfare of flora and fauna.[219] As the MEC must comply with these standards, impacts to air resources are anticipated to be minimal, and no impacts to flora or fauna are anticipated due to air emissions from the MEC. No mitigation measures beyond those discussed in Section 4.4 are proposed.

4.8 Water Resources

Electric power generating plants have the potential to impact water resources in several ways. Construction of the project will require the movement and removal of soils. This handling of soils can result in soil erosion and changes in water flow patterns such that water resources are adversely impacted. Operation of the MEC requires water for cooling (see Section 3.1). The use of water for cooling could remove water from the ecosystem. This removal could have adverse impacts on water resources, flora, and fauna. Operation of the MEC could result in the emission of pollutants to waterbodies; such emissions could adversely impact water quality and habitat for flora and fauna.

Impacts to water resources as a result of the project are anticipated to be minimal. Soil erosion and construction related impacts to water resources are anticipated to be minimal. The project will increase the MEC's use of cooling water; however, the water used for cooling is wastewater from the Mankato WWTP. Accordingly, the impact of increased cooling water use on water resources is anticipated to be minimal. Emissions of pollutants to waterbodies are anticipated to be minimal and within all applicable standards; thus, impacts to water resources due to potential pollutants are anticipated to be minimal.

[216] Parks, City of Mankato, http://www.mankatomn.gov/city-services-a-z/city-services-n-z/parks.
[217] Site Permit Application, Section 7.0.
[218] Id.
[219] Site Permit Application, Section 8.1.

Surface Waters

The MEC site contains no waterbodies or watercourses. There is a stormwater basin (detention pond) located in the northeast corner of the site (**Figure 11**).[220] The basin was designed and constructed to contain stormwater from the MEC as originally proposed, i.e., with the MEC expansion project.[221] The basin discharges to a drainage ditch on the east side of the site.[222] This drainage ditch is a tributary of the Minnesota River.[223] The river itself is located approximately 1,800 feet west of the MEC site.

Construction

Impacts to surface waters could occur due to construction activities. These activities could expose and disturb soils, increasing erosion and the potential for sediment to reach surface waters. Construction of the project will disturb approximately four acres.[224] Though there are no surface waters at the site, disturbed soils could move, via rainfall events, to the stormwater basin and through the drainage ditch.

Impacts to surface waters as a result of project construction are anticipated to be minimal and can be mitigated. Construction of the CTG and HSRG will impact approximately two acres of a paved, impervious surface and will not require substantial earth movement or grading (**Figure 8**).[225] Construction of new cooling tower cells will impact approximately one acre of a flat, gravel surface.[226] Substantial earth movement or grading will not be required for these cells.[227] The applicant indicates that it will employ several erosion and sediment control measures during construction of the project, including silt fences, hay bales, matting, and mulching.[228] The stormwater basin at the MEC will collect and filter stormwater during construction of the project.[229] The project will require an NPDES/SDS stormwater construction permit from the MPCA (see Section 2.3). This permit may require specific mitigation measures to minimize potential impacts to water resources resulting from construction of the project. Commission site permits require permittees to minimize soil erosion and associated impacts on surface waters (**Appendix B**).

Operation

Impacts to surface waters could occur due to the use of water for cooling at the MEC and to emissions of pollutants from the MEC. These potential operational impacts are anticipated to be minimal.

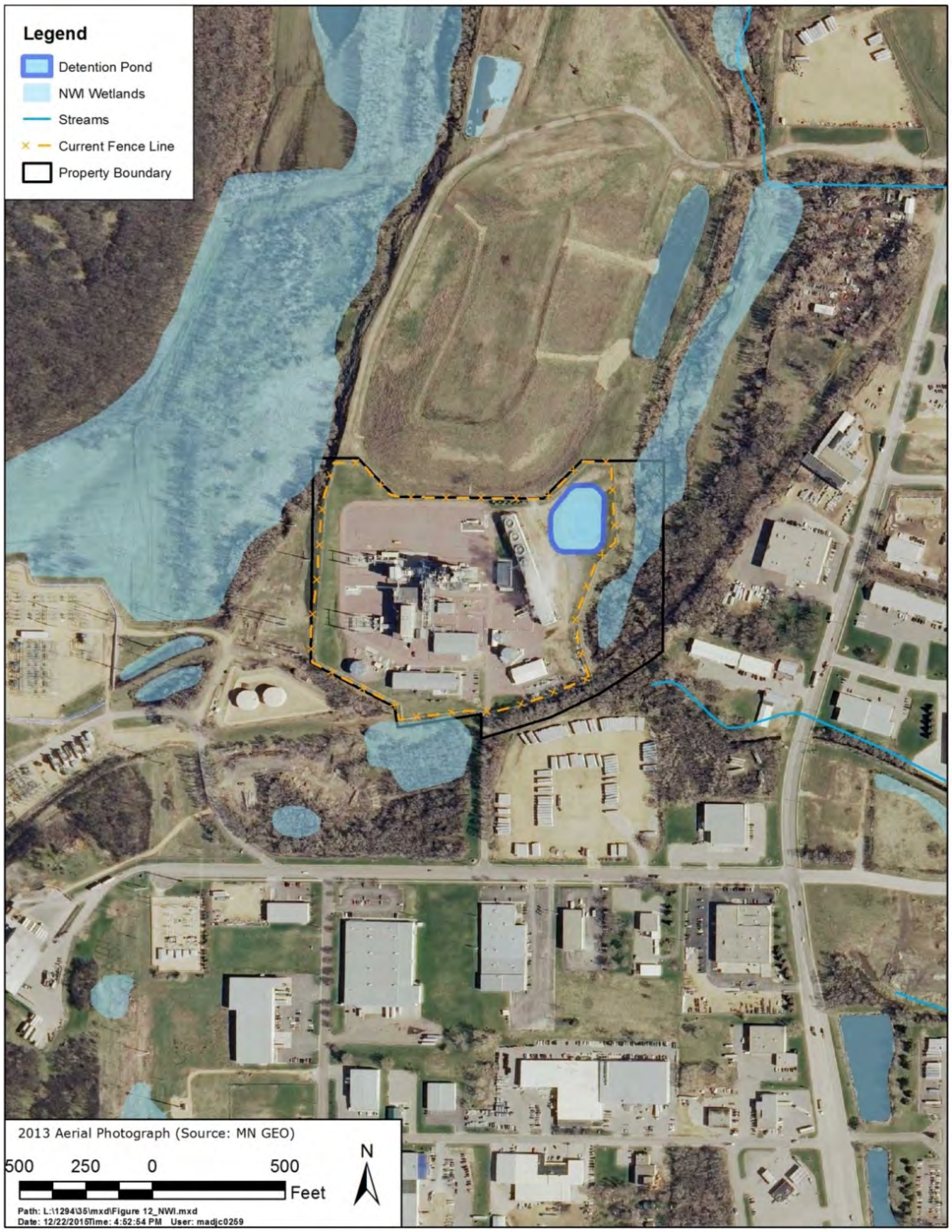
Evaporative Loss of Cooling Water

There are currently eight cooling tower cells at the MEC. The expansion project will require the addition of four more cells, resulting in a total of 12 cooling tower cells (see Section 3.1). This addition will increase the tower's ability to dissipate heat and will increase water evaporation from the tower. When running at full power, the MEC currently has the potential to evaporate 3.48 million gallons per day (MGD).[230] With the expansion project, the MEC will have the potential to evaporate 6.04 MGD.[231]

[220] Site Permit Application, Section 8.3.
[221] Id.
[222] Id.
[223] Id.
[224] Id.
[225] Id.
[226] Id.
[227] Id.
[228] Id.
[229] Id.
[230] Site Permit Application, Section 2.7.6.

Because the MEC does not run continuously, its average daily water evaporation is considerably less – approximately one-tenth of its maximum potential evaporation.[232] On average, the MEC evaporates 0.34 MGD; with the expansion project, the MEC will evaporate, on average, approximately 0.47 MGD.[233]

Figure 11. Water Resources



[231] Id.
[232] Id.
[233] Id.

The wastewater used for cooling at the MEC, were it not lost to evaporation, would be discharged by the Mankato WWTP to the Minnesota River.[234] The Mankato WWTP treats and discharges, on average, approximately 7.0 MGD.[235] Thus, evaporation from the MEC, with the expansion project, will remove approximately 6.7 percent of the WWTP's average discharge to the Minnesota River.[236]

The evaporative loss of cooling water from the MEC could impact water resources and ecosystems by removing water otherwise available to ecosystems in the project area. However, the potential impacts of evaporative losses from the MEC are anticipated to be minimal. First, the cooling water used at the MEC is wastewater. Thus, it is water that has already provided ecosystem services to humans, flora, and fauna. Second, the evaporative loss from the MEC and resulting reduction in discharge from the Mankato WWTP is not anticipated to impact the Minnesota River or the habitat it provides for flora and fauna. The evaporative loss is insignificant compared with the flow volume of the Minnesota River.[237] Thus, though evaporation from cooling towers at the MEC will remove water from the water systems and ecosystems in the project area, the impacts of this removal are anticipated to be minimal.

Emissions to Surface Waters

Water used at the MEC and rainfall at the site could become polluted with oils, chemicals, and other substances used at the MEC. If these polluted waters are not properly treated or handled, their discharge could impact surface waters in the project area. However, because waters at the MEC are treated and handled to minimize the discharge of pollutants, impacts to surface waters are anticipated to be minimal.

Process wastewater, i.e., wastewater from power systems, is collected and treated and then discharged to the Mankato WWTP.[238] The Mankato WWTP, after further treatment, discharges to the Minnesota River.[239] No changes in this process are anticipated as a result of the project. Accordingly, the handling of process wastewater at the MEC is not anticipated to impact surface waters.

Stormwater from the power production areas of the MEC is treated to separate oil and water – oil is shipped off-site for disposal; water is recycled as cooling water makeup.[240] Stormwater from non-power production areas is routed to the stormwater basin.[241] Discharges from the basin are regulated by an NPDES/SDS permit.[242] No changes in the handling of stormwater are anticipated as a result of the project. The project will not increase the amount of impervious surface within the MEC site.[243] The applicant indicates that it will maintain the MEC site in good order and keep road surfaces clean to minimize potential pollutants in stormwater.[244] The applicant also indicates that it will maintain

[234] Site Permit Application, Section 8.3.6.
[235] City of Mankato, Plant History, http://www.mankatomn.gov/city-services-a-z/city-services-n-z/wastewater-treatment/plant-history.
[236] (0.47 MGD / 7.0 MGD) = 0.067.
[237] A minimum flow for the Minnesota River at Mankato is approximately 3,000 cubic feet per second, or about 1,940 MGD (see National Weather Service, Advanced Hydrologic Prediction Service, http://water.weather.gov/ahps2/hydrograph.php?wfo=mpx&gage=MNKM5).
[238] Site Permit Application, Section 2.7.9.
[239] Site Permit Application, Section 8.3.6
[240] Id.
[241] Id.
[242] Id.
[243] Site Permit Application, Section 8.3.5.
[244] Id.

vegetation buffers along the perimeter of the MEC to minimize stormwater impacts on surface waters.[245]

The MEC utilizes and stores liquids (e.g., fuel, chemicals) that could, if released, mix with stormwater or otherwise flow to the stormwater basin. The applicant indicates that such liquids are stored within appropriate containment areas.[246] Handling and unloading areas are equipped with secondary containment.[247] The MEC has a spill prevention, contingency, and countermeasure (SPCC) plan.[248] The plan identifies staff responsible for maintenance and inspection of storage tanks, steps to take in the event of a release, locations of spill response supplies at the MEC, and notification and communication responsibilities.[249] The MEC has a risk management plan for the storage of ammonia at the MEC.[250] The plan is similar to the SPCC and includes details specific to the proper handling of ammonia.[251]

In sum, impacts to surface waters due to emissions of potential pollutants are anticipated to be minimal. Impacts are avoided and minimized by facilities and processes in place at the MEC.

Floodplains

The MEC site is located outside of the 100-year floodplain, as identified by the Federal Emergency Management Agency (**Figure 12**).[252] The 100-year floodplain elevation is approximately 25 feet below the base elevation of the MEC.[253] Thus, no impacts to the 100-year floodplain or to development near the floodplain are anticipated as a result of the project. No mitigation measures are proposed.

Groundwater

The MEC is located on a portion of an old limestone quarry which was converted to a landfill.[254] The landfill is now closed and the site was reworked to construct the MEC. The project does not require any groundwater wells.[255] Cooling water will continue to be supplied by the Mankato WWTP; service water will continue to be supplied by the city of Mankato's municipal water system.[256]

Potential Impacts

Impacts to groundwater as a result of the project are anticipated to be minimal. Potential impacts to groundwater from the project could occur through (1) surface water impacts and (2) impacts directly to groundwater resulting from concrete foundations.

Because surface waters are hydrologically connected to groundwater, impacts to surface waters can lead to impacts to groundwater. Soils underlying the MEC site are fairly permeable, and the MEC sits atop a former quarry.[257] Thus, any pollutants in surface waters are likely to percolate downward into

---

[245] Id.
[246] Site Permit Application, Section 8.3.4.
[247] Id.
[248] Additional Project Information from Applicant.
[249] Id.
[250] Id.
[251] Id.
[252] Site Permit Application, Section 8.3.1.
[253] Id.
[254] Site Permit Application, Section 2.4
[255] Site Permit Application, Section 8.3.4.
[256] Id.
[257] Site Permit Application, Section 8.3.5.

groundwater. As discussed above, impacts to surface waters at the MEC are anticipated to be minimal. Accordingly, impacts to groundwater are anticipated to be minimal.

Figure 12. Floodplains

Direct impacts to groundwater could occur as a result of project construction and the placement of concrete foundations. Some portion of the soluble components of the concrete could leach into groundwater prior to the setting and hardening of the concrete. Because of the relatively low solubility of concrete components, direct impacts to groundwater are anticipated to be minimal.

Mitigation
Impacts to groundwater can be mitigated by measures to prevent impacts to surface waters (discussed above).

Wetlands
There are no wetlands within the MEC site (**Figure 11**).[258] There are wetlands in the project area, but these areas would not be impacted by the project. Accordingly, no impacts to wetlands are anticipated as a result of the project; no mitigation measures are proposed.

4.9 Flora

Electric power generating plants have the potential to impact flora through the removal or disturbance of vegetation during construction. Potential impacts to flora due to the project are anticipated to be minimal.

There is no flora within the MEC site.[259] There are treed areas to the south and east of the site (**Figure 2**). Construction within the MEC site will not impact flora. The applicant indicates that materials for construction of the project will be transported on existing roads.[260] The project will require temporary use of approximately 15 acres outside of the MEC site for construction laydown and parking.[261] This land will be agricultural land or vacant industrial land.[262] The applicant indicates that some clearing of flora may be necessary to create a walkway from the construction laydown area to the MEC site.[263] Commission site permits require that permittees minimize impacts to flora (**Appendix B**). In sum, impacts to flora as a result of the project are anticipated to be minimal; no mitigation measures are proposed.

4.10 Fauna

Electric power generating plants have the potential to impact fauna through a variety of means including displacement and habitat loss. Potential impacts to fauna due to the project are anticipated to be minimal.

The MEC site is an industrial property that does not include habitat for fauna.[264] Fencing around the site prevents many species from entering or crossing the site.[265] There are forest and wetland habitats to the east of the MEC site; there are forest, grassland, and wetland habitats northwest of the site along the Minnesota River.[266] These habitats are outside of the MEC site and away from possible, temporary construction laydown areas and will not be impacted by the project. Some species in the project area may be disturbed or displaced by construction noise. Any such impacts are anticipated to be temporary and are not anticipated to impact wildlife populations. On whole, impacts to fauna as a result of the project are anticipated to be minimal; no mitigation measures are proposed.

---

[258] Site Permit Application, Section 8.3.3.
[259] Site Permit Application, Section 8.4.1.
[260] Id.
[261] Id.
[262] Site Permit Application, Section 6.1.
[263] Site Permit Application, Section 8.4.1.
[264] Site Permit Application, Section 8.4.2.
[265] Id.
[266] Id.

4.11 Rare and Unique Natural Resources

Impacts to rare and unique natural resources (flora and fauna) from the project could result from ecosystem changes, introduction of invasive species, and habitat loss. Potential impacts to rare and unique natural resources due to the project are anticipated to be minimal.

Flora
A review of natural resource databases indicates that there is one rare plant community in the project area – a mesic prairie (**Table 7**). In addition to this rare plant community, there are two rare plant species in the project area – *Berula erecta* and Hair-like Beak-rush (**Table 7**). The mesic prairie community and these rare plant species are distant from the MEC site; the two rare species are found in habitats along the Minnesota River.[267]

Fauna
A review of natural resource databases indicates that there is one animal assemblage area, eleven rare and unique animal species, and habitat for an additional species in the project area (**Table 7**). The majority of the rare and unique species are associated with the Minnesota River. The river contains the animal assemblage area – a freshwater mussel concentration area – as well as several fish (Paddlefish, Blue Sucker, Shovelnose Sturgeon) and mussel species (Rock Pocketbook, Yellow Sandshell, Monkeyface, Black Sandshell, Round Pigtoe, Hickorynut). The only animal species not confined to the Minnesota River are two snake species – the North American Racer and Western Foxsnake.

The Northern Long-Eared Bat (NLEB) is found throughout eastern and central North America.[268] The bats hibernate in caves and mines during winter months and roost in forested areas during summer months.[269] The NLEB was listed by the USFWS as a threatened species on April 2, 2015. The primary reason for the listing is the rapid decline in NLEB populations due to white nose syndrome, a fungal disease that has quickly spread throughout the species' range.[270] Because of this disease, other possible causes of NLEB mortality may now be important factors affecting the viability of NLEB populations in the United States.[271] One such cause is the loss or degradation of summer roosting habitat (trees).

Potential Impacts
Impacts to rare and unique species due to the project are anticipated to be minimal. The MEC site contains no habitat for rare and unique species and is located away from such habitat in the project area. Impacts to water resources as a result of the project are anticipated to be minimal (see Section 4.8). Thus, impacts to rare and unique species associated with the Minnesota River are anticipated to be minimal.

The two rare snake species in the project area could cross through the MEC site. In doing so, they could be impacted by construction activities. The applicant indicates that it will use exclusionary silt fencing to prevent movement of these species across the site and will use wildlife friendly erosion control practices to mitigate potential impacts to these species.[272] Impacts to trees as a result of the project are

[267] Site Permit Application, Section 9.0.
[268] USFWS Endangered Species, Northern Long-Eared Bat, http://www.fws.gov/midwest/endangered/mammals/nleb/.
[269] Id.
[270] Id.
[271] Id.
[272] Site Permit Application, Section 9.0.

anticipated to be minimal (see Section 4.9). Thus, impacts to potential roosting habitat for the NLEB are not anticipated.

Mitigation
Impacts to rare and unique species due to the project are anticipated to be minimal. Impacts to two rare snake species in the project area could be mitigated by exclusionary fencing and wildlife friendly erosion control practices.

Table 7. Rare and Unique Species in Project Area[273]

Type	Common Name	Scientific Name	Federal Status	State Status
Plant Community	Mesic Prairie	---	None	None
Plant	---	*Berula erecta*	None	Threatened
Plant	Hair-like Beak-rush	*Rhynchospora capillacea*	None	Threatened
Animal Assemblage	Freshwater Mussel Concentration Area	---	None	None
Fish	Paddlefish	*Polyodon spathula*	---	Threatened
Fish	Blue Sucker	*Cycleptus elongates*	---	Special Concern
Fish	Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	---	Watchlist
Mussel	Rock Pocketbook	*Arcidens confragosus*	---	Endangered
Mussel	Yellow Sandshell	*Lampsilis teres*	---	Endangered
Mussel	Monkeyface	*Quadrula metanevra*	---	Threatened
Mussel	Black Sandshell	*Ligumia recta*	---	Special Concern
Mussel	Round Pigtoe	*Pleurobema sintoxia*	---	Special Concern
Mussel	Hickorynut	*Obovaria olivaria*	---	Watchlist
Reptile	North American Racer	*Coluber constrictor*	---	Special Concern
Reptile	Western Foxsnake	*Patherophis ramspotti*	---	Watchlist
Bat	Northern Long-Eared Bat	*Myotis septentrionalis*	Threatened	Special Concern

273 Site Permit Application, Section 9.0, Table 9-1; USFWS Endangered Species, Northern Long-Eared Bat, http://www.fws.gov/midwest/endangered/mammals/nleb/.

5.0 Application of Siting Factors to the Proposed Project

The Power Plant Siting Act requires the Commission to locate electric power generating plants in a manner that is "compatible with environmental preservation and the efficient use of resources" and that minimizes "adverse human and environmental impact[s]" while ensuring electric power reliability.[274] Minnesota Statute Section 216E.03, subdivision 7(b) identifies considerations that the Commission must take into account when designating power plant sites.[275]

Minnesota Rule 7850.4100 lists 14 factors for the Commission to consider in its site permitting decisions, including effects on human settlements, effects on public health and safety, and effects on the natural environment (**Figure 13**).[276] In this section, the information gathered by EERA staff during the environmental review process, as presented in this EA, is applied to these factors.

The discussion here focuses first of the first 12 siting factors of Minnesota Rule 7850.4100 (factors A through L). Siting factors M and N – the unavoidable and irreversible impacts of the project – are discussed at the end of this section.

There are three siting factors which are not relevant to the project and are not discussed further here. These are:

- The use of existing rights-of-way, division lines, and boundaries (factor H);
- The use of existing infrastructure rights-of-way (factor J);
- Costs which are dependent on design and route (factor L).

Factors H and J are relevant solely to the routing of transmission lines. Factor L is relevant only when there is more than one design and/or route with costs that can be compared. The only design for the project is the applicant's proposed design.

5.1 Siting Factors and Elements

Some of the siting factors in Minnesota Rule 7850.4100 describe a resource in relatively succinct terms, e.g., effects on archaeological and historic resources. Other siting factors are more descriptive and include a list of factor elements, i.e., parts that make up the sum of the whole factor. For example, the factor "effects on human settlements" includes the factor elements displacement, noise, aesthetics, cultural values, recreation, and public services. Finally, there are siting factors that are relatively succinct, but for which elements have been identified through the scoping process and analyzed in this EA. For example, the factor "public health and safety" includes the elements air emissions, water vapor plumes, water emissions, and fire and electrocution.

[274] Minnesota Statute 216E.02.
[275] Minnesota Statute 216E.03, Subd. 7.
[276] Minnesota Rule 7850.4100.

Figure 13. Factors Considered by the Commission for Electric Power Generating Plant Site Permits

In determining whether to issue a site permit for a large electric power generating plant, the Commission shall consider the following factors of Minnesota Rule 7850.4100:

A. Effects on human settlement, including, but not limited to, displacement, noise, aesthetics, cultural values, recreation, and public services;

B. Effects on public health and safety;

C. Effects on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining;

D. Effects on archaeological and historic resources

E. Effects on the natural environment, including effects on air and water quality resources and flora and fauna;

F. Effects on rare and unique natural resources;

G. Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity;

H. Use or paralleling of existing right-of-way, survey lines, natural divisions lines, and agricultural field boundaries;

I. Use of existing large electric power generating plant sites;

J. Use of existing transportation, pipeline, and electrical transmission systems or rights-of-way;

K. Electrical systems reliability;

L. Costs of constructing, operating, and maintaining the facility which are dependent on design and route;

M. Adverse human an natural environmental effects which cannot be avoided; and

N. Irreversible and irretrievable commitments of resources.

5.2 Siting Factors for Which Impacts are Anticipated to be Minimal

There are several siting factors for which impacts are anticipated to be minimal with the general conditions in section 4.0 of the Commission's generic site permit template (**Appendix B**). These are:

- Effects on human settlements (factor A);
- Effects on public health and safety (factor B);
- Effects on land-based economies (factor C);

- Effects on archaeological and historic resources (factor D);
- Effects on the natural environment (factor E);
- Effects on rare and unique natural resources (factor F).

5.3 Siting Factors for Which Impacts are Anticipated to be Minimal to Moderate, and Which May Require Special Conditions to Mitigate

There are no siting factors for which impacts are anticipated to be minimal to moderate with the general conditions in section 4.0 of the Commission's generic site permit template (**Appendix B**). Thus, there are no impacts that require special conditions in a Commission site permit in order for the impacts to be mitigated. As discussed in this EA, impacts of the project are minimized and mitigated by its location, by processes already in place at the MEC, and by permits other than the Commission's site permit, e.g., MPCA air permit.

5.4 Siting Factors that are Well Met

There are several siting factors that do not describe a resource or impact but rather indicate the state's interest in efficient design and use of resources, particularly the state's limited land resources. For the applicants' proposed project, these factors are well met:

- Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity (factor G);
- Use of existing large electric power generating plant sites (factor I);
- Electrical system reliability (factor K).

The project utilizes an existing large electric power generating plant site, the MEC site (see Section 3.1). This location maximizes energy efficiencies and mitigates adverse environment effects (see Section 4). The project will ensure reliable electrical power for projected electrical needs within the state (see Section 1.1).

5.5 Unavoidable Impacts

Electric power generating plants are large infrastructure projects that have the potential for adverse human and environmental impacts. As discussed in this EA, the impacts associated with the MEC expansion project are anticipated to minimal. Despite being minimal, there are some impacts that cannot be avoided.

The project will utilize natural gas to create electrical energy. The use of natural gas – a limited, carbon feedstock – is unavoidable. Air emissions are unavoidable. Though public health risks associated with the project are anticipated to be within state guidelines, the emission of additional combustion by-products into the air will increase the risk of adverse public health impacts. Air emissions will include carbon dioxide, a greenhouse gas. Though the project will increase greenhouse gas emissions at the MEC, it is anticipated to lower greenhouse gas emissions in Minnesota overall.

Aesthetic impacts are unavoidable. The project will introduce a new emissions stack and additional water vapor plumes into the project area. Temporary construction-related impacts cannot be avoided. These include construction noise and increased traffic near the MEC site.

5.6 Irreversible and Irretrievable Commitments of Resources

The commitment of a resource is irreversible when it is impossible or very difficult to redirect that resource to a different future use. An irretrievable commitment refers to the use or consumption of a resource such that it is not recoverable for later us by future generations.

The commitment of land for the MEC expansion project is likely an irreversible commitment. In general, land utilized for electric power generating plants remains in use by these plants for a relatively long period of time. Repurposing the land for a different future use is possible; however, it would require substantial resources to do so.

There are few commitments of resources associated with the project that are irretrievable. These commitments include the steel, concrete, and carbon (e.g., natural gas) resources committed to the project, though it is possible that the steel could be recycled at some point in the future. Labor and fiscal resources required for the project are also irretrievable commitments.

Appendices

Appendix A. Environmental Assessment Scoping Decision

In the Matter of Mankato Energy Center II, LLC's Application for a Site Permit for the 345 MW Expansion of the Mankato Energy Center

ENVIRONMENTAL ASSESSMENT SCOPING DECISION

DOCKET NO. IP6949/GS-15-620

The above matter has come before the Deputy Commissioner of the Department of Commerce (Department) for a decision on the scope of the environmental assessment (EA) to be prepared for the Mankato Energy Center expansion project proposed by Mankato Energy Center II, LLC in Blue Earth County.

Project Description

Mankato Energy Center II, LLC (applicant) proposes to add a combustion turbine generator, a heat recovery steam generator, and associated equipment to the existing Mankato Energy Center (MEC) in the city of Mankato, Blue Earth County. This expansion of the MEC will allow for the production of an additional 345 megawatts of electrical power. The MEC was designed and constructed to accommodate this expansion.

The project will use natural gas as a fuel source. Existing infrastructure installed for the MEC (e.g., electrical transmission, gas pipeline, water service) will be used for the expansion project. The applicant indicates that construction of the project is anticipated to begin in 2016, with a projected operational date of July 1, 2018.

Project Purpose

The MEC expansion project was selected in a Commission resource acquisition process to provide a new source of electrical power to meet the projected needs of Xcel Energy's electric power customers.

Regulatory Background

The applicant's proposed project requires a site permit from the Minnesota Public Utilities Commission (Commission). The applicant submitted a site permit application to the Commission on August 5, 2015. The Commission accepted the application as complete on October 14, 2015.

Department of Commerce, Energy Environmental Review and Analysis (EERA) staff is responsible for conducting environmental review for site permit applications submitted to the Commission.[1] The site permit application is being reviewed under the alternative permitting process; accordingly, EERA staff will prepare an environmental assessment (EA) for the project.[2]

[1] Minnesota Statute 216E.04.
[2] Minnesota Rule 7850.3700.

Scoping Process
Scoping is the first step in the development of the EA for the project. The scoping process has two primary purposes: (1) to gather public input as to the impacts and mitigation measures to study in the EA, and (2) to focus the EA on those impacts and mitigation measures that will aid in the Commission's decision on the site permit application.

EERA staff gathered input on the scope of the EA through a public meeting and an associated comment period. This scoping decision identifies the impacts and mitigation measures that will be analyzed in the EA.

Public Scoping Meeting
Commission staff and EERA staff held a joint public information and environmental assessment scoping meeting on October 13, 2015, in the city of Mankato, Minn. Three persons attended the meeting; these persons made no comments on the project.[3]

Public Comments
A comment period ending on October 27, 2015, provided the public an opportunity to submit written comments on impacts and mitigation measures for consideration in the scope of the EA. Comments were received from one person and two state agencies.[4] These comments did not identify specific impacts or mitigation measures to study in the EA.

Agency Comments
The Minnesota State Historic Preservation Office noted that, based on its review of the project, there were no archaeological or historic resources in the project area that would be impacted by the project.[5]

The Minnesota Department of Transportation (MnDOT) noted that the project did not appear to impact MnDOT right-of-way.[6] MnDOT indicated that consideration should be given to the movement of oversize/overweight equipment for the project, and that the applicant should coordinate with MnDOT if such equipment is transported on local highways.[7]

HAVING REVIEWED THE MATTER, consulted with Department staff, and in accordance with Minnesota Rule 7850.3700, I hereby make the following scoping decision:

MATTERS TO BE ADDRESSED

The issues outlined below will be analyzed in the EA for the proposed Mankato Energy Center expansion project. The EA will describe the project and the human and environmental resources

[3] Comments on Scope of Environmental Assessment, eDockets Number 201510-115183-01.
[4] Id.
[5] Id.
[6] Id.
[7] Id.

of the project area. It will provide information on the potential impacts of the project as they relate to the topics outlined in this scoping decision, including possible mitigation measures. It will identify impacts that cannot be avoided and irretrievable commitments of resources, as well as permits from other government entities that may be required for the project. The EA will discuss the project with respect to the siting factors found in Minnesota Rule 7850.4100.

I. GENERAL DESCRIPTION OF THE PROJECT

A. Project Description
B. Project Purpose
C. Project Costs

II. REGULATORY FRAMEWORK

A. Certificate of Need
B. Large Electric Power Generating Plant Site Permit
C. Environmental Review Process
D. Other Permits and Approvals

III. ENGINEERING, DESIGN, AND CONSTRUCTION

A. Power Generation Systems
B. Air Emission Controls
C. Water Use
D. Fuel Supply
E. Electrical Interconnection
F. Project Construction

IV. AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATIVE MEASURES

The EA will include a discussion of the following human and environmental resources potentially impacted by the proposed project. Potential impacts, both positive and negative, of the project will be described. Based on the impacts identified, the EA will describe mitigation measures that could reasonably be implemented to reduce or eliminate the identified impacts. The EA will describe any unavoidable impacts resulting from implementation of the proposed project.

Data and analyses in the EA will be commensurate with the importance of potential impacts and the relevance of the information to consideration of the need for mitigation measures.[8] EERA staff will consider the relationship between the cost of data and analyses and the relevance and importance of the information in determining the level of detail of information to be prepared for the EA. Less important material may be summarized, consolidated or simply referenced.

If relevant information cannot be obtained within timelines prescribed by statute and rule, or if the costs of obtaining such information is excessive, or the means to obtain it is not known, EERA staff will include in the EA a statement that such information is

[8] Minnesota Rule 4410.2300.

incomplete or unavailable and the relevance of the information in evaluating potential impacts.[9]

A. Environmental Setting
B. Socioeconomics
C. Human Settlements
    1. Noise
    2. Aesthetics
    3. Displacement
    4. Cultural Values
    5. Public Services
    6. Zoning and Land Use Compatibility
D. Public Health and Safety
    1. Air Emissions and Air Quality
    2. Cooling Tower Plumes
    3. Fire / Electrical
E. Land Based Economies
    1. Agriculture
    2. Forestry
    3. Mining
    4. Recreation and Tourism
F. Archaeological and Historic Resources
G. Natural Environment
    1. Water Resources
    2. Air Resources
    3. Flora
    4. Fauna
H. Threatened / Endangered / Rare and Unique Natural Resources
I. Costs that are Design Dependent
J. Adverse Impacts that Cannot be Avoided
K. Irreversible and Irretrievable Commitments of Resources

V. SITES TO BE EVALUATED IN THE ENVIRONMENTAL ASSESSMENT

The EA will evaluate the site proposed by the applicant in their site permit application (see attached map). No other sites will be will be evaluated in the EA.

VI. IDENTIFICATION OF PERMITS

The EA will include a list and description of permits from other government entities that may be required for the proposed project.

[9] Minnesota Rule 4410.2500.

ISSUES OUTSIDE THE SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The EA for the Mankato Energy Center expansion project will not consider the following:

A. No-build alternative.
B. Issues related to project need, size, type, or timing.
C. Any site alternative not specifically identified for study in this scoping decision.
D. The manner in which landowners are compensated for sites.

SCHEDULE

The EA is anticipated to be completed and available in February 2016. A public hearing will be held in the project area after issuance of the EA and is anticipated to occur in March 2016.

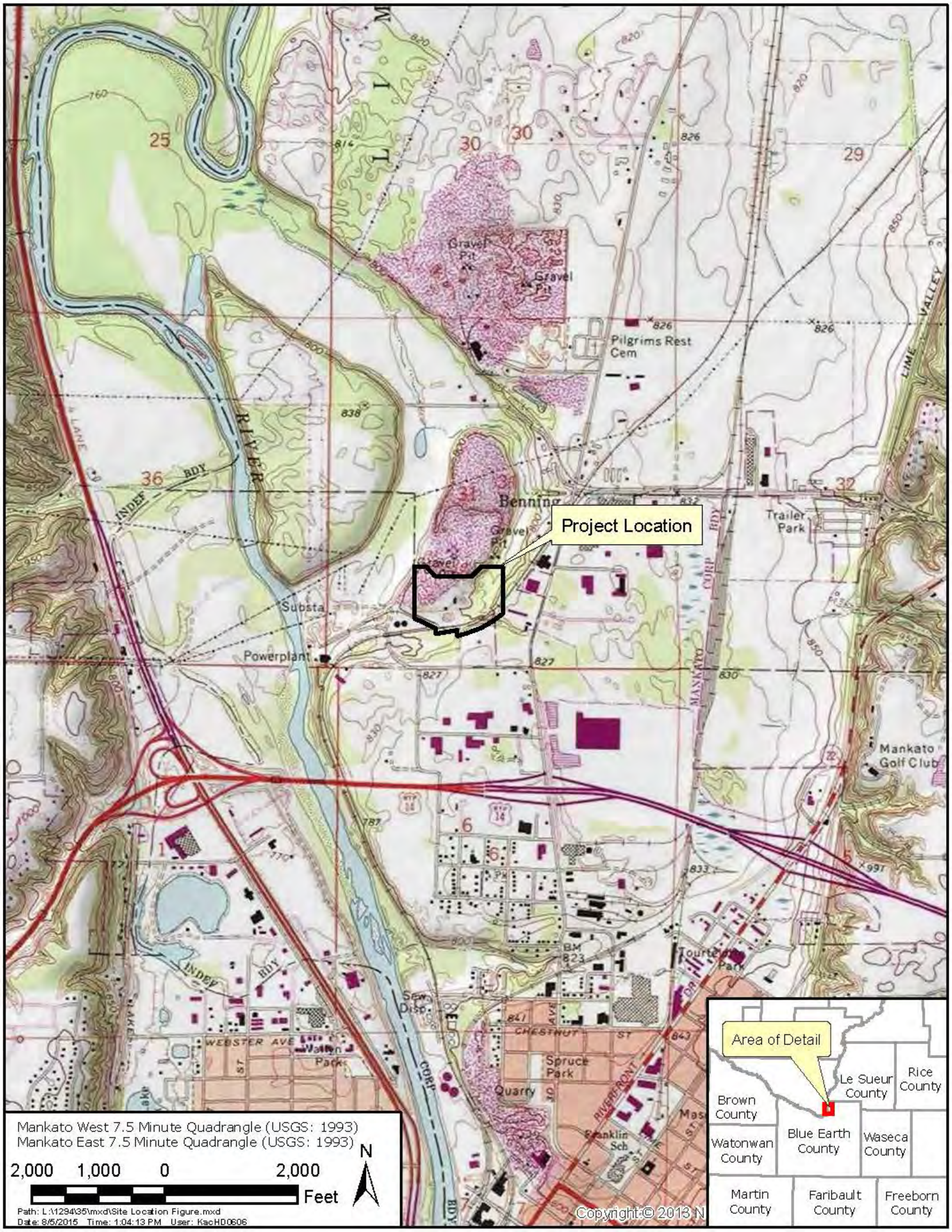
Signed this 3rd day of November, 2015

STATE OF MINNESOTA
DEPARTMENT OF COMMERCE

William Grant, Deputy Commissioner

Mankato Energy Center Expansion Project

Site Location Map



Appendix B. Generic Site Permit Template

STATE OF MINNESOTA PUBLIC UTILITIES COMMISSION

SITE PERMIT FOR A
LARGE ELECTRIC POWER GENERATING PLANT AND ASSOCIATED FACILITIES

IN
[*COUNTY*]

ISSUED TO
[*PERMITTEE*]

PUC DOCKET NO. [*Docket Number*]

In accordance with the requirements of Minnesota Statutes Chapter 216E and Minnesota Rules Chapter 7850 this site permit is hereby issued to:

[*PERMITTEE*]

The Permittee is authorized by this site permit to construct and operate [*Provide a description of the project authorized by the Minnesota Public Utilities Commission*].

The large electric power generating plant and associated facilities shall be built within the site identified in this permit and as portrayed in the official site map(s) and in compliance with the conditions specified in this permit.

Approved and adopted this ____ day of [*Month, Year*]

BY ORDER OF THE COMMISSION

____

Daniel P. Wolf,
Executive Secretary

CONTENTS

FIGURES

ATTACHMENTS

1.0 SITE PERMIT

The Minnesota Public Utilities Commission (Commission) hereby issues this site permit to [*Permittee Name*] (Permittee) pursuant to Minnesota Statutes Chapter 216E and Minnesota Rules Chapter 7850. This permit authorizes the [*Permittee Name*] to construct and operate [*Provide a description of the project as authorized by the Minnesota Public Utilities Commission*], and as identified in the attached site permit map(s), hereby incorporated into this document.

1.1 Pre-emption

Pursuant to Minn. Stat. § 216E.10, this site permit shall be the sole approval required for the construction of the large electric power generating plant (LEPGP) and associated facilities and this permit shall supersede and preempt all zoning, building, or land use rules, regulations, or ordinances promulgated by regional, county, local and special purpose government.

2.0 PROJECT DESCRIPTION

[*Provide a description of the project as authorized by the Minnesota Public Utilities Commission*]

2.1 Project Location

The project is located in the following:

County	Township Name	Township	Range	Section

2.2 Associated Facilities

3.0 DESIGNATED SITE

The site designated by the Commission in this permit is the site described below and shown on the site permit maps attached to this permit (Attachment [*X*]).

[*As applicable, provide a detailed description of the authorized site.*]

The anticipated project layout is shown on the site permit map(s). The anticipated layout represents the approximate location of the LEPGP and associated facilities and seeks to minimize the overall potential human and environmental impacts of the project, which were evaluated in the permitting process. Any modifications to the facility depicted in the anticipated layout shall be done in such a manner as to have comparable overall human and environmental impacts and shall be specifically identified in the site plan pursuant to Section 8.3.

4.0 GENERAL CONDITIONS

The Permittee shall comply with the following conditions during construction and operation of the energy generating system and associated facilities over the life of this permit.

4.1 Notification

Within 14 days of issuance of this permit, the Permittee shall send a copy of the permit to any regional development commission, county, city, and township in which any part of the site is located.

The Permittee shall provide all affected landowners with a copy of this permit and, as a separate information piece, the complaint procedures at the time of the first contact with the affected landowners after issuance of this permit. The Permittee shall contact landowners prior to entering the property or conducting maintenance within the site, unless otherwise negotiated with the affected landowner.

4.2 Construction and Operation Practices

The Permittee shall follow those specific construction practices, operation practices, and material specifications described in [*Permittee Name and Title of Application*] to the Commission for a site permit for the [*Project Name*], dated [*Date*], and the record of the proceedings unless this permit establishes a different requirement in which case this permit shall prevail.

4.2.1 Field Representative

The Permittee shall designate a field representative responsible for overseeing compliance with the conditions of this permit during construction of the project. This person shall be accessible by telephone or other means during normal business hours throughout site preparation, construction, cleanup, and restoration.

The Permittee shall file with the Commission the name, address, email, phone number, and emergency phone number of the field representative 14 days prior to commencing construction. The Permittee shall provide the field representative's contact information to affected landowners, residents, local government units and other interested persons. The Permittee may change the site manager at any time upon notice to the Commission, affected landowners, residents, local government units and other interested persons.

4.2.2 Employee Training and Education of Permit Terms and Conditions

The Permittee shall inform all employees, contractors, and other persons involved in the construction and ongoing operation of the facility of the terms and conditions of this permit.

4.2.3 Temporary Work Space

Temporary work space and equipment staging areas shall be selected to limit the removal and impacts to vegetation. Temporary work space shall not be sited in wetlands or native prairie as defined in sections 4.2.9 and 4.2.10. Temporary work space shall be sited to comply with standards for development of the shorelands of public waters as defined in Section 4.2.9. Temporary easements outside of the authorized site boundary will be obtained from affected landowners through rental agreements and are not provided for in this permit.

4.2.4 Noise

Construction and routine maintenance activities shall be limited to daytime working hours, as defined in Minn. R. 7030.0020, to ensure nighttime noise level standards will not be exceeded.

4.2.5 Aesthetics

The Permittee shall consider input pertaining to visual impacts from landowners or land management agencies prior to final location of structures with the potential for visual disturbance. To minimize aesthetic impacts, the Permittee shall preserve the natural landscape, minimize vegetation removal, and prevent any unnecessary destruction of the natural surroundings in the vicinity of the Project during construction and maintenance.

4.2.6 Soil Erosion and Sediment Control

The Permittee shall implement those erosion prevention and sediment control practices recommended by the Minnesota Pollution Control Agency (MPCA) Construction Stormwater Program.

The Permittee shall implement reasonable measures to minimize erosion and sedimentation during construction and shall employ perimeter sediment controls, protect exposed soil by promptly planting, seeding, using erosion control blankets and turf reinforcement mats, stabilizing slopes, protecting storm drain inlets, protecting soil stockpiles, and controlling vehicle tracking. Contours shall be graded as required so that all surfaces provide for proper drainage, blend with the natural terrain, and are left in a condition that will facilitate re-vegetation and prevent erosion. All areas disturbed during construction of the facilities shall be returned to pre-construction conditions.

In accordance with the MPCA requirements, Permittee shall obtain a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Construction Stormwater permit from the MPCA.

4.2.7 Public Lands

In no case shall the generating plant or associated facilities including foundations, access roads, underground cable, and transformers, be located in the public lands identified in Minn. R. 7850.4400, subp. 1, or in federal waterfowl production areas. The generating plant and associated facilities shall not be located in the public lands identified in Minn. R. 7850.4400, subp. 3, unless there is no feasible and prudent alternative.

4.2.8 Wetlands and Shoreland

The generating plant and associated facilities, including access roads, underground cables, and transformers shall not be placed in public waters and public waters wetlands, as shown on the public water inventory maps prescribed by Minnesota Statutes Chapter 103G, except that electric collector or feeder lines may cross or be placed in public waters or public waters wetlands subject to permits and approvals by the Minnesota Department of Natural Resources (DNR) and the United States Army Corps of Engineers (USACE), and local units of government as implementers of the Minnesota Wetlands Conservation Act. The generating plant and associated facilities including foundations, access roads, underground cables, and transformers, shall be located in compliance with the standards for development of the shorelands of public waters as identified in Minn. R. 6120.3300, and as adopted, Minn. R. 6120.2800, unless there is no feasible and prudent alternative.

Construction in wetland areas shall occur during frozen ground conditions to minimize impacts. When construction during winter is not possible, wooden or composite mats shall be used to protect wetland vegetation. Soil excavated from the wetlands and riparian areas shall be contained and not placed back into the wetland or riparian area. Wetlands and riparian areas shall be accessed using the shortest route possible in order to minimize travel through wetland areas and prevent unnecessary impacts.

Wetland and water resource areas disturbed by construction activities shall be restored to pre-construction conditions. Restoration of the wetlands will be performed by Permittee in accordance with the requirements of applicable state and federal permits or laws and landowner agreements.

4.2.9 Native Prairie

The Permittee shall prepare a prairie protection and management plan in consultation with the DNR if native prairie, as defined in Minn. Stat. § 84.02, subd. 5, is identified within the site boundary. The Permittee shall file the plan 30 days prior to submitting the site plan required by Section 8.3 of this permit. The plan shall address steps that will be taken to avoid impacts to native prairie and mitigation to unavoidable impacts to native prairie by restoration or management of other native prairie areas that are in degraded condition, by conveyance of conservation easements, or by other means agreed to by the Permittee, DNR and the Commission.

The generating plant and associated facilities including foundations, access roads, collector and feeder lines, underground cables, and transformers shall not be placed in native prairie unless addressed in a prairie protection and management plan and shall not be located in areas enrolled in the Native Prairie Bank Program. Construction activities, as defined in Minn. Stat. § 216E.01, shall not impact native prairie unless addressed in a prairie protection and management plan.

4.2.10 Vegetation Management

The Permittee shall disturb or clear the site only to the extent necessary to assure suitable access for construction, safe operation and maintenance of the project.

The Permittee shall minimize the number of trees to be removed in selecting the site layout specifically preserving to the maximum extent practicable windbreaks, shelterbelts, living snow fences, and vegetation, to the extent that such actions do not violate sound engineering principles.

4.2.11 Invasive Species

The Permittee shall employ best management practices to avoid the potential spread of invasive species on lands disturbed by project construction activities.

4.2.12 Noxious Weeds

The Permittee shall take all reasonable precautions against the spread of noxious weeds during all phases of construction. When utilizing seed to establish temporary and permanent vegetative cover on exposed soil the Permittee shall select site appropriate seed certified to be free of noxious weeds. To the extent possible, the Permittee shall use native seed mixes. The Permittee shall consult with landowners on the selection and use of seed for replanting.

4.2.13 Roads

The Permittee shall advise the appropriate governing bodies having jurisdiction over all state, county, city or township roads that will be used during the construction phase of the project. Where practical, existing roadways shall be used for all activities associated with construction of the facility. Oversize or overweight loads associated with the facility shall not be hauled across public roads without required permits and approvals. The Permittee shall, prior to the use of such roads, make satisfactory arrangements with the appropriate state, county, and city governmental bodies having jurisdiction over the roads to be used for construction, for repair and maintenance of those roads that will be subject to extra wear and tear due to transportation of equipment and materials. The Permittee shall notify the Commission of such arrangements upon request of the Commission.

The Permittee shall promptly repair private roads or lanes damaged when moving equipment or when obtaining access to the site, unless otherwise negotiated with the affected landowner.

4.2.14 Archaeological and Historic Resources

The Permittee shall make every effort to avoid impacts to identified archaeological and historic resources when constructing the facility. If required by the State Historic Preservation Office (SHPO), the Permittee shall conduct a survey of the project site. If a survey is required, the results shall be submitted to the Commission with the site plan pursuant to Section 8.3.
In the event that a resource is encountered, the Permittee shall contact and consult with SHPO and the State Archaeologist. Where feasible, avoidance of the resource is required. Where not feasible, mitigation must include an effort to minimize project impacts on the resource consistent with SHPO and State Archaeologist requirements.

Prior to construction, workers shall be trained about the need to avoid cultural properties, how to identify cultural properties, and procedures to follow if undocumented cultural properties, including gravesites, are found during construction. If human remains are encountered during construction, the Permittee shall immediately halt construction and promptly notify local law enforcement and the State Archaeologist. Construction at such location shall not proceed until authorized by local law enforcement or the State Archaeologist.

4.2.15 Interference with Communication Devices

If interference with radio or television, satellite, wireless internet, GPS-based agriculture navigation systems or other communication devices is caused by the presence or operation of the project, the Permittee shall take whatever action is feasible to restore or provide reception equivalent to reception levels in the immediate area just prior to the construction of the project.

4.2.16 Restoration

The Permittee shall restore the areas affected by construction of the facility to the condition that existed immediately before construction began to the extent possible. The time period to complete restoration may be no longer than 12 months after completion of the construction, unless otherwise negotiated with the affected landowner. Restoration shall be compatible with the safe operation, maintenance and inspection of the project. Within 60 days after completion of all restoration activities, the Permittee shall advise the Commission in writing of the completion of such activities.

4.2.17 Cleanup

All waste and scrap that is the product of construction shall be removed from the site and all premises on which construction activities were conducted and properly disposed of upon completion of each task. Personal litter, including bottles, cans, and paper from construction activities shall be removed on a daily basis.

4.2.18 Pollution and Hazardous Wastes

All appropriate precautions to protect against pollution of the environment shall be taken by the Permittee. The Permittee shall be responsible for compliance with all laws applicable to the generation, storage, transportation, clean up and disposal of all wastes generated during construction and restoration of the site.

4.2.19 Damages

The Permittee shall promptly repair or fairly compensate landowners for damage to crops, fences, private roads and lanes, landscaping, drain tile, or other damages sustained during construction and operation unless otherwise negotiated with the affected landowner.

4.2.20 Public Safety

The Permittee shall provide educational materials to landowners adjacent to the site and, upon request, to interested persons about the project and any restrictions or dangers associated with the project. The Permittee shall also provide any necessary safety measures such as warning signs and gates for traffic control or to restrict public access. The Permittee shall submit the location of all underground facilities, as defined in Minn. Stat. § 216D.01, subd. 11, to Gopher State One Call following the completion of construction at the site.

4.2.21 Site Identification

The site shall be marked with a visible identification number and or street address.

4.3 Other Requirements

4.3.1 Safety Codes and Design Requirements

The electric energy generating system and associated facilities shall be designed to meet or exceed all relevant local and state codes, Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards, the National Electric Safety Code (NESC), and North American Electric Reliability Corporation (NERC) requirements.

4.3.2 Other Permits and Regulations

The Permittee shall comply with all applicable state rules and statutes. The Permittee shall obtain all required permits for the project and comply with the conditions of these permits. The Permittee shall submit a copy of such permits to the Commission upon request.

5.0 SPECIAL CONDITIONS

The Permittee shall provide a report to the Commission as part of the site plan submission required under Section 8.3 that describes the actions taken and mitigative measures developed regarding the project and the following special conditions. Special conditions shall take precedence over other conditions of this permit should there be a conflict.

[*Describe any special conditions*]

Examples of special conditions included in permits:

- *Avian Mitigation Plan*
- *Environmental Control Plan*
- *Agriculture Mitigation Plan*
- *Vegetation Management Plan*
- *Property Restrictions*
- *Minnesota Department of Natural Resources Requirements*
- *Minnesota Pollution Control Requirements*
- *Minnesota State Historical Preservation Office Requirements*
- *Minnesota Department of Transportation Requirements*

For example:

Landscaping Plan

The Permittee shall develop a site specific landscaping plan in consultation with Chisago County, and considering local government ordinances and setbacks, that reasonably mitigates the visual impacts to all adjacent residences. The landscaping plan shall be filed at least 14 days prior to the pre-construction meeting.

Vegetation Management Plan

The Permittee shall develop a vegetation management plan in consultation with the DNR to the benefit of pollinators and other wildlife, and to enhance soil water retention and reduce storm water runoff and erosion. The vegetation management plan shall be filed at least 14 days prior to the pre-construction meeting.

Security Fence

The security fence surrounding the facility shall be designed to minimize the visual impact of the project. While maintaining compliance with the NESC, the Permittee shall install an eight-foot wood pole and woven wire fence, or substantially similar, around the perimeter of the facility. This type of fence is commonly referred to as a "deer fence" or "agricultural fence." The *permittee shall consult with the DNR to insure the design of the facilities preserves or replaces identified natural wildlife, wetland, woodland or other corridors.*

6.0 DELAY IN CONSTRUCTION

If the Permittee has not commenced construction or improvement of the site within four years after the date of issuance of this permit the Permittee shall file a report on the failure to construct and the Commission shall consider suspension of the permit in accordance with Minn. R. 7850.4700.

7.0 COMPLAINT PROCEDURES

Prior to the start of construction, the Permittee shall submit to the Commission the procedures that will be used to receive and respond to complaints. The procedures shall be in accordance with the requirements of Minn. R. 7829.1500 or Minn. R. 7829.1700, and as set forth in the complaint procedures attached to this permit.

Upon request, the Permittee shall assist the Commission with the disposition of unresolved or longstanding complaints. This assistance shall include, but is not limited to, the submittal of complaint correspondence and complaint resolution efforts.

8.0 COMPLIANCE REQUIREMENTS

Failure to timely and properly make compliance filings required by this permit is a failure to comply with the conditions of this permit. Compliance filings must be electronically filed with the Commission.

8.1 Site Plan

At least 30 days prior to commencing construction, the Permittee shall provide the Commission with a site plan that includes specifications and drawings for site preparation and grading; specifications and locations of structures to be constructed including all electrical equipment, pollution control equipment, fencing, roads, and other associated facilities; and procedures for cleanup and restoration. The documentation shall include maps depicting the site boundary and layout in relation to that approved by this permit.

The Permittee may not commence construction until the 30 days has expired or until the Commission has advised the Permittee in writing that it has completed its review of the documents and determined that the planned construction is consistent with this permit. If the

Permittee intends to make any significant changes to its site plan or the specifications and drawings after submission to the Commission, the Permittee shall notify the Commission at least five days before implementing the changes. No changes shall be made that would be in violation of any of the terms of this permit.

8.2 Periodic Status Reports

The Permittee shall report to the Commission on progress regarding site construction. The Permittee need not report more frequently than monthly. Reports shall begin with the submittal of the site plan for the project and continue until completion of construction or restoration, whichever is later.

8.3 Notification to Commission

At least ten days before the facility is to be placed into service, the Permittee shall notify the Commission of the date on which the facility will be placed into service and the date on which construction was complete.

8.4 As-Builts

Within 60 days after completion of construction, the Permittee shall submit copies of all final as-built plans and specifications developed during the project.

8.5 GPS Data

Within 60 days after completion of construction, the Permittee shall submit to the Commission, in the format requested by the Commission, geo-spatial information (e.g., ArcGIS compatible map files, GPS coordinates, associated database of characteristics) for all structures associated with the generating system.

8.6 Emergency Response

The Permittee shall prepare an Emergency Response Plan in consultation with the emergency responders having jurisdiction over the facility prior to project construction. The Permittee shall submit a copy of the plan, along with any comments from emergency responders, to the Commission at least 30 days prior to construction. The Permittee shall provide as a compliance filing confirmation that the Emergency Response Plan was provided to the emergency responders and Public Safety Answering Points (PSAP) with jurisdiction over the facility prior to commencement of construction. The Permittee shall obtain and register the facility address or other location indicators acceptable to the emergency responders and PSAP having jurisdiction over the facility.

9.0 COMMISSION AUTHORITY AFTER PERMIT ISSUANCE

9.1 Final Boundaries

After completion of construction the Commission may determine the need to adjust the final site boundaries required for the project. This permit may be modified, after notice and opportunity for public hearing, to represent the actual site boundary required by the Permittee to operate the project authorized by this permit.

9.2 Expansion of Site Boundaries

No expansion of the site boundary described in this permit shall be authorized without the approval of the Commission. The Permittee may submit to the Commission a request for a change in the boundary of the site for the project. The Commission will respond to the requested change in accordance with applicable statutes and rules.

9.3 Modification of Conditions

After notice and opportunity for hearing this permit may be modified or amended for cause, including but not limited to the following:

(a) violation of any condition in this permit;

(b) endangerment of human health or the environment by operation of the Project; or

(c) existence of other grounds established by rule.

9.4 More Stringent Rules

The issuance of this permit does not prevent the future adoption by the Commission of rules or orders more stringent than those now in existence and does not prevent the enforcement of these more stringent rules and orders against the Permittee.

10.0 PERMIT AMENDMENT

This permit may be amended at any time by the Commission. Any person may request an amendment of the conditions of this permit by submitting a request to the Commission in writing describing the amendment sought and the reasons for the amendment. The Commission will mail notice of receipt of the request to the Permittee. The Commission may amend the conditions after affording the Permittee and interested persons such process as is required.

11.0 TRANSFER OF PERMIT

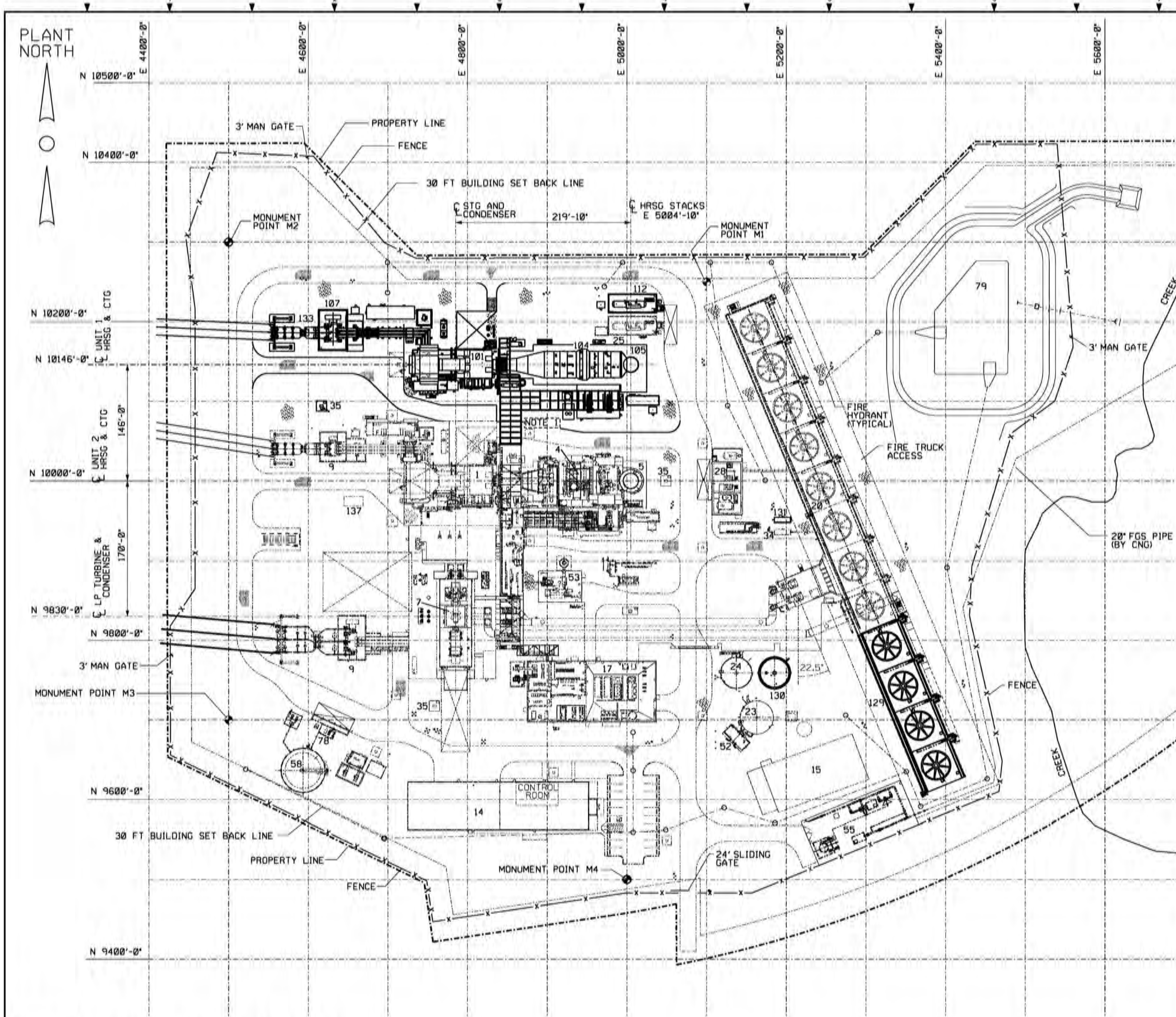
The Permittee may request at any time that the Commission transfer this permit to another person or entity. The Permittee shall provide the name and description of the person or entity to whom the permit is requested to be transferred, the reasons for the transfer, a description of the facilities affected, and the proposed effective date of the transfer.

The person to whom the permit is to be transferred shall provide the Commission with such information as the Commission shall require to determine whether the new Permittee can comply with the conditions of the permit. The Commission may authorize transfer of the permit after affording the Permittee, the new Permittee, and interested persons such process as is required.

12.0 REVOCATION OR SUSPENSION OF THE PERMIT

The Commission may initiate action to revoke or suspend this permit at any time. The Commission shall act in accordance with the requirements of Minn. R. 7850.5100, to revoke or suspend the permit.

Appendix C. Expansion Site Plan



EXISTING FACILITY LEGEND

1. COMBUSTION TURBINE
4. HRSG
5. HRSG STACK
7. STEAM TURBINE
9. GENERATOR STEP-UP TRANSFORMER
14. ADMIN/MAINTENANCE/WAREHOUSE/CONTROL ROOM BLDG
15. EXISTING WAREHOUSE BUILDING
17. WATER TREATMENT EQUIPMENT AREA
20. COOLING TOWER
23. SERVICE / FIRE WATER STORAGE TANK
24. DEMIN WATER STORAGE TANK
25. AMMONIA STORAGE TANK
28. COOLING TOWER CHEMICAL FEED ENCLOSURE
34. OIL / WATER SEPARATOR
35. OIL / WATER SUMP & PUMPS
52. FIRE PUMP SKID ENCLOSURE
53. AUXILIARY BOILER
55. FUEL GAS YARD AREA (BY CNG)
58. FUEL OIL STORAGE TANK
78. FUEL OIL UNLOADING STATION
79. SEDIMENT POND / STORMWATER BASIN

EXPANSION FACILITY LEGEND

101. COMBUSTION TURBINE
104. HRSG
105. HRSG STACK
107. GENERATOR SETP-UP TRANSFORMER
112. ANHYDROUS AMMONIA STORAGE TANK
129. COOLING TOWER ADDITION
130. DEMIN WATER STORAGE TANK
131. OIL / WATER SEPARATOR
133. 115KV SWITCHYARD
137. DIESEL GENERATOR

NOTE:

1. CONTRACTOR TO DESIGN PIPE RACK TO ALLOW 30 FEET WIDE ACCESS ROAD (EAST-WEST IN-PLANT ROAD) UNDER NEW PIPE BRIDGE EXTENSION. MATCH EXISTING BOTTOM OF STEEL TO PROVIDE CLEAR HEIGHT FOR CRANE ACCESS BETWEEN NEW CTG-01 AND THE EXISTING CTG-02.

CONCEPTUAL

LEGEND:

- GRAVEL
- ASPHALT
- CONCRETE
- ELECTRICAL MANHOLE
- STORM WATER CATCH BASIN

60 0 60 120 180

SCALE IN FEET

MONUMENT POINTS:	PLANT COORDINATES:	BLUE EARTH COUNTY COORDINATES:
M1	N.10250'-0", E.5100'-0"	FOR TRANSLATION BETWEEN PLANT COORDINATES & BLUE EARTH COUNTY COORDINATES SEE DRAWING MK-GEN-DE-C1-0001
M2	N.10300'-0", E.4500'-0"	
M3	N.9700'-0", E.4500'-0"	
M4	N.9500'-0", E.5000'-0"	

Appendix D. Noise Modeling and Assessment

3862 Clifton Manor Place
Haymarket, Virginia 20169 USA
703-753-1602 (O)
703-753-1522 (F)
www.hesslernoise.com

TECHNICAL MEMORANDUM

Title:	Assessment of Compliance with Regulatory Noise Limits after Plant Expansion
Project:	Mankato Energy Center Expansion
Location:	Mankato, MN
Prepared For:	Calpine
Prepared By:	David M. Hessler, P.E., INCE
Revision:	0
Issue Date:	June 22, 2015
Reference No:	TM-2018-061915-0
Attachments:	-

1.0 Introduction

The planned expansion of the Mankato Energy Center, which is currently a 1 on 1 combined cycle plant, to a 2 on 1 configuration has raised the question of whether the built-out facility will naturally remain in compliance with State of Minnesota noise regulations or whether additional noise controls might be required to meet the applicable noise limits. In order to definitively understand the plant's current sound emissions and determine if additional noise from the second CTG powertrain would jeopardize compliance, a field monitoring survey was carried out from May 21 to June 9, 2015 to measure the existing operational sound levels at several key property line positions where current or future sound levels will be maximum. Given the surroundings and circumstances of this site, the State noise regulations effectively apply at the site boundaries. A somewhat lengthy survey using automated monitors was required to capture intermittent and largely unpredictable periods of operation. Four typical runs of roughly 17 hours each were measured, including two cold starts and two warm starts.

In general, the test results confirm that the existing facility is in full compliance the applicable noise limits and the measured levels indicate that sufficient headroom exists for the additional equipment to be installed without the need for any special or non-standard noise controls.

2.0 Regulatory Noise Limits

Minnesota Noise Pollution Statute and Rule 7030.0040 "Noise Standards" essentially limits the permissible daytime and nighttime sound levels at the boundaries of adjoining land uses based on their Noise Area Classifications, as detailed in Subpart 2 of Section 7030.0050 of the Rule. In this instance, the plant is completely surrounded by industrial land uses (Noise Area Classification 3) for quite some distance in all directions. For example, there is another power plant immediately to the east, a capped landfill to the north and light manufacturing in other directions. Consequently, operational noise from the facility is effectively limited to **80 dBA L10(1 hr)** and **75 dBA L50(1 hr)** at the site property line, irrespective of time of day.

No receptors that might actually be sensitive to noise, such as residences, schools, churches, etc., are evident from current aerials of the site vicinity nor were any observed during a ground inspection of the site environs out to about a half a mile. The facility currently receives no noise complaints, nor has received any for some time.

Somewhat unusually the Minnesota noise limits are expressed as the L10 and L50 statistical sound levels. These metrics are the sound levels exceeded 10 and 50%, respectively, of each hourly measurement period, or for 6 and 30 minutes. The L10 sound level tends to measure the near-maximum sound level that occurred only briefly during the measurement interval and the L50 sound level largely measures the "average" level. The L10 limit is of relevance to short-duration, high amplitude noise, such as can be produced during normal start-ups and shutdowns.

3.0 Survey Methodology

3.1 Measurement Locations

Figure 3.1.1 on the following page shows the site area and the monitoring positions.

The control position inside the ST building was on the mezzanine level near where the HRH and LP bypass lines enter the condenser. This meter was set up to record when the plant was generally operational and, specifically, when ST bypass was occurring during start-up.

Position 1 was due north of the existing CTG at the northern fence line. This and the remaining site boundary positions were intended to measure existing noise at the points where it is currently maximum or where it will be maximum after the build-out.

Position 2 was on the northern fence line close to the end of the cooling tower

Position 3 was near but not on the southern property line in the area where the cooling tower is going to be extended. Once completed the expanded cooling tower will generally approach the southern property line in a manner similar to how it currently approaches the northern boundary.

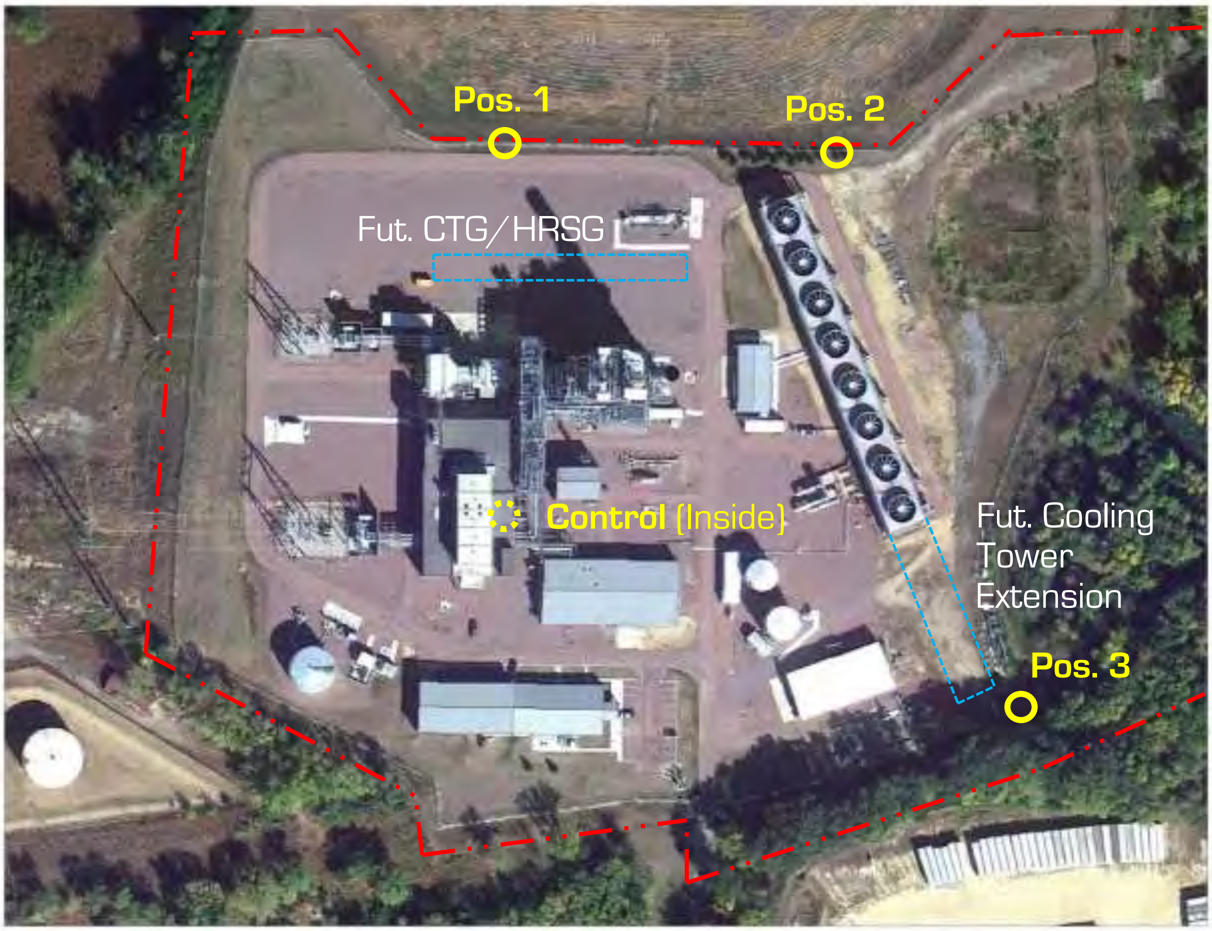


Figure 3.1.1
Site Area Showing Approx. Property Line and Survey Monitor Positions

3.2 Measurement Equipment and Parameters

Rion Model NL-22, ANSI Type 2 sound level data loggers, were used at each position and set to record and store a variety of statistical measures, including the L10 and L50 levels, on an hourly basis over the entire survey period. The instruments were field calibrated and synchronized at the beginning of the survey and checked at the end. The calibration drift was within the -0.2/+0.3 dB range on all instruments. At Positions 1 through 3 the microphone was mounted on the property line chain link fence at a height of about 5 ft. above grade. The meter and batteries were in weather-tight cases on the ground. The control position inside the steam turbine building was on the mezzanine level near where to the HRH and LP steam turbine bypass lines entered the condenser.

3.3 Survey Conditions

During the survey period the plant ran over the following four intervals:

Table 3.3.1
Plant Operations during the Survey Period

Plant Start		Plant Shutdown	
Date	Time	Date	Time
5/26	4:09 a.m.	5/26	10:25 p.m.
5/27	6:07 a.m.	5/27	10:23 p.m.
6/8	5:04 a.m.	6/8	11:25 p.m.
6/9	5:07 a.m.	6/9	10:25 p.m.

Consequently, the starts on 5/26 and 6/8 were cold, while the starts on 5/27 and 6/9 occurred after outages of only a few hours and were warm/hot restarts.

The general weather parameters during the two operational periods are plotted below.

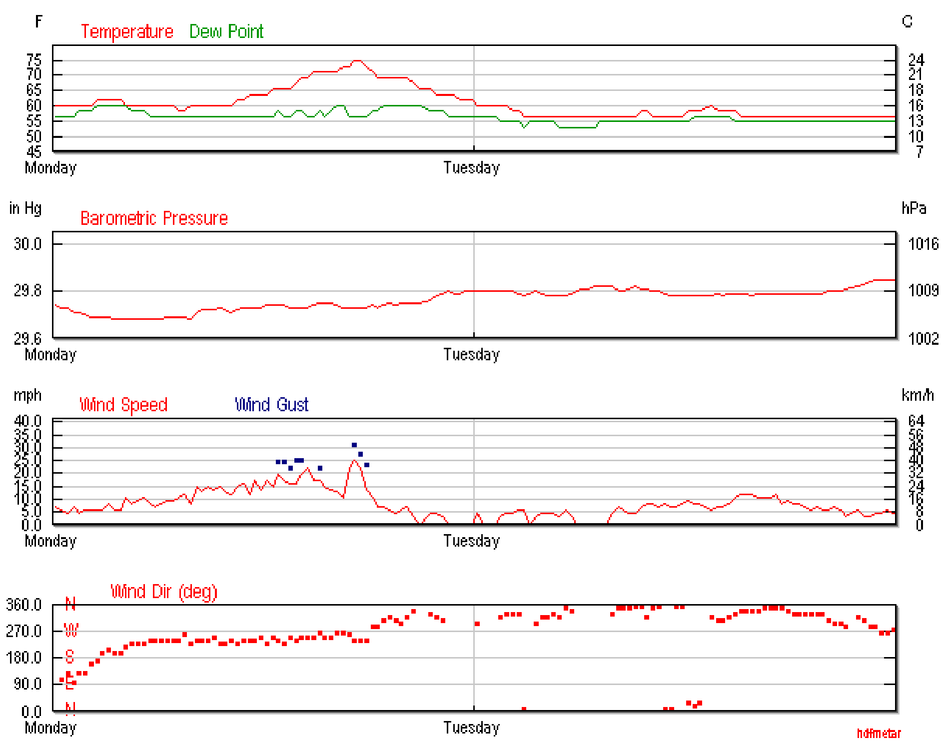


Figure 3.3.1
Weather Conditions in Mankato, MN May 26 to 27

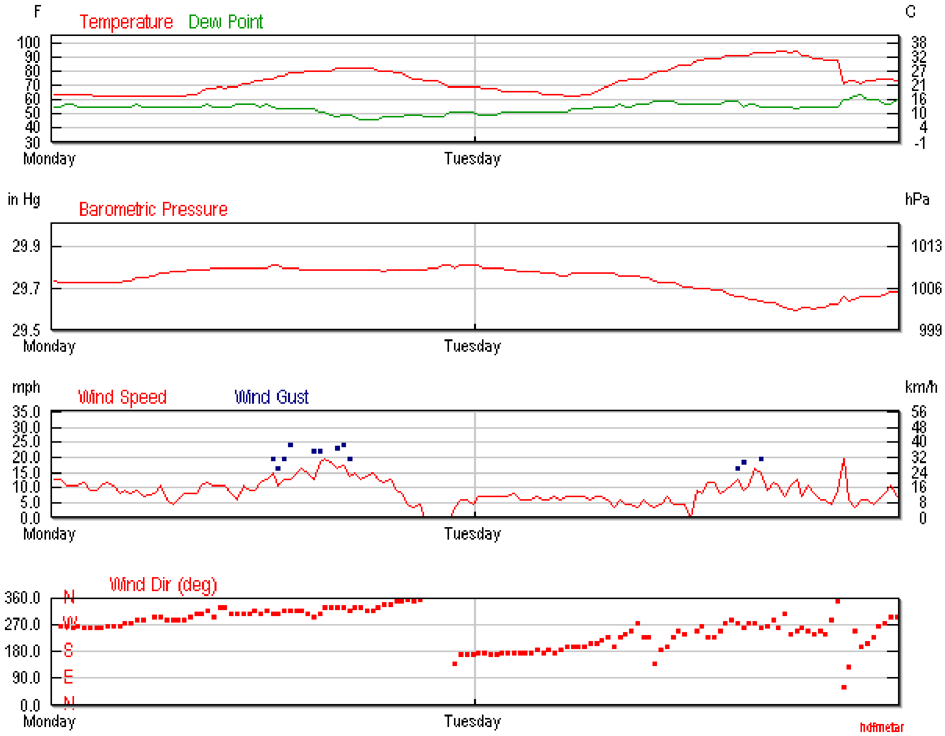


Figure 3.3.2
Weather Conditions in Mankato, MN June 8 to 9

During the first run on May 26 it was overcast and fairly windy. A thunderstorm occurred around 6:30 p.m. On May 27th the winds subsided considerably.

Over the June operational period (June 8 and 9) it was generally clear with moderate winds.

4.0 Survey Results

4.1 Control Position

The L10 and L50 sound levels measured inside the ST building near the condenser and bypass lines are plotted below for the entire survey period.

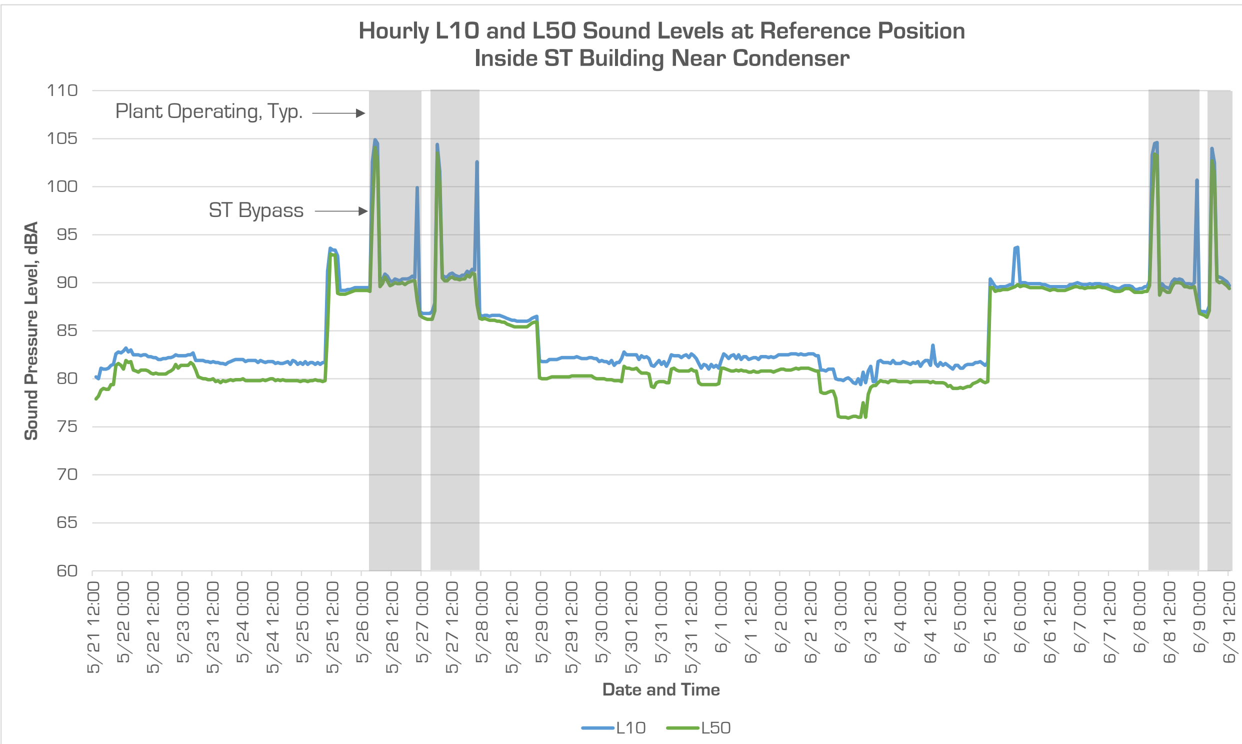


Figure 4.1.1

This plot provides a graphic history of plant operation and agrees with the on/off times obtained from plant operations after the survey. The noise spikes at the beginning of each run are ST bypass activity, which was bit longer (about 3 hours) during the cold starts than during the subsequent warm starts (about 2 hours). The sound level at this particular monitoring location was sustained at about 104 dBA during bypass. The blue (L10) spikes at end of each run are brief noise events at shutdown apparently lasting only a few minutes.

4.2 Position 1 – Boundary North of Existing CTG

The hourly L10 and L50 sound levels measured at Position 1 are plotted below along with the permissible noise limits.

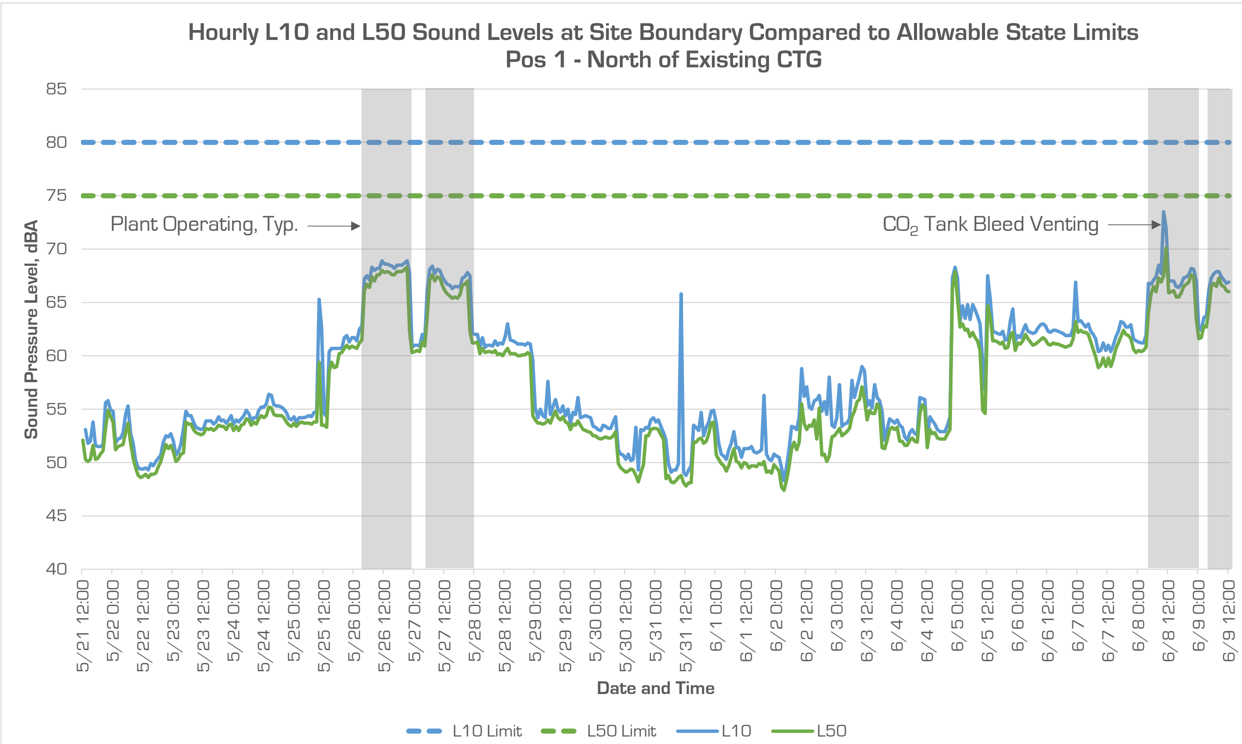


Figure 4.2.1

In general, these results show that the existing plant is certainly in compliance with the allowable sound levels at the northern site boundary. Neglecting the results on 5/26, which may have been elevated by high winds and a thunderstorm, the measured level during the other three runs generally fluctuates around 67 dBA with little difference between the L10 and L50 statisticals. This is well below the respective limits of 80 and 75 dBA. The noise spike on 6/8 around 10:45 a.m. is associated with some short duration venting noise to draw down the pressure in the CTG fire protection CO_2 tank during the offloading of more gas. This plot also shows that, despite the sound levels of 104 dBA observed inside the ST building, transient noise during start-up and shutdown has no significant influence on the overall facility level at this position.

What these results suggest in terms of regulatory compliance is that an increase in the L50 facility sound emissions of about 8 dBA can be tolerated before the level would exceed the permissible limit of 75 dBA. The installation of the second turbine to the north of the existing unit would essentially have the effect of moving the principal noise source closer to this measurement position by about 120 ft. Most of the noise from the existing powertrain would be blocked and replaced by the new powertrain. The contribution from the cooling tower would remain unchanged. This translation in the main noise source from about 250 ft. away to roughly 130 ft. would theoretically result in an increase of about 6 dBA. Consequently, an L50 sound level after build-out of about 73 dBA is expected. While this is fairly close to the limit it would still be compliant. A similar L10 level of roughly 74 dBA would probably go along with this, so no issue is anticipated with maintaining the L10 limit of 80 dBA.

4.3 Position 2 – Boundary North of Existing Cooling Tower

The hourly L10 and L50 sound levels measured at Position 2 at the northern end of the cooling tower are plotted below.

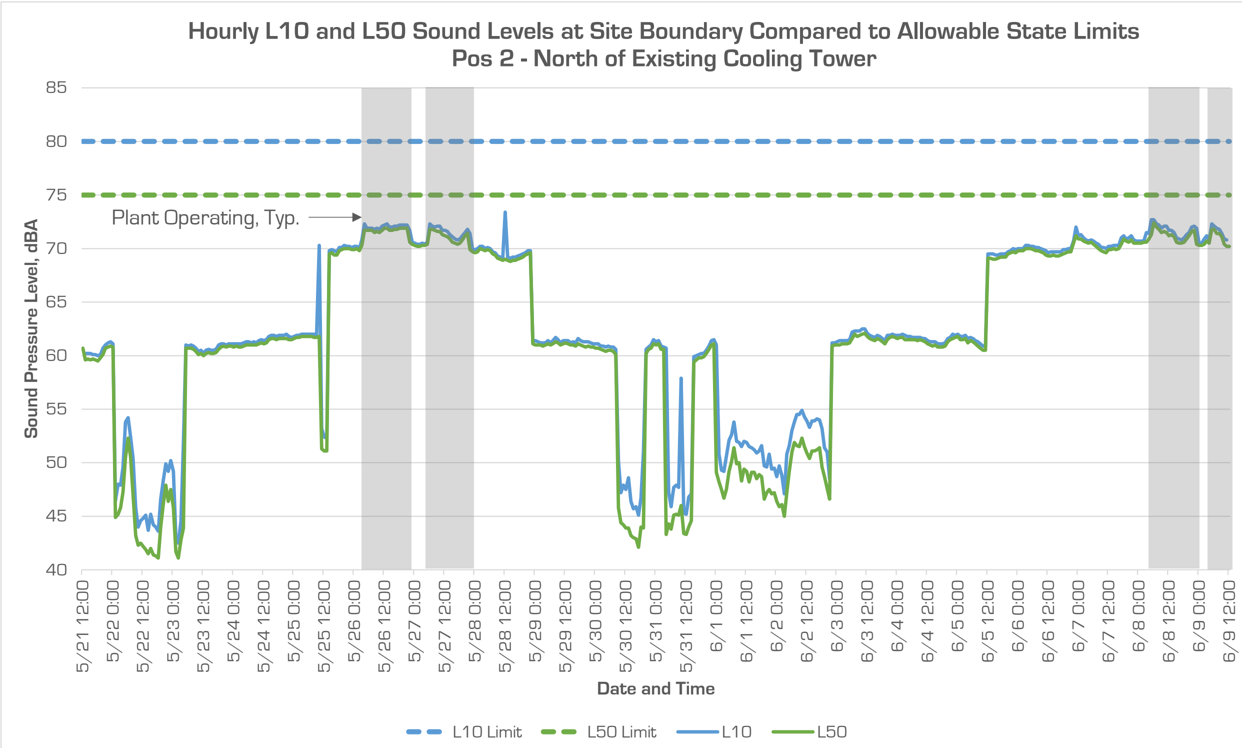


Figure 4.3.1

This position is dominated by cooling tower noise; principally water fall and basin splash. A fairly constant L10/L50 level of about 72 dBA occurs at this location during operation demonstrating compliance with the State noise limits. The sound level at this location is not expected to change in any meaningful way after the build-out. Additional noise from the new CTG powertrain should be significantly less than 72 dBA at this location and therefore should not have any real influence on the total sound level.

4.4 Position 3 – Boundary South of Future Cooling Tower Extension

The hourly L10 and L50 sound levels measured at Position 3 beyond the southern end of the cooling tower are plotted below.

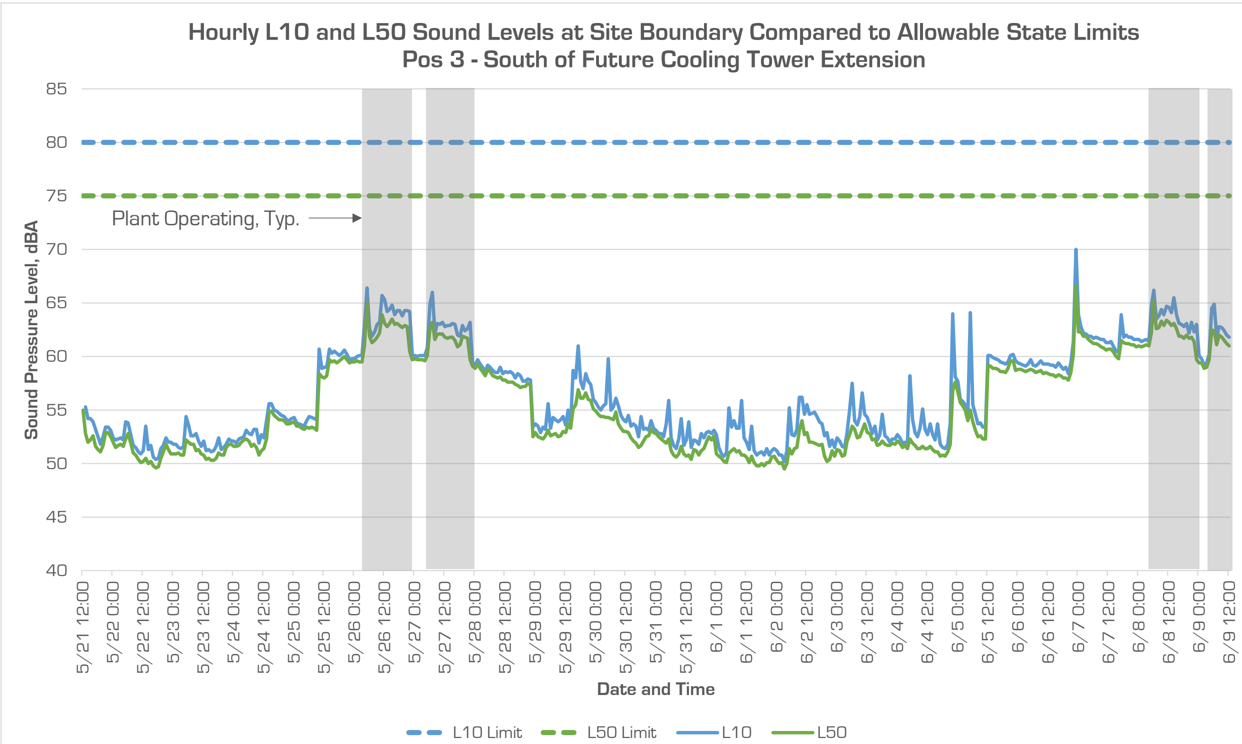


Figure 4.4.1

While the existing sound level at this location is fairly low during plant operation in the 63 to 65 dBA range, it is expected to increase substantially once four more cells are added to the cooling tower. Once the build-out is complete the sound level at the property line beyond Position 3 is likely to be somewhat similar to the existing sound level at Position 2 but probably a little lower due to the slightly greater distance from the tower to the property line. A conservative estimate of the future sound level during normal plant operation can be made by adding the current L50 level of about 63 dBA to the 72 dBA measured at Position 2 to get a total of 72.5 dBA. This suggests that compliance will be maintained after the cooling tower is extended.

One additional comment on Figure 4.4.1 is that steam turbine bypass noise during each plant start-up is clearly evident at this location, which is more or less exposed to the east side of the ST building where the many ventilation louvers allow interior noise to escape. The L50 sound level during this operating mode reaches a maximum of 65 dBA during cold starts. Combined with the Position 2 level, this would put the total estimated level at the southern boundary during start-up at about 73 dBA. While this is close to the L50 limit compliance is still expected.

4.0 Conclusions

A due diligence survey of the existing property line sound levels at the Mankato Energy Center was carried out to determine how much, if any, headroom was left between the current sound emissions of the plant and the permissible State noise limits to accommodate additional noise from the planned expansion. The survey, which was executed using automated continuously recording sound monitors over a 19 day period at key fence line positions, captured four typical plant runs, including two cold starts and two warm starts.

The results unequivocally demonstrate that the plant is currently in compliance with the noise limits of 75 dBA L50 and 80 dBA L10, which apply to the industrial land uses surrounding the site property. Measurements at the points of maximum current or future noise show that sufficient margin exists at all points to accommodate the estimated increase in noise associated with the addition of a second CTG/HRSG powertrain and four more cells to the cooling tower. The estimated maximum L50 sound level after expansion at each of the three worst-case test points is, coincidentally, about 73 dBA. While close to the effective L50 limit of 75 dBA compliance is anticipated during both normal and transient operation. Only slightly higher L10 levels (say 74 to 75 dBA) are expected at the design points based on the survey results so compliance is also anticipated with the L10 noise limit of 80 dBA.

Appendix E. Air Permit Amendment Application

This appendix contains a portion of the applicant's air permit amendment application. The entire application includes a large amount of data and air modeling information in a variety of file formats and is not reproduced here. The application is available upon request from the Minnesota Pollution Control Agency, www.pca.state.mn.us.

WENCK File #1294-0035
November 2015

Air Emissions Permit Major Amendment Application

Submitted by:

Calpine Corporation

700 Summit Avenue
Mankato, MN 56001

Responsive partner.
Exceptional outcomes.

Prepared by:

WENCK Associates, Inc.
1802 Wooddale Drive
Woodbury, MN 55125
Phone: 651-294-4580
Fax: 651-228-1969

Table of Contents

Table of Contents (Cont.)

TABLES

FIGURES

APPENDICES

Executive Summary

Mankato Energy Center, LLC (MEC I) currently owns one (1) 1 X 1 combined cycle power block consisting of one combustion turbine, one heat recovery steam generator (HRSG), and one steam turbine (referred to herein as the Existing Facility). The existing unit in combined cycle mode is capable of producing approximately 375 MW at peak load at winter conditions. The Existing Facility is operated by Calpine Operating Services Company, Inc. (COSCI). All entities are wholly owned indirect subsidiaries of Calpine Corporation (Calpine).

The current combustion turbine is fired primarily by natural gas with distillate fuel oil as a backup fuel. The combustion turbine exhausts to a separate HRSG having supplementary duct firing capacity of 800 MMBtu/hr. The steam generated in the HSRG exhausts in to the steam turbine. The unit is equipped with dry low-NO_x (DLN) burners and a selective catalytic reduction (SCR) system to reduce nitrogen oxides (NO_x) emissions and a catalyst oxidation system to control carbon monoxide (CO) and volatile organic compound (VOC) emissions from the combustion turbine and duct burner exhaust.

Calpine is proposing to install a new combustion turbine/HRSG train (referred to herein as the Expansion Project), converting the Existing Facility to a 2 X 1 combined cycle power block (referred to herein as the Combined Facility). The proposed Expansion Project will be owned by Mankato Energy Center II, LLC (MEC II) and operated by COSCI. The new combustion turbine/HRSG train will generate an additional 345 MW at peak load at winter conditions. The proposed combustion turbine will be fired with natural gas only and will exhaust to the new HRSG having a supplementary duct firing capacity of 824 MMBtu/hr. The duct burners will also be fired only with natural gas. The steam generated by the new HRSG will exhaust into the existing steam turbine.

MEC II will install SCR and DLN burners to reduce NO_x emissions and a catalyst oxidation system to control CO and VOC emissions from the proposed combustion turbine. The HRSG duct burner exhaust will be controlled by the proposed SCR and catalyst oxidation system and low-NO_x burners. The equipment selection is not yet final. The proposed new combustion turbine will be an F-Class turbine with similar characteristics to the existing unit. The new HRSG will also be designed to produce steam conditions matching the existing equipment. In order to provide additional cooling due to the increased steam flow to the steam turbine, four new cells will be added to the existing cooling tower. A new anhydrous ammonia tank will be installed to provide the reagent to the new SCR.

Secondary combustion sources at the Combined Facility include the existing natural gas fired auxiliary boiler with a rated heat input of 70 MMBtu/hr, the existing diesel fired fire pump engine, the existing bath heater, and a proposed diesel fired emergency generator. Other non-combustion related sources include storage tanks and the new and existing cooling tower cells.

The project site is located in Mankato, MN. The location is shown in Figures 2-1 and 2-2 at the end of Section 2.

The Expansion Project is subject to review under the federal Prevention of Significant Deterioration (PSD) rules for emissions of NO_x, CO, VOCs, particulate matter (PM), PM with diameter less than 10 microns (PM_{10}), PM less than 2.5 microns ($PM_{2.5}$), and greenhouse gases (GHGs).

MEC II will apply Best Available Control Technology (BACT) to control emissions. As mentioned above, exhaust from the proposed combustion turbine will be controlled using SCR and DLN burners to control NO_x emissions and a catalytic oxidizer to control CO and VOC emissions. Emissions from the proposed HRSG low-NO_x duct burners will be controlled using an SCR and catalytic oxidizer. The proposed diesel fired emergency generator will be limited to 100 hours of non-emergency operation annually and will be operated and maintained in accordance with manufacturers' specifications to ensure low emissions. The additional cooling tower cells will incorporate a mist eliminator having a 0.0005% tower drift rate. Additional details are provided in Section 5.

An Additional Impacts Analysis shows that no adverse impacts on soils, vegetation, and visibility will be caused by emissions from the Expansion Project and from associated growth. An Endangered Species Act (ESA) analysis shows that there are no federal endangered species in the area. In addition, a National Historical Preservation Act (NHPA) analysis shows that no historical buildings or artifacts will be affected by the Expansion Project. Section 6 provides additional details.

Air dispersion modeling was performed to demonstrate that the Existing Facility and Expansion Project emissions do not cause or contribute to a violation of the Minnesota and National Ambient Air Quality Standards (MAAQS and NAAQS) and PSD increment standards. The modeling demonstration was conducted in the following three steps. Additional details are provided in Section 7.

1. Preliminary modeling of the emissions from the Expansion Project alone shows that the maximum downwind ambient concentrations are less than the PSD significant impact level (SIL) for 1-hour CO, annual NO_2, PM_{10} and the vacated SIL for $PM_{2.5}$. Therefore, no further analysis of 1-hour CO, an annual NO_2, PM_{10} emissions was required. No further NAAQS analysis of $PM_{2.5}$ emissions was required but a $PM_{2.5}$ Increment screening analysis was still required.
2. Refined modeling of the Combined Facility shows that predicted concentrations of 1-hour NO_2 and 8-hour CO comply with the respective NAAQS and MAAQS. There are no PSD increments for these pollutants and averaging periods.
3. $PM_{2.5}$ Increment screening modeling shows that the Combined Facility will be a small consumer of increment. The analysis also determined that monitored background concentrations in the area have improved significantly over the past several years, increasing the amount of "headroom" between the project impacts and the PSD Class II increment standards.

This application identifies the state and federal air quality requirements that apply to the Expansion Project and the testing, monitoring, recordkeeping, and reporting procedures that will be utilized to demonstrate compliance. The Existing Facility currently operates under a "synthetic" limit on formaldehyde, hexane and total HAP emissions, equivalent to the recently promulgated Maximum Achievable Control Technology Standard for combustion turbines (40 CFR 63, Subp. YYYY), to ensure that the Facility qualified as a non-major source of hazardous air pollutants. The Expansion Project will not change the current "synthetic" limit on formaldehyde, hexane and total hazardous air pollutants (HAPs). The Expansion Project proposes the use of continuous emission monitors (CEMS) to demonstrate compliance with the BACT emission limits on NO_x and CO emissions from the proposed combustion turbine/duct burner stack.

1.0 Prevention of Significant Deterioration Applicability

MEC I is currently subject to state and federal PSD requirements because the facility qualifies as a major stationary source under the PSD rules, defined in 40 CFR 52.21(b)(1)(i). The Existing Facility potential emissions of PM, PM_{10}, $PM_{2.5}$, SO_2, NO_x, VOC, and CO are greater than the PSD major source threshold of 100 tons/yr. The Existing Facility potential GHG emissions are greater than the PSD major source threshold of 100,000 tons/yr.

If emissions of one or more regulated pollutants from a project at an existing major facility exceed the major modification thresholds, the project is subject to PSD review. Potential emissions of PM, PM_{10}, $PM_{2.5}$, NO_x, VOC, CO, and carbon dioxide equivalent (CO_2e) exceed the PSD major modification thresholds for the Expansion Project. Additional discussion on emission calculation methodology is included in Section 5.

Table 1-1 shows a comparison of the total potential emissions from the Expansion Project with the PSD major modification threshold for each pollutant. The Combined Facility post project total emissions are also provided in Table 1-1.

Table 1-1 Potential Emissions and PSD Applicability Thresholds

Pollutant	Combined Facility Post Project Total Potential Emissions (tpy)	Expansion Project Potential Emissions (tpy)	PSD Major Modification Threshold (tpy)
PM	189.05	68.00	25
PM_{10}	175.88	54.83	15
$PM_{2.5}$	173.20	52.15	10
SO_2	98.58	30.46	40
NO_x	354.01	167.44	40
VOC	647.01	382.58	40
CO	1,266.03	768.64	100
Lead	0.026	6.61E-03	0.6
CO_2e	3,100,582	1,585,055	75,000
Asbestos	NA	NA	0.007
Beryllium	3.92E-04	4.24E-05	0.004
Mercury	3.07E-03	9.20E-04	0.1
Vinyl chloride	NA	NA	1
Hydrogen sulfide	NA	NA	10
Sulfuric acid mist	14.88	4.58	7
Total reduced sulfur	NA	NA	10
Reduced sulfur compounds	NA	NA	10

As a major stationary source subject to PSD review, the Expansion Project must satisfy the following requirements specified in 40 CFR 52.21, which include the following:

- Apply BACT to control emissions of each regulated pollutant for which the potential emissions exceed the PSD major modification threshold: the evaluation of BACT for each pollutant and emission source is detailed in Section 3.

- Evaluate the impact of air, ground, and water pollution on soils, vegetation, and visibility caused by emissions from the Expansion Project and from associated growth; these additional impacts are summarized in Section 6 and are described in more detail in the Environmental Assessment (EA) and questionnaire submitted to the Public Utilities Commission (PUC). Projects are also required to evaluate the impact on endangered species and national historical sites. These impacts are also summarized in Section 6.
- Perform air dispersion modeling to demonstrate that the potential emissions will not cause or contribute to an exceedance of the NAAQS or PSD Increment Standard; the modeling methodology and results are summarized in Section 7. A modeling report is provided in Appendix H.
- Perform an air emissions risk analysis (AERA) to determine cumulative impacts of the Combined Facility. Results of this analysis are summarized in Section 8 and a full report and application forms are provided in Appendix I.

2.0 Project Description

2.1 PROJECT SITE

The project site is located in the Mankato City limits. The Existing Facility site is approximately 25 acres in size. The Expansion Project will be located on the Existing Facility site. The project location is shown in Figures 2-1 and 2-2.

2.2 GENERATING TECHNOLOGY

A combined cycle facility refers to a power block arrangement with at least one combustion turbine generator, 1 HRSG that may be equipped with duct burners, and 1 steam turbine-generator. Two combustion turbine/HRSG trains will provide steam to 1 steam turbine-generator at the Combined Facility. The power block configuration is shown in Figure 2-3 at the end of this section.

The current and proposed combustion turbines are F-Class models which utilize compressed air and fuel to produce electricity and high temperature exhaust gas. The proposed combustion turbine will be fired by natural gas only.

Each combustion turbine consists of the following equipment in series:

- an inlet air filter;
- a compressor, where air is drawn in and compressed;
- a combustor, where fuel is mixed with the compressed air and burned;
- a power turbine, where the combusted gases expand to rotate a turbine; and
- an electric generator.

The HRSG recovers waste heat from the exhaust gases of the combustion turbine. The waste heat is used to produce steam, creating additional power generation in combination with a steam turbine. Inside the HRSGs, the hot exhaust gases are directed across the heat transfer tube surface causing the water in the tubes to boil and change phase into steam. The steam turbine receives the steam produced by the two HRSGs. The steam will expand through the steam turbine and cause the turbine shaft to rotate. This drives the generator to produce electrical power.

Air pollution control equipment for the current and proposed combustion turbine includes DLN burners and SCR for NO_x control; catalytic oxidization system for CO and VOC control. The current and proposed HRSG low-NO_x duct burners will also be controlled by the existing and proposed SCR and catalytic oxidizer. Natural gas combustion produces minimal particulate and SO_2 emissions. Thus, no specific control equipment is required for either pollutant.

DLN burners limit the production of NO_x by premixing the compressed air and natural gas prior to injection into staged lean combustors. This results in a relatively cool combustion zone. More NO_x is produced in high-temperature zones; therefore, the lower temperature in the combustion zone reduces the NO_x produced. The SCR uses anhydrous ammonia and a catalyst to convert NO_x emissions to elemental nitrogen and water.

As mentioned previously, a catalytic oxidizer is employed on the existing equipment and will be installed on the new unit to reduce emissions of CO and VOC emissions.

The proposed and existing combined cycle units have the ability to operate with and without duct burners. The duct burners utilize excess oxygen in the exhaust gas to combust additional natural gas increasing steam production. The HRSG duct burners for the proposed unit will add approximately 824 MMBtu/hr (HHV) of heat input.

The current combustion turbine is a Siemens F-Class model which is no longer manufactured. Since the existing and new combustion turbine/HRSG trains will be operating in parallel to supply steam to the existing steam turbine, it is preferred that the proposed unit be of similar performance and exhaust gas characteristics to ensure a stable combined cycle operation. In order to obtain a combustion turbine with compatible characteristics, MEC II will purchase either: 1) a grey market version, 2) an off-market version, or 3) a newer version but de-rated combustion turbine.

2.3 ANCILLARY EQUIPMENT

New emission sources for the Expansion Project will also include a proposed diesel-fired emergency generator, four additional cooling tower cells, natural gas piping, and electrical equipment insulated with sulfur hexafluoride (SF_6). MEC II also plans to install an anhydrous ammonia tank, a water tank, condensate tank and a small diesel tank for the proposed diesel fired emergency generator.

MEC I installed an indirect-gas fired bath heater as part of the Existing Facility. The bath heater is a small natural gas combustion source at 2.87 MMBtu/hr. The bath heater qualified as a Minn. R. 7007.1300, Subpart 4 insignificant activity during the original permitting. However, the bath heater can no longer qualify as an insignificant activity under Subpart 4 because this is not an initial Title V permit. The source is included in the application as an emission unit.

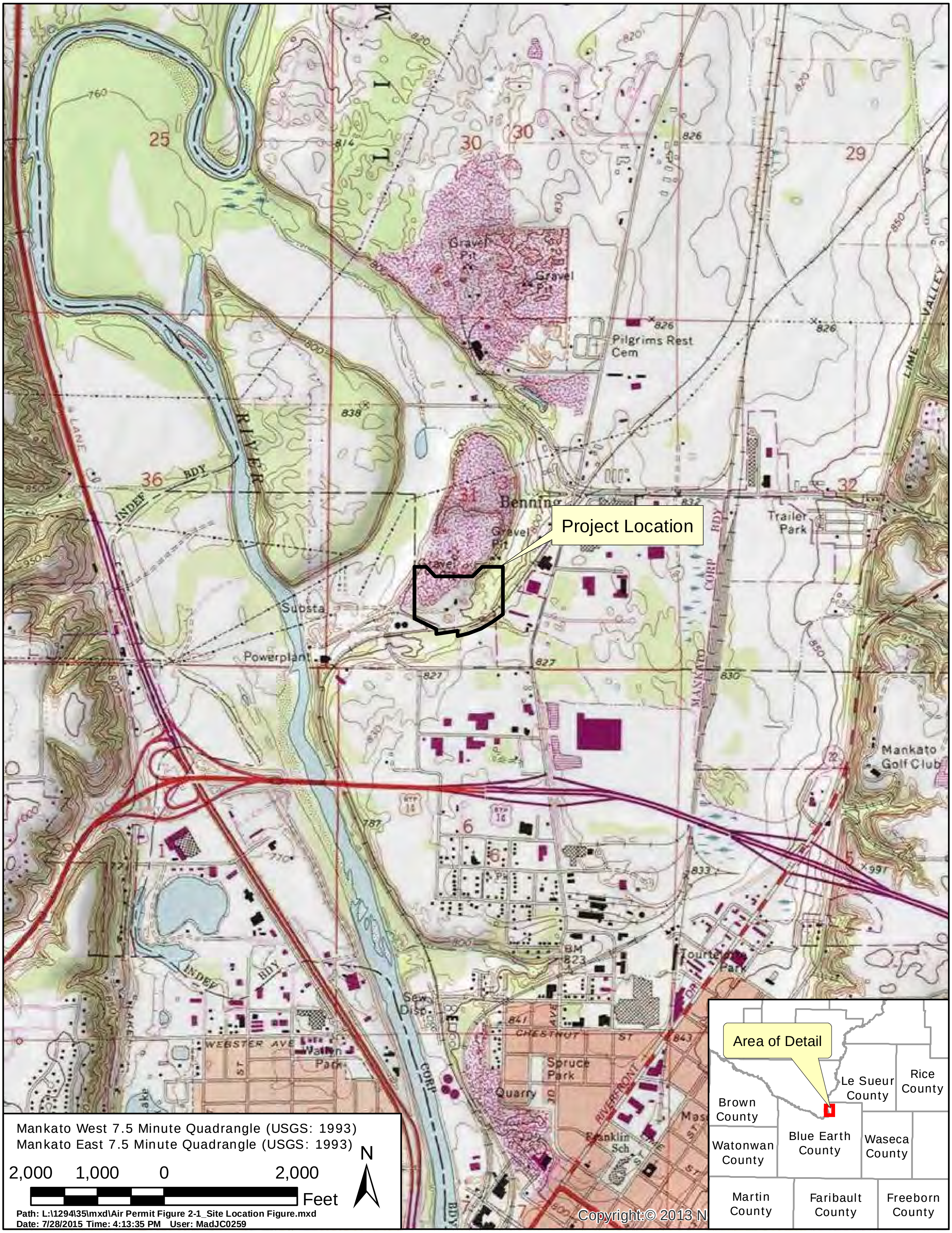
2.4 PROPOSED EQUIPMENT SUMMARY

Below is a summary of the proposed and existing equipment at the facility and relation to control equipment and stack vents. This equipment schedule is included in the attached form for the proposed equipment and the current permit for the existing equipment. A process flow diagram is also provided below for the Expansion Project equipment in Figure 2-4 and included with Form GI-02 in Appendix A.1.

Table 2-1 Equipment Summary

Emission Unit Description	EU Number	Control Equipment Description	Control Equipment Number	Stack Vent Number
Proposed Equipment as part of the Expansion Project				
Combustion Turbine #1	EU 008	Dry Low-NOx Burner SCR Catalytic Oxidizer	CE 010 CE 011 CE 012	SV 007
Duct Burners (Combustion Turbine #1)	EU 009	SCR Catalytic Oxidizer	CE 011 CE 012	SV 007
Diesel Fired Emergency Generator	EU 010	NA	NA	SV 008
Cooling Tower*	FS 001	NA	NA	NA
Natural Gas Fugitives	FS 002	NA	NA	NA
Breaker Fugitives	FS 003	NA	NA	NA
Current Equipment as part of the Existing Facility				
Combustion Turbine #2	EU 002	Dry Low-NOx Burner Water Injection SCR Catalytic Oxidizer	CE 002 CE 004 CE 006 CE 008	SV 002
Duct Burners (Combustion Turbine #2)	EU 004	SCR Catalytic Oxidizer	CE 006 CE 008	SV 002
Auxiliary Boiler	EU 005	NA	NA	SV 003
Diesel Fired Fire Pump Engine	EU 007	NA	NA	SV 005
Bath Heater	EU 011	NA	NA	SV 009

* Calpine is proposing to install 4 additional cooling tower cells to existing FS001.



MANKATO ENERGY CENTER

Site Location Map

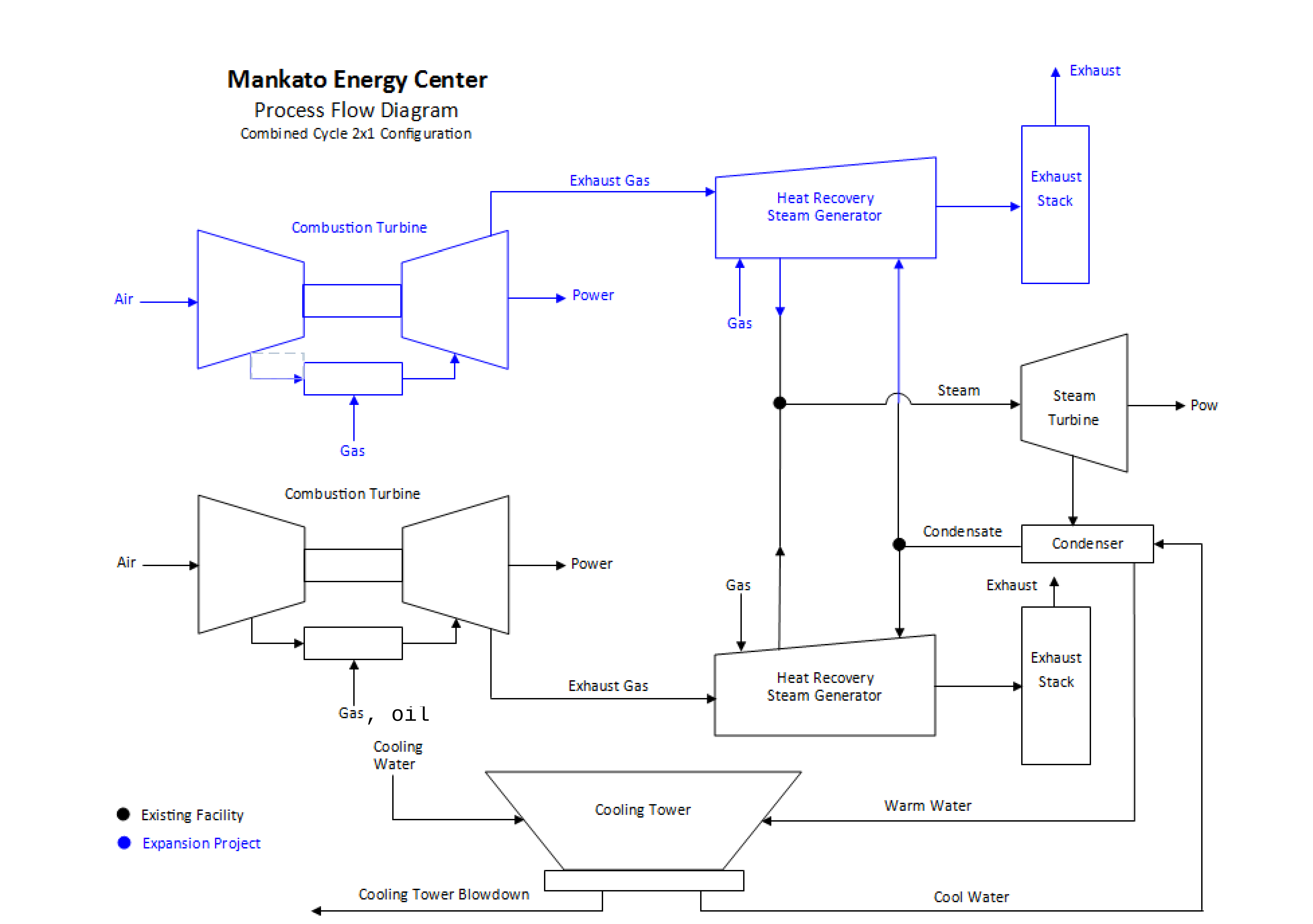
WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

Nov 2015

Figure 2-1

MANKATO ENERGY CENTER	WENCK ASSOCIATES	Nov 2015	
Aerial Photograph Site Location Map	Responsive partner. Exceptional outcomes.	Figure 2-2	



MANKATO ENERGY CENTER

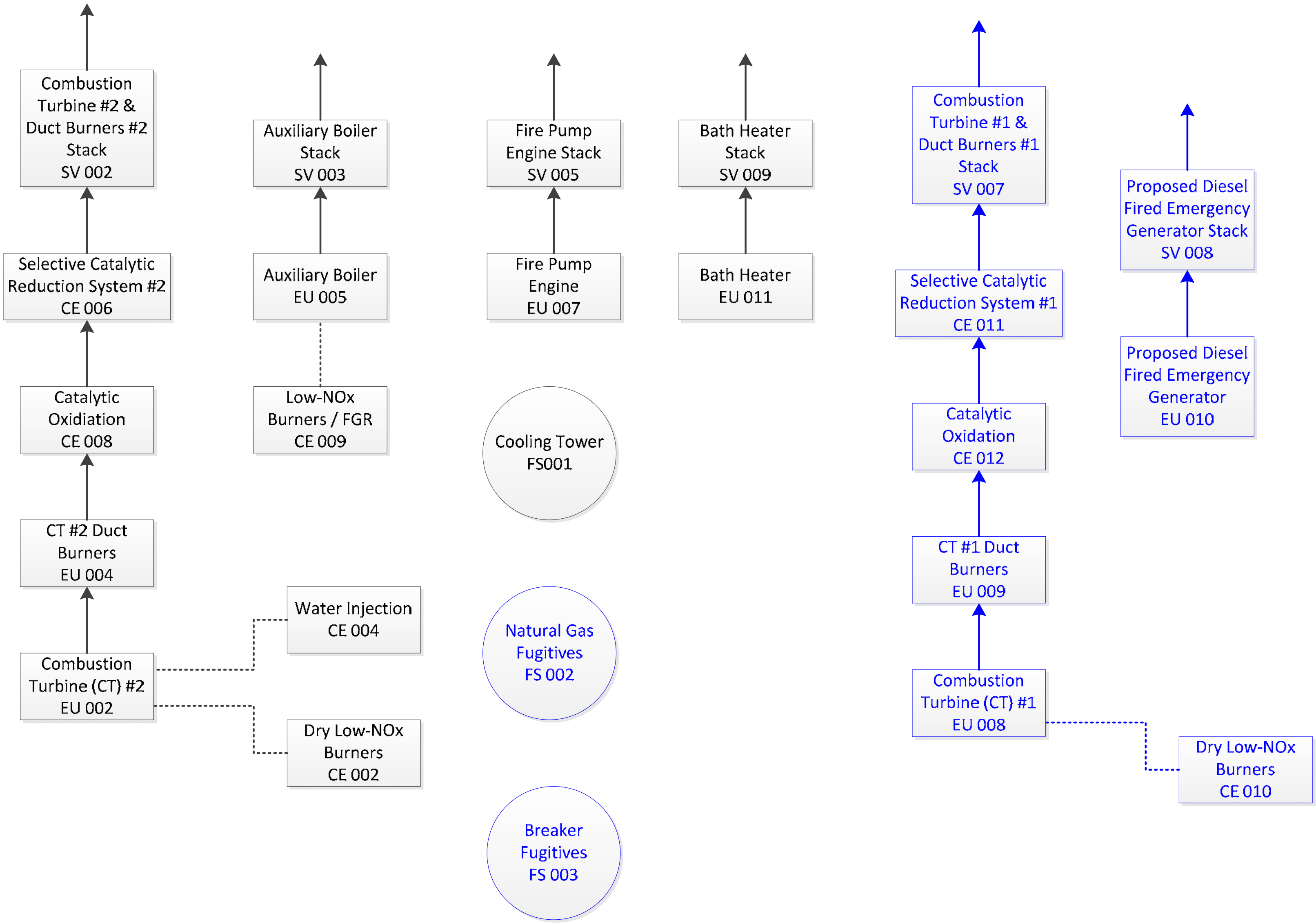
Process Flow Diagram

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

Nov 2015

Figure 2-3

Figure 2-4 Equipment Summary Diagram



WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

3.0 Best Available Control Technology Determination

The Expansion Project is subject to PSD review for emissions of NO_x, CO, PM/PM_{10}/$PM_{2.5}$, VOC and GHG. These regulations require MEC II to complete a case-by-case BACT determination for each piece of equipment associated with the Expansion Project that has the potential to emit air pollutants subject to PSD.

This section documents the BACT determination for each piece of equipment associated with the Expansion Project that has the potential to emit NO_x, CO, PM/PM_{10}/$PM_{2.5}$, VOC and GHG.

3.1 BACT DEFINITION

BACT is defined in 40 CFR 52.21(j) BACT as follows:

> "an emission limitation (including a visible emission standard) based on the maximum degree of reduction of each air pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental and economic impacts, and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant…"

BACT has been determined using Environmental Protection Agency's (EPA's) top-down approach. Following the top-down approach, progressively less stringent control technologies are analyzed until a level of control considered BACT is reached on the basis of environmental, energy, and economic impacts. The steps involved, include:

- Step 1 - Identify applicable options;
- Step 2 - Eliminate technically infeasible options;
- Step 3 - Rank remaining alternatives by control effectiveness;
- Step 4 - Evaluate most effective controls; and
- Step 5 - Select BACT

In determining BACT for the emission units included this project, information from the following sources were evaluated:

- On-line EPA RACT/BACT/LAER Clearinghouse (RBLC) System and other state BACT control technology databases;
- EPA/State/Local Air Quality Permits and Applications;
- Control Technology Vendors;
- AP-42-Section 3.1 Stationary Gas Turbines for Electricity Generation; and
- Alternative Control Techniques Document – NO_x emissions form Stationary Gas Turbines EPA-453/R-93-007.

The following sections outline the results of the evaluations to determine BACT for the various emissions units associated with the Expansion Project.

3.2 BACT DETERMINATION FOR COMBINED CYCLE COMBUSTION TURBINE/HRSG OPERATION

The Expansion Project will install an additional natural gas fired combustion turbine equipped with DLN burners. The turbine will exhaust to a separate HRSG which is equipped with an 824 MMBtu/hr natural gas only duct burner. MEC II is proposing to install downstream from the HRSG an SCR system to reduce NO_x emissions, and a catalytic oxidizer to reduce CO and VOC emissions. A summary of recent BACT determinations, including those for ancillary equipment, is included in Appendix B.

3.2.1 Control of Oxides of NO_x Emissions

A top-down evaluation of NO_x control technologies revealed that DLN burners and SCR are equivalent to the best available control alternatives for natural gas-fired combined cycle units. Both of these technologies will be applied to the proposed expansion at MEC II. The proposed NO_x emission performance levels are as follows:

- 3.0 ppmvd @ 15% O_2 for natural gas combustion with DLN burner technology, low-NO_x duct burners and SCR technology.

The operating temperatures within combustion turbine burner systems result in the formation of NO_x emissions. Thermal NO_x and fuel NO_x are the two primary NO_x formation mechanisms in combustion turbines. Thermal NO_x is formed by the dissociation of atmospheric nitrogen and oxygen in the turbine combustor and the subsequent formation of NO_x. When fuels containing nitrogen are combusted this additional source of nitrogen results in fuel NO_x formation. Thermal NO_x is the dominant mechanism for NO_x emissions for the proposed turbine because natural gas fuel contains little or no nitrogen. The formation rate of thermal NO_x increases exponentially with an increase in temperature.

The following technologies were identified as potentially able to control NO_x emissions from stationary combined-cycle combustion turbines:

- DLN burner technology;
- Wet controls – water and steam injection;
- Rich/Quench/Lean (RQL) combustion;
- SCR;
- Selective Non-catalytic reduction (SNCR);
- EMx, formerly SCONOX™ catalytic oxidation/absorption; and
- Catalytic combustion – XONON™

3.2.1.1 Technical Feasibility of NO_x Control Alternatives

The previously referenced information resources were consulted to determine the extent of applicability or each identified control alternative.

<u>Combustion Turbine DLN Burner Technology</u>
DLN burners use an advanced combustion design to suppress NO_x formation and/or promote CO burnout while firing natural gas. The technology can include a lower combustion temperature with lean mixtures of air and fuel, staged premix combustion, or decreased residence time. For turbines such as those proposed for the Expansion Project, DLN burners can achieve 25 ppm NO_x without the addition of any further controls. As

discussed earlier, MEC II is proposing a turbine equipped with the DLN burner technology, which will be utilized while firing natural gas.

Wet Combustion – Water or Steam Injection

Water or steam injection into the flame area of the turbine combustor lowers the flame temperature and reduces the formation of thermal NO_x. A water injection system consists of a water treatment system, pump(s), water metering valves and instrumentation, turbine-mounted injection nozzles, and piping. Water or steam injection can control NO_x concentrations to 25 ppm at 15 percent O_2 for natural gas combustion and 42 ppm for distillate fuel oil combustion. The water-to-fuel ratio (WFR) is the most important factor affecting performance of this control technology and varies by manufacturer and model.

Because the proposed turbine will be equipped with DLN burners that generate NO_x levels equivalent to what is attainable with wet control, this control technology will be eliminated from further consideration in the BACT determination for natural gas firing. The existing combustion turbine utilizes water injection to control NO_x emissions when combusting distillate fuel oil. Because the proposed turbine will only fire natural gas, water injection is not required and would not provide any additional control.

Rich/Quench/Lean (RQL) Combustion

RQL combustors burn fuel-rich in the primary zone and fuel-lean in the secondary zone. Incomplete combustion under fuel-rich conditions in the primary zone produces an atmosphere with a high concentration of CO and hydrogen. The CO and hydrogen replace some of the oxygen normally available for NO_x formation and also act as reducing agents for any NO_x formed in the primary zone. Thus fuel nitrogen is released with minimal conversion to NO_x. The lower peak flame temperatures due to partial combustion also reduce the formation of thermal NO_x. As the combustion products leave the primary zone, they are cooled through rapid dilution and combustion is completed under fuel-lean conditions. Thermal NO_x is minimized during lean combustion because of the low flame temperature.

As indicated in the Alternative Control Techniques (ACT) document, RQL combustors are not commercially available for most turbine designs. Therefore because it is not technically feasible, this control alternative utilizing RQL combustion is eliminated from further consideration in this BACT determination.

Selective Catalytic Reduction (SCR)

SCR can be installed in HRSGs to control NO_x emissions from the combustion turbines and duct burners. Anhydrous ammonia is injected into the flue gas stream, upstream of the SCR catalyst bed, where it mixes with the NO_x to form molecular nitrogen and water. The reactions take place on the surface of the catalyst. The function of the catalyst is to effectively lower the activation energy required for the NO_x decomposition reactions.

Depending on system design and the inlet NO_x level, NO_x removal of up to 70-90 percent is achievable at optimum theoretical conditions. Depending on the catalyst, NO_x reduction occurs within a reaction window of 400 to 1100 degrees Fahrenheit. The design of the HRSG allows for catalyst installation in the optimum temperature zone. As stated earlier MEC II is proposing to install SCR to reduce NO_x emissions from the combustion turbine and duct burner system.

Selective Non-Catalytic Reduction (SNCR)

SNCR technology involves using ammonia or urea injection similar to SCR technology but at a higher temperature window of 1600 to 2200 degrees Fahrenheit, without the use of a catalyst. In certain applications the low end of the operating temperature window can be reduced from 1600 to 1300 degrees Fahrenheit. However, outside of the temperature limits the ammonia can be converted to NO_x, resulting in an increase in NO_x emissions.

Because the exhaust temperatures in combustion turbines typically do not exceed 1250 degrees Fahrenheit, the operative temperature window of this control alternative is not technically feasible in this application. The exhaust temperature is typically around 1150 degrees Fahrenheit at the combustion turbine exit during steady state conditions and 200 degrees Fahrenheit at the exhaust stack, which is less than the acceptable range for SNCR application. Additionally, this technology requires a residence time of approximately 100 milliseconds. This is relatively slow for exhaust gas operating velocities. Thus there may not be adequate residence time for the NO_x destruction chemical reaction. Furthermore, a review of the RBLC database for recent BACT/Lowest Achievable Emission Rate (LAER) determinations did not indicate that SNCR systems have been successfully installed for NO_x control for similar combined-cycle units. For the above reasons, SNCR will no longer be considered for this analysis because it is not technically feasible for the size of the proposed unit.

EM_x™ (Formerly SCONOx™) Catalytic Oxidation/Absorption

EM_x™ is a trade name for a proprietary experimental NOx control technology being marketed by EmeraChem, LLC (formerly Goal Line Technologies). EM_x™ guarantees NO_x emission concentration of 2 ppmv based on an inlet NO_x concentration of 25 ppm. The technology works by allowing the exhaust gases to react with potassium carbonate that is coated on a platinum catalyst surface. The CO is oxidized to CO_2 and exhausted out the stack. The NO is oxidized to NO_2 and then reacts with the potassium carbonate absorber coating on the catalyst to form potassium nitrites and nitrates at the catalyst surface until the catalyst requires regeneration.

The EPA Region IX issued a letter dated March 23, 1998, indicating that emissions data from Sunlaw's Federal Cogeneration facility in Vernon, California has "demonstrated in practice" NO_x emissions at or below 2.0 ppm (3-hour average) using SCONOx™. Although this letter is not a Federal LAER determination, the letter does state that future projects subject to LAER should evaluate this technology for feasibility of application. The South Coast Air Quality Management District (SCAQMD) of California also adopted (effective June 12, 1998) a "BACT" guideline for gas turbines less than 50 MW equal to 2.5 ppm at 15 percent O_2 (1-hour average corrected for efficiency) based on SCONOx™ technology.

However in Appendix B of a document titled Supporting Material for BACT Review for Electrical Generation Technologies (July 23, 2001), SCAQMD recognized that this technology has not been applied to larger turbines such as those proposed by MEC II when the agency stated the following:

> *"Because the technology has not been demonstrated for all sizes of turbines, the ARB staff is not considering the SCONOx technology for the purposes of establishing guideline levels".*

In preparation of the Existing Facility 2004 PSD application, ABB Alstom Power was contacted as the license holder of this technology for turbines of similar size to those proposed for the Expansion Project. According to Noel Kuch of ABB Alstom, the largest turbine that this technology has been commercially installed on is 43 MW.

In addition to the scale-up concern, there is also significant energy impacts associated with this application of EM_x^{TM} technology. There is a power output penalty, and a fuel penalty associated with the use of the catalyst. The increased backpressure in the turbine from the catalyst installation increases the heat input required and reduces the power output of the turbine. EM_x^{TM} technology has been used to define LAER in non-attainment areas in smaller (32 MW systems). EM_x^{TM} can match the performance of SCR without the ammonia slip; however, catalyst must be regenerated periodically while online using hydrogen produced by a natural gas reforming unit, making this technology not cost effective when compared to SCR. No RBLC entries for permits issued after 2006 have listed SCONOx™ as BACT. The proposed unit will be equipped with a combination DLN Combustor technology as well as SCR (equivalent control technology) which is capable of reducing emissions to an equivalent level; therefore EM_x^{TM} will be eliminated from consideration in the BACT analysis.

<u>Catalytic Combustion – XONON™</u>

Another new NO_x control technology being developed is catalytic combustion. Catalytic combustion minimizes peak temperatures and NO_x formation. The XONON™ system is being developed for commercial application by Catalytic Combustion Systems to utilize this technology. Their system includes a pre-burner, a fuel injection and mixing system, a flameless catalyst module and a flameless burnout zone. The pre-burner starts the turbine and a fuel injection system provides a uniform fuel and air mixture to the catalyst, where a portion of the fuel is combusted at reduced temperature to reduce thermal NO_x emissions. The remainder of the fuel is combusted in the burnout zone with minimal NO_x emissions.

The technology has only been tested in small turbines (less than 10 MW) and it is not commercially available for the proposed turbine size. Although the vendor is in the process of developing the technology for larger units, the complete application is believed to be years away from development. Until such time that the technology is commercially available, catalytic combustors are not considered technically feasible. In view of this limitation, utilizing catalytic combustor control is eliminated from further consideration in this BACT determination.

3.2.1.2 Proposal for NO_x BACT for the Combustion Turbine / HRSG

Various control alternatives were reviewed for technical feasibility in controlling NO_x emissions from the proposed combustion turbine/HRSG train. Combustion control utilizing the DLN combustor technology based on lean premix combustion controls and SCR (both of which are proposed for implementation) is equivalent to the highest ranking control technology.

As stated previously, the existing technology for MEC I is a Siemens Westinghouse FD-2 combustion turbine which is no longer a standard offering from the manufacturer. It is preferable that the Expansion Project use a gas turbine technology with similar performance and exhaust gas characteristics to provide stable and reliable combined cycle operation, since the existing and new combustion turbine/HRSG trains will be operating in parallel to supply steam to the existing steam turbine. In order to provide a combustion turbine with comparable operating characteristics, MEC II has the following procurement options:

- a unit from the gray market,
- an original manufacturer equipment (OEM) off-market unit built from spare components, or
- a newer unit, slightly de-rated to the match the performance of the existing unit.

Each of these options has long term reliability concerns which could affect the emissions performance. A combustion gas turbine with latest available technology could offer lower emissions, supporting a BACT limit of 2 ppm NO_x at the stack. However, the turbine would have to be significantly de-rated to match the existing equipment, negating the performance and efficiency benefits that would otherwise justify its purchase. In addition, operating a modern combustion turbine at a significant de-rating could cause stability and reliability issues when in parallel with the existing combustion turbine/HRSG train.

Calpine believes that using a combustion turbine technology similar to the existing equipment for the new expansion is an economically viable option that will provide reliable operation over the life of the plant.

In conclusion, BACT for the proposed natural gas-fired combustion turbine/HRSG is the following:

- 3.0 ppmvd using a 3-hour block average @ 15% O_2 for natural gas combustion with DLN burner technology, low NO_x duct burners, and SCR technology. This limit does not apply during startup, shutdown, malfunction, tuning, and combustion turbine shakedown

MEC II is proposing BACT limits that apply during startup and shutdown operation. These limits are described in further detail in Section 4. Definitions for combustion turbine shakedown and tuning are also provided in Section 4.

3.2.2 Control of CO Emissions

MEC II proposes to install a catalytic oxidizer to decrease CO emissions. The proposed CO emission rates for the combustion turbine/HRSG emission source including the duct burner are as follows:

- 4 ppmvd using a 3-hour block average @ 15% O_2 (while operating at normal turbine base load capacity) and 4.7 ppmvd using a 3-hour block average @ 15% O_2 (while operating at load conditions less than the turbine base load capacity) for natural gas combustion with DLN burner technology, low NO_x duct burners, and catalytic oxidizer.

Normal turbine base load capacity is defined as 90% or greater of capacity for the ambient conditions. Less than turbine base load capacity is defined as greater than or equal to 60% capacity to less than 90% of rated capacity for the ambient conditions.

CO emissions from any combustion process are formed due to incomplete combustion of the fuel. Typically, CO emissions from combustion sources depend on the oxidation efficiency of the fuel. By controlling the combustion process carefully, CO emissions can be minimized. The DLN system used during natural gas firing achieves low NO_x emissions at high efficiency and with no water consumption by optimizing the combustion to produce a lower flame temperature. CO emissions are also reduced through more thorough mixing of fuel and air in the DLN burner, which promotes more complete combustion. Additionally, the HRSG duct burners employ good combustion practices to further minimize the formation of CO emissions.

A review of the RBLC database shows that two types of CO control technologies have been proposed for combined-cycle applications. The technologies available include the following:

- Combustion control, and
- Catalytic oxidizer.

3.2.2.1 Technical Feasibility of CO Control Alternatives

Combustion Control
CO is formed due to incomplete combustion or inefficient combustion of the fuel. Improperly tuned turbines operating at off-design levels decrease combustion efficiency, increasing CO emissions. By controlling the combustion process carefully, the generation of CO emissions can be minimized. Improved mixing of fuel and air in the proposed DLN combustors and HRSG duct burners promotes complete combustion of the fuel, which minimizes CO emissions.

Catalytic Oxidizer In addition to good combustion control the proposed HRSG will be equipped with a catalytic oxidizer. A catalytic oxidizer removes CO from the combustion turbine and duct burner exhaust gas. The technology does not require introduction of additional chemicals for the reaction to proceed. The oxidation of CO to CO_2 uses the excess air present in the turbine exhaust and the activation energy required for the reaction to proceed is lowered in the presence of the catalyst. The catalytic oxidizer is considered the most stringent level of control for combustion turbines similar to the proposed MEC II turbine—capable of oxidizing 80 to 90 percent of the inlet CO concentration.

3.2.2.2 Proposal for CO BACT for the Combustion Turbine / HRSG

Both of the available alternatives for controlling CO emissions will be applied to the proposed combustion turbine/HRSG train. The catalytic oxidizer represents the most effective level of control. Furthermore, it will not result in any significant impacts of unregulated air pollutants or unreasonable impacts in other media. Because MEC II is proposing to install a catalytic oxidizer to control CO emissions from the combustion turbine and duct burner, and a catalytic oxidizer results in the greatest control effectiveness, no further analysis is required under a top down BACT analysis. BACT for controlling CO emissions is proposed as follows:

- 4 ppmvd using a 3-hour block average @15% O_2 (while operating at normal base load conditions) and 4.7 ppmvd using a 3-hour block average @ 15% O_2 (while operating at load conditions less than the turbine base load capacity) for natural gas combustion with DLN technology, low NO_x duct burners, and catalytic oxidizer. This limit does not apply during startup, shutdown, malfunction, tuning, and combustion turbine shakedown.

MEC II is proposing BACT limits that apply during startup and shutdown operation. These limits are described in further detail in Section 4.

Similar to the discussion in the NO_X BACT section above, the existing technology for MEC I is a Siemens Westinghouse FD-2 combustion turbine which is no longer a standard offering from the manufacturer. It is preferable that the Expansion Project use a gas turbine technology with similar performance and exhaust gas characteristics to provide stable and reliable combined cycle operation, since the existing and new combustion turbine/ HRSG trains will be operating in parallel to supply steam to the existing steam turbine.

A combustion gas turbine with latest available technology could offer lower emissions, supporting a lower BACT limit at the stack. However, the turbine would have to be significantly de-rated to match the existing equipment, negating the performance and efficiency benefits that would otherwise justify its purchase. In addition, operating a modern combustion turbine at a significant de-rating could cause stability and reliability issues when in parallel with the existing combustion turbine/HRSG train.

3.2.3 Control of VOC Emissions

Similar to CO emissions, VOC emissions are formed in any combustion process due to incomplete combustion of the fuel. The VOCs may consist of a wide spectrum of volatile and semi-volatile organic compounds. By controlling the combustion process carefully, VOC emissions can be minimized. As stated earlier, MEC II is proposing to install a catalytic oxidizer to reduce CO emissions from the turbines. These systems will also reduce VOC emissions from the turbine.

The proposed VOC emission rates for the turbine/HRSG emission source are as follows:

- 3.4 ppmvd using a 3-hour block average @ 15% O_2 for natural gas combustion with DLN burner technology, low NO_x duct burners, and catalytic oxidizer.

Based on a review of the RBLC database, it was shown that two types of VOC control technologies have been proposed for combined-cycle applications. The technologies available include the following:

- Combustion control, and
- Catalytic oxidizer.

3.2.3.1 Technical Feasibility of VOC Control Alternatives

<u>Combustion Control</u>
VOCs are formed due to incomplete combustion or inefficient combustion of the fuel. Improperly tuned turbines operating at off-design levels decrease combustion efficiency, increasing VOC emissions. By controlling the combustion process carefully, the generation VOC emissions can be minimized.

Catalytic Oxidizer In addition to good combustion control the proposed turbines will be equipped with a catalytic oxidizer. A catalytic oxidizer serves to remove VOCs from the combustion turbine/duct burner exhaust gas. The technology does not require introduction of additional chemicals for the reaction to proceed. The oxidation of VOCs uses the excess air present in the turbine exhaust and the activation energy required for the reaction to proceed is lowered in the presence of the catalyst. The catalytic oxidizer is considered the most stringent level of control for turbines similar to the proposed MEC II turbine.

3.2.3.2 Proposal for VOC BACT for the Combustion Turbine/HRSG

Both of the available control alternatives for controlling VOC emissions will be applied to the proposed combustion turbine/HRSG train. The catalytic oxidizer represents the most effective level of control. Furthermore, it will not result in any significant impacts of unregulated air pollutants or unreasonable impacts in other media. Because MEC II is proposing to install a catalytic oxidizer to control CO and VOC emissions from the new combustion turbine and duct burner, and an oxidation catalyst systems results in the greatest control effectiveness, no further analysis is required under a top down BACT analysis. BACT for controlling VOC emissions is proposed as:

- 3.4 ppmvd using a 3-hour block average @ 15% O_2 for natural gas combustion with DLN burner technology, low NOx duct burners, and catalytic oxidizer. This limit does not apply during startup, shutdown, malfunction, tuning, and combustion turbine shakedown.

MEC II is proposing BACT limits that apply during startup and shutdown operation. These limits are described in further detail in Section 4.

3.2.4 Control of PM/PM_{10}/$PM_{2.5}$ Emissions

PM may be formed from non-combustible constituents in fuel or combustion air, from products of incomplete combustion, or from post-combustion formation of ammonium sulfates in units with an SCR. All of the particulate emissions from the combustion turbine are assumed be in the form of PM_{10} and $PM_{2.5}$.

The proposed PM emission limits are based on vendor data and operating experience at MEC and other units in Calpine's fleet. Good combustion control is regarded as BACT for PM/PM_{10}/$PM_{2.5}$. Add-on controls are technically and economically infeasible due to the high flow rates, very low concentrations of PM/PM_{10}/$PM_{2.5}$, and the extremely small particle diameters. Mankato Energy is not aware of any combined cycle project that has been required to install add-on PM/PM_{10}/$PM_{2.5}$ controls.

The proposed PM/PM_{10}/$PM_{2.5}$ emission rate for the proposed combustion turbine/HRSG emission source is 11.9 lb/hr using a 3-hour block average for natural gas firing.

Potential Combined Cycle Unit PM/PM_{10}/$PM_{2.5}$ Control Alternatives
Based on a review of the RBLC database and the references listed earlier the following PM/PM_{10}/$PM_{2.5}$ control technologies are available to potentially control emissions from combined cycle units:

- Fuel specifications: clean burning fuel;
- Good combustion practices/combustion control; and
- Low-sulfur fuel.

3.2.4.1 Technical Feasibility of PM/PM_{10}/$PM_{2.5}$ Control Alternatives

Fuel Specifications: Clean Burn Fuel
MEC II is proposing to burn pipeline-quality natural gas. Among traditional fuels natural gas is considered a clean burning fuel since it has a very low potential for generating particulates. The RBLC database indicates that pipeline-quality natural gas is the clean burning fuel of choice for similar combined cycle applications.

Good Combustion Practice/Combustion Control
Based upon a review of the RBLC, good combustion practice is listed as a control alternative for many similar combined cycle applications. MEC II will maintain the combustion turbines in good working order in accordance with manufacturers' guidance and implement good combustion practices to minimize particulate emissions. As discussed earlier, the proposed

combustion turbine will be equipped with DLN burners that will also contribute towards good combustion practice and further help lower particulate emissions.

The Expansion Project's combustion turbine will burn natural gas only. The sulfur content of natural gas will not exceed 0.8 grains per 100 standard cubic feet of gas.

3.2.4.2 Proposed PM / PM_{10} / $PM_{2.5}$ BACT for the Combustion Turbine / HRSG

Various control alternatives were reviewed for technical feasibility in controlling PM/PM_{10}/$PM_{2.5}$ emissions from the proposed turbine/HRSG. The proposed combustion turbine will use a combination of all of the above control alternatives in order to provide the best available particulate control.

In conclusion, BACT for controlling PM/PM_{10}/$PM_{2.5}$ emissions from the proposed turbine is proposed as the maintenance of the turbine/HRSGs in good working order, implementation of good combustion practices with DLN burner technology, and use of clean-burning natural gas fuel as the only fuel to meet a PM/PM_{10}/$PM_{2.5}$ emission rate of 11.9 lb/hr using a 3 hour block average. This limit will apply at all times including during startup, shutdown, or malfunction. This limit will not apply prior to combustion turbine shakedown which is further defined in Section 4.

3.2.5 Control of Greenhouse Gas (GHG) Emissions

3.2.5.1 Available GHG Control Technologies

Inherently Lower-Emitting Processes/Practices/Designs

MEC II performed a search of the EPA's RACT/BACT/LAER Clearinghouse for natural gas fired combustion turbine generators in combined cycle operation and found no entries which address BACT for GHG emissions. Calpine has permitted several units under GHG BACT regulations. Those analyses determined that BACT for GHG emissions was maintenance of the high energy efficiency that is inherent with natural gas fired combined cycle power plants. GHG BACT permit conditions were established which set an efficiency limit (also referred to as heat rate) appropriate for each particular combination of gas turbine, heat recovery steam generator, and steam turbine model. The net heat rate was based on a design base load rate, without duct firing with factors added to account for a design margin and degradation.

A summary of available, lower greenhouse gas emitting processes, practices, and designs for combined cycle units is presented below.

3.2.5.1.1 Combined Cycle Energy Efficiency Processes, Practices, and Combustion Turbine Design

CO_2 is a product of combustion of fuels containing carbon, which is inherent in any power generation technology using fossil fuel. It is not possible to reduce the amount of CO_2 generated from combustion, as CO_2 is the essential product of the chemical reaction between the fuel and the oxygen in which it burns, not a byproduct caused by imperfect combustion. As such, there is no technology available that can effectively reduce CO_2 generation by adjusting the conditions in which combustion takes place.

The only effective means to reduce the amount of CO_2 generated by a fuel-burning power plant is to generate as much electric power as possible from the combustion, thereby reducing the amount of fuel needed to meet the plant's required power output. This result is obtained by using the most efficient generating technologies available, so that as much of the energy content of the fuel as possible goes into generating power.

The most efficient way to generate electricity from a natural gas fuel source is the use of a combined cycle design. For fossil fuel technologies, efficiency ranges from approximately 30-50% (higher heating value [HHV]). A typical coal-fired Rankine cycle power plant has a base load efficiency of approximately 30% (HHV), while a modern F-Class natural gas fired combined cycle unit operating under optimal conditions has a baseload efficiency of approximately 50% (HHV).

Combined cycle units operate based on a combination of two thermodynamic cycles: the Brayton and the Rankine cycles. A combustion turbine operates on the Brayton cycle and the HRSG and steam turbine operate on the Rankine cycle. The combination of the two thermodynamic cycles allows for the high efficiency associated with combined cycle plants. The technology proposed for the additional combustion turbine at MEC II has not been chosen but will be "F" Class combustion turbine technology. In addition to the high-efficiency primary components of the turbine, there are a number of other design features employed within the combustion turbine that can improve the overall efficiency of the machine. These additional features include those summarized below.

Periodic Burner Tuning

Modern F-Class combustion turbines have regularly scheduled maintenance programs. These maintenance programs are important for the reliable operation of the unit, as well as to maintain optimal efficiency. As the combustion turbine is operated, the unit experiences degradation and loss in performance. The combustion turbine maintenance program helps restore the recoverable lost performance. The maintenance program schedule is determined by the number of hours of operation and/or turbine starts. There are three basic maintenance levels, commonly referred to as combustion inspections, hot gas path inspections, and major overhauls. Combustion inspections are the most frequent of the maintenance cycles. As part of this maintenance activity, the combustors are tuned to restore highly efficient low-emission operation.

Reduction in Heat Loss

Modern F-Class combustion turbines have high operating temperatures. The high operating temperatures are a result of the heat of compression in the compressor along with the fuel combustion in the burners. To minimize heat loss from the combustion turbine and protect the personnel and equipment around the machine, insulation blankets are applied to the combustion turbine casing. These blankets minimize the heat loss through the combustion turbine shell and help improve the overall efficiency of the machine.

Instrumentation and Controls

Modern F-Class combustion turbines have sophisticated instrumentation and controls to automatically control the operation of the combustion turbine. The control system is a digital type and is supplied with the combustion turbine. The distributed control system (DCS) controls all aspects of the turbine's operation, including the fuel feed and burner operations, to achieve efficient low-NO_X combustion. The control system monitors the operation of the unit and modulates the fuel flow and turbine operation to achieve optimal high-efficiency low-emission performance for full-load and part-load conditions.

3.2.5.2 Heat Recovery Steam Generator Energy Efficiency Processes, Practices, and Designs

The HRSG takes waste heat from the combustion turbine exhaust and uses it to convert boiler feed water to steam. Duct burning involves burning additional natural gas in the ducts to the heat recovery boiler, which increases the temperature of the exhaust coming from the combustion turbines and thereby creates additional steam for the steam turbine.

The modern F-Class combustion turbine-based combined cycle HRSG is generally a horizontal natural circulation drum-type heat exchanger designed with three pressure levels of steam generation, reheat, split superheater sections with interstage attemperation, post-combustion emissions control equipment, and condensate recirculation. The HRSG is designed to maximize the conversion of the combustion turbine exhaust gas waste heat to steam for all plant ambient and load conditions. Maximizing steam generation will increase the steam turbine's power generation, which maximizes plant efficiency.

Heat Exchanger Design Considerations

HRSGs are heat exchangers designed to capture as much thermal energy as possible from the combustion turbine exhaust gases. This is performed at multiple pressure levels. For a drum type configuration, each pressure level incorporates an economizer section(s), evaporator section, and superheater section(s). These heat transfer sections are made up of many thin walled tubes to provide surface area to maximize the transfer of heat to the working fluid. Most of the tubes also include extended surfaces (e.g., fins). The extended surface optimizes the heat transfer, while minimizing the overall size of the HRSG. Additionally, flow guides are used to distribute the flow evenly through the HRSG to allow for efficient use of the heat transfer surfaces and post-combustion emissions control components. Low-temperature economizer sections employ recirculation systems to minimize cold-end corrosion, and stack dampers are used for cycling operation to conserve the thermal energy within the HRSG when the unit is off line.

Insulation

HRSGs take waste heat from the combustion turbine exhaust gas and uses that waste heat to convert boiler feed water to steam. As such, the temperatures inside the HRSG are nearly equivalent to the exhaust gas temperatures of the turbine. For F-Class combustion turbines, these temperatures can approach 1250°F. HRSGs are designed to maximize the conversion of the waste heat to steam. One aspect of the HRSG design in maximizing this waste heat conversion is the use of insulation. Insulation minimizes heat loss to the surroundings, thereby improving the overall efficiency of the HRSG. Insulation is applied to the HRSG panels that make up the shell of the unit, to the high-temperature steam and water lines, and typically to the bottom portion of the stack.

Minimizing Fouling of Heat Exchange Surfaces

HRSGs are made up of a number of tubes within the shell of the unit that are used to generate steam from the combustion turbine exhaust gas waste heat. To maximize this heat transfer, the tubes and their extended surfaces need to be as clean as possible. Fouling of the tube surfaces impedes the transfer of heat. Fouling occurs from the constituents within the exhaust gas stream. To minimize fouling, filtration of the inlet air to the combustion turbine is performed. Additionally, cleaning of the tubes is performed during periodic outages. By reducing the fouling, the efficiency of the unit is maintained.

Minimizing Vented Steam and Repair of Steam Leaks

As with all steam-generated power facilities, minimization of steam vents and repair of steam leaks is important in maintaining the plant's efficiency. A combined cycle facility has just a few locations where steam is vented from the system, blowdown tank vents and vacuum pumps/steam jet air ejectors. These vents are necessary to improve the overall heat transfer within the HRSG and condenser by removing solids and air that potentially blankets the heat transfer surfaces lowering the equipment's performance. Additionally, power plant operators are concerned with overall efficiency of their facilities. Therefore, steam leaks are repaired as soon as possible to maintain facility performance. Minimization of vented steam and repair of steam leaks will be performed for this project.

3.2.5.2.1 Plant-wide Energy Efficiency Processes, Practices, and Designs

There are a number of other components within the combined cycle plant that help improve overall efficiency, including:

- **Fuel gas preheating** – The overall efficiency of the combustion turbine is increased with increased fuel inlet temperatures. For the F-Class combustion turbine based combined cycle unit, the fuel gas is generally heated with high temperature water from the HRSG. This improves the efficiency of the combustion turbine.
- **Drain operation** – Drains are required to allow for draining the equipment for maintenance (i.e., maintenance drains), and also to allow condensate to be removed from the steam piping and drains for operation (i.e., operation drains). Operation drains are generally controlled to minimize the loss of energy from the cycle. This is accomplished by closing the drains as soon as the appropriate steam conditions are achieved.
- **Multiple combustion turbine / HRSG trains** – Multiple combustion turbine/HRSG trains help with part-load operation. The multiple trains allow the unit to achieve higher overall plant part-load efficiency by shutting down trains operating at less efficient part-load conditions and ramping up the remaining train(s) to high-efficiency full-load operation.
- **Boiler feed pump fluid drives** – The boiler feed pumps are used as the means to impart high pressure on the working fluid. The pumps require considerable power. To minimize the power consumption at part-loads, the use of fluid drives or variable-frequency drives can be employed. For this project, fluid drives are being used to minimize power consumption at part-load, improving the facility's overall efficiency.

3.2.5.2.2 Add-On Controls

In addition to power generation process technology options discussed above, it is appropriate to consider add-on technologies as possible ways to capture GHG emissions that are emitted from natural gas combustion in the proposed Expansion Project's CTG/HRSG unit and to prevent them from entering the atmosphere. These emerging carbon capture and storage (CCS) technologies generally consist of processes that separate CO_2 from combustion process flue gas, and then inject it into geologic formations such as oil and gas reservoirs, unmineable coal seams, and underground saline formations. Of the emerging CO_2 capture technologies that have been identified, only amine absorption is currently commercially used for state-of-the-art CO_2 separation processes. Amine absorption has been applied to processes in the petroleum refining and natural gas processing industries and for exhausts from gas-fired industrial boilers. Other potential absorption and membrane technologies are currently considered developmental.

The U.S. Department of Energy's National Energy Technology Laboratory (DOE-NETL) provides the following brief description of state-of-the-art post-combustion CO_2 capture technology and related implementation challenges:

> …In the future, emerging R&D will provide numerous cost-effective technologies for capturing CO_2 from power plants. At present, however, state-of-the-art technologies for existing power plants are essentially limited to amine absorbents. Such amines are used extensively in the petroleum refining and natural gas processing industries… Amine solvents are effective at absorbing CO_2 from power plant exhaust streams—about 90 percent removal—but the highly energy-intensive process of regenerating the solvents decreases plant electricity output…[1]

The DOE-NETL adds:

…Separating CO_2 from flue gas streams is challenging for several reasons:

- CO_2 is present at dilute concentrations (13-15 volume percent in coal-fired systems and 3-4 volume percent in gas-fired turbines) and at low pressure (15-25 pounds per square inch absolute [psia]), which dictates that a high volume of gas be treated.
- Trace impurities (particulate matter, sulfur dioxide, nitrogen oxides) in the flue gas can degrade sorbents and reduce the effectiveness of certain CO_2 capture processes.
- Compressing captured or separated CO_2 from atmospheric pressure to pipeline pressure (about 2,000 psia) represents a large auxiliary power load on the overall power plant system…[2]

If CO_2 capture can be achieved at a power plant, it would need to be routed to a geologic formation capable of long-term storage. The long-term storage potential for a formation is a function of the volumetric capacity of a geologic formation and CO_2 trapping mechanisms within the formation, including dissolution in brine, reactions with minerals to form solid carbonates, and/or adsorption in porous rock. The DOE-NETL describes the geologic formations that could potentially serve as CO_2 storage sites as follows:

"Geologic carbon dioxide (CO_2) storage involves the injection of supercritical CO_2 into deep geologic formations (injection zones) overlain by competent sealing formations and geologic traps that will prevent the CO_2 from escaping. Current research and field studies are focused on developing better understanding of 11 major types of geologic storage reservoir classes, each having their own unique opportunities and challenges. Understanding these different storage classes provides insight into how the systems influence fluids flow within these systems today, and how CO_2 in geologic storage would be anticipated to flow in the future. The different storage formation classes include: deltaic, coal/shale, fluvial, alluvial, strandplain, turbidite, eolian, lacustrine, clastic shelf, carbonate shallow shelf, and reef.

---

[1] DOE-NETL, *Carbon Sequestration: FAQ Information Portal*, http://extsearch1.netl.doe.gov/search?q=cache:e0yvzjAh22cJ:www.netl.doe.gov/technologies/carbon_seq/FAQs/tech-status.html+emerging+R%26D&access=p&output=xml_no_dtd&ie=UTF-8&client=default_frontend&site=default_collection&proxystylesheet=default_frontend&oe=ISO-8859-1 (last visited Aug. 8, 2011).

[2] *Id.*

Basaltic interflow zones are also being considered as potential reservoirs. These storage reservoirs contain fluids that may include natural gas, oil, or saline water; any of which may impact CO_2 storage differently…"[3]

3.2.5.3 Step 2: Eliminate Technically Infeasible Options

In this section, Mankato Energy addresses the potential feasibility of implementing CCS technology as BACT for GHG emissions from the proposed project's gas turbine/HRSG train. Each component of CCS technology (i.e., capture and compression, transport, and storage) is discussed separately.

3.2.5.3.1 CO_2 Capture and Compression

Though amine absorption technology for CO_2 capture has been applied to processes in the petroleum refining and natural gas processing industries and to exhausts from gas-fired industrial boilers, it is not yet commercially available for power plant gas turbine exhausts, which have considerably larger flow volumes and considerably lower CO_2 concentrations. The Obama Administration's Interagency Task Force on Carbon Capture and Storage confirms this in its recently completed report on the current status of development of CCS systems:

"Current technologies could be used to capture CO_2 from new and existing fossil energy power plants; however, they are not ready for widespread implementation primarily because they have not been demonstrated at the scale necessary to establish confidence for power plant application. Since the CO_2 capture capacities used in current industrial processes are generally much smaller than the capacity required for the purposes of GHG emissions mitigation at a typical power plant, there is considerable uncertainty associated with capacities at volumes necessary for commercial deployment."[4]

3.2.5.3.2 CO_2 Transport

Even if it is assumed that CO_2 capture and compression could feasibly be achieved for the proposed project, the high-volume CO_2 stream generated would need to be transported to a facility capable of storing it. There are no potential geologic storage sites in in Minnesota or the Midwest to which CO_2 could be transported if a pipeline was constructed. The current CO_2 pipelines are shown in Figure 3-1 on the map found at the end of Section 3.[5] Therefore, in order to access any potentially large-scale storage capacity site, assuming that it is eventually demonstrated to indefinitely store a substantial portion of the large volume of CO_2 generated by the proposed project, a very long and sizable pipeline would need to be constructed to transport the large volume of high-pressure CO_2 from the plant to the storage facility, thereby rendering implementation of a CO_2 transport system infeasible.

3.2.5.3.3 CO_2 Storage

Even if it is assumed that CO_2 capture and compression could feasibly be achieved for the proposed project and that the CO_2 could be transported economically, the feasibility of CCS technology would still depend on the availability of a suitable sequestration site. The

---

[3] DOE-NETL, **Carbon Sequestration:** Geologic Storage Focus Area, http://www.netl.doe.gov/technologies/carbon_seq/corerd/storage.html (last visited Aug.8, 2011)
[4] *Report of the Interagency Task Force on Carbon Capture and Storage* at 50 (Aug. 2010).
[5] Denbury Resources, 2012, "CO2 Transportation," Investor Slides, April, 2012, 25p.

suitability of potential storage sites is a function of volumetric capacity of their geologic formations, CO_2 trapping mechanisms within formations (including dissolution in brine, reactions with minerals to form solid carbonates, and/or adsorption in porous rock), and potential environmental impacts resulting from injection of CO_2 into the formations. Potential environmental impacts resulting from CO_2 injection that still require assessment before CCS technology can be considered feasible include:

- uncertainty concerning the significance of dissolution of CO_2 into brine,
- risks of brine displacement resulting from large-scale CO_2 injection, including a pressure leakage risk for brine into underground drinking water sources and/or surface water,
- risks to fresh water as a result of leakage of CO_2, including the possibility for damage to the biosphere, underground drinking water sources, and/or surface water,[6] and
- potential effects on wildlife.

Potentially suitable storage sites, including EOR sites and saline formations, exist in Iowa and Illinois. Figure 3-2 shows possible storage sites[7]. However, there are no pipelines that connect to these formations.

Based on the reasons provided above, Calpine believes that CCS technology should be eliminated from further consideration as a potential feasible control technology for purposes of this BACT analysis. However, to answer possible questions that the public or the EPA may have concerning the relative costs of implementing hypothetical CCS systems, Calpine has estimated such costs. Those cost estimates are presented on Table 3-1 at the end of Section 3.

3.2.5.4 Step 3: Rank Remaining Control Technologies

As documented above, implementation of CCS technology is currently infeasible, leaving energy efficiency measures as the only technically feasible emission control options. As all of the energy efficiency related processes, practices, and designs discussed in Section 3.2.5.1 of this application are being proposed for this project, a ranking of the control technologies is not necessary for this application.

3.2.5.5 Step 4: Evaluate Most Effective Controls and Document Results

As all of the energy efficiency related processes, practices, and designs discussed in Section 3.2.5.1 of this application are being proposed for this project, an examination of the energy, environmental, and economic impacts of the efficiency designs is not necessary for this application. Because the CCS add-on control option discussed in Section 3.2.5.2 was determined to be technically infeasible, an examination of the energy, environmental, and economic impacts of that option is not necessary for this application. However, MEC II is including estimated costs for implementation of CCS.

---

[6] *Id.*
[7] Exhibit 36, Current State and Future Direction of Coal-fired Power in the Eastern Interconnection, Final Study Report June 2013

3.2.5.6 Step 5: Select BACT

MEC II proposes as BACT for this project, the following energy efficiency processes, practices, and designs for the proposed combined cycle combustion turbine:

- Use of Combined Cycle Power Generation Technology
- Combustion Turbine Energy Efficiency Processes, Practices, and Designs
  - Efficient turbine design
  - Turbine inlet air cooling
  - Periodic turbine burner tuning
  - Reduction in heat loss
  - Instrumentation and controls
- HRSG Energy Efficiency Processes, Practices, and Designs
  - Efficient heat exchanger design
  - Insulation of HRSG
  - Minimizing fouling of heat exchange surfaces
  - Minimizing vented steam and repair of steam leaks
- Plant-wide Energy Efficiency Processes, Practices, and Designs
  - Fuel gas preheating
  - Drain operation
  - Multiple combustion turbine/HRSG trains
  - Boiler feed pump fluid drive design

Calpine calculated the design base load net heat rate without duct firing for the 1 x 1 Expansion Project combined cycle plant using the new CTG/HRSG train and the existing steam turbine. A compliance margin was applied based upon reasonable degradation factors that may foreseeably reduce efficiency under real world conditions. The design base load net heat rate for the proposed 1 X 1 combined cycle unit without duct firing is 7,075 Btu/kW-hr (HHV) without the application of degradation factors. Note that this rate reflects the facility's "net" power production, meaning the denominator is the amount of power provided to the grid; it does not reflect the total amount of energy produced by the plant, which also includes auxiliary load consumed by operation of the plant.

To determine an appropriate heat rate, the following compliance margins are added to the base heat rate value:

- A 3.3% design margin reflecting the possibility that the constructed facility will not be able to achieve the design heat rate.
- A 6% performance margin reflecting efficiency losses due to equipment degradation prior to maintenance overhauls.
- A 3% degradation margin reflecting the variability in operation of auxiliary plant equipment due to use over time.

These factors are consistent with the compliance margin factors used in previous Calpine GHG BACT analyses. As a result of these adjustments, MEC II is proposing a BACT net heat rate for the Project of 7,979 Btu/kWh (HHV), corrected to the following conditions of:

- Ambient Dry Bulb Temperature: 6ºF
- Ambient Relative Humidity: 59%
- Barometric Pressure: 14.28 psia
- Fuel Lower Heating Value: 21,500 Btu/lb
- Fuel HHV/LHV Ratio: 1.109

A GHG BACT limit of 1,000 lb/MW-hr on a gross power production basis is proposed based on 1 X 1 combined cycle operation. Calpine is proposing a heat rate demonstration test 180 days after first fire and again prior to obtaining a new permit to verify compliance with the heat rate limit. Although derived from a slightly less efficient operating mode, this limit will account for the range of possible MEC operating scenarios. The calculation of the net heat rate is provided on Table 3-2 at the end of this section.

3.3 BACT DETERMINATION FOR THE DIESEL ENGINE-DRIVEN EMERGENCY EQUIPMENT

The proposed diesel fired emergency generator will be used for emergency situations, if any. However, the diesel engine-driven equipment will be operated for a minimal period on a bi-weekly basis for testing.

3.3.1 Control of NO_x Emissions from Emergency-Use Diesel Engines

As a result of the intended use of the proposed diesel fired emergency generator and subsequent limited operation, allowable NO_x emissions from these units are minimal with an emission rate of 0.66 tons/yr. Based on a review of similar emission sources associated with recent power plant projects, these types of emission sources typically do not have add-on controls but should be operated according to the manufacturer's specifications. Therefore, for the proposed diesel fired emergency equipment, BACT for controlling NO_x emissions is proposed as maintenance in good working order, operation according to the manufacturer's specifications and limiting non-emergency operation of the diesel engine to 100 hours per year.

3.3.2 Control of CO Emissions from Emergency-Use Diesel Engines

Again, as a result of the intended use of the proposed diesel fired emergency generator and subsequent limited operation, allowable CO emissions from these units are minimal with an emission rate of 0.66 tons/yr. Based on a review of similar emission sources associated with recent power plant projects, these types of emission sources typically do not have add-on controls but should be operated according to the manufacturer's specifications. Therefore, for the proposed diesel fired emergency equipment, BACT for controlling CO emissions is proposed as maintenance in good working order, operation according to the manufacturer's specifications, and limiting non-emergency operation of the diesel engine to 100 hours per year.

3.3.3 Control of VOC Emissions from the Emergency-Use Diesel Engines

The allowable VOC emissions from the proposed diesel fired emergency generator are minimal with a limited emission rate of 0.04 tons/yr. MEC II completed a review of similar emission sources associated with recent power plant projects. It was determined that these types of emission sources typically do not have add-on controls but should be operated according to the manufacturer's specifications. Therefore, for the proposed diesel fired emergency generator, BACT for controlling VOC emissions is proposed as maintenance in good working order, operation according to the manufacturer's specifications, and limiting non-emergency operation of the diesel engine to 100 hours per year.

3.3.4 Control of PM/PM_{10}/$PM_{2.5}$ Emissions from the Emergency-Use Diesel Engines

The allowable PM/PM_{10}/$PM_{2.5}$ emissions from the proposed diesel fired emergency generator are minimal with a limited emission rate of 0.01 tons/yr. Based on a review of similar emission sources associated with recent power plant projects, these types of emission sources typically do not have add-on controls but should be operated according to the manufacturer's specifications. Therefore, for the proposed diesel fired emergency generator, BACT for controlling particulate matter emissions is proposed as maintenance in good working order, operation according to the manufacturer's specifications, and limiting non-emergency operation of the diesel engine to 100 hours per year.

3.3.5 Control of GHG Emissions from the Emergency-Use Diesel Engines

Similar to the pollutants above, as a result of the intended use of the proposed diesel fired emergency generator and subsequent limited operation, allowable CO_2e emissions from these units are minimal with an emission rate of 208 tons/yr. Generators of this size typically do not have add-on controls but should be operated according to the manufacturer's specifications. Therefore, for the proposed diesel fired emergency equipment, BACT for controlling greenhouse gas emissions is proposed as maintenance in good working order, operation according to the manufacturer's specifications, and limiting non-emergency operation of the diesel engine to 100 hours per year.

3.4 BACT DETERMINATION FOR THE COOLING TOWER

The existing cooling tower is used for temperature management of process water for the installation. The 4 new cells will accommodate the additional cooling requirements of the expanded combined cycle unit. Projected annual emissions are minimal with an estimated emission rate of 6.58 tons per year for total particulate, 0.64 tons per year for PM_{10}, and 0.01 tons per year for $PM_{2.5}$ for the 4 additional cells. Based on a review of similar projects, cooling towers associated with combined cycle power plants are equipped with high efficiency mist eliminators. The existing cooling tower and proposed additional cooling tower cells will incorporate a mist eliminator (0.0005% tower drift rate).

In conclusion, BACT for controlling PM/PM_{10}/$PM_{2.5}$ emissions for the proposed additional cooling tower cells is the use of a mist eliminator and maintenance of the fans and equipment in good working order and operation according to the manufacturer's specifications with an estimated PM/PM_{10}/$PM_{2.5}$ emissions rates of 6.58 tons per year, 0.64 tons per year, and 0.01 tons per year, respectively.

3.5 BACT DETERMINATION FOR THE DIESEL FUEL STORAGE TANKS

The proposed diesel fired emergency generator will be equipped with its own diesel storage tank. The tank will have a capacity of less than 6,000 gallons and will be used to store diesel fuel. Due to the low volatility of this material, potential VOC emissions are anticipated to be negligible. Based on a search of the RBLC, no control is proposed for this source. BACT is proposed as using a fixed roof tank and maintaining the tank in good working condition.

3.6 BACT DETERMINATION FOR NATURAL GAS PIPING FOR GHG EMISSIONS

Natural gas is delivered to the site via pipeline. Gas will be metered and piped to the new combustion turbine and duct burner. Project GHG fugitive emissions from the natural gas piping components associated with the new CT/HRSG train will include emissions of methane (CH_4) and carbon dioxide (CO_2).

3.6.1 Step 1: Identify All Available Control Technologies

The following technologies were identified as potential control options for piping fugitives:

- Implementation of leak detection and repair (LDAR) program using a hand held analyzer;
- Implementation of alternative monitoring using a remote sensing technology such as infrared cameras; and
- Implementation of audio/visual/olfactory (AVO) leak detection program.

The use of instrument LDAR and remote sensing technologies are technically feasible. Since pipeline-quality natural gas is odorized with a small amount of mercaptan, an AVO leak detection program for natural gas piping components is technically feasible.

3.6.2 Step 2: Eliminate Technically Infeasible Options

There are no technically infeasible control options.

3.6.3 Step 3: Rank Remaining Control Technologies

The use of a LDAR program with a portable gas analyzer meeting the requirements of 40 CFR 60, Appendix A, Method 21, can be effective for identifying leaking methane. The U.S. EPA has allowed the use of an optical gas imaging instrument as an alternative work practice for a Method 21 portable analyzer for monitoring equipment for leaks in 40 CFR 60.18(g). For components containing inorganic or odorous compounds, periodic AVO walk-through inspections provide predicted control efficiencies of 97% control for valves, flanges, relief valves, and sampling connections, and 95% for compressors.

3.6.4 Step 4: Evaluate Most Effective Controls and Document Results

The frequency of inspection and the low odor threshold of mercaptans in natural gas make AVO inspections an effective means of detecting leaking components in natural gas service. The predicted emission control efficiency is comparable to the LDAR programs using Method 21 portable analyzers.

3.6.5 Step 5: Select BACT

Any leak detection program implemented would be solely due to potential greenhouse gas emissions. Since the uncontrolled CO_2e emissions from the natural gas piping represent approximately 0.01% of the total site-wide CO_2e emissions, any emission control techniques applied to the piping fugitives will provide minimal CO_2e emission reductions. Quarterly AVO inspections are proposed as BACT.

3.7 BACT DETERMINATION FOR ELECTRICAL EQUIPMENT INSULTATED WITH SF_6

The generator circuit breakers associated with the proposed unit will be electrically insulated using SF_6 gas. SF_6 is a colorless, odorless, non-flammable, and non-toxic synthetic gas. It is a fluorinated compound that has an extremely stable molecular structure. The unique chemical properties of SF_6 make it an efficient electrical insulator. The gas is used for electrical insulation, arc quenching, and current interruption in high-voltage electrical equipment. SF_6 is only used in sealed and safe systems which under normal circumstances do not leak gas. As part the Expansion Project, two new SF_6 breakers will be installed. The new combustion turbine generator circuit breaker will contain approximately 35 lbs of SF_6 gas. An additional breaker containing approximately 72 lbs of SF_6 will be installed between the combustion turbine generator step-up transformer and the 115kV transmission line. Both proposed circuit breakers will be equipped with low pressure alarms and low pressure lockouts. The alarms will alert operating personnel of any leakage in the system and the lockout prevents any operation of the breaker due to lack of "quenching and cooling" SF_6 gas.

3.7.1 Step 1: Identify All Available Control Technologies

Step 1 of the Top-Down BACT analysis is to identify all feasible control technologies. One technology is the use of state-of-the-art SF_6 technology with leak detection to limit fugitive emissions. In comparison to older SF_6 circuit breakers, modern breakers are designed as a totally enclosed-pressure system with far lower potential for SF_6 emissions. In addition, the effectiveness of leak-tight closed systems can be enhanced by equipping them with a density alarm that provides a warning when 10% of the SF_6 (by weight) has escaped. The use of an alarm identifies potential leak problems before the bulk of the SF_6 has escaped, so that it can be addressed proactively in order to prevent further release of the gas.

One alternative considered in this analysis is to substitute another, non-greenhouse-gas substance for SF_6 as the dielectric material in the breakers. Potential alternatives to SF_6 were addressed in the National Institute of Standards and Technology (NTIS) Technical Note 1425, *Gases for Electrical Insulation and Arc Interruption: Possible Present and Future Alternatives to Pure SF_6.*[8]

3.7.2 Step 2: Eliminate Technically Infeasible Options

According to the report NTIS Technical Note 1425, SF_6 is a superior dielectric gas for nearly all high voltage applications.[9] It is easy to use, exhibits exceptional insulation and arc-interruption properties, and has proven its performance by many years of use and investigation. It is clearly superior in performance to the air and oil insulated equipment used prior to the development of SF_6 -insulated equipment. The report concluded that although "…various gas mixtures show considerable promise for use in new equipment, particularly if the equipment is designed specifically for use with a gas mixture… it is clear that a significant amount of research must be performed for any new gas or gas mixture to be used in electrical equipment." Therefore, there are currently no technically feasible options besides use of SF_6.

3.7.3 Step 3: Rank Remaining Control Technologies

The use of state-of-the-art SF_6 technology with leak detection to limit fugitive emissions is the highest ranked control technology that is technically feasible for this application.

---

[8] Christophorous, L.G., J.K. Olthoff, and D.S. Green, *Gases for Electrical Insulation and Arc Interruption: Possible Present and Future Alternatives to Pure SF6,* NIST Technical Note 1425, Nov.1997.
[9] *Id.* at 28 – 29.

3.7.4 Step 4: Evaluate Most Effective Controls and Document Results

Energy, environmental, or economic impacts were not addressed in this analysis because the use of alternative, non-greenhouse-gas substance for SF_6 as the dielectric material in the breakers is not technically feasible.

3.7.5 Step 5: Select BACT

Based on this top-down analysis, MEC II concludes that using state-of-the-art enclosed-pressure SF_6 circuit breakers with leak detection would be the BACT control technology option. The circuit breakers will be designed to meet the latest of the American National Standards Institute (ANSI) C37.013 standard for high voltage circuit breakers.[10] The proposed circuit breakers at the generator output and the step-up transformer output will have low pressure alarms and low pressure lockouts. These alarms will function as early leak detectors that will bring potential fugitive SF_6 emissions problems to light before a substantial portion of the SF_6 escapes. The lockouts prevent any operation of the breakers due to lack of "quenching and cooling" SF_6 gas. The Expansion Project will also complete monthly inspections of the pressure of the breakers.

3.8 BACT DETERMINATION FOR THE CONDENSATE TANK

The Expansion Project is proposing to install a small condensate tank. The condensate tank will emit a small amount of VOC. The use of the condensate tank will be minimal and on a batch cycle. The tank will have a capacity of less than 50 gallons. Due to the low volatility of this material; potential VOC emissions are anticipated to be negligible. Based on a search of the RBLC, no control is proposed for this source. BACT is proposed as maintaining the tank in good working condition.

3.9 BACT SUMMARY

The emission limitations that are proposed to represent BACT for the emission units associated with the Facility are summarized in Table 3-1.

[10] ANSI Standard C37.013, *Standard for AC High-Voltage Generator Circuit Breakers on a Symmetrical Current*

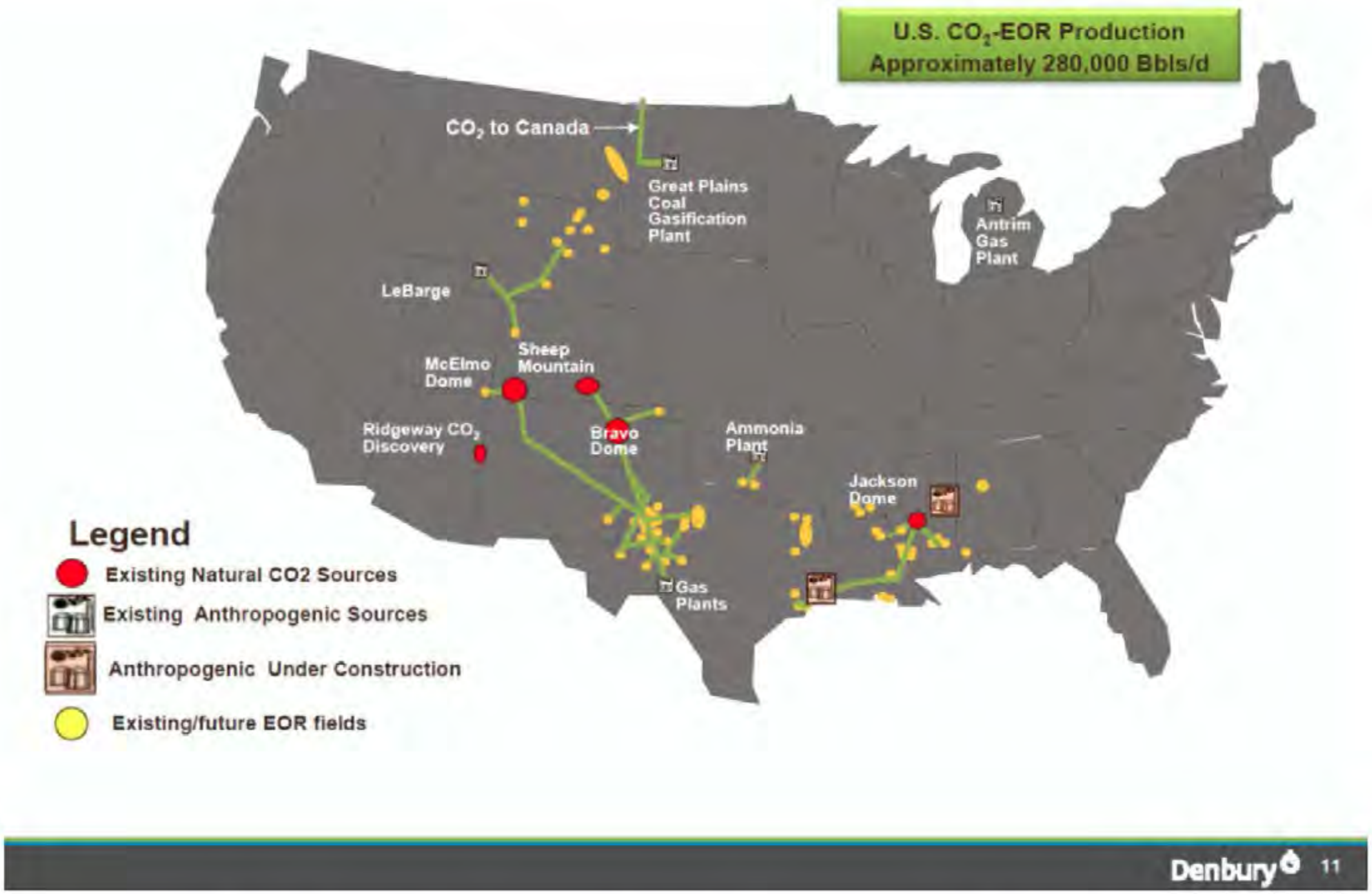
Table 3-1 BACT Summary

Proposed Equipment	BACT Limitation				
	NO_x	CO	$PM / PM_{10} / PM_{2.5}$	VOC	GHG
Combined Cycle Combustion System – Natural Gas	3.0 ppmvd using a 3-hour block average @ 15% O_2 [2]	4.0 ppmvd using a 3-hour block average @15% O_2 (while operating at normal turbine base load conditions), 4.7 ppmvd using a 3-hour block average @15% O_2 (while operating at load conditions less than the turbine base load capacity)[1, 2]	11.9 lb/hr using a 3-hour block average. This limit applies at all times including startup, shutdown, tuning or malfunction.	3.4 ppmvd using a 3-hour block average @15% O_2 [2]	1,000 lb CO_2e/MWhr (gross) And Expansion Project net heat rate of 7,979 Btu/kWh (HHV) without duct firing
Proposed Diesel Fired Emergency Generator	Limiting hours of non-emergency operation to less than 100 hr/yr	Limiting hours of non-emergency operation to less than 100 hr/yr	Limiting hours of non-emergency operation to less than 100 hr/yr	Limiting hours of non-emergency operation to less than 100 hr/yr	Energy Efficiency Measures
Diesel Storage Tank	NA	NA	NA	Fixed Roof Tank	NA
Cooling Tower	NA	NA	Mist eliminator with 0.0005% drift	NA	NA
Natural Gas Piping	NA	NA	NA	N/A	Quarterly AVO Inspections
Electrical Equipment Insulated with SF_6	NA	NA	NA	NA	State-of-the-art enclosed-pressure SF_6 circuit breakers with leak detection and monthly pressure inspections.
Condensate Tank	NA	NA	NA	Maintaining the tank in good working condition	NA

[1] For the CO limit applicability, full load is all operation at 90% or greater of rated capacity for the ambient conditions and less than full load is all operation greater than or equal to 60% load and less than 90% of the rated capacity for the ambient conditions.
[2] The limit does not apply during startup, shutdown, malfunction, tuning, and combustion turbine shakedown.

Table 3-2 Net Heat Rate Calculation

Operating Mode		Net Plant Output - KW	Net Heat Rate (HHV)		Heat Input (HHV)	
CTG		200,826			2,056	
Duct Burner					824	
STG		96,392				
Total Auxiliary Load		6,648				
Total Net Output - Base Operations with Duct Burning		290,570	7,075	Btu/kWh	2,056	MMBtu/hr
Weighted Average Heat Rate		**7075**				
Design Margin		3.3%				
Performance Margin		6.0%				
Degradation Margin		3.0%				
Calculated Weighted Average Heat Rate with Compliance Margins		**7979**				



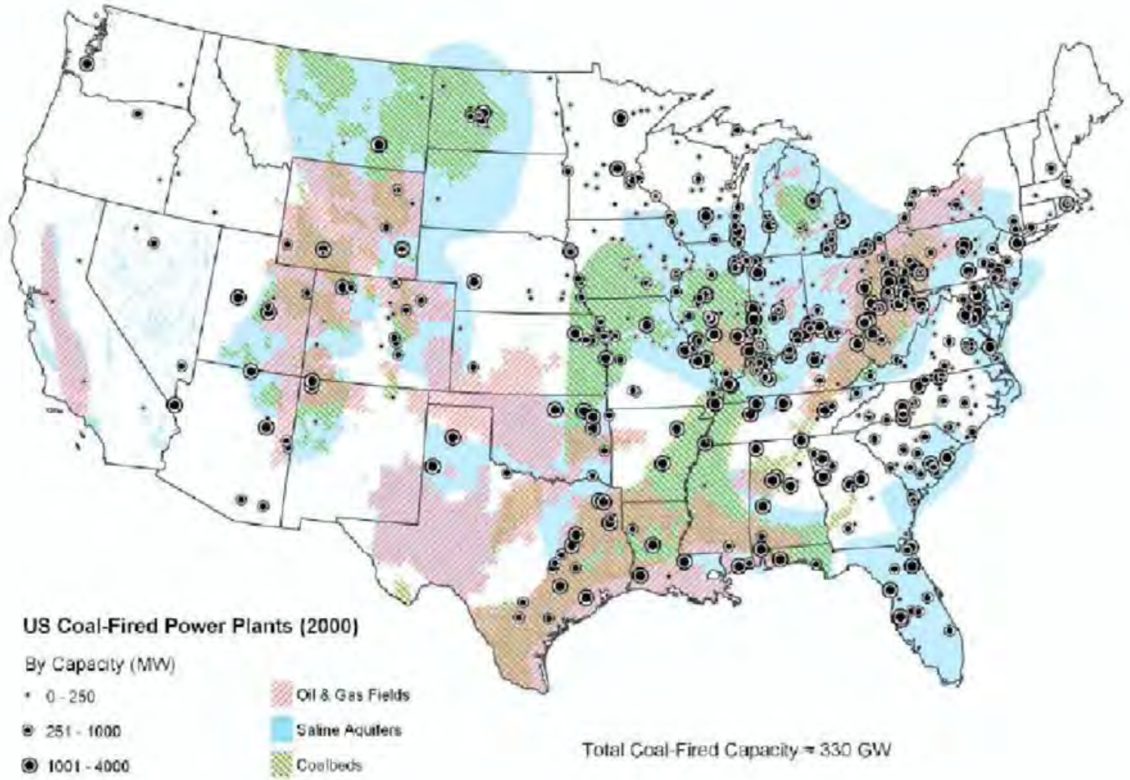
Source: Current State and Future Direction of Coal-fired Power in the Eastern Interconnection, ICF Incorporated, June 2013.

Current CO_2 Pipeline Map

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

Nov 2015

Figure 3-1



Source: Current State and Future Direction of Coal-fired Power in the Eastern Interconnection, ICF Incorporated, June 2013.

Possible CO_2 Storage Sites

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

Nov 2015

Figure 3-2

4.0 Requested Permit Changes

The following section addresses the requested changes to the current permit as a result of the Expansion Project. These proposed changes are also included in the required Forms CD-01s included in Appendix A.1.

4.1 PERMIT OWNERS

As mentioned previously, MEC I currently owns the Existing Facility. The Existing Facility is operated by COSCI. All entities are wholly owned indirect subsidiaries of Calpine Corporation (Calpine). The proposed Expansion Project will be owned by MEC II and also operated by COSCI. Calpine would like both owners listed on the air permit. Below is an example of the ownership and operator agreement that Calpine is requesting for the air permit title page.

AIR EMISSION PERMIT NO. 01300098-003
Total Facility Operating Permit
IS ISSUED TO
MANKATO ENERGY CENTER
for their facility
located at
1 Fazio Lane
Mankato, Blue Earth County, Minnesota 56001

4.2 STARTUP/SHUTDOWN EMISSION LIMITS

As part of the permitting for the current permit number 01300098-002, Calpine revised the SUSD limits to reflect a lb/event and tons/yr basis. MPCA advised Calpine that, because the SUSD limits serve as BACT limits, a time-based annual limit (or 12-Month Rolling Sum limit) alone is not workable for federal-enforceability considerations. Instead, MPCA requested that alternative limits be proposed that effectively limit emissions on both a short-term (e.g., hourly) and long-term (i.e., annual) basis. Based on permit requirements applicable to several other Calpine facilities, in 2010 Calpine proposed to limit SUSD emissions on a "Lb/Event" and "Tons/Yr (12-Month Rolling Sum)" basis. Calpine believed that limiting SUSD emissions in this manner allows for sufficient operating flexibility and meets MPCA's requirements for short-term BACT limitations. Therefore, the current permit includes SUSD limit for the current turbine in units of worst case lb/event and tons/yr.

The current permit includes "Lb/Event" limits and annual (12-Month Rolling Sum) limits for each of Warm/Cold start scenarios on Natural Gas and Distillate Fuel Oil. Note that explicit limits on the number of startups and/or the length of startups are not required. The limits on maximum emissions per startup/shutdown event in conjunction with 12-Month limits serve to effectively limit emissions to BACT levels for short-term and long-term periods.

Startup and shutdown operating mode is all operation of SV 002 or SV 007 at less than 60 percent of the CTG maximum potential load based on ambient conditions at the time of operation when combusting natural gas for fuel oil as applicable. The steam turbine is online when any steam is fed to the steam turbine.

A unit startup is considered a cold start if **either** of the following conditions exist:

1. The steam turbine first stage inter-metal temperature is less than 650°F, or
2. The HRSG high pressure steam drum is below 212°F (i.e. there is no positive pressure in the steam drum).

A unit startup is considered a warm start if **both** of the following conditions exist:

1. The steam turbine first stage inter-metal temperature is at least 650°F, and
2. The HRSG high pressure steam drum pressure is at least 212°F.

Calpine is proposing the following SUSD limits for the Combined Facility in GP 005.

Table 4-1 Summary of SUSD Proposed Limits for the Combined Facility

Pollutant	CT #1 SV 007 Lb/Event (Natural Gas)*	CT #2 SV 002 Lb/Event (Natural Gas)*	SV 002 Lb/Event (Fuel Oil)*	Annual SUSD Emissions for the Combined Facility (tpy)
NO_x	414	323.5	459.3	≥ 66.8
VOC	2,959.5	2,693.8	749.1	≥ 547
CO	5,919	5,387.6	1,498.2	≥ 1,093.9

* The worst case lb/event values are based on the highest lb/event for cold, warm or shutdown event for SV 007, SV 002 combusting natural gas and SV 002 combusting fuel oil.

The annual limits are based on projected number of cold and warm starts and shutdown events for each unit and the lb/event values for each type of start and fuel for SV 002 and SV 007. The per event limits above were determined for each pollutant using manufacturer predictions and data from the existing combustion turbine. The VOC startup and shutdown emissions are based on one half of the CO estimates. Additional details on the annual startup and shutdown emission calculations are included in Appendix C and described in Section 5.1.

Operation of the DLN, SCR and catalytic oxidizer are not available during initial startup of SV 002 or SV 007, but will come on-line as soon as combustion turbine exhaust conditions support operations. During shutdown, control equipment operation shall continue as long as physically possible.

As described in Section 3.2.1.2, in order to provide a combustion turbine with comparable operating characteristics, MEC II has the following procurement options:

- a unit from the gray market,
- an original manufacturer equipment (OEM) off-market unit built from spare components, or
- a newer unit slightly de-rated to the match the performance of the existing unit.

The SV007 startup emissions represent the worst case startup emissions from three combustion turbine options listed above.

Occasionally a combustion turbine, without warning, automatically initiates a shutdown and drops out of steady state operation. Potential reasons for unplanned shutdowns include but are not limited to a drop in natural gas supply pressure or sensor malfunction where there is no operational issue with the unit. During this time the Facility may determine that the unit is functioning properly and it can return to steady state operation without ceasing operation.

On other occasions the facility may commence shutdown and, for a reason unknown to the Facility, be asked by the grid operator to come back to steady state prior to shutting down completely. A turbine runback shall be defined as the period of time during which a turbine is returned to steady state operation after the initiation of a shutdown without ceasing operation. Calpine is proposing that these situations be considered SUSD operation and not included in compliance for the normal operating mode.

4.3 FACILITY SHAKEDOWN AND TUNING DEFINITIONS

Calpine is proposing that the lb/event SUSD limits proposed in Section 4.2 above and the normal operating load BACT limits included in Section 3 will not be in effect until after shakedown occurs for the proposed unit.

The Expansion Project shakedown is defined as the period of time commencing on the day of initial start-up of the new unit and terminating on the earlier of the following three dates:

1. 180 days after initial start-up of CT#1, or
2. 60 days after achieving maximum production of CT#1, or
3. Submittal of successful Compliance Test and CEMS Certification reports of the new unit.

Calpine is also proposing that the normal operating load BACT limits will not be applicable during times of combustion turbine tuning. Tuning is adjustment of the equipment for optimization of combustion and/or emissions performance. Maintenance and testing, like tuning, are required, to maintain and maximize the equipment’s availability and reliability, which in turn reduce unscheduled repairs and breakdown.

4.4 FACILITY FORMALDEHYDE, HEXANE AND TOTAL HAP EMISSION LIMITS

As noted previously, the Existing Facility currently operates under a “synthetic” limit on formaldehyde, hexane and total combined HAP emissions to ensure that the Existing Facility qualified as a non-major source of hazardous air pollutants. The Expansion Project will not change the current “synthetic” limit on formaldehyde, hexane, or total combined HAP emissions. Rather, Calpine is proposing to add a new group in the permit that addresses synthetic minor limits for both the Existing Facility and Expansion Project. The proposed limits are provided below. The new group is listed as GP 004 in the attached Form CD-01s in Appendix A.1.

Formaldehyde	Less than or equal to 9.0 tons per year on a 12-month rolling sum, regardless of fuel type. This limit applies to the total emissions from SV 002, SV 003, SV 005, SV 007, SV 008 and SV 009, and at all times including startup, shutdown, and malfunction
Hexane	Less than or equal to 9.0 tons per year on a 12-month rolling sum, regardless of fuel type. This limit applies to the total emissions from SV 002, SV 003, SV 005, SV 007, SV 008 and SV 009, and at all times including startup, shutdown, and malfunction
Total HAPs	Less than or equal to 22.5 tons per year on a 12-month rolling sum, regardless of fuel type. This limit applies to the total emissions from SV 002, SV 003, SV 005, SV 007, SV 008 and SV 009, and at all times including startup, shutdown, and malfunction

4.5 PROPOSED DIESEL FIRED EMERGENCY GENERATOR BEST MANAGEMENT PRACTICES

As specified previously, a proposed diesel fired emergency generator is proposed as part of the Expansion Project. In addition, a fire pump was installed as part of the original permitting and is located at the Existing Facility. These emission sources are for emergency purposes only and they are tested once per month. MEC I and MEC II will follow best management practices (BMPs) for both pieces of equipment.

The existing diesel fired fire pump and proposed diesel fired generator both employ BMPs and therefore do not need to be included in the modeling demonstration based on MPCA's Modeling Guidance (2014). Calpine will select four of the BMPs listed below in lieu of including the existing diesel fired fire pump and proposed diesel fired emergency generator in the modeling analysis.

The proposed BMPs for the existing diesel fired fire pump and proposed diesel fired emergency generator are the following:

a. Select a generator that operates on “ultra-low” sulfur diesel fuel.
b. Build the stack high enough to ensure good dispersion.
c. Vent the emissions upward.
d. Install the generator in a location that doesn’t affect “fresh air.”

5.0 Emission Calculations

This section discusses the emissions associated with the individual emission units that will be installed as part of the Expansion Project. This discussion supplements the emission calculations included later in this section. The Expansion Project will include the following emission unit groupings:

A. Natural Gas-Fired Combined Cycle Equipment (Combustion Turbine and HRSG Equipped with Duct burners)
B. Diesel Fired Emergency Generator with associated Fuel Oil Storage Tank
C. New Cooling Tower Cells
D. Natural Gas Piping
E. Electrical Equipment Insulated with SF_6
F. Condensate Tank

5.1 GAS-FIRED COMBINED CYCLE EQUIPMENT

A manufacturer has not yet been selected for the proposed combustion turbine. However, operational and emissions data have been provided for the potential F-Class turbine with similar characteristics to the existing unit. This data includes operational and emissions data for natural gas, different load scenarios, various ambient temperatures, and operating scenarios. The data also includes the contribution from the HRSG duct burners in the appropriate emissions cases. The calculations based on the worst-case operational and emissions data calculations have been included in Appendix C.

Potential NO_x, CO, and VOC emissions were calculated for the combined cycle system (both combustion turbine and HRSG duct burners) using the worst-case emission rates derived from the data of potential turbines, all ambient temperatures, and all load and operating scenarios. The emission values represent the calculated maximum controlled emissions from data at ambient conditions for the combined cycle system. The maximum controlled emissions include the combustion turbine and duct burners, and incorporate the proposed combustion turbine BACT limits (See Section 3.2 for combined cycle combustion turbine/HRSG operation).

Potential PM, PM_{10}, and $PM_{2.5}$ emissions were based on vendor data, operating experience and stack tests from other similar Calpine facilities. SO_2 emissions are based on a grain loading limit of 0.8 grains of sulfur/100 standard cubic feet.

Annual emissions for NO_x, CO and VOC include the contribution of emissions from startup and shutdown events. The worst case emissions based on a per event basis were determined for each pollutant using manufacturer predictions and data from the existing combustion turbine. The lb/event values were determined using the highest lb/event value from cold start, warm start or shutdown events. The annual emissions were then calculated based on the worst case annual number of events and the duration of each event type. These startup and shutdown emission quantities were added to steady state emissions for the remaining operating hours of the year, for a combined total of 8760 hours. The VOC startup and shutdown emissions are based on ½ of the CO estimates. Equation 5.1 below shows an example of the annual emissions calculation for the proposed combustion turbine. Additional information on the calculation methodology is provided in the data calculation sheets included in Appendix C. Limits for the startup and shutdown emissions for the Combined Facility are included in the Forms in Appendix A.

$$Equation\ 5.1$$

$$Maximum\ Hours\ of\ SUSD\ \left(\frac{hrs}{yr}\right)$$
$$= 50\ \frac{cold\ starts}{yr} * 5\frac{hrs}{start} + 250\ \frac{warm\ starts}{yr} * 3.5\frac{hrs}{start} + 300\ \frac{shutdowns}{yr} * 1\frac{hrs}{shutdown}$$
$$= 1425\ hrs/yr$$

$$Annual\ NOx\ SUSD\ Emissions\ (tpy)$$
$$= 414\frac{lb}{coldSUevent} * 50\frac{events}{yr} + 220\frac{lb}{warmSUevent} * 250\frac{events}{yr} + 27\frac{lb}{SDevent}$$
$$* 300\frac{events}{yr} = 41.9\frac{tons}{yr}$$

$$Annual\ NOx\ Normal\ Operation\ Emissions\ (tpy) = 34.1\ \frac{lb\ NOx}{hr} * 7335\frac{hrs}{yr} = 124.9\ \frac{tons}{yr}$$

$$Annual\ NOx\ Total\ Emissions\ (tpy) = 41.9\ SUSD\frac{tons}{yr} + 124.9\ Normal\ Operation\frac{tons}{yr} = 166.8\ \frac{tons}{yr}$$

Greenhouse gas emissions are based on emission factors from 40 CFR Part 98 Subpart C (GHG Mandatory Reporting Rule, Combustion); converted from kg/MMBtu to lb/MMBtu based on 2.2046 lb/kg. GWP Conversion factors are from Table A–1 to Subpart A of Part 98—Global Warming Potentials.

All combustion turbine Hazardous Air Pollutant (HAP) emissions, except for formaldehyde and hexane were calculated using the maximum manufacture heat input capacity and emission factors taken from AP-42, Chapter 3.1, Station Gas Turbines, (4/00). Formaldehyde and hexane emissions were calculated using emission factors from natural gas stack test data for MEC I and the projected maximum turbine heat input capacity for natural gas for the proposed combustion turbine. The limited annual emissions for formaldehyde will remain at the current permit limit of 9 tons/yr for the Combined Facility. The limited annual emissions for hexane will remain at the current permit limit of 9 tons/yr for the Combined Facility. The limited annual emissions for total HAP emissions will remain at the current permit limit of 22.5 tons/yr for the Combined Facility.

Potential duct burner criteria pollutant emissions are included in the uncontrolled, controlled, and limited combined cycle system criteria pollutant emission calculations. HAP emissions from the duct burners were calculated using the maximum designed heat input capacity for the duct burners and emission factors taken from AP-42, Chapter 1.4 "Natural Gas Combustion" (7/98) for Boilers greater than 100 MMBtu/hr. Greenhouse gas emissions are based on emission factors from 40 CFR Part 98 Subpart C (GHG Mandatory Reporting Rule, Combustion); converted from kg/MMBtu to lb/MMBtu based on 2.2046 lb/kg. GWP Conversion factors are from Table A–1 to Subpart A of Part 98—Global Warming Potentials.

5.2 PROPOSED DIESEL FIRED EMERGENCY GENERATOR

Worst-case vendor emission factors were used to calculate all criteria pollutant emissions. HAP emissions are based on emission factors from AP-42 Section 3.4 “Large Stationary Diesel and All Stationary Dual-fuel Engines” (10/96). Greenhouse gas emissions are based on emission factors from 40 CFR Part 98 Subpart C (GHG Mandatory Reporting Rule, Combustion); converted from kg/MMBtu to lb/MMBtu based on 2.2046 lb/kg. GWP Conversion factors are from Table A–1 to Subpart A of Part 98—Global Warming Potentials.

This proposed diesel fired generator unit will be used for emergency purposes only, during equipment testing, if there is an equipment failure, or electricity is not available from the electric grid. MEC II is proposing to limit the maximum non-emergency engine usage to 100 hours of operation per year. This is appropriate based on historical power outage data and expected maintenance operation.

5.3 PROPOSED DIESEL FIRED EMERGENCY GENERATOR FUEL TANK

The proposed diesel fired emergency generator will have a 6,000 gallon fuel oil tank. The tank will be a horizontal fixed roof tank. VOC emissions from the fire pump fuel tank are based on Tanks 4.09D. Tanks 4.09D is a Windows-based computer software program that estimates VOC and HAP emissions from fixed- and floating-roof storage tanks. Tanks 4.09D is based on the emission estimation procedures from AP-42 Chapter 7.

5.4 COOLING TOWER

Potential PM was calculated using the calculation methods used in AP-42, Chapter 13.4 "Wet Cooling Towers", (01/95). Potential PM_{10} and $PM_{2.5}$ emissions were derived from the calculated PM emissions using the calculation procedure in "Calculating Realistic PM_{10} Emissions form Cooling Towers", by Reisman and Frisbie, Environmental Progress, Vol. 21, No.2 along with the proposed drift rate of 0.0005%, flow rate of the cooling tower, total dissolved solids (TDS) for the make-up water and number of cycles of the make-up water.

5.5 NATURAL GAS PIPING

As mentioned previously, natural gas is delivered to the site via pipeline. Gas will be metered and piped to the new combustion turbine and HRSG duct burner. Greenhouse gas fugitive emissions from the natural gas pipeline system associated with the Expansion Project are calculated. Emissions for the total facility fugitive emissions for the Combined Facility are also calculated.

Emission factors are provided for valves, flanges/connectors, relief valves, and open-ended lines. Emissions factors for valves, flanges/connectors, relief valves, and open-ended lines were obtained from 40 CFR Part 98 Subpart W "Mandatory Reporting of Greenhouse Gases: Petroleum and Natural Gas Systems; Final Rule" Table W-7.

Emissions from sampling connections are based MPCA Form EC-14, Table EC-14.1. MPCA obtained the SOCMI emissions factors from "Protocol for Equipment Leak Emissions Estimates" (EPA-453/R-95-017), Table 2-1.

5.6 ELECTRICAL EQUIPMENT INSULATED WITH SF_6

SF_6 emissions from the new generator and step-up transformer circuit breakers associated with the Expansion Project are calculated using a predicted SF_6 maximum annual leak rate of 0.5% by weight as specified by the vendor. The global warming potential factors used to calculate CO_2e emissions are based on Table A-1 of Mandatory Greenhouse Gas Reporting

Rules.[11] In addition, SF_6 emissions from the Existing Facility breakers were also calculated using the methodology above. The emissions from the Existing Facility are included in the total Combined Facility emissions totals.

5.7 CONDENSATE TANK

The Expansion Project is proposing to install a 50 gallon condensate tank. The tank will be a horizontal fixed roof tank. VOC emissions from the condensate tank are based on Tanks 4.09D. Tanks 4.09D is a Windows-based computer software program that estimates VOC and HAP emissions from fixed- and floating-roof storage tanks. Tanks 4.09D is based on the emission estimation procedures from AP-42 Chapter 7. The tank will be used minimally and the majority of the time will be empty. Calpine used an estimated tank volume of 10% for the calculations. This is a conservative estimate and results in negligible emissions. The proposed condensate tank qualifies as an insignificant activity under Minn. R. 7007.1300, Subpart 3(I) but was included in the PSD netting analysis and Form CH-04a.

5.8 SUMMARY OF PSD NETTING EMISSION CALCULATIONS

In order to determine if the Expansion Project is subject to PSD review, netting calculations were performed for the units described in Sections 5.1 through 5.7. In general, two tests are available to determine PSD applicability:

- Past actual to future potential emissions; and
- Past actual to future projected actual emissions.

The Expansion Project involves the installation of new emission units, not modification of existing units; therefore, only the past-actual-to-future-potential test is applied. There are no emission units that will be removed as part of the project. Only future potential emissions will be evaluated to determine the net emissions increase for the Expansion Project. Table 5-1 provides a summary of the PSD applicability test for the Expansion Project. Emission calculations are provided in Appendix C. As shown below, the Expansion Project is subject to PSD for PM, PM_{10}, $PM_{2.5}$, NO_x, CO, VOC and GHG. This analysis is also shown on the required forms in Appendix A.

[11] Global Warming Potentials, 40 C.F.R. Pt. 98, Subpt. A, Tbl. A-1.

Table 5-1 Expansion Project Potential Emissions and PSD Applicability Thresholds

Pollutant	CT/HRSG# 1 (tpy)	Proposed Diesel Fired Emergency Generator / Fuel Oil Tank/Condensate Tank (tpy)	Cooling Tower* (tpy)	Fugitive/ SF6 Emissions (tpy)	Project Potential Emissions (tpy)	PSD Major Modification Threshold (tpy)
PM	52.12	0.01	15.87	NA	68.00	25
PM_{10}	52.12	0.01	2.70	NA	54.83	15
$PM_{2.5}$	52.12	0.01	0.02	NA	52.15	10
SO_2	30.20	0.26	NA	NA	30.46	40
NO_x	166.78	0.66	NA	NA	167.44	40
VOC	382.54	0.20	NA	NA	382.58	40
CO	767.98	0.66	NA	NA	768.64	100
Lead	6.61E-03	NA	NA	NA	6.61E-03	0.6
CO_2e	1,578,145	208.1	NA	6,702	1,585,055	75,000
Asbestos	NA	NA	NA	NA	NA	0.007
Beryllium	4.24E-05	NA	NA	NA	4.24E-05	0.004
Mercury	9.20E-04	NA	NA	NA	9.20E-04	0.1
Vinyl chloride	NA	NA	NA	NA	NA	1
Hydrogen sulfide	NA	NA	NA	NA	NA	10
Sulfuric acid mist	4.58	NA	NA	NA	4.58	7
Total reduced sulfur	NA	NA	NA	NA	NA	10
Reduced sulfur compounds	NA	NA	NA	NA	NA	10

* Cooling tower emissions are based on the total cells (12 cells). However, Calpine is proposing to only install 4 new cells. This is a conservative assumption.

6.0 Additional Impacts Analysis

This section describes the impacts on soils, vegetation, and visibility caused by emissions from the Expansion Project and from associated growth.

The Expansion Project site is located in the City of Mankato boundary within Lime Township and Blue Earth County. The Expansion Project site is located approximately one-quarter mile east of Nicollet County and approximately three miles south of Le Sueur County and is located within the boundary of the Existing Facility. The Existing Facility site was recently annexed by the City of Mankato, with a population of 55,941 (U.S. Census Bureau, 2000). The Existing Facility location is shown in Section 2, Figures 2-1 and 2-2.

Approximately 25 acres of land was developed as part of the original project. Access to the facility is provided from the south off Summit Avenue. To the south, across Summit Avenue is an industrial park for light industrial and services. Undeveloped woodlands bound the proposed site to the west. The adjoining property to the east consists of woodlands interspersed with several small-to-medium sized businesses. A closed construction-demolition waste landfill and yard waste composting facility border the site to the north.

The site is located within an established industrial and manufacturing area and lies within an exhausted limestone quarry currently being utilized as a construction-demolition waste landfill and yard waste composting facility. The nearest residential areas are approximately one mile to the north of the site, approximately one-half mile to the south of the site, approximately one mile to the east of the site, and approximately one and 1/4 miles to the west of the site in North Mankato. Highway 169 is located approximately one half mile west of the site, and Highway 14 is located approximately one-half mile south of the site.

As described previously, the Expansion Project involves construction of a second combustion turbine/HRSG train that will be fueled with natural gas only. The Expansion Project will add approximately 290 MW of baseload capacity and 55 MW of peaking capacity at winter conditions. In addition to the combustion turbine/HRSG train, the Expansion Project includes a proposed diesel fired emergency diesel generator, 4 additional cooling tower cells, and a new anhydrous ammonia tank.

Electricity from the facility is currently interconnected directly into Xcel Energy's (Xcel's) Wilmarth Substation, which is located just to the west of the Existing Facility.

Cooling water is supplied by effluent taken from the municipal wastewater treatment system, located approximately 1 mile due south of the site on the east bank of the Minnesota River. The water is treated prior to delivery. The effluent is discharged back to the City of Mankato wastewater treatment plant. Potable and process water is supplied from the City of Mankato.

6.1 GROWTH ANALYSIS

Construction of the Expansion Project will require a work force of 250 people over a period of 24 to 27 months. This represents the number of construction workers working at the plant over the duration of the project, not necessarily a peak number on a given day. It is anticipated that workers commuting to the site from throughout the three-county area will fill most of the construction jobs available. In 2010, the total civilian labor force for Blue Earth, Le Sueur, and Nicollet Counties was 43,378 with an unemployment rate for the surrounding area of 3.4 percent (Minnesota Department of Employment and Economic Development Website, June 2015). Following construction activities, the Combined Facility expects to employ an additional 2 full time employee equivalents for day-to-day operations and maintenance, for a total of approximately 19 full time employees. The Expansion Project will not require an increase in small support industries.

No related industrial growth is expected to accompany the Expansion Project. Emergency and full maintenance capacity is contained within the plant. With no associated commercial or industrial growth projected, it then follows that there will be no growth-related air pollution impacts.

6.2 SOILS AND VEGETATION

The New Source Review Workshop Manual (USEPA OAQPS, Draft October 1990, Chapter D, Section II.C) specifies that the analysis of soils and vegetation should be based on an inventory of the soils and vegetation types found within the impact area of the proposed project. The impact area is defined as the circular area with a radius extending from the source to the most distant point where dispersion modeling predicts that a significant ambient impact level will occur. As documented in Section 7 of this application, compliance with the secondary NAAQS will ensure that there are no adverse impacts to the types of soils and vegetation in the vicinity of the Expansion Project. Therefore, no adverse impacts to soils and vegetation are expected to occur as a result of the Expansion Project.

Despite the low predicted ambient air concentrations resulting from the Expansion Project emissions, information was acquired on the soil and vegetation types at and in the vicinity of the proposed project. The Existing Facility site has been previously disturbed during facility construction and prior to that, by activities associated with past gravel and limestone mining activities and the demolition landfill. The disturbance for the construction of the Expansion Project will take place entirely within the boundaries of the Existing Facility. Wooded areas exist on the east edge of the site along a drainage ditch, which receives stormwater runoff from the site and surrounding areas and flows northerly to the Minnesota River. Wooded areas also exist along the south side of the site along the railroad tracks. The construction of the Expansion Project or operation of the Combined Facility will not result in significant changes in land cover or land use at the facility.

6.3 RARE AND UNIQUE NATURAL RESOURCES

A review of the Minnesota Natural Heritage Information System (NHIS) database was requested from the Minnesota DNR to determine if rare plant communities or animal species, unique resources, or other significant natural features are known to occur on or near the site of the facility.

<u>Federally Listed Species</u>
No federally listed endangered or threatened species were identified by the NHIS search. The NHIS letter mentions that the U.S. Fish and Wildlife Service listed the Northern Long-eared Bat (*Myotis septentrionalis)* as threatened under the Endangered Species Act and implemented an interim 4(d) rule effective May 4, 2015, which generally prohibits purposeful taking of northern long-eared bats throughout the species' range. The Northern Long-eared Bat is also a state-listed species of special concern in Minnesota. The bat hibernates in caves and mines during the winter and roosts underneath bark or in cavities

and crevices of trees. The northern long-eared bat was not identified as being in the vicinity of the facility in the NHIS query results. There will only be very limited clearing of trees (less than one acre) during the construction of the Expansion Project. Therefore no impacts to the northern long-eared bat are anticipated.

Calpine submitted an Endangered Species Act (ESA) consultation request to US EPA Region 5. A copy of the request is included in Appendix E along with additional supporting documentation.

6.4 ARCHAEOLOGICAL AND HISTORIC RESOURCES

The Expansion Project will include the construction of one additional CTG/HRSG, four new cooling tower cells, and related auxiliary equipment within the fence line of the Existing Facility. Information was requested from the State Historic Preservation Office (SHPO) about possible archeological, historical, or architectural resources located on or near the proposed project site. A response letter dated April 2, 2015 was received from SHPO indicating that no known or suspected archeological resources are present in the area that would be affected by the Expansion Project. Two historic architectural structures (farmsteads) were identified within Section 31. The Expansion Project will take place within the fence line of the Existing Facility which is within a developed industrial area of the City of Mankato and would not impact either of these identified resources. Less than 15 acres of land will be leased from a local land owner for construction laydown space. This temporary space will not be in close proximity to the historic properties. Based on these findings and due to the disturbed nature of the site from the previous construction activity for the Existing Facility, construction of the Expansion Project and operation of the Combined Facility will have no impact on archeological, historical, or architectural resources.

Calpine submitted a National Historical Preservation Act consultation request to US EPA Region 5. A copy of the request is included in Appendix F along with additional supporting documentation.

6.5 WATER USAGE AND WATER QUALITY

The majority of water that will be utilized at the Combined Facility will be cooling water supplied by the City of Mankato WWTP plant. A small amount of service water (approximately five percent of the total water utilized) from the City of Mankato will also be utilized by the facility. The Combined Facility will be designed to maximize the existing water reuse and recycling measures and to minimize wastewater discharges. The Existing Facility has two separate discharge points – one each for process and domestic wastewater. Both discharge points ultimately end up at the City of Mankato WWTP. Process wastewater consisting of cooling tower blowdown, reverse osmosis reject, and other minor low volume waste streams are all ultimately discharged to the City WWTP. The City WWTP discharges to the Minnesota River. The Combined Facility will continue to operate in the same manner as existing conditions and will not add or change wastewater flow pathways or discharge points.

The majority of process water that has been utilized is lost to the atmosphere through evaporation, which will account for approximately 75 percent of all water that comes into the Combined Facility. The remaining process water is discharged back to the City WWTP. As part of the original construction of the Existing Facility, MEC I constructed a process water treatment system including a phosphorus removal and dechlorination system prior to discharge to the City WWTP. This system is located at the City's WWTP site and will continue to be utilized during operation of the Combined Facility. MEC II will install upgrades as required at the WWTP to accommodate the Expansion Project.

Cooling water from the Mankato WWTP that is treated and routed to the Combined Facility would otherwise be discharged directly to the Minnesota River under the Mankato WWTP's existing NPDES permit. The wastewater generated from the Combined Facility will continue to be treated for phosphorus and chlorine removal prior to discharge, and as a result it is anticipated that phosphorus and total suspended solids loads to the Minnesota River will be reduced as a direct result of the Combined Facility's water use and discharge.
Domestic wastewater generated from the Existing Facility (i.e., bathrooms and sink areas in the administrative building and water treatment building) is discharged directly to the City of Mankato sanitary sewer system. This discharge is authorized by the City of Mankato and subject to appropriate discharge limits and monitoring requirements. No significant changes to sanitary discharge are expected as a result of the Expansion Project.

6.6 VISIBILITY ANALYSIS

MPCA guidance, "MPCA Air Dispersion Modeling Guidance", July 2014, was consulted in determining if a visibility analysis is required for the Expansion Project. The guidance indicates that all major sources or major modifications within 300 km of a Class I area should conduct an impact analysis for the Class I area.

There are no Class I areas within 300 kilometers (km) of the Combined Facility. The closest Class I area is Rainbow Lake Wilderness Area, located northeast of the Combined Facility in northern Wisconsin. Below is a summary of the nearest Class I areas with approximate distances and direction from the Combined Facility.

- Rainbow Lake Wilderness Area, WI – 320.6 km Northeast
- Boundary Water Canoe Wilderness Area, MN – 432.6 km North
- Voyageurs National Park, MN – 471.8 km North
- Isle Royale National Park, MI – 537.3 km Northeast
- Badlands National Park, SD – 644.8 km West
- Seney Wilderness Area, MI – 647.6 km Northeast

It was determined that a Class I increment analysis is not required for the Expansion Project because the Combined Facility is further than 300 km from Rainbow Lake Wilderness Area.

Although not required by MPCA guidance, PSD rules or the 2008 FLAG guidance, a visibility analysis was performed for the nearest Class I Area (Rainbow Lake Wilderness) in order to show the minimal impact the Combined Facility will have on the Class I areas. The screening procedure consisted of the methodology outlined in the EPA document Workbook for Estimating Visibility Impairment.

The Draft Federal Land Managers' Air Quality Related Values Workgroup (FLAG) guidance (June 27, 2008) contains an initial screening criteria to determine if a project causes or contributes to an impairment on visibility or air quality related values (AQRV) within a Class I area. The guidance states:

> *"… the Agencies are using a fixed Q/D factor of 10 as a screening criteria for sources locating greater than 50 km from a Class I area. Furthermore, the Agencies are expanding the screening criteria to include all AQRVs, not just visibility. Therefore, the Agencies will consider a source locating greater than*

50 km from a Class I area to have negligible impacts with respect to Class I AQRVs if its total SO_2, NO_x, PM_{10} and H_2SO_4 annual emissions (in tons per year, based on 24-hour maximum allowable emissions, divided by the distance (km) from the Class I area (Q/D) is 10 or less. The Agencies would not request any further Class I AQRV impact analyses from such sources.

The total emissions from the Combined Facility of SO_4, NO_x, PM and soot are as follows:

- PM = 192.91 tons/year
- NO_x (as NO_2) = 354.01 tons/year
- Soot = 0 tons/year
- Primary SO_4 = 0 tons/year
- Total = 546.92 tons/year

The closest Class I area to the Combined Facility is Rainbow Lake Wilderness, WI:

- Q = 546.92 tons/year
- D = 320.6 km
- Q / D = 546.92 / 320.6 = 1.71

Following the procedures documented in the 2008 FLAG guidance results in a Q/D value less than 10. Therefore, it is concluded that the Expansion Project would not be considered to cause or contribute to impairment on visibility or an AQRV within a Class I area.

A visibility screening analysis was also performed for Rainbow Lake Wilderness. The screening procedure is divided into three levels. Each level represents a screening technique for an increasing possibility of visibility impairment. A Level 1 analysis involves a series of conservative tests that help to identify sources having little potential for adverse or significant visibility impairment of a potentially affected Class I Area. These calculations were performed for the distance from the Combined Facility to Rainbow Lake Wilderness using the EPA VISCREEN model. The PM and NO_x emissions used in this visibility analysis are conservatively assumed to be for the Combined Facility. The results of the VISCREEN run are shown in Table 6-1.

Table 6-1 Level 1 VISCREEN Analysis for Rainbow Lake Wilderness

Background	Theta	Azi	Distance	Alpha	Delta E		Contrast	
					Critical	Plume (project Results)	Critical	Plume (project Results)
Maximum Visual Impacts INSIDE Class I Area								
Sky	10	85	321.3	84	2.0	0.001	0.05	0
Sky	140	85	321.3	84	2.0	0	0.05	0
Terrain	10	92	329.2	77	2.0	0	0.05	0
Terrain	140	92	329.2	77	2.0	0	0.05	0
Maximum Visual Impacts OUTSIDE Class I Area								
Sky	10	80	315.8	89	2.0	0.001	0.05	0
Sky	140	80	315.8	89	2.0	0	0.05	0
Terrain	10	65	299.1	104	2.0	0	0.05	0
Terrain	140	65	299.1	104	2.0	0	0.05	0

The results for the Rainbow Lake Wilderness VISCREEN analysis are well below the Delta E critical value of 2.0. The results are no greater than approximately 0.05% of the Delta E critical thresholds. In addition, the plume contrast values are zero for all scenarios indicating that the proposed project will not impair visibility in Rainbow Lake Wilderness. As shown from the VISCREEN analysis the Expansion Project will not impair visibility in Rainbow Lake Wilderness. Detailed VISCREEN results are included in Appendix G.

Long-range transport modeling would not be appropriate for the Expansion Project. Guidance provided in the Interagency Work-group for Air Quality Modeling (IWAQM) report on long-range transport modeling for Class I impact analyses states that CALPUFF and other long-range assessment methodologies are not reliable beyond a distance of approximately 200 km. As indicated above, it is the policy of the USEPA that Class I impacts are normally not considered to be of concern beyond 300 km from a proposed source.

7.0 Ambient Air Quality Analysis

An air dispersion modeling analysis was performed for the Expansion Project. The purpose of the modeling analysis was to demonstrate that the emissions from the Combined Facility would not cause or contribute to a violation of the MAAQS and NAAQS and PSD increment standards. The modeling demonstration was conducted in two steps:

1. Preliminary modeling was conducted to determine whether emissions from the Expansion Project alone would result in any predicted maximum ambient concentrations of criteria pollutants above the PSD significant ambient impact levels.

2. The predicted concentrations for 1-hour nitrogen dioxide (NO_2) exceeded the respective significant ambient impact levels. Additional modeling for this pollutant and averaging time was performed to demonstrate compliance with NAAQS and MAAQS. PSD increment standards have not yet been developed for 1-hour NO_2.

7.1 SIL ANALYSIS

A SIL analysis was completed as part of the Expansion Project. Pollutants modeled in this SIL analysis were PM_{10}, $PM_{2.5}$, NO_2, and CO. The modeled concentrations of each pollutant were compared to their respective SIL value using High First High (H1H) modeled impacts. The SIL modeling analysis was completed for the following averaging periods with the following results:

Table 7-1 Class II Significant Impact Level Modeling Results

Pollutant	Averaging Period	Modeled Impact H1H (µg/m^3)	SILs (µg/m^3) *As of 10/26/2010	Percent of SIL (%)	Exceed SIL?	Radius of Impact (if exceeds SIL)
PM_{10}	24-Hour	1.42	5	28.30	No	--
	Annual	0.15	1	14.85	No	--
$PM_{2.5}$	24-Hour	0.78	1.2	65.31	No	--
	Annual	0.05	0.3	17.71	No	--
NO_2	1-Hour	27.61	7.52	367.00	Yes	50 km
	Annual	0.65	1	65.00	No	--
CO	1-Hour	755.10	2000	37.76	No	--
	8-Hour	468.00	500	93.60	No	

Based on the results above, further modeling is not required for PM_{10}, $PM_{2.5,}$ CO, and annual NO_2. However, cumulative modeling is required for 1-hour NO_2 emissions as modeled concentrations for that pollutant and averaging period are greater than the SIL. Additionally a $PM_{2.5}$ PSD Increment screening analysis was completed.

The radius of impact listed in Table 7-1 is based on the distance from the site to the furthest receptor greater than the SIL. It was common practice in the past to reduce the extent of the receptor grid used in SIL modeling down to the radius of impact for cumulative modeling. EPA's March 1, 2011 memo entitled "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" states on page 3:

> "*…we deem it appropriate and acceptable in most cases to limit the cumulative impact analysis to only those receptors that have been shown to have significant impacts from a proposed new source based on the initial SIL analysis…"*

Based on this statement from EPA, the size of the receptor grid used in the SIL model runs was reduced to include only those receptors with modeled concentrations greater than the 1-hour NO_2 SIL. Separate receptor grids were created for receptors inside and outside the nearby ADM facility.

7.2 NAAQS

Under the federal Clean Air Act (CAA) and the PSD regulation, a Class II area is a geographic area other than national parks, monuments and wilderness areas that are classified as Class I. Most of Minnesota is Class II. To receive a PSD permit in a Class II area, the Permittee must demonstrate that the NAAQS and MAAQS are protected, but less stringent standards are in place for a Class II area than a Class I area. A Class II air quality analysis was completed for the project as part of the air permit application.

The Expansion Project includes both fugitive sources and stacks, as well as nearby industrial background sources for the NO_x modeling only. The modeled fugitive sources include the cooling towers. The facility stacks include the facility combustion turbine stacks, the auxiliary boiler stack, bath heater stack, fire pump stack, and the proposed diesel fired emergency generator stack. The existing diesel fired fire pump and proposed diesel fired emergency generator are not required to be modeled as indicated in Section 7.6 below. Air pollution control equipment efficiencies and proposed air permit limits are included in the air emission estimates that were used in the modeling. Haul roads were not required to be included in the modeling analysis because predicted concentrations from the Expansion Project were less than the SIL for PM_{10} and $PM_{2.5}$. No changes to the haul roads are proposed as part of the Expansion Project.

The AERMOD air dispersion model was used to estimate Class II ambient air concentrations. The USEPA recommends AERMOD as a "Preferred Model" for Class II air quality analyses. Building downwash was predicted for the facility stacks using the BPIP-PRIME downwash model. Both AERMOD and BPIP-PRIME were developed by USEPA.

As shown in Table 7-2 below, the Class II air quality analysis showed a small modeled exceedance of NO_2 over the 1-hour averaging period. A culpability analysis of the modeled exceedance shows that the Combined Facility does not contribute more than a SIL toward the exceedance, which indicates that the Combined Facility is not a significant contributor to the exceedance.

Table 7-2 Maximum Predicted Ambient Air Concentrations

Pollutant	Averaging Period	Modeled Impact ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Predicted Ambient Air Concentration ($\mu g/m^3$)	MAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Percent of Standard (%)
NO_2	1-Hour (H8H)	189.69	54.56[a]	189.69	-	188[b]	100.9

[a] Background level is 3-year average of maximum monitored observations for FHR 423 monitor (2011-2013).
[b] Not to be exceeded more than the three-year average of the 98th percentile of 1-hour concentrations.

An ozone impacts analysis is also required of any major PSD modification where there is an increase in NO_x and VOC emissions which exceeds the significance threshold for ozone (40 tpy) because NO_x and VOCs are precursors to ozone. A quantitative modeling analysis for ozone has not yet been developed to be used for this permit. Therefore a qualitative analysis was decided to be used. In this analysis, data from the Blaine ozone monitor was used. This data shows that the monitoring station has recorded average ozone concentrations at or below 89% of the NAAQS standard during 2012-2014. NO_x and VOC emissions from the Combined Facility account for less than 0.04% of the stationary source emissions in the state according to the 2012 Criteria Point Air Emissions by Facility summary. This data indicates there is no reason to expect emissions from the Combined Facility would alter the compliance status with respect to the ozone standard.

7.3 PSD INCREMENTS

PSD allows facilities to construct emission units, but restricts the amount of additional pollution an area can receive. It does this by imposing "PSD increments," or limits on the concentration of air pollution since a certain date.

There are increments that apply in normal (or Class II) areas as well as increments for protected (Class I) areas such as National Parks and Wilderness areas. The allowed increase in a concentration of a pollutant is lower in a Class I area than in a Class II area.

As part of this modeling analysis, MEC II conducted a $PM_{2.5}$ Increment Screening Analysis. This screening process was completed for the purpose of demonstrating compliance and screening out of a cumulative air dispersion modeling analysis. In the past it has been acceptable to demonstrate that project impacts were below the SIL and background concentration was at least one SIL below the NAAQS. However, in the EPA's most recent guidance on $PM_{2.5}$ modeling, that approach was deemed unacceptable when screening out of a $PM_{2.5}$ increment analysis.

The $PM_{2.5}$ Increment Screening Analysis ultimately determined that the Expansion Project impact will be a small consumer of increment. The analysis also determined that monitored background concentrations in the area have improved significantly over the past several years, increasing the amount of "headroom" between the Expansion Project impacts and the PSD Class II increment standards. These results indicate that further refined increment modeling is not required. For a detailed report of the techniques used and complete results of this analysis, please see Appendix H.

7.4 CLASS I INCREMENT ANALYSIS

As outlined in the MPCA's Air Dispersion Modeling Guidance (July 2014), source applicability to complete a Class I increment analysis is based on a source's proximity to a Class I area. The most current recommendation is that all major sources or major modifications within 300 km of a Class I area should conduct an impact analysis of the affected Class I area(s).

As described in Section 6.6, there are no Class I areas within 300 kilometers (km) of the facility. The closest Class I area is Rainbow Lake Wilderness Area, located northeast of the Combined Facility in northern Wisconsin. Below is a summary of the nearest Class I areas with approximate distances and direction from the Combined Facility.

- Rainbow Lake Wilderness Area, WI – 320.6 km Northeast
- Boundary Water Canoe Wilderness Area, MN – 432.6 km North
- Voyageurs National Park, MN – 471.8 km North
- Isle Royale National Park, MI – 537.3 km Northeast
- Badlands National Park, SD – 644.8 km West
- Seney Wilderness Area, MI – 647.6 km Northeast

It was determined that a Class I increment analysis is not required for the project because the Combined Facility is more than 300 km from Rainbow Lake Wilderness Area.

8.0 Applicable Requirements

The significant applicable state and federal air quality regulations are summarized in this section. The MPCA forms that identify all applicable requirements are included as Appendix A.

8.1 PSD APPLICABILITY

The Expansion Project is subject to PSD for PM, PM_{10}, $PM_{2.5}$, NO_x, CO, VOC, and GHG emissions as shown in Table 5-1. PSD requires installation of BACT for new emission units. A BACT limit for PM, PM_{10}, $PM_{2.5}$, NO_x, CO, VOC, and GHG emissions are proposed for each new emission unit as described in Section 3. The Expansion Project does not trigger PSD for SO_2 because the combustion turbine will be fired with natural gas only.

8.2 MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY

The project includes equipment governed by Maximum Achievable Control Technology (MACT) standards specified in 40 CFR 63. The Combined Facility is a synthetic minor source with respect to HAPs. Highlighted regulations are included in Appendix A.2.

- The existing fire pump is an existing source at an area source with respect to MACT. The unit is rated at less than 500 hp. The unit is subject to 40 CFR Part 63 Subpart ZZZZ. Requirements are already listed in the current permit.
- The proposed diesel fired emergency engine will be a new source, rated at greater than 500 hp, located at an area source of HAP. It will comply with 40 CFR 63 Subpart ZZZZ through compliance with 40 CFR 60, Subpart IIII.
- As noted above, the Combined Facility is not a major source with respect to HAPs and will continue to be a minor source following the Expansion Project. 40 CFR Part 63 Subpart YYYY is only applicable to major sources of HAPs and therefore is not applicable to the proposed combustion turbine.
- The existing and proposed duct burners are classified as Electric Utility Steam Generating Units (EUSGUs). The proposed Electric Utility Steam Generating Unit source category definition published in 67 FR 6521, Table 1 includes coal-fired and oil-fired EUSGUs. Because the existing duct burners burn natural gas and the duct burners will fire natural gas, the proposed 40 CFR 63 Subpart UUUUU and 112(g), Case-by-Case MACT requirements are not applicable to these units.

8.3 NEW SOURCE PERFORMANCE STANDARDS (NSPS)

The Expansion Project will have equipment subject to the following New Source Performance Standards (NSPS). Highlighted NSPS Standards are included in Appendix A.2 of this application.

- The proposed combustion turbine and duct burners will be subject to 40 CFR 60 Subpart KKKK: Standards of Performance for Stationary Combustion Turbines. According to the applicability of NSPS KKKK, the proposed combustion turbine will be exempt from 40 CFR 60 Subpart GG and the associated proposed duct burner will be exempt from NSPS Subpart Da: Standards of Performance for Electric Utility Steam Generating Units.

- The existing combustion turbine and its associated existing duct burners are not subject to NSPS KKKK. NSPS Subpart KKKK is only applicable to units that have commenced construction, modification or reconstruction after February 18, 2005. Calpine commenced construction on the existing combustion turbine and duct burners on November 1, 2004.
- The proposed combustion turbine and duct burners will be subject to 40 CFR 60 Subpart TTTT: Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units.
- The proposed diesel fired emergency generator will be subject to 40 CFR 60 Subpart IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines.

8.3.1 NSPS Subpart KKKK

The proposed combustion turbine and duct burners will be subject to 40 CFR 60 Subpart KKKK: Standards of Performance for Stationary Combustion Turbines. As noted previously, the proposed combustion turbine will be exempt from 40 CFR 60 Subpart GG: Standards of Performance for Electric Utility Steam Generating Units. The proposed HRSG and duct burners are exempt from 40 CFR Part 60 Subpart Da: Standards of Performance for Electric Utility Steam Generating Units.

The Expansion Project will install a NO_x CEMS on CT #1 in accordance with §60.4345, to demonstrate compliance with the NSPS KKKK limits of 15 ppm at 15% O_2, or 0.43 lb NO_x/MWh. The NO_x limit includes startup and shut down emissions and is demonstrated on a 4 hour rolling average. Consistent total SO_2 composition of the combustion fuel will be demonstrated either by fuel purchase contract specifications, or through representative fuel sampling in accordance with §60.4365.

8.3.2 NSPS Subpart TTTT

The proposed CT#1 and duct burners will be subject to 40 CFR 60 Subpart TTTT: Standards of Performance for Greenhouse Gas Emissions. Based on this regulation, a heat output based limit of 1000 lb CO_2/MWh is required for the CT as the combustion turbine will supply more than its design efficiency times the potential electric output as net electric sales and the unit will burn natural gas only (Table 2 of Subpart TTTT).

The projected design LHV efficiency of the unit is 45 percent. The air permitting for the unit is based on 100 percent capacity factor (or no requested annual capacity factor for the unit). Therefore, this unit will be subject to the output based limit in Table 2 of Subpart TTTT. The BACT limit results in emissions below this limit. This is lower than the NSPS and will ensure compliance with the standard. A copy of 40 CFR 60 Subpart TTTT highlighted for applicability for the proposed CT is included in Appendix A.2.

8.4 STATE RULES

8.4.1 Air Emission Standards

In addition to the generally applicable state requirements, the Expansion Project will install equipment subject to unit-specific standards.

- The proposed combustion turbine will be subject to Minn. R. 7011.2350 Stationary Gas Turbines for the Combustion Turbines.

- The proposed fuel oil tank for the proposed diesel fired emergency generator will be subject to Minn. R. 7011.1500 through 7011.1520 for the Fuel Oil Tanks.
- The cooling towers will be subject to the Industrial Process Equipment rule, Minn. R. 7011.0715 Standards of Performance For Post-1969 Industrial Process Equipment.
- The proposed diesel fired emergency generator will be subject to Minn. R. 7011.2300 Standards of Performance For Stationary Internal Combustion Engines.

8.4.2 Environmental Review

Calpine has applied to the Minnesota Public Utilities Commission for a Site Permit in accordance with the Minnesota Power Plant Siting Act (Minnesota Statutes Chapter 216E and Minnesota Rules 7850) on August 5, 2015. The Site Permit application contains environmental information as specified by Minnesota Rules 7850.1900, Subpart 3. Data and other information on air impacts is one area that are covered in the Site Permit application.

8.4.3 Air Emissions Risk Analysis

MEC I completed an Air Emissions Risk Analysis ("AERA") in accordance with MPCA technical guidance (Facility Air Emissions Risk Analysis Guidance; Version 1.0; September 2003) as part of the 2004 Site Permit. The results of the 2004 analysis demonstrated compliance with all applicable standards.

MPCA guidance no longer exempts natural gas-fired combustion units from review. Therefore, the AERA addressed emissions resulting from combustion of the natural gas combustion in the proposed combustion turbine and associated proposed duct burners.

An AERA was conducted as part of the Expansion Project. The purpose of the AERA is to assess the potential health risk attributed to air emissions from a given source. The AERA includes both quantitative and qualitative analyses. In the quantitative portion of the analysis, the potential incremental cancer risks and non-cancer hazard indices are estimated using procedures outlined in MPCA guidance. The qualitative portion of the analysis identifies and discusses items of potential interest that cannot be easily quantified.

The MPCA's AERA guidance allows for a preliminary assessment based on the use of screening level air dispersion modeling to predict exposure levels. Maximum one-hour impacts for each pollutant were determined for assessing acute exposures. The maximum annual impacts for each pollutant were determined for assessing chronic exposures and/or cancer risk. These exposures were then compared with pollutant-specific toxicity values supplied by the MPCA. Hazard indices and cancer risks were then calculated. A detailed summary of the AERA and its findings are presented in Appendix I.

8.5 COMPLIANCE ASSURANCE MONITORING (CAM)

Compliance Assurance Monitoring (CAM) applies on a pollutant specific basis to emissions units that:

1. Are subject to an emission limit or standard, and
2. use add-on pollution control to achieve compliance with the applicable limit or standard, and
3. have pre-controlled potential emissions greater than the Part 70 major source level for that pollutant.

There are also many exemptions from CAM, such as being subject to an emission limit or standard proposed by the EPA after April 15, 1990, under Sections 111 or 112 of the Clean Air Act.

Proposed pollution control equipment at MEC II includes DLN burners for the combustion turbine and SCR and oxidation catalyst for the combustion turbine and duct burners. DLN burners do not meet the definition of add-on controls under the CAM regulation.

SCR reduces NO_x emissions, and the combined cycle unit is subject to a NSPS standard promulgated after April 15, 1990, which exempts them from CAM for the NSPS limits. MEC II is also proposing a NO_x BACT limit, which does not qualify for an exemption, making the combustion turbine and duct burners subject to CAM for NO_x. MEC II is installing a NO_x CEMS to demonstrate compliance with the proposed emission limitation. A CAM plan has been prepared for the NO_x CEMS and is included in Appendix A.3 of this application.

The catalytic oxidizer reduces emissions for both CO and VOC. MEC II will use a CO CEMS to comply with the CO emission limit. The CAM rule indicates that the use of a CEMS or PEMS meets the requirements of the CAM rule, so a CAM plan has been prepared for the CO CEMS and is included in Appendix A.3 of this application. The CO CEMS is proposed as a surrogate for VOC emissions as well.

8.6 PRE-CONSTRUCTION MONITORING REQUEST

On January 22, 2013, the United States Court of Appeals for the District of Columbia Circuit (Court) granted a request from the EPA to vacate and remand portions of two PSD $PM_{2.5}$ rules. The Court vacated the portion of the PSD rules that established a $PM_{2.5}$ SIL. The Court also vacated the portion of the PSD rules that established a $PM_{2.5}$ Significant Monitoring Concentration (SMC), finding that EPA was precluded from using the $PM_{2.5}$ SMC to exempt permit applicants from the statutory requirement to compile preconstruction monitoring data. Therefore, all applicants for a federal PSD permit should include ambient $PM_{2.5}$ monitoring data as part of the application process.

EPA issued guidance that addressed EPA's recommendations for completing an air quality analysis for $PM_{2.5}$ following the Court's decision. The May 20, 2014 Guidance for $PM_{2.5}$ Permit Modeling, provides additional information on how a permitting should select and include ambient $PM_{2.5}$ monitoring data.

The guidance indicates that even though the PSD application must include ambient monitoring data representative of the area of concern, this data need not be collected by the PSD applicant if existing data is determined by the permitting authority to represent the air quality in the area of concern over the 12-month period prior to the submittal of a complete PSD application.

Currently, there are no $PM_{2.5}$ ambient monitors located at the Existing Facility. However, there are several $PM_{2.5}$ monitors located in Minnesota that are operated and maintained by either the Minnesota Pollution Control Agency (MPCA) or other permitees. MEC II is proposing to use a representative existing monitor to supply ambient $PM_{2.5}$ monitoring data for the Expansion Project. The memorandum located in Appendix D documents the selection criteria and justification for using an existing $PM_{2.5}$ monitoring data as a representation of the current $PM_{2.5}$ emission levels at the Existing Facility.